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University-Industry-Government Cooperation within an agricultural context: the case of Penela Business Incubator

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Project

University-Industry-Government Cooperation within an agricultural context: the case of Penela Business Incubator

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I declare to be the author of this project, which is an original and unpublished work that has never been submitted to another institution of higher education to obtain an academic degree or other qualification. I also certify that all quotations are properly identified and that I am aware that plagiarism constitutes a serious lack of ethics, which could lead to the cancellation of this project.

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Abstract

This case study explores the relationship of university-industry-government cooperation, with specific reference to the incubator of Penela, Portugal. This example is considered in the context of the knowledge-based economy. The main goal is to implement acquired knowledge, complement several existing studies, try to show how the triple helix model explains the role of the Incubator as a mechanism for technology transfer and how it contributes to the dynamics of innovation and entrepreneurship in the region. It describes the ties relating to formal R&D links, human resources, and informal cooperation for the sample of 13 firms based on the Penela incubator and universities. The relationship between the local authorities of the municipality of Penela and the incubator HIESE is also presented. In summarize, the impact of the above relations on the development of the agricultural and biotechnological industry of Penela is considered. The results confirm that the dynamics of relations between the scientific community (the University of Coimbra, Polytechnic Institute of Coimbra and the Pedro Nunes Institute), industry and local government (Penela Municipality) led to the emergence of the HIESE incubator, which operates as the mechanism of technology and knowledge transfer and stimulates establishing of cooperational links between university and industry, which are mostly informal. At the same time, communication between tenants is not very common. The perception by tenants of the incubator is still more like a prestigious real estate case, rather than an opportunity to develop R&D networks with the university. Besides it, the participation of universities in incubation activities does not necessarily make transfer of results of academic research through spin-offs.

Key-words: university-industry-government cooperation; business incubator; Triple Helix, innovation.

Contents

INTRODUCTION 1

CHAPTER 1. SCIENCE AND INNOVATION: THE THEORETICAL FRAMEWORK 4

1. Science, technology and R&D activity 4

2. Innovation 5

2.1 Typologies of innovation 5

2.2 The non-linear vs linear model of innovation process 7

3. Knowledge/technology transfer (KTT) 8

4. The Triple Helix (TH) model 12

4.1. The Triple Helix and the knowledge based economy 12

4.2. University- Industry- Government (U-I-G) configuration 13

4.3. Implications of U-I-G 16

5. Business Incubators (BIs): definition, genesis and evolution of the concept 17

5.1. Objectives of BIs, archetypes, actors involved 19

5.2. Incubation process 21

5.3. The services provided by BI 22

5.4. Types of links between universities and tenants, internal relationship between firms in BI 23

5.5. Advantages and disadvantages of BIs 24

5.6. Recent studies review focusing on U-I-G interactions in context of BI in Portugal and other countries 25

6. Agricultural industry in Portugal 28

6.1. Agriculture economy of Portugal: evolution and performance 28

6.2. Characteristic of Penela agriculture sector 30

CHAPTER 2. OBJECTIVES AND METHODOLOGY 32

1. Objectives 32

2. Methodology 32

CHAPTER 3. CASE STUDY: PENELA BUSINESS INCUBATOR AND U-I-G INTERACTION 34

1. HIESE Incubator: context and characterization 34

1.1. Creators of HIESE 34

1.1.1. Local authority – Municipality of Penela 34

1.1.2. The Pedro Nunes Institute (IPN) 35

1.1.3. University of Coimbra (UC) 35

1.1.4. Polytechnic Institute of Coimbra (IPC) 36

1.2. Services and activities provided by HIESE Incubator 37

1.3 HIESE management, financing, partners 38

2. Firms based on the HIESE Incubator 39

2.1. Company in virtual start (pre-incubation) 39

2.1.1. EcoXperience 39

2.1.2. Microgene 40

2.1.3. Q/snack 40

2.1.4. S&DG (Storage and Distributed Generation Solutions) 40

2.1.5. Segmento Figuardo 40

2.1.6. Transwood. LDA 41

2.2. Company in physical incubation 41

2.2.1. ActionLive 41

2.2.2. Buglife 41

2.2.3. Pavisa 42

2.2.4. Primelayer 42

2.2.5. Webervas 42

2.2.6. Wise Shape 42

2.2.7. Wocadi 43

2.3 Pre-incubation business project virtual start 43

2.3.1. Numen 43

2.3.2. Reddish 43

2.3.3. Toal 44

2.3.4. 2Gther 44

3. Analysis of cooperation U-I-G 44

3.1. Factors motivating firms to be based on the Incubator 44

3.2. Cooperation between firms located at HIESE and University (types, intensity) 49

3.3. Forms of knowledge/technology transfer between firms and university (types, benefits, effects) 52

3.4. Relationship between tenants of HIESE Incubator 55

3.5. Relationship between local authority and HIESE Incubator 56

4. Influence of U-I-G cooperation on Penela agricultural and biotechnology sector development 57

CONCLUSION 59

LIMITATIONS 63

FUTURE STUDIES 64

BIBLIOGRAPHY 65

LIST OF ANNEXES 81

List of Figures

Figure 1. 1 Knowledge transfer among university- industry knowledge bases 11

Figure 1. 2 From "state-centric" to the laissez-faire and triple helix models. 14

Figure 1. 3 The evolution of the BI concept 18

Figura 1. 4 The Business Incubation Process 21

List of Tables

Table 3.1 Motivational factors of company location in the HIESE Incubator 45

Table 3.2 General characteristics of the companies 46

Table 3.3 R&D activities of the sample companies 48

Table 3.4 The U-I cooperation links and their intensity 50

Table 3.5 Reasons for the non – existence of cooperation with universities 52

Table 3.6 Forms of knowledge/technology transfer resulting from cooperational links 53

Table 3.7 Benefits to firms after cooperation 53

Table 3.8 The universities' benefit from cooperation 54

Table 3.9 The final results of knowledge/technology transfer 54

Table 3.10 Cooperation links between tenants of the HIESE incubator 55

List of abbreviations

APBA - Portuguese Business Angels Association

BA - Business angel

BI - Business Incubator

BPS - Basic Payment Scheme

CAP - Common Agricultural Policy

Centro 2020 - Operational Program for the Central Region

CERNAS - Natural Resources, Environment and Society Study Centre

CINEP - Pedagogy Study in Teaching Centre

CTCV - Technological centre of ceramics and glass

DNA - Deoxyribonucleic acid

EC- European Community

ESAC - Coimbra Agriculture School

ESEC - Coimbra Education School;

ESTeSC - Coimbra Health School

ESTGOH - Oliveira do Hospital Management and Technology School

EU - The European Union

GVA - Gross value added

HIESE - Habitat for Business Innovation in Strategic Sectors of Penela

IIA - Applied Research Institute

INESC - Association with Institute of Systems and Computer Engineering

INOVIPC - Polytechnic of Coimbra Training Centre

IoT - Internet of things

IPC - Polytechnic Institute of Coimbra

IPN - Pedro Nunes Institute

ISCAC - Coimbra Business School

ISEC - Coimbra Institute of Engineering

ISO - International Organization for Standardization

KM - Knowledge Management

KTT - Knowledge/technology transfer

LNEG - The National Laboratory of Energy and Geology

NBIA - American National Business Incubation Association

NUT - Nomenclature of Territorial Units for Statistical purposes.

OECD - Organization for economic cooperation and development

PAMAF - Support Program for Agricultural and Forest Modernization

PD-ICE - Strategic Program of Innovation, Competitiveness and Entrepreneurship

PDO- Protected Designation of Origin

PEDAP - Program for the development of Portugues Agriculture

PGI - Protected Geographical Indication

PRODER - Rural Development Program

R&D - Research and Experimental Development

RNA - Ribonucleic acid

RNI - National Network of Incubators

RURIS – Rural Development Program of Continental Portugal

S&T - Science and Technology Park

SBIR - Small Business Innovation Research

SME - Small and Medium Enterprises

SP - Science Park

SRLL - Smart Rural Living Lab

TBI - Technology Business incubator

TH - Triple Helix

TTO - Technology Transfer Office

UAA - utilized agricultural areas

UBI – University Business Incubators

UC - University of Coimbra

U-I - University-Industry

U-I-G - University-Industry-Government

UTAD - The University of Trás-os-Montes and Alto Douro

WCM - Wise Composite Material

INTRODUCTION

We live in the era of continuous transformation, where, it is widely known, that the living standard of nations and increase in revenues depend on their scientific and technological potential (Marques, Caraça, & Diz, 2010), ability to innovate and quick adapting to the new demands of the world in which we live.

The development of high technology and innovation allows countries around the world to increase their social and economic potential. Expanding the role of knowledge in society and the academy in economic can be analyzed in terms of the Triple Helix model of the university-industry-government relationships (Leydesdorff & Etzkowitz, 2001). This model is based on the transition from an industrial society to the knowledge-based society, in which universities acquire the new role of "entrepreneurship" - key to the dynamic processes of evolution required to enhance innovation, and the collaboration between academia, industry, and government that create synergy, of which is expected to occur circulation of knowledge (Leydesdorff & Etzkowitz, 2001) that leads to innovation stimulation (Herliana, 2015). Each institution takes on the role of another: the university, in addition to providing academic knowledge, research and development, can take the role of industry through the knowledge transfer (Ueasangkomsate & Jangkot, 2017), and the promotion of new companies through incubators (Leydesdorff & Etzkowitz, 2011). Government plays industry role through grants and regulatory environment, providing funding for university laboratories. Industry, besides product and process development, can perform as academia by providing training and research. Such cooperation provides benefits for all parties involved and for economic and society as a whole, while the overlapping of these separate institutional areas provides for the creation of a new independent hybrid organizations, such as venture capital firms, incubators and science parks, aimed at increasing innovation (Etzkowitz, 2003).

Among the various infrastructures and mechanisms business incubators seem to be effective policy tool by which countries can implement the triple helix model, to promote of entrepreneurship, innovation, and develop new-technology based firms (Schwartz & Hornych, 2010), promote technology commercialization and investment attraction (Marques et al., 2010). Incubators are being introduced around the world, bringing together various social actors and their various goals and objectives, Portugal is no exception.

The main reason for choosing this topic arise from the interest in innovation, and the practical examination of the triple helix model applying to a small member of European Union – Portugal. The study is focused on the HIESE Incubator, how this infrastructure enhances the creation of conditions for new firms, strengthens the U-I-G collaboration, promotes development of relationship between tenants. And finally, through applying of Triple Helix system in this case to explore the influence of such types of interaction on the agricultural and biotechnology industry development in Penela rural region. We intend to contribute to a better knowledge of the current reality of Incubators in Portugal and complement the existing studies about The Triple Helix agents/collaboration to explained the integration of interaction, knowledge transfer and different roles of each player in the system of knowledge production, implementation, and commercialization.

This study includes four sets of research questions related to the knowledge on: 1 - understanding the importance and essence of HIESE incubator as the important actor in the innovation process; 2 - main motivations of firms based on the incubator and local government in cooperation with the university; 3 - firms and incubator characteristics that influence the existence of links; 4 - the cooperation links between the companies located in the HIESE and University (types, intensity); 5 - ways of KTT, their results, effects, and benefits; 6 - HIESE contribution to the agriculture and biotechnology industries of Coimbra district, Penela.

The work is divided into three chapters. After the Introduction, Chapter 1 presents theoretical aspects, where Sections 1-3 define and discuss the main concepts of science, technology, R&D, innovation, knowledge/technology transfer. Section 4 is devoted to Triple Helix framework. In Section 5, we define business incubators, its involved, process and the services provided. Also, we establish types of U-I links and give brief literature review of U-I cooperation. Section 6 is devoted to performance of Portugal's agriculture industry, and, particularly, Penela agriculture sector. After explaining the methodology, specification of objectives and research questions in Chapter 2, we present the case study in Chapter 3. We give the general characteristics of the HIESE incubator, its creators and tenants. Provide the results and discussion of the empirical data. In the general conclusions we present and discuss the final results of our investigation, as well as its main limitations and contributions to the KTT mechanism through HIESE Incubator and its influence on agriculture and biotechnology industries.

CHAPTER 1. SCIENCE AND INNOVATION: THE THEORETICAL FRAMEWORK

1. Science, technology and R&D activity

Throughout this case study, we will use a set of concepts and terms that, although they are well known in the literature, deserve due explanation. It is important to consider the role of science and technology in innovation. In this regard, we follow the distinction made by Caraça (2011, p. 80), which defines science as "the set of organized knowledge about the causal mechanisms of observable facts, obtained through the objective study of empirical phenomena" and technology as "all scientific or empirical knowledge directly applicable to the production, improvement or use of goods or services". In short, technology represents the application of human intelligence to use the laws of science for human purposes.

Another concept that is often used with science and technology is research and experimental development (R&D). Thus, the Organization for Economic Cooperation and Development (OECD) expresses in the Oslo Manual (OECD, 2005, p. 40):

> "Research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications".

In order for an activity to be recognized as an R&D, it must satisfy five basic criteria: be new, creative, uncertain, systematic, transferable and replicable. Three types of R&D activity can be distinguished:

- basic research is an experimental or theoretical work aimed at obtaining new knowledge about fundamental phenomena and observable facts, without any specific application or use (OECD, 2002). The goals of basic research are to analyze properties, structures, and relationships in order to formulate and test hypotheses, theories, or laws. The results of such research, as a rule, are not negotiable, but are disseminated in the form of publications or through an exchange between interested parties (Marques, 1998);
- applied research is an original investigation conducted with the aim to acquire new knowledge. This type of research is conducted either to determine the possible use of the results of basic research, or to establish methods or new ways

to achieve predetermined goals. The results of applied research can be transformed into a new prototype, product or process, to new operations, methods, or systems that can be registered in a patent form or kept confidential (Marques, 1998);

- experimental development is a systematic work based on the knowledge from research and practical experience, aimed to gain additional knowledge that is focused at producing of new products or processes or improving existing products or processes (OECD, 2002).

Thus, these concepts represent a successively larger universe of activities which are highly interdependent, yet nevertheless distinct from each other.

2. Innovation

2.1 Typologies of innovation

The concept of innovation requires in-depth learning, given its great role in the scientific and technical system and in the economies of the countries. Innovation is "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (OECD, 2005, p. 46). While earlier the OECD (1971, p.11) considered technological innovation as "the first application of science and technology in a new way with commercial success".

For the purpose of this work, it is important to distinguish between the concepts of innovation and invention. Fagerberg (2004, p. 3) argues that "invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice".

In turn, O'Sullivan and Dooley (2009) state that innovation is use of a new product with benefits adding the value to consumers, which play the role of a source of competitive advantage and a key factor in economic growth, technological progress and in corporate survival (Drucker, 1994). Companies have to innovate to gain and maintain competitive advantage, either by influencing their environment or by responding to organizational and environmental demands changes (Hueske, Endrikat, & Guenther, 2015). Vaivode (2015) states that entrepreneurship is the driving force of innovation.

The concept of innovation is very broad, so various classifications have been developed and used in the literature (Abernathy & Clark, 1985; Cumming, 1998; Johannessen, Olsen, & Lumpkin, 2001; Lundvall, 1992; Schumpeter 1939). The basic classification can be divided into two structures: a macro level - innovative products are new to the whole world, in the market or in the industry; and micro level - innovation is new to the firm or customer. For our case study, it is very important to understand micro level innovations, which Lundvall (1992, p. 8) describes as:

> "on-going processes of learning, searching and exploring, which result in new products, new techniques, new forms of organization and new markets".

Product innovation can take the form of a product, service, or idea that someone regards as new (Caraça, Lundvall, & Mendonça, 2009; Lundvall, 1992; Marques, 2014a). Rainey (2005, p.1) states that this type of innovation "concentrates on improving the strategic position and product delivery capabilities of the organization through creativity and leadership".

According to the OECD (2005, p.49) process innovation is "the implementation or adoption of new or significantly improved production or delivery methods". They include the adaption of existing production lines, the installation of new infrastructure, the introduction of new technologies, methods of work, which is especially important in case of reorganizing of the company or exploring new markets (Jenssen & Aasheim, 2010).

Organizational innovation is reflected in changes in authority, organizational structure, workplace organization, in remuneration systems (Slappendel, 1996), the introduction of new management methods or corporate strategic orientations (OECD, 2005). Such innovations can increase firm productivity by reducing administrative or transaction costs, improving job satisfaction. The ISO 9000 is an example, which represents a set of rules for ensuring the transparency of processes, their documentation and ensuring their reproducibility and control (Marques, 2014b; Tidd, Bessant, & Pavitt, 1997).

According to the OECD (2005, p.49), marketing innovation is defined as "the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing".

Innovations are developed through innovative efforts that are made in society and the economy, with the participation of all types of agents: public or private, including firms,

the state, universities and non-profit institutions (Caraça, 2011; Etzkowitz, 2008; Lundvall, 1992; Marques, 2014a; Marques, 2016a).

2.2 The non-linear vs linear model of innovation process

To understand how innovation activities are conducted, there have been many attempts to impose a certain conceptual order in the analysis of the innovation process. In this regard, various models of the innovation process have been developed, ranging from a linear model to a more complex. Rothwell (1994) identifies five generations of innovative models that show the stages of evolution of economic reality and economic thinking of the scientists' community.

The innovative model of the first generation (1950s till mid-1960s) is a linear model of "technology push", where the process has sequential phases: Basic research→ Design→ Manufacturing→ Marketing→ Sales. This concept suggests that more R&D leads to more successful new products.

The second generation of linear models is "market pull" (mid-1960s till early-1970s), which is characterized by successive stages: Market need→ Development→ Manufacturing→ Sales. The orientation of the entire innovation process takes place to in accordance with the requirements of the customer.

Later, Kline and Rosenberg (1986) present a critical systematic model that does not correspond to the idea of a sequence of steps. In this model, new knowledge is not necessarily the driving force of innovation. Instead, the process begins with determining market demand, which stimulates research and design, and then - redesign, production, and finally marketing. There are also important feedback loops with the knowledge base stored in the organization and around the world, with new fundamental research being conducted or ordered as needed.

At the beginning of the XXI century Caraça et al. (2009) propose a new innovation model that combines organizational and institutional aspects and is based on an interactive learning process with multiple channels, which complements and broadens the perspectives of the Kline and Rosenberg model in the light of the learning economics. This model is also focused on the firm level, the main sequential stages of the internal innovation process and the information loop between them are preserved, but the stage at which the first step in the innovation process occurs is not indicated as

the central chain of innovation rotates on itself to completely follow the dynamics of the learning process. According to Caraça et al. (2009), the way how a company is organized and how it interacts with science and with customers is crucial to its success. In this model research is aiming to understand markets and organizations that are on an equal position with scientific research, which are aimed at developing new technology, and experience-based learning is recognized as a prerequisite for transforming scientific knowledge into economic performance.

Chesbrough (2003a; 2003b; 2004) further developes the concept of open innovation, which assumes that innovation is based on firms' need to combine their internal and external technological developments to produce successful innovations that create added value for the company. But Marques (2014a, p. 201) criticizes the model as it "carries on with the linear view of innovation based on "technology-push", to the detriment of interactive rationales and learning throughout the whole innovation process". Also, Trott and Hartmann (2009) argue that open innovation concept from Chesbrough (2003a; 2003b; 2004) is "old wine in new bottls".

3. Knowledge/technology transfer (KTT)

Another concept that is significantly important in R&D activities is knowledge/technology transfer. It is widely known that the society in which we live gradually turns into the "knowledge society" (Toffler, 1990). A very basic definition of knowledge is provided by Colman (2001), he describes it as "anything that is known". Davenport and Prusak (1997, p.5) give the broader definition, as "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". Knowledge is the most valuable asset of the firm to achieve the competitive advantage (Plessis, 2005) and is critical to the success of the firm, as it provides the basis for making decisions which resources and capabilities to use, develop, or discard when the environment changes (Ndofor & Levitas, 2004). In turn, resources are vital for innovation, and lack of them can be an innovative barrier (Mueller, Rosenbusch, & Bausch, 2013).

Kouvelis and Lus (2013) emphasize that the company's ability to get the results will depend significantly on the experience and knowledge it has already gained. However, organizations face innumerable challenges in managing knowledge. Dayasindhu (2002,

p.552) states that “knowledge management (KM) is creating, acquiring, interpreting, retaining and transferring knowledge to improve performance by purposefully modifying behaviour based on new knowledge”. According to Paulin and Suneson (2012) the key role of KM is the spreading of knowledge, enabling knowledge access from any level of the organization and facilitating its transfer to cooperating organizations.

In addition, in the era of knowledge-based economy, the acquisition of new technologies through research and development by the company itself or the technology transfer from external sources (Lai & Tsai, 2009) is crucial for enhancing a company's competitive advantage (Lai, 2011; Lin, Tan, & Chang, 2002). However, even for companies with extensive financial and technological capabilities, it is not easy to organize independent R&D activities. Especially for Small and Medium Enterprises (SMEs) that face limited resources and internal capabilities, it is important be able to use external knowledge to survive (Lin et al., 2002).

Cutler (1989, pp. 17-24) defines KTT as “the process by which knowledge concerning the making or doing of useful things contained within one organized setting is brought into use within another context”. In other words, technology transfer is the process of sharing skills, knowledge, technologies, methods of manufacturing and facilities among industries, universities, governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials, or services. Tsai (2001) argues that the knowledge/technology transfer between the departments of organization provides the opportunity for learning from each other and interact, that leads to new knowledge creation, and, in parallel develops the ability of organizational units to innovate.

The university-industry KTT is a complicated process that requires the engagement of both parties (Ankrah, Burgess, Grimshaw, & Shaw, 2013), where they learn from the interaction. Active participation of the recipients is crucial for KTT, and preliminary knowledge base about relevant parties and absorption capacity significantly affect the outcome of the interaction (Ternouth, Garner, Wood, & Forbes, 2012). While, the absorptive capacity of the organization is significantly related to the abilities and attitudes of the individuals, their interaction, and exchange of experience (Cohen, 2010).

The economically relevant knowledge can be grouped into four broad categories (Lundvall & Johnson, 1994; OECD 1996):

- know-what - the knowledge about facts. It can be typically written down in patents, researchers and KTT managers have to work together;
- know-why - scientific knowledge of principles and laws of motion in nature, in the human mind and society. They can be created at universities without business presence. The results of basic research are published in scientific papers;
- know-how - refers to skills. From the university knowledge-base can be transferred to researchers mobility, only those who can transfer it, who also applies, "learns it by doing";
- know-who - refers to specific and selective relationship.

Knowledge "know-what" and "know-why" are explicit knowledge and can be expressed in formal and systematic way. Other types of knowledge are "tacit knowledge" – particularly "know-how" and "know-who" (Lundvall & Johnson, 1994; OECD 1996). Tacit knowledge consists partly of technical skills – with highly context specific and has a personal quality, which makes it difficult to formalize and communicate (Nonaka, 1994). Hence, tacit knowledge is incommunicable, unarticulated or as Polanyi (1966, p. 4) stated: "we can know more than we can tell". Nonaka (1994) states that organization creates knowledge through the continuous dialogue and interactions between explicit knowledge and tacit knowledge, they are complementary. Four models of conversions are distinguished:

- socialization - transformation of new tacit knowledge through the exchange of experience;
- combination - transformation of explicit knowledge into more complex and systematic sets of explicit knowledge;
- externalization – converting tacit knowledge into explicit;
- internalization – converting of explicit knowledge into tacit knowledge by individuals. Is closely related to "learning by doing" (Nonaka, Toyama, & Konno, 2000).

Knowledge creation is a dynamic, interactive spiral process from the individual level to the organizational level and eventually between organizations. Knowledge is transferred

outside the organization, and knowledge from other organizations interacts to create new knowledge. For the KTT between university and firms, various types of connections can be established (formal, human or informal links), which may be expressed in the form of a license agreement after patent registration, license agreement, acquisition/sales or simple transfer. Lengyel (2005) makes description of university-industry knowledge transfer, that is presented in the Figure 1.1.

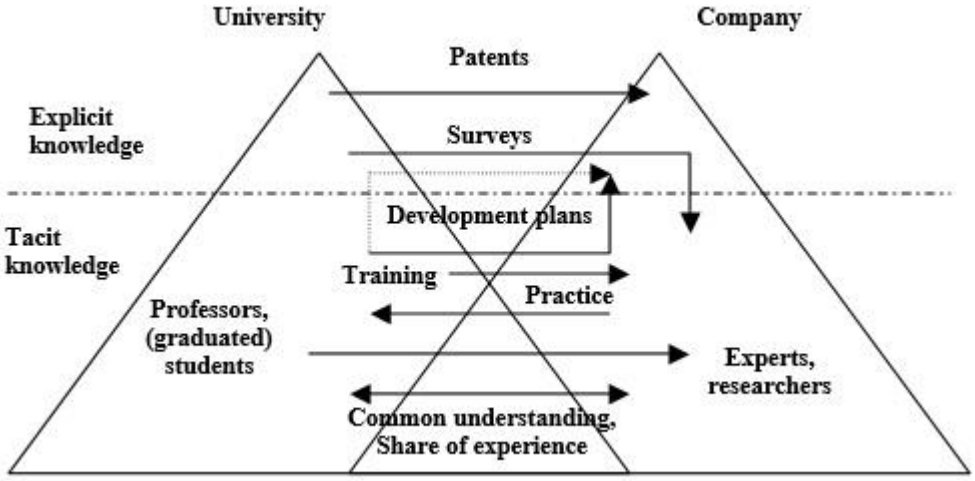

Figure 1.1 Knowledge transfer among university-industry knowledge bases.

Source: Adapted from Lengyel (2005: 306).

Patents expressed transfer of explicit knowledge between university and company (transfer of know-what). Universities' surveys, research results that include explicit knowledge elements have to be embedded into the firms' tacit knowledge base. Through development plans, consultancy universities tacit knowledge is transformed into the firms' explicit knowledge (know-why). Tacit knowledge should be divided into two types of elements: experienced knowledge can be transferred by personal mobility between the two spheres (professors, students, companies' experts – know-how), while common understanding needs an overlap of the university-industry socialized knowledge (know-who) (Lengyel, 2005).

The formal type of technology transfer provides access to codified scientific knowledge that firms can use to improve the quality of their inventions or realize efficiency gains for business R&D. While the informal mechanism of KTT provides access to tacit knowledge without the use of significant human or financial resources that may be

required to integrate scientific knowledge into a firm's research and development process (Grimpe & Hussinger, 2013).

4. The Triple Helix (TH) model

Nowadays, in the knowledge-based society, university, industry, and government play an important role and form the Triple Helix in stimulating innovation. The implementation of this model is the basis of a favorable innovation climate, since it contributes to the development of its components, and their combination promotes a synergistic effect, which increases the innovation activity.

4.1. The Triple Helix and the knowledge based economy

The knowledge based economy is the dominant paradigm of post-industrial economic development that emerged in the 1980s, recognizing the significant role of knowledge and technology in economic growth (OECD, 1996).

Ranga and Etzkowitz (2013) emphasize that the TH model interprets shift from the previous industry-government dyad in the industrial society to the growing triad relationship between university-industry-government (U-I-G) in the knowledge society, where university enhanced its role in the innovation process (Etzkowitz & Leydesdorff, 2000).

According to Sharabati-Shahin and Thiruchelvam (2013), U-I-G alliances attain a new level of prominence by creating new institutional (incubators, science parks and the venture capital firms) and social formats for the production, transfer, and application of knowledge (Ranga & Etzkowitz, 2013), which essentially is a driving force of economic development (Vaivode, 2015). U-I-G interaction aims to promote innovation and sustainable development in the knowledge-based society (Dzisah & Etzkowitz, 2008), creating a network of communications (Etzkowitz & Leydesdorff, 2000) and leads to improving each other’s performance, otherwise there’s no reason to create networks (Luna & Velasco, 2010).

Etzkowitz, Gulbrandsen and Levitt (2000) notice that the university can play the role of the company's founder through incubator, while the industry takes the role of educator through firms, the government is a venture capitalist in the framework of the Small Business Innovation Research (SBIR) and other programs.

In the knowledge-based economy, the university becomes a key player in the innovation system and becomes more important to industrial innovation (Marques, Caraça, & Diz, 2006), by the reasons:

- firstly, the recent expansion of traditional academic tasks (teaching and research) to the "third mission" - attracting the university to socio-economic development;
- secondly, the ability of the university to provide students with new ideas, skills and entrepreneurial talent, with the result that students can become entrepreneurs, promote economic growth, and create jobs. In addition, universities train people through entrepreneurship and incubation programs, training modules in science parks (Almeida, Mello, & Etzkowitz, 2012; Etzkowitz, 2008; Looy, Landoni, Callaert, Pottelsberghe, Sapsalis, & Debackere, 2011);
- thirdly, the ability of universities to create and formally transfer technologies, rather than relying solely on informal ties (Ranga & Etzkowitz, 2013).

Currently, most of the countries are trying to achieve some kind of TH model and stimulate U-I-G relationships in order to develop an innovative environment and gain competitive advantage through faster dissemination of knowledge (Etzkowitz, 2008). This can be achieved by creating an entrepreneurship environment, particularly: (1) establishing of spin-off companies from universities (Marques et al., 2006); (2) implementing trilateral initiatives such as science and technology parks and business incubators (Marques et al., 2006; Rubin, Aas, & Stead, 2007); (3) the formation of strategic alliances between firms (Tether, 2002); (4) creation of hybrid institutions with non-profit interface functions (Marques, 1998); and (5) signing R&D contracts with government laboratories and academic research groups (Benner & Sandström, 2000).

4.2. University – Industry - Government (U-I-G) configuration

The evolutionary Triple Helix model was developed by Etzkowitz and Leydesdorff (1995) to study the U-I-G relationships in the knowledge-based economy and from the very beginning it was implemented in two aspects: neo-institutional and neo-evolutionary.

A neo-institutional view (Etzkowitz, 2003, 2008; Etzkowitz & Leydesdorff, 2000) on the TH model acts as an operationalization of an innovation system (regional, national, etc.) by determining its main institutional actors: university, industry and government,

and exploring the various configurations of the positioning of these organizations relative to each other and their movement and reorientation, one being the gravitational center around which the others revolve (Ranga & Etzkowitz, 2013).

A triple helix relationship in this perspective between U-I-G means the evolution of institutional relations, starting with the socialist ("state-centric") or more liberal (laissez-faire) model (Figure 1. 2).

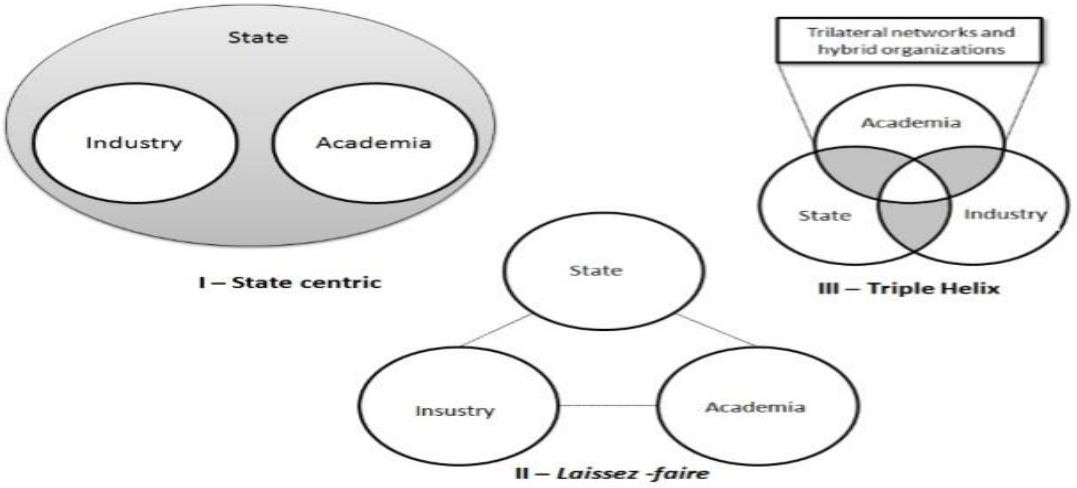

Figure 1.2 From "state-centric" to the laissez-faire and triple helix models.

Source: Etzkowitz, H. (2003: 302).

In the first configuration (I – State-centric) the policy and behavior of governments dominate (Marques, 2014b), which cover both industry and academia, as well as direct and structure their relationships. The knowledge sector has a secondary role (Marques, 2014b), the academy's role in teaching and research is far from the needs of industry, and the universities themselves have little or no incentive to participate in the commercialization of their research (Leydesdorff, 2013; Sarpong, Abdrazak, Alexander, & Meissner, 2017). According to Etzkowitz and Leydesdorff (2000), this model was implemented in the Soviet Union and the formerly Socialist countries of Eastern Europe.

The second model (II - Laissez faire) is characterized by a predominance of the economy/market (Marques, 2014b), with significant barriers in the U-I-G interaction and emphasizes the autonomous movement of each entity to a new global knowledge model (Etzkowitz, 2003; Etzkowitz & Leydesdorff, 2000; Leydesdorff, 2013). Zheng &

Harris (2007) emphasize that the role of government is limited to eliminating market failures, while universities participate in basic research and training.

The third, is the hybrid triple helix model (III – Triple Helix), which is a combination of the two previous models, facilitates the generation of a knowledge-based infrastructure overlying various institutional spheres where each takes on the role of the other (when the other is weak or under-performing) within the framework of emerging tripartite interface between hybrid organizations (Etzkowitz & Leydesdorff, 2000; Etzkowitz, 2003; Etzkowitz, 2017; Metcalfe, 2010).

Under this model, the university becomes a central actor, playing a significant role in promoting teaching, innovation and knowledge transfer, acquires entrepreneurial status, and creates opportunities to take risks and respond to challenges (Guerrero, Cunningham, & Urbano, 2015).

Etzkowitz (2016) argues that the entrepreneurial university paradoxically includes the growth of university autonomy, and the significant participation of external stakeholders (close relationship with industry and government). Consequently, governments encourage the academy to transfer knowledge to economic agents through the financing of national projects, financing the development of supporting infrastructure at the regional and state levels (Rossi & Rosli, 2015).

Along with the neo-institutional model of the U-I-G network relationships, there is the neo-evolutionary perspective that aimed at studying possible synergies between U-I-G, which are supposed to enhance development of the knowledge base in the national (or, regional) innovation system. However, in this model there is no overlap between the three helices (Leydesdorff, 2008, 2012; Leydesdorff & Meyer, 2006), but all functions are highly interdependent. According to Leydesdorff (2011), when two of the helices form bilateral relations, the third helix acts as a selection environment through having mutual relations with each of the first two, but not with their interaction. When such electoral environments are combined at the system level, they form a synergetic mechanism that ensures the systemic nature of the economic and innovation system and its ability to self-organize.

Any interpretations of the TH model can differ slightly from each other, but still form the model (Leydesdorff & Zawdie, 2010).

4.3. Implications of U-I-G

The introduction of the TH model leads to the elimination of duplication of R&D costs, investments, and transaction costs (Safiullin, Fatkhiev, & Grigorian, 2014), and at the same time, efficient allocation of resources is provided. Industry gains access to innovative ideas and academic laboratories, in turn, academics can commercialize these ideas. The synergy resulting from networking among members contributes more to the economy in the form of innovation than the contribution of independent units.

Under the TH model the university, in addition to the role of learning and creating new knowledge, acquires an entrepreneurial role and a high level of autonomy, which allows defending own strategic direction and interact with various institutional areas in equal positions in order to develop joint projects for economic and social development, especially at the regional level (Marques 2014b, 2016b; Looy et al., 2011). These changes led to the possibility of practical application of university discoveries through the formal transfer of research and development results to society. In addition, universities, through the use of their research and teaching abilities, have come to create new enterprises (Marques, 2016b).

The implementation of TH model leads to a change in the innovation cycle configuration. Thus, the process of innovation can be presented in the form of a sequence that does not need to correspond with product life cycle theory. The model takes into account the possibility of the impact of expectations that leaves free space for chance and uncertainty. A successful innovation changes the opportunity structure for the institutional actors involved, that in turn are expected to change the dynamics (Etzkowitz & Leydesdorff, 2000).

With this model an analytically the drivers are no longer conceptualized as ex ante causes, but viewed in expectations that can be evaluated only ex post. From the evolutionary perspective, selection (ex post) is structure determined, while variation may be random (Leydesdorff & Besselaar, 1997). A qualified consumer can directly influence the firm's innovation strategy and on the rejection of the implemented innovation, current product lines or software.

As Etzkowitz and Leydesdorff (2000) state the Triple Helix is not the ready-made, standardized innovation model for all states, but each country will form their own TH model with a unique transformation. For the government that undertakes the measures

on the TH model implementation is much more easily to achieve large-scale innovation projects, to protect university interest in entrepreneurship through policies, to form consensus in regional innovation, artificially foster university-industry links by government authority. From the other hand, academia and industry possibly can lost their flexibility to deal with problems in the innovation process and government need to "pull" university and industry forward (Markov, Bagautdinova, & Yashin, 2013).

Finally, TH emphasizes the importance of wider dissemination of knowledge, hence, provides the most feasible generation and dissemination of innovation into the wider sections of society via rapid commercialization, while society becomes much more conscious of the importance of science and technology.

5. Business Incubators (BIs): definition, genesis and evolution of the concept

The global monitoring of entrepreneurship (GEM, 2010) emphasizes that a country's prosperity greatly depends on the development of the entrepreneurial sector. In this case, Business Incubators were created worldwide as a special environment for enterprise growth and, in fact, are examples of Triple Helix, part of a global knowledge and technology management model for regional and national development (Etzkowitz, 2002).

Business incubation, as an example of Triple Helix, is part of a global knowledge and technology management model for regional and national development (Etzkowitz, 2002). BI is an important KTT mechanism (Marques et al., 2006) that dynamizes Unoversity-Industry (U-I) cooperation and promotes science, technology, innovation, entrepreneurship and accelerates the process of technology commercialization (Mansano & Pereira, 2016; Wonglimpiyarat, 2016).

According to the American National Business Incubation Association (NBIA, 2010, p.1) business incubation is "a unique and highly flexible combination of business development processes, infrastructure and people designed to nurture new and small businesses by supporting them through the early stages of development and change". Bruneel, Ratinho, Clarysse and Groen (2012) indicate that, since the first BI was created in 1959 in New York (USA), this concept is gaining popularity in the 1980s and then is

spreading around the world in different forms (technology, business, and innovation centers). The evolution of the concept is represented in Figure 1.3:

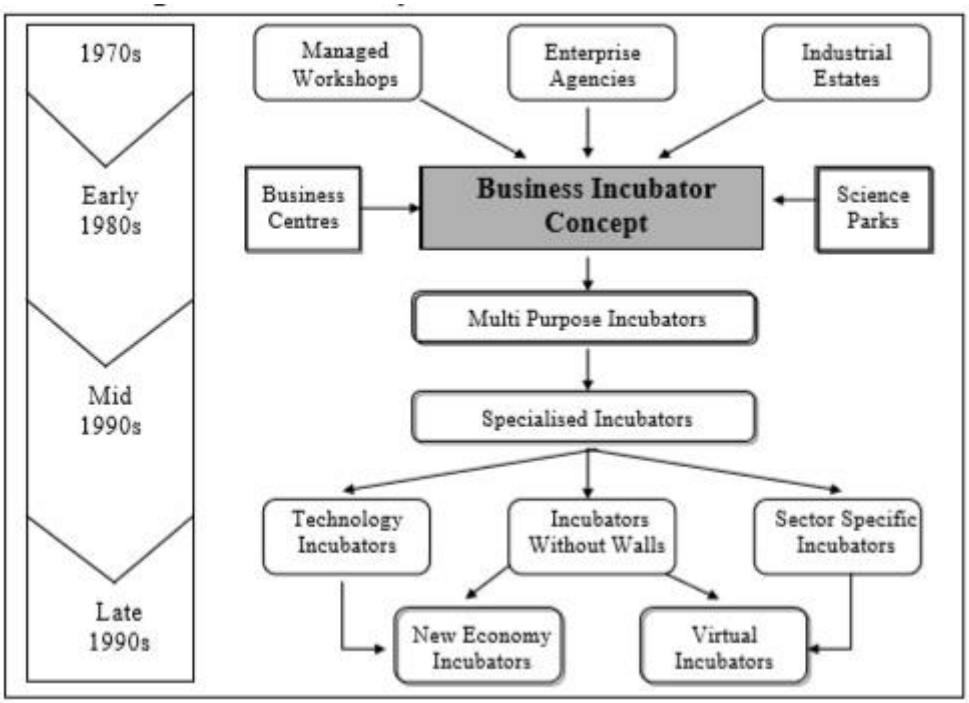

Figure 1. 3 The evolution of the BI concept.

Source: CSES (2002: 3)

Tola and Contini (2015) note that first BIs generation sought to create a favorable micro-environment for new firms by providing physical space, shared resources, and some financial support at an early stage. Theodorakopoulos, Kakabadse and McGowan (2014) stressed that the second generation is shifting emphasis from tangible to more intangible services with high added value, such as: product development support, market opportunity assessment, access to knowledge intensive service, business expertise and networking of entrepreneurs and providing financing for entrepreneurship (Pauwels, Clarysse, Wright, & Hove, 2016). The latest generation (from 2000), provides training and mentorship services for tenants in a time-limited program (Cohen & Hochberg, 2014), helps build networks with business angels, venture capitalists and other for fundraising initiatives (Pauwels et al., 2016).

The first incubator in Portugal (AITEC) was created in 1987, in association with Institute of Systems and Computer Engineering (INESC) with the aim to provide a support network for the establishment of new firms. Nowadays in Portugal exists the

National Network of Incubators (RNI) which includes 121 active incubators in mainland Portugal and islands, integrating science-based incubators, linked to universities, as well as others linked to local authorities and business associations. Generally, most incubators in Portugal do not present a sectoral focus and are mainly marked by a predominantly urban and local geographical scope.

5.1. Objectives of BIs, archetypes, actors involved

One of the main goal of BI is to establish successful enterprises that create jobs, commercialize new technologies, develop entrepreneurial spirit (Bose & Kiran, 2014; Wonglimpiyarat, 2016), are financially viable and are able to make significant contribution to the development of local and national economies after the end of the incubator program (Marques et al., 2010). To achieve this, BIs provide space for entrepreneurial activity and other basic services, stimulate internal networks and knowledge sharing between tenants (Bollingtoft, 2012; Kitagawa & Robertson 2012; Pettersen, Aarstad, Høvig, & Tobiassen, 2015; Sá & Lee 2012).

There is a wide variety of incubator classifications (Barbero, Casillas, Wright, & Garcia, 2014), however, in our opinion, the archetypes are most fully represented by Carayannis and Zedtwitz (2005):

1. Regional BIs - are managed by municipal government (Nowak & Grantham, 2000), aiming to support local commerce and wealth, job creating in a specific geographical area;
2. University business incubators (UBIs) – set up by the university (Wonglimpiyarat, 2016), are focused on promoting university entrepreneurship and supporting newly established technology enterprises (Cooper, Hamel, & Connaughton, 2012). Such incubators prefer to accept student entrepreneurs from their host university (Carayannis & Zedtwitz, 2005);
3. Independent commercial incubators - are profit-oriented, help entrepreneurs to start their own business in specific industry or focuse on specific technology. Barbero et al. (2014) note that such incubators are characterized by the developer's personal investments and their subsequent participation in the management of the company after the start;
4. Corporate BIs are established by big organizations, act in the interests of their parent corporation and have access to its network and knowledge;

5. Virtual incubators - are focused on providing business expertise and facilitate access to strategic partnerships with outside enterprises without providing physical infrastructure (Theodorakopoulos et al., 2014).

All types differ in competitive focus: industry, geography, segment; and in their strategic goal of supporting new entrepreneurs (non-profit or for-profit). Most incubators can combine two or more types. According to Carayannis and Zedtwitz (2005) the combination of a traditional and virtual BIs allows entrepreneurs to make rational use of the services provided, and for the incubator to earn extra income and improve reputation in the community.

Regardless of the type of incubator, the following participants can be:

- universities and research institutions that can offer services, access to intellectual capital and new technologies;
- other public and private business enterprises that provide accounting, marketing, consulting service for tenants;
- government agencies, that through research grants, funds, subsidies, tax incentives and indirect loan, support both long-term and research projects, as well as less favorable areas or regions with less venture capital;
- financial structures - business angels (BAs), banks and venture capitalists are focused on providing seed capital and investments at an early stage. Venture capital is an important tool for economic development, key element of the innovation infrastructure (Powell, Koput, Bowie, & Smith-Doerr, 2002). BAs are informal, high-risk capital providers, implement the project on mentoring and fill the gap in private investment. In Portugal well known are The Portuguese Business Angels Association (APBA) and Biocant Ventures;
- tenants: companies, such as university spin-offs, other firm spin-off, start-ups. According to Soetanto and Jack (2016), a spin-off includes new firms founded by university staff/recent graduates that apply results from their research or advanced knowledge obtained at the university. They are more focused on the technical aspects of innovation, however have gaps in finance and management competence (Diez-Vial & Fernández-Olmos, 2017);
- mentors that are able to provide tenants with additional networks and business expertise in area of operations, markets, and expansion.

5.2. Incubation process

The incubation of new enterprises is a highly flexible process. According to Bose & Kiran (2014), incubation process can be divided into three phases (Figura 1.4): pre-incubation, incubation and graduation.

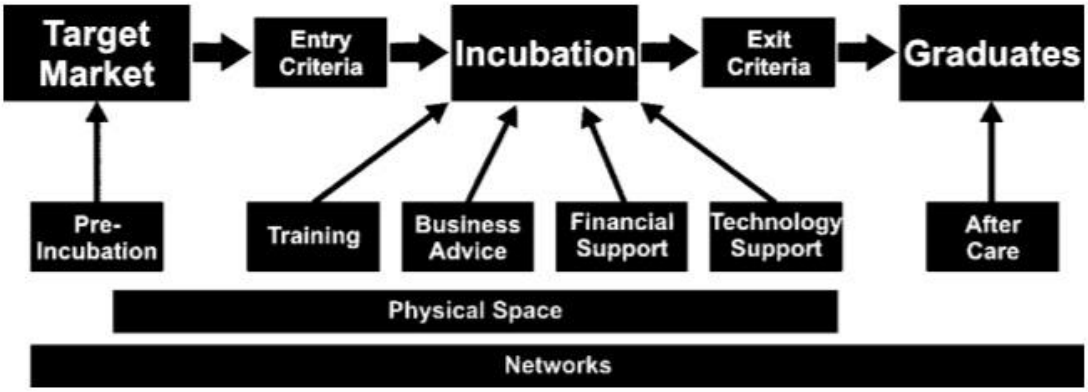

Figura 1.4 The Business Incubation Process.

Source: Bose and Kiran (2014: 67).

Pre-incubation is a preparatory stage, when a potential tenant must create a business plan with a clear mission, determines the potential market, field of activity and make technological, financial, marketing forecasts. Potential entrepreneurs can be selected by assessing their sales profits and growth potential, political and social constraints, and revil analysis (Aerts, Matthyssens, & Vandenbempt, 2007). The wrong screening can lead to failure of cooperation. This stage cannot last more than one year (Marques, 2010), after which the transition to a physical or virtual incubator takes place, or the company leaves, depending on the evaluation of the management of the incubator.

The second phase is the incubation itself. The entrepreneur becomes a tenant and is provided with incubator facilities.

In the third stage, the company successfully completes the business incubation program and achieves financial sustainability. This stage aims to support the installation of a young company outside the incubator, rather than relocate the business (Bruneel et al., 2012), so the incubator has to ensure graduation within a 3-year period (Rothaermel & Thursby, 2005b). While, Schwartz (2009) find that graduation has a negative effect on the survival of a firm in the post-incubation period. However, Marques (2010) notes that

sometimes companies can stay in the incubator for a longer time as this can help the company maintain income and provide a better image.

5.3. The services provided by BI

Business incubators can make it easier for an entrepreneur to create a new business by providing a variety of services, such as:

1. Infrustructure: office space, meeting rooms, furniture, electricity, phone, internet, 24-h security, office support, etc. Some sector industry incubators can offer laboratories and specific equipment, or provide links with hoste university, national laboratories or research centers (Marques, 2010);
2. Business service: providing professional services such as obtaining licenses, strategy advice, market research, accounting, legal advice for incorporation and taxation issues, and human resource management. BIs help for developing of leadership and management skills through providing valuable coaching and training support (Bruneel et al., 2012);
3. Access to financial resources: in most cases, capital is a critical issue for new enterprises. Some incubators may use their own seed fund to invest in their tenants or may serve as a link between their tenants and potential sources of finance (government grant schemes, banks, venture capitalists or business angels). Hence, the type of financing may vary from seed grants, to credit and equity. Taking in account that venture capital firms often are risk averse, bet in investments at a later stage, incubators can help companies prepare their business plans before asking investors to finance them for the initial phase. Besides, Marques (2010) notes that incubators can also play a role of advisors to investors or participate in the capital of the closed companies, which will generate future gains as these companies grow;
4. Access to institutionalized networks that facilitate access to potential customers, suppliers, technology partners and investors. Aerts et al. (2007) emphase that network access is a crucial success factor for start-ups and network support reinforces the relationship between innovation strategy of company and its performance (Soetanto & Jack, 2016).

The set of services depends on the incubator focusing and necessities of the tenants.

5.4. Types of links between universities and tenants, internal relationship between firms in BI

There are various channels through which academic researchers interact with industry, such as: formal, informal and human resources links. Lee and Kim (2016) emphasize the importance of having such linkages between firms, while Díez-Vial and Montoro-Sánchez (2016) argue that it is easier for firms to interact face to face and use informal relations, which provides a basis for further development of official agreements.

Firms in BI can establish following formal relationships (Marques et al., 2010):

- joint (collaborative) research projects - collaboration agreements between enterprises and scientific institutions, which involve research work undertaken by both parties or on the basis of a consortium (Debackere & Veugelers, 2005);
- R&D contracts - research commissioned by industry and conducted only by university researchers (D'Este & Patel, 2007);
- consultations with university staff for industry that do not assume original research (D'Este & Patel, 2007), but involve a contract or spin-offs and are carried out on a predetermined basis to support the development of a specific project in accordance with the needs of companies;
- analysis and testing in university departments.

Ahuja (2000) argues that such cooperational links which involve regular meetings with the academia, are focus on specific issues, use close contact and coordination, normaly are based on contractual relationships with a legal contract (Grimpe & Hussinger, 2013). The main forms of KTT arising from such links of cooperation are licensing, license agreement after the registration of patents and acquisition of technologies developed in universities (Czarnitzki, Hussinger, & Schneider, 2012; Jensen & Thursby, 2001; Minguillo & Thelwall, 2011; Thursby & Kemp, 2002). However, D'Este and Patel (2007) argue, that patenting and licensing constitute a small part of interactions between public and private institutions compared to other formal forms, such as joint research and R&D contracts. While, Salavisa, Sousa and Fontes (2012) note that the results of biotechnology firms are more often expressed in patents.

Moreover, many of these formal relationships are accompanied and complemented by informal links (Grimpe & Hussinger, 2013; Siegel, Waldman, & Link 2003; Perkmann & Walsh, 2007), such as: personal contact with university staff, attending seminars and

conferences, access to specialized literature, university equipment and research department, which also allows to exchanged knowledge (Bakouros, Mardas & Varsakelis, 2002; Diez-Vial & Montoro-Sánchez, 2016; Marques et al., 2010; Grimpe & Fier 2009); and human resources that are associated with improvement, training, recruitment or allocation of qualified human capital (Vedovello, 1997). Grimpe & Hussinger (2013) argue that these informal relationships and human links are ways of knowledge exchange between enterprises and researchers, which are more tacit, but are extremely important. In addition, close interaction of staff from the university, and the firm can improve an absorptive capacity of the enterprise by acquiring talented researchers from academia, which leads to better exploitation of scientific research and reduction of time delays between the acquisition of knowledge and inventions. Freitas, Geuna and Rossi (2013) indicate that personal contractual agreements between firms and individual academics account at least 50% of university-industry cooperation.

Moreover, Bakouros et al. (2002) emphasize, that cooperation links among firms such as joint research of tenants, sharing of equipment, commercial transaction, social interaction can be significant for the innovative activity. Besides it, such firms can be a source of technological knowledge that can improve local innovation capacity (Diez-Vial & Montoro-Sánchez, 2016).

5.5. Advantages and disadvantages of BIs

There are a lot of authors such as Marques (2010), Lalkaka (2001, 2006), Wiggins and Gibson (2003) who highlighte the following benefits of business incubators:

- for companies based on BI: opportunities to increase the chances of success in the market; enhancement of authority and image of the company; improvement of scientific and technical knowledge; ensuring interaction between organizations, and the exchange of sources; facilitating access to investors and capital, government programs; providing access to the network;
- for universities / research institutions: strengthening the interaction between the university-research industry; promoting the commercialization of research results obtained at universities and transferring to the university laboratories the knowledge and know-how obtained by university staff / students involved in incubator projects (Rothschild & Darr, 2005); facilitating the incubation of

academic spin-offs; providing opportunities for graduates to use their entrepreneurial skills and implement their training in practice;

- for local, regional and central government: overcoming market constraints on the creation of new firms; promoting employment and subsequent income for the community, which will contribute to regional economic development; increase the taxpayer base for the state;
- for the local community: promoting entrepreneurial culture; creating local income as most companies are located in the regional area.

Despite the advantages Lalkaka (2001, 2006) presented some concerns of BIs:

- focusing on a selected group of potential "winners";
- dependence on government support, in cases of policies, structures, and funding;
- limited opportunities due to cooperation with a few companies;
- contribution to the creation of new jobs in the short term;
- are expensive in providing expert support or workspaces;
- are skills - intensive projects, requiring experienced management teams;
- can double the potential market opportunities;
- create dependence, protecting entrepreneurs from the real market situations;
- require a good business infrastructure in a good location;
- require external grants for the period of gaining financial independence.

Marques (2010) notes that careful planning of the incubator and its activities, quick implementation, support and strong leadership can help avoid most of the problems.

5.6. Recent studies review focusing on U-I-G interactions in context of BI in Portugal and other countries

With the emergence of the incubation phenomenon in the 1980s, the study of its contribution to economic growth, job, and wealth creation started (Phan, Siegel, & Wright, 2005). Sá and Lee (2012) state that the crucial feature of incubators, that is also the key factor of its success (Ratinho & Henriques, 2010), is providing to tenants collaborative relationships with other organizations, in particular, ties with university, as

such collaboration plays crucial role in technology transfer and the marketing of knowledge (Feliu & Rodríguez, 2017).

Many studies have been carried out on business incubators, among them are: Bruneel et al. (2012); Colombo and Delmastro (2002); Etzkowitz, Mello and Almeida (2005); Mian (1996); Mian, Lamine and Fayolle (2016); Phan et al. (2005); Salvador (2010); Smith and Zhang (2012); Sofouli and Vonortas (2007). These studies describe various aspects of the development of incubators, and TBIs, in particular, in different countries; their different objectives; types of services support provided evolved over time; impact on the growth performance of new firms. As for the studies of U-I interaction links, can be highlighted the works of Bakouros et al. (2002); Berbegal-Mirabent, García and Ribeiro-Soriano (2015); Bollingtoft (2012); D'Este and Patel (2007); Diez-Vial and Montoro-Sánchez (2016); Marques et al. (2010); Phillimore (1999); Ratinho and Henriques (2010); Rothaermel and Thursby (2005a, 2005b); Rubin et al. (2015); Schwartz and Hornych (2010); Vedovello (1997); Wonglimpiyarat (2016); Franco and Haase (2015); Link, Siegel and Bozeman (2007) among many others. But, most of them are focused on U-I interaction in contexts of Science and Technology (S&T) Parks, Universities, firms and BIs, UBI, Technology Transfer Offices (TTO), others analyze researchers' motivations (Franco & Haase, 2015) and engaging. While there are only few studies that analyze incubators as an important innovative actor that will promote the development of U-I-G cooperation links.

As for Portugal, we know such authors like Marques et al. (2010), Ratinho and Henriques (2010), who made previous effort to focus on U-I interactions exclusively in BIs context. For ourselves, we identified as a fundamental - Marques et al. (2010) empirical study that is focused on the U-I cooperation, with the reference on portugues BIs as an effective KTT mechanism. Considering the size of the incubation firm, its economic sector, R&D activity and origin, the authors explored establishing of links with the promoting university, their types, and intensity, as well as the advantages, consequences and results for firms and universities. The results showed a predominance of human resources and an informal type of KTT with their inherent medium and high intensity, while the formal connections are of low density (especially in R&D activity). The authors came to the conclusion that the university contributes to the development of companies' activities more through the provision of information than with the creation of market-ready innovations as the basic form of KTT was a simple transfer that is

associated with informal contacts. Later, Rubin et al. (2015) confirm those conclusions. While, Stal, Andreassi and Fujinoc (2016) in their study about UBI find that is making more effort to promote and support the creation of technology-based companies than in universities research results transfer through spin-off companies.

Numerous extensive studies have shown that geographical proximity between firms and universities is critical enough for the development of informal networks (Phillimore, 1999; Vedovello, 1997) which, in the long run, improve the firm's innovative capabilities (Colombo & Delmastro, 2002; Diez-Vial & Montoro-Sánchez 2016; Phillimore, 1999; Vedovello, 1997), underlie further more formal interaction (D'Este & Patel, 2007) and help to improve their quality (Link et al., 2007). In later studies, D'Este, Guy and Iammarino (2013) stated that geographic proximity plays crucial role in establishing U-I relationship, and Maietta (2015) stresses that geographic proximity to a university plays a crucial role in innovative products of the company.

Later, Ratinho and Henriques (2010) found that the Portuguese BI model is more similar to the traditionally linear innovation (Phillimore, 1999), and its contribution in the context of Portugal in job creation and economic growth is weak and has little effect on the creation of a company.

Previously, Rothaermel and Thursby (2005a) in their study focused on U-I collaborations based on a technological incubator, which was supposed to facilitate the knowledge and technology transfer from academia to incubator tenants and how this affects technology ventures performan. Rothaermel and Thursby (2005b), in their next study, examined the U-I relationships, with an emphasis on collaboration between incubator firms and sponsoring university, and how this collaboration affects on the reduction in the probability of a new firm failing and, at the same time, can retard the firm graduation from incubator. Sofouli and Vonortas (2007) discover that business incubators in Greece have a strong working relationship with a research-intensive university.

Schwartz and Hornych (2010) in their investigation in Germany about U-I cooperation links and inter-firm tenants networking do not find confirmation about more promoting role of specialized incubator on etablishing such ties in comparing with traditional (diversified) incubator, however in this cooperation informal relationships dominate. Moreover, there was no true evidence of the increased effectiveness of establishing

links among tenants at the expense of a specialized incubator (Schwartz & Hornych, 2008), and basically such internal links are also mostly informal.

Numerous studies (Bollingtoft, 2012; Colombo & Delmastro, 2002; Diez-Vial & Montoro-Sánchez, 2016; Phillimore, 1999) also highlight the important role incubators play in developing networks among tenant firms, since this synergy plays a significant role in promoting innovation incubators. However, Bakouros et al. (2002) found a low level of local interactions between firms in parks, while Cooper et al. (2012) in their research based on UBI emphasized that cooperation content was characterized by business or social interaction.

Thus, the data obtained from the above studies, the study of the determining factors in the U-I collaboration increases interest in knowing how this interaction takes place in a young HIESE business incubator in Penela region in Portugal.

6. Agricultural industry in Portugal

6.1. Agriculture economy of Portugal: evolution and performance

In the early 1980s, the agricultural sector stagnated and did not satisfy either the national food needs or the wages of the active population of the segment. With the accession of Portugal to the European Community (EC) in 1986, the Common Agricultural Policy (CAP) was applied, which resulted in: changes in the prices of agricultural products, which affected the competitiveness of them; creating an enabling environment for technological, structural and institutional changes in sector. In addition, Portugal gained access to the funds of the European Union (EU), as well as national operational programs in support of agriculture and rural development, funded jointly by European funds. Next stages of sector evolution can be defined (Avilles, 2014):

- First stage (1986 - 1992), that is characterized by the alignment of the Portuguese agricultural policy with the prices and markets of the EC; 700 million euros of financial support within the Program for the development of Portugues Agriculture (PEDAP); Portugal integration into the Common Market and the European Monetary System;
- Second stage - reflects the changes within reform of 1992 and the Commission's Agenda 2000. Is characterized by the shift from support of the product market price to producer support, introducing of payments for hectare of cultivated area

and animals' heads; structural and environmental support under the Support Program for Agricultural and Forest Modernization (PAMAF) 1994-1999 and Rural Development Program of Continental Portugal (RURIS) 2000-2006;

- Third stage is characterized by the reform of 2003 with that represents the shift to income support by the introduction of a single payment scheme not linked to production of any particular product; structural and environmental support under Rural Development Program (PRODER) 2007-2013.

The CAP program for the period 2014 - 2020 is going to support Portugal's farming sector and rural areas with investments nearly EUR 8 billion (job creation and growth, modernization and innovation). The rules of "greening" is applied, when 30% of the direct payment envelope paid per hectare is associated with diversification of crops, conservation of permanent pastures and/or conservation of areas of ecological interest. Basic Payment Scheme (BPS) continues to be in force. There will also be more stringent control over active farmers who are entitled to direct payments and a new 25% support for young farmers in the first 5 years in addition to existing grants. The new rural development program aims to reduce the deficit in the Portuguese agricultural trade balance by increasing production and exports (European Commission, 2016).

Portugal has total area of 91 605 km², that comprises mainland and the islands of the Azores and Madeira. The territory is diverse, in which agriculture area occupies 40.4% and forest covers 34.8% of its total area (FAO, 2015). Rural population of country consists 35.9 % (FAO, 2017) from total population of 10.6 million, total employment in agriculture 10.5% (European Commission, 2016). Portuguese agriculture and its production (Annex I) are very diverse due to the different soil, climate and landscape. The distinctive characteristics of the Portuguese agricultural sector are:

- contribution to the Portuguese economy with 2.3% of the total GVA and 6.9% of employment while industry;
- 72.3% of the farms are considered as small-scale structures that have less than 5 hectares;
- the legal form of farms operators are mainly individual producers (95.0%) and only 11.4 thousand are companies (4.4% of the total). However, the big holdings (100 or more hectares of utilized agricultural areas (UAA)) that consists 39.9% of all companies. In comparing with 2009 the number of companies has increased by 68.2% (INE, 2017g);

- the aging of farms owners, whose average age has increased from 63 in 2009 to 65 in 2016. Young farmers represent only 2.5% of Portuguese farmers are under 35 years old (INE, 2017g).

The evolution of the agricultural sector in Portugal in statistical indicators reflects a negative trend. Agricultural holding area used in Portugal in 2016 is 3.64 million hectares (which decreased by 9% compared with 1989), where 51.5 % are occupied by permanent grasslands, 28.6% are used for arable lands and 19.4% - for permanent crops (INE, 2016). In 2016 Portugal has 258 agricultural holdings, which reflects a steady decline over the past 27 years by 50% (INE, 2017g). Sheep occupy the largest amount in livestock production (36.5%), followed by pigs (31.1%), cattle (26%) and goats (6.5%) (INE, 2017g). The households that receive income exclusively from farm activity represent only 6.1% (INE, 2017g).

Alberto and Almeida (2011) noted the ineffectiveness of the CAP Portugal in the case of solving the problem of outflow of population from rural areas as the farming sector does not provide sufficient income to provide good standards of living. In addition, Portugal has become more dependent on food imports, and exports are limited by the winemaking and gardening.

6.2. Characteristic of Penela agriculture sector

Penela is located in Coimbra district and has an area of 134.8 km^2. Statistically, Penela is located in the Central Region (NUT II), in the in the North Pinhal subregion (NUT III). The municipality of Penela is part of the Terras de Sicó. The geographic setting of the municipality is characterized by heterogeneity of relief. The most significant heights are in the eastern part of the region, in predominantly shale rocks that make up Serra do Espinha, mainly consisting of forest with a production function. To the west of the Dueça river, due to the calcareous nature of the soils and the Mediterranean climate, flora is characterized by portuguese oak (Quercus faginea), cork oak (Quercus suber), medronheiro (Arbustus unedo) and odoriferous plants. Among species cultivated by humans the pine tree and the eucalyptus are represented, that are associated to areas of poor sandy or clayey soil.

Penela is well known for the production of high-quality products such as Rabaçal cheese, olive oil, honey Serra da Lousã, nuts and wine (Vinho Terras de Sicó).

Recognition of their quality allowed to use the Protected Designation of Origin (PDO) or the Protected Geographical Indication (PGI).

91% of territory of Penela area is occupied with rural lands. In 2009, Penela UAA were 1 131 hectares and wooded area – 821 hectares (INE, 2016). As of 2009, Penela's permanent crop area was 707 hectares, 76% of which are occupied with olive plantations and 22% with vineyards (INE, 2009b). In comparing with 1999 quantity of olive farms decreased by 20% and vineyards by 36% (INE, 2009a). For the same period area of temporary crops consisted 334 hectares, mainly represented by fodder plants, temporary grasses and grazing, cereals (INE, 2009c).

Among 602 individual producers of agricultural products more than half have 65 or more years. The production of olives in 2017 consisted about 770 tons, but 2016/2012/2010 showed only 240-260 tons (INE, 2017c). Wine production, claimed by PGI in grapes in 2017, amounts to 1128 thectoliters (almost 11% of Coimbra region production), of which 70% is occupied by red/rose wine (INE, 2017f). The production of wine without certification was in amount of 690 thousand of hectolitres, which is typical for the last 10 years. In the period of 1999-2009, in Penela observed a significant (more than 50%) decrease in the number of sheep and goat farms (197 sheep and 174 goat farms respectively). A similar trend was observed with the total number of goat livestock - there was 790 heads, which is 33% less than in 1999. The number of sheep is 2479, which respectively decreased by 15% (INE, 2017e). The decline in milk production in the Central Region is observed in subsequent periods until 2016. In comparison with 2009, the production of sheep's milk decreased by 19% and goat's by 16% (INE, 2017b). The lack of goat's milk has a direct impact on the production Rabaçal's certified cheese in Penela.

In Penela as well as throughout Portugal, the issue of fires is very acute, it was possible to achieve significant improvements, so only 9 hectares of burnt area were registered in comparison with 1911 hectares in 2012 (INE, 2017a).

CHAPTER 2. OBJECTIVES AND METHODOLOGY

1. Objectives

This study focuses on HIESE Incubator as an infrastructure that fosters the creation of conditions for new enterprises, and strengthens the links between universities, industry and government, promotes the development of relationship between firms in the incubator. Thus, it is necessary to answer a number of research questions, which are:

- What are the main motivations of companies to be based on HIESE incubator?
- What are the characteristics of each entity located at HIESE?
- What are the cooperation links established between the enterprises located at the HIESE and University (types, intensity)?
- How is the knowledge/technology resulting from the cooperation made? What are the final results, benefits and effects?
- Are there cooperation links among tenants of the HIESE Incubator? What types?
- What is the relationship between the local authority and HIESE Incubator?
- How does the HIESE contribute to the development of agriculture and biotechnology in Coimbra district, Penela?

This work intends to indicate how cooperation between the U-I-G can contribute to a better implementation of innovative activity, for the benefit of society, the economy, and the progress of science and technology.

2. Methodology

Case study research is considered a powerful empirical research method that often produces unanticipated insights, and our case can be categorized as exploratory since our research questions are to gain insights in the evolution of the value proposition of BIs (Yin, 2009). We conducted in-depth case studies of the supply side of incubation using the HIESE incubator located in Portugal, and its U-I collaboration links. In this case, the methodology of qualitative research was preferred given the need for a deep understanding and local contextualization of the topic (Miles & Huberman, 1994).

Based on a review of the specialized literature of U-I cooperation and BI, namely Marques et al. (2010), for our research set of taxonomies were developed: taxonomy of U-I cooperation links, taxonomy of general characteristics HIESE Incubator, taxonomy

of general characteristics of companies (Annex II, III, IV); through the use of which we identify existing links of cooperation and analyze the relevance of the general characteristics of the company and incubator in the determination, or not, of U-I cooperation links.

The data for this case study were collected through interviews (Annex V, VI, VII) with the management of HIESE, firms based on the Penela business incubator and the local government (Municipality of Penela). The survey was conducted according to three types of previously elaborated "Interview scripts", based on Marques et al. (2010) and on the Benchmarking report of the European Commission (CSES, 2002). These "Interview scripts" include open and closed questions, nominal and numerical scales**.**

The first script of interview was addressed to the director of HIESE business incubator and concentrated on the following: 1) identification of the incubator and its characteristics; 2) management and financing 3) services and activities provided to firms; 4) evaluation of U-I cooperation links.

The firms' script is focused on the: 1) general identification of the firm; 2) firms' characteristics; 3) U-I cooperation; 4) assessing the localization in the HIESE incubator and the relationship with university; 5) relationship with other tenants.

The third script is used with the aim of finding out, strategies and policies of Municipality of Penela.

The scripts of interview with the director of HIESE and firms have taken into account the above three types taxonomy. All interviews were typically between 60 and 90 min.

At the same time, we use a set of information provided by articles on the subject of cooperation in specialized magazines and books, and articles of the non-specialized press, information prospectuses.

Field work was carried out in the period from April to June 2018. In April was conducted interview with the director of HIESE, during May –June ten companies were interviewed, while three companies refused to participate in the survey. Also, in June, a representative of local authorities answered to our questions.

In the final phase, the qualitative analysis was taking place, based on the application of classical methods of research on the type of data, namely: content and taxonomic analysis. Based on the analysis conclusions were made.

CHAPTER 3. CASE STUDY: PENELA BUSINESS INCUBATOR AND U-I-G INTERACTION

1. HIESE Incubator: context and characterization

The HIESE - Habitat for Business Innovation in Strategic Sectors of Penela was built in 2016. HIESE is an innovation space, incubator that hosts "Smart Rural Smart HIESE", the structuring project of entrepreneurship and rural innovation ecosystem of the Center Region which appeared as a result of partnership between the municipality of Penela, the Pedro Nunes Institute (IPN), the University of Coimbra (UC) and Polytechnic Institute of Coimbra (IPC). HIESE offers facilities and services to support enterprises, especially in the early stages of their life cycle, enhances their potential for innovation, growth, and competitiveness. The incubator is also a part of Smart Rural Living Lab (SRLL), which is part of Living Labs European network (ENoLL, 2018). SRLL aims to become a pilot project involving numerous interested parties operating in rural areas, working together with citizens and institutions, to develop and provide better services in specific conditions, such as low population density and rural communities.

1.1. Creators of HIESE

1.1.1. Local authority – Municipality of Penela

Municipality of Penela is located in Coimbra district and is divided into 4 civil parishes: the Union of Parishes of São Miguel, Santa Eufémia and Rabaçal, and the Parishes of Espinhal, Podentes and Cumeeira. In administrative and statistical terms, the Municipality of Penela is located in the Center Region (NUT II), in the Northern Pinhal Sub-Region (NUT III). The area is about 134.8 km^2 and resident population is 5556 (INE, 2017d) inhabitants, 59% of which are in active age (between 15 and 64 years). The territory is mainly with rural assignment, and business activity is concentrated in the two existing industrial zones - Industrial Zone of Penela and of Louriceira, that represent sectors of civil construction, metal-mechanics, textiles and confections, forest exploration and wood processing, hospital medical and agro-alimentary consumables.

The main vectors for Penela development are innovation and entrepreneurship. In 2006 Municipality of Penela adopted the Strategic Program of Innovation, Competitiveness and Entrepreneurship (PD-ICE), which became the basis for the subsequent strategy

"Smart rural". In addition, the local government has taken initiatives such as HIESE, smARTES, Minihabitat, FabLab to support this vector of development.

1.1.2. The Pedro Nunes Institute (IPN)

The Pedro Nunes Institute (IPN) – association for Innovation and Development in Science and Technology was created in 1991 by initiative of the University of Coimbra. It is a private non-profit organization, that aims to promote innovation and technology transfer, creating of cooperation links between the scientific and technological environment and the business sectors. This linkage is essentially made through R&D carried out with companies, identifying and solving technological problems leading to innovation; providing consultancy, training and other specialized services; promoting of new technology-based firms and supporting of their consolidation. IPN consists of:

1. IPN incubator - Association for the Development of Incubation Activities for Ideas and Businesses. Is a private, non-profit institution established in 2002 on the initiative of IPN and the University of Coimbra. Its mission is to promote the creation of spin-offs through the support of innovative ideas and the technological base. IPN incubator has supported more than 270 enterprises and was awarded with the "Best Science-Based Incubator 2010", "The World's Top University-linked Business Incubators & Accelerators 2017/2018";
2. IPN Business Accelerator was launched on May 2014, is a business support infrastructure for innovative tech-based firms that have already overcome the early stage of development (incubation stage) and are already operating in the market and want further rapid growth or achievement of international markets;
3. Six Technological Development Laboratories for R&D and companies support;
4. The IPN Training Department is a Portuguese-certified training entity that offers high-quality training and consulting services in various fields.

1.1.3. University of Coimbra (UC)

The University of Coimbra (UC) is one of the oldest in Europe, was founded in 1290 by King D. Dinis. In 2013 UC was classified as World Heritage by the UNESCO for its role as the center of production of Portuguese language literature and thinking and for the universal value of its campus. Nowadays, UC is the world leading university that offers education and research in all study levels and various fields.

The University also develops activities for knowledge transfer and entrepreneurship supporting, the development of economic structure. UC has twelve education and research units, each of which has scientific, pedagogical, administrative and financial autonomy. The units are the follows:

- eight faculties (faculty of Arts and Humanities, Law, Medicine, Sciences and Technology, Pharmacy, Economics, Psychology and Educational Sciences, Sport Sciences and Physical Education);
- the Institute of Interdisciplinary Research;
- the College of Arts;
- the Institute of Nuclear Sciences Applied to Health;
- the European University Judicial Court.

UC has 45 centres of pure and applied research that are responsible for the KTT to the entrepreneurial world. There are Outreach and Training Support Units such, as: library, archive, press, 25th April Documentation Centre, Health Sciences Library.

1.1.4. Polytechnic Institute of Coimbra (IPC)

Polytechnic Institute of Coimbra (IPC) is a public institute of higher education, which was founded in 1979. The main goal of the IPC is to conduct research activity and applied research, knowledge and technology transfer and their economic and social valorization. It consists of six units:

- Coimbra Agriculture School (ESAC);
- Coimbra Education School (ESEC);
- Coimbra Health School (ESTeSC);
- Oliveira do Hospital Management and Technology School (ESTGOH);
- Coimbra Business School (ISCAC);
- Coimbra Institute of Engineering (ISEC).

Besides, Coimbra Polytechnic Institute encompasses two R&D units:

- Applied Research Institute (IIA) - tool for fostering and management of research, that consists of five laboratories;

- Natural Resources, Environment and Society Study Centre (CERNAS) - research unit that is a part of the National Scientific and Technological System. CERNAS conducts research related to such problems as: exhaustion of energy resources and raw materials combined with global trends of climate change, demographic growth and environmental degradation.

IPC equipped with two training centers: Innovation and Pedagogy Study in Teaching Centre (CINEP) and Polytechnic of Coimbra Training Centre (INOVIPC).

1.2. Services and activities provided by HIESE Incubator

The mission of HIESE Incubator is to stimulate the emergence of new enterprises linked to strategic sectors, through using and sharing of physical space, agricultural or forestry. Strategic sectors for HIESE are identified in the PD-ICE, by municipality of Penela, such as: agro-industry, forestry, environmental services, clean energy, communication and electronic technologies for social services, tourism products and services. These sectors are preferable, but not a limiting factor.

HIESE Incubator offers a wide range of services to its tenants: physical and virtual incubation; co-working; mentoring; internationalization (international cooperation and research projects); consulting; rural platform; training; incubation and acceleration programs; business plans (technological and economic viability); specialized technical assistance in the areas of legal, taxation and accounting, hygiene and safety at work, financing, investment and job creation; networking.

BI HIESE is the space of innovation that allows placing up to 20 companies in a separate or in co-work spaces. The HIESE building (1000 m2) was reconstructed and expanded from an old rural house, to the two-storey modern incubator equipped with an elevator with independent and common physical space, equipped properly with infrastructure and telecommunication networks. Independent offices are provided with: electricity to the power limit determined by the management body; individual accounts for fixed telephony; access to the internet; office furniture (tables, chairs and cabinets); maintenance and cleaning of common use space and outdoor areas; video surveillance and anti-intrusion alarm systems.

The premises available for physical incubation have areas of 24, 25 and 35 m^2, with favorable prices (Annex VIII), which vary depending on the company's time in the

incubator (the number of years of placement up to 5 years or after the incubation period). Virtual incubation exists in two forms:

- virtual start - is intended for entrepreneurs who start their activity, even if they did not set up a company;
- follow-up incubation - intended for graduates who do not require physical space, but who wish to continue to enjoy the HIESE services.

The duration of the virtual incubation period is 3 months with automatic renewal for periods of equal duration by agreement of both parties. Prices for all spaces available for rent are presented in the HIESE Regulation (HIESE, 2018). For business, research, testing and production of agroforestry products or services is provided the rural platform with 10 hectares of agricultural area and 20 hectares of forest area with water, electricity, greenhouses and road access.

1.3 HIESE management, financing, partners

It is a private non-profit organization, that doesn't have its own legal form, since it operates on the basis of a partnership between Municipality of Penela and IPN Incubator. The building of HIESE is owned by the Municipality, personal is hired by IPN Incubator through signing of a work contracts. The structure of the management of the incubator is submitted by:

1. Executive director of the HIESE;
2. Executive committee, that is represented by: Mayor of Penela, Executive director of IPN Incubator, Executive director of HIESE.

Currently, the HIESE team is working on the formation of an advisory board. Funding resources of organization are represented by European Funds through Operational Program for the Central Region (Centro 2020), the municipality of Penela funds and rental incomes. The infrastructure of HIESE costs EUR 1.2 million, which was financed by the program Centro 2020 by 75% and 25% by Municipality of Penela.

Every year the HIESE conducts "Competition of business ideas" in Smart Rural Contest with the aim to promote and support the emergence of business ideas, creating new business projects. In this competition, companies can win funds for consulting or computer equipment in amount of EUR 5000, EUR 3000 and EUR 2000 respectively for 1st, 2nd and 3rd prize; and placement in the incubation space from half a year till one

year. Also, young entrepreneurs between the ages of 23 and 40 are provided with grants for the development of business initiatives, ranging up to a maximum of 6 months (depending on the evolution of the idea) and vary between 700 and 1200 euros, depending on the academic degree of the candidates.

HIESE has already signed protocols with research entities, such as:

- University of Coimbra;
- Technological centre of ceramics and glass (CTCV);
- The University of Trás-os-Montes and Alto Douro (UTAD);
- School of Hospitality and Tourism of Coimbra;
- University of Minho;
- The National Laboratory of Energy and Geology (LNEG);
- The Polytechnic of Leiria.

2. Firms based on the HIESE Incubator

At the moment, there are 13 companies placed in the incubator. Some of them are in the virtual start and others in physical incubation. In addition, we also pay attention to the pre-incubation business projects (4), to better understand how the HIESE contributes to the development of entrepreneurship in the region, providing an opportunity to fully focus on future business through financial support. Also, there are few scholarship projects that we will not focus on because they are not very informative for our research.

2.1. Company in virtual start (pre-incubation)

2.1.1. EcoXperience

The company was established in 2016, took the 1st prize in the 1st wave of Smart Rural Competition. At the University of Coimbra, the company has developed a technology of reusing of used food oils to make detergents and cleaning products. Currently, EcoXperience offers an environmental kit (“Soapy”) on the market that allows children/adults to transform the used food oil into liquid soap (dermatologically tested, 100% biodegradable and hypoallergenic). The company’s goal is also to promote environmental education, with this aim workshops are held for schoolchildren for: raising awareness about recycling daily waste, encouraging reuse of waste, warning of

the danger of improper disposal of used cooking oil in the ecosystem. In the future, it is planned to launch domestic and industrial lines (with the launch in the municipality of Penela) for the hotel, restaurant and cafeteria sector. Besides, in 2018 company obtained EUR 700 thousand in funding from Portugal 2020 to develop "One-N-Done", a 100% green capsule that converts used cooking oils into various detergents.

2.1.2. Microgene

Microgene is a private limited company, established in 2015, which specialized in the production, import and distribution of laboratory devices, equipment, instruments in vitro diagnostic products and research with a wide range of laboratory work areas. From April 2018 company installs in HIESE incubator, where is production site in vitro diagnostic with laboratory equipment is situated. Main activity of the firm is focused on R&D activity in biotechnology (DNA/RNA), that consists its full time period.

2.1.3. Q/snack

Q/snack - private limited company, established in 2017. At the moment company sales and distributes food product – 100% quinoa snacks that are made of whole quinoa and with flavors. It is doesn't contain additives, preservatives, artificial colorings, sugar, lactose, gluten and cholesterol. The company plans to start own production of Q/snack in Portugal and to explore the possibilities of growing quinoa in Portugal.

2.1.4. S&DG (Storage and Distributed Generation Solutions)

It is a young company, that was founded in 2017 and works in energy sector. Company offers consulting services for business and management; solutions in production, storage, distribution and sale of electricity; solutions in production of wind, geothermal and solar electricity. Also, company is focused on the use of vehicular natural gas filling stations in compressed air storage stations, for what was awarded with honorable mentions at 2nd wave of "Competition of business ideas" Smart Rural Contest".

2.1.5. Segmento Figuardo

The Segmento Figuardo is a private limited company, that was founded in 2017 and aims to reinvent the traditional flavors of our country, giving them new flavors, new applications and new connoisseurs. The company offers to the most demanding

customer the perfect union between traditional Portuguese gastronomy and innovation in totally Portuguese products from small local producers and artisans in precious cooperation with the most distinguished Chefs. In 2017 company won the 3st prize in the “Competition of business ideas” in HIESE.

2.1.6. Transwood. LDA

Transwood. LDA is a private limited company that was established in 2007. The company business is wholesale trade of gross wood and derivative products, land register. The activity is concentrated in management and commercialization of forest products; forest exploration; provision of services related to forestry and trade in machinery and equipment related to the activity.

2.2. Company in physical incubation

2.2.1. ActionLive

Actionlive, Lda. is a dynamic company, launched in 2005, that works in service sector, focused in such directions:

- accounting, taxation and social security consultancy. Also, provides accounting outsourcing in areas: closing of the account year, preparation of the annual management report, treatment of current taxation, processing of salaries and other related activities, etc.;
- consulting in company establishing, investigating of car accidents in the scope of legal and contractual coverage and definition of responsibilities, car park management, etc.;
- providing certified training in various fields.

2.2.2. Buglife

BugLife company wons the 3rd prize in the 2nd wave of the “Competition of business ideas” Smart Rural Contest”. The company is devoted to the creation of insects such as domestic cricket and the bug/Tenébrio that can be efficiently applied for the production of animal combined feed. This type of feed is especially important for aquaculture due to its high protein content and essential amino acids.

2.2.3. Pavisa

PaviSá company works on flooring, civil construction and public works.

2.2.4. Primelayer

The company was established in 2006 and offers development of technological solutions in different areas. Provides such services as:

- development of web/web gis platforms for decision support, in the direction of environment, civil protection and land management;
- development of mobile applications for IOS and Android, focused on municipal management, tourism, health, among others;
- development of sensing projects to simplify and improve the management of cities through involving the integration of Internet of things (IoT) solutions;
- strategic planning of urban development, mobility and demographic projections.

2.2.5. Webervas

Webervas is a limited liability Portugal company, launched in 2013, which sells and distributes food and cosmetic products through advertising and the internet. The company also plans to expand its activities through the production of herbal extracts – raw material for food supplements/cosmetics/pharmaceutical industry; to produce its own food supplements productsusing own extract and to deliver supplies of the extract to Portugal and Europe market. The business idea implementation is planning through using of HIESE rural platform, where to industrial pavilion will be build and through close collaboration with university. The staff is expected extand from 2 to 11 people.

2.2.6. Wise Shape

In September 2017 Wise Shape won the 2st prize in the “Competition of business ideas” Smart Rural Contest. The company develops a new technology based on a cementitious composite material named Wise Composite Material (WCM) for application to tanks intended for both the fermentation process and the storage of still and fortified wines (Wise Tank). The new high-tech material uses nanomaterials and industrial-waste materials, by-products as partial substitution of cement and has many clear advantages. Innovativeness of the project scope is based on material innovation (Wise Material),

technology innovation in the vinification industry (Wise Tech) and optimized design (Wise Design). The range of application of this material can be diversified (for example in furniture production).

2.2.7. Wocadi

Wocadi is a company that sales and distributes medical and pharmaceuticals devices. Wocadi sales diagnostic equipment/diagnostic solutions (for various types of diseases, namely, cardiovascular, metabolic, oncological, infectious, etc.) and reagents to various health facilities where the diagnosis can be done by any health professional or even by the self-testing. Also Wocadi offers services of equipment check (Reflotron), maintenance and realization of control solutions.

2.3 Pre-incubation business project virtual start

2.3.1. Numen

Numen is a young technological start-up, which explores a new form of engineering development, based on phenomena occurring in Nature. Currently, is developing new geometry of solar collectors with the aim of increasing the resistance to heating of water and space in order to accelerate the transition of this consumption towards solar energy. In 2017 was awarded with honorable mentions at 1st wave of "Competition of business ideas" Smart Rural Contest".

2.3.2. Reddish

The project is focused on the purifying and commercialization of red crawfish "Procambarus clarkia" in order to support the strategy to control and eradicate the invasion of this wild population of freshwater crustacean, which causes serious losses in agribusiness, mainly rice farms in Portugal. The business model is based on capture, purification, and distribution of crawfish, and the recognition of this product as a value-added product in gourmet catering and sushi in Portugal. Reddish won the 1st prize in the 2nd wave of HIESE business idea competition and collaborate with various research organizations to implement the project.

2.3.3. Toal

In September 2017 Toal Ecobebidas project in the "Competition of business ideas" Smart Rural Contest". The idea of the Toal project is to turn the by-products of cheese (excess whey from cheese production), fruit (strawberries, which cannot be sold to the final consumer) and the vegetable industry into healthy and nutritious organic drinks. The products are based on the use of excess whey from the manufacture of cheese, a very polluting by-product, and strawberries that are not of sufficient size for sale to the final consumer Two innovative drinks, no dyes or preservatives, similar to liquid yogurt (Toal Protein) and fruit juice (Toal Energy), which only differ in content: one of the proteins and the other energy. The drinks are virtually free of fat, are rich in antioxidants and probiotics, which help maintain the immune system and gastrointestinal tract. The project also helps to combat the environmental problem, preventing the penetration of whey from the cheese production into the water supply system and helps to deal with the problem of food waste.

2.3.4. 2Gther

The project is an experimental, unified technology platform aimed at uniting people by interests with the aim of sharing experience and acquiring a new one. The organization of interested people takes place through a website and mobile application and provides an opportunity to simplify the organization and planning for the accumulation of experience. Currently, the focus is on the direction of well-being and healthy lifestyle.

3. Analysis of cooperation U-I-G

In order to get the answers we are interested in, we interviewed the director of the HIESE incubator, the directors of 13 companies located in HIESE and representatives of local authorities. Ten firms (76.9% of the total population) responded to our structured questionnaire.

3.1. Factors motivating firms to be based on the Incubator

One of the important tasks of our research is to study a sample of companies located in the incubator. To answer the question about the main motivations of firms for placement in the incubator, companies were offered selection criteria, the aggregate

values of which are presented Table 3.1. Also general characteristics of the companies were made (Table 3.2).

Table 3.1 Motivational factors of company location in the HIESE incubator

Factors that motivated the installation of the company in the incubator	No. of firms (N=10)	%
To benefit from the rented space	9	90,0
To benefit from the prestige and image from the Incubator	8	80,0
To access funding sources (special incentives offered by Government)	3	30,0
To benefit from technical, management and financial support	5	50,0
To benefit from the access to knowledge and contacts in the agricultural and biotechnology area	3	30,0
To develop R&D links with the university	2	20,0
To access national markets	2	20,0
To access contacts with other firms	3	30,0
To access international markets	1	10,0
Other factors	0	0,0

According to Table 3.1, the main factor that prompted firms to be placed in the incubator was the ability to rent space at a reduced price (9 firms, which corresponds 90% of the sample), which was also mentioned by the only spin-off company in support of earlier results (Hewitt-Dundas, 2015). The next advantage was the image and prestige of the HIESE incubator, which the firms were expected to receive, that Salvador (2010) had previously described as “brand names”. This motivator was identified by 8 out of 10 companies (80%).

Among the less pointed factors was “benefit from technical, management and financial support” - 50% of the all sample. Such criteria as “access to funding sources”, “benefit from the access to knowledge and contacts in the agricultural and biotechnology area” and “access contacts with other firms” reach 30% of companies for each of the items (3 companies in each).

These results, similar to the results of Bakouros et al. (2002), show that the Portuguese industry (namely in Penela region), in most cases, perceives incubators as a prestigious real estate case, and not as an opportunity to develop R&D networks with universities (only 20% of the total sample), which could have a significant impact on improving innovative capabilities (Marques et al., 2010; Lee & Kim, 2016). It is noteworthy that the development of R&D links with the university was chosen by the firms that are at

the initial stage of work (founded in 2017), and their directors are natives of another country. And one firm independently develops R&D links with the university, since its origin is university spin-off. However, in the context of the influence of the incubator on the development of biotechnology and agriculture, three companies (30% of total sample) indicated, along with the space and prestige, the possibility of access to knowledge and contacts in these areas.

Concerning the general characteristics of the 10 companies under research, 3 firms position themselves as existing companies and as start-ups (which is 30% of the total sample in each). The second most frequent type of origin is a subsidiary of already existing firm, which represents 20% of the total amount of companies. The incubator has very few university's and other firm's spin-offs, that are followed by equal parts, each of which is 10% of the total quantity. In fact, there is only one university firm, which confirms the previous results (Marques et al., 2010; Stal et al., 2016) that the universities' participation in incubation activities does not necessarily lead to the transfer of academic research results through spin-offs. And the number of employees in our single spinn-off is up to three that support previous research from Italy of Salvador (2010), results of Zhang (2008) and Clarysse, Wright, Lockett, Mustar and Knockaert (2007) that this kind of firm is a significant smaller source of employment than other start-ups.

As for the sector of economic activities of companies established in HIESE, 30% among all firms belong to the biotechnology (environmental and industrial) sector, that confirm previous studies of Marques et al. (2010) about university interest in knowledge-intensive firms. To agriculture sector belong 10% of all firms and other sectors (60%) such as: energy, trade of gross wood and derivative products, food industry, service sector (accounting, consulting, training), software development (web/web gis platforms, mobile), sales and distribution of medical and pharmaceuticals devices. The fact that firms belong to these sectors of activity is consistent with the sectoral orientation of the incubator; in other words, it's not just the filling of rental space, but the promotion of entrepreneurship in accordance with the predetermined strategy of the incubator and the region in particular. The one spin-off firm operates in biotechnology sector that corresponds to the trend (Salvador, 2010; Shane 2005).

Seven firms, that represents 70% of all the companies from the sample, are incubated in the HIESE less than 1 year, and only three are placed here for the period more than one

but less than 3 years. These data are easily explained by the young age of the incubator, which is at the initial stage of its.

Table 3.2 General characteristics of the companies

Characteristics of firms		No. of firms (N=10)	%
The origin of the company	University Spin-off firm	1	10,0
	Other firm's spin-off	1	10,0
	Start_up	3	30,0
	Already existing firm	3	30,0
	Subsidiary of already existing firm	2	20,0
	Total	10	100,0
The sector of economic activity(*)	Biotechnology	3	30,0
	Agriculture	1	10,0
	Other sectors	6	60,0
	Total	10	100,0
The incubation time	Less than 1 year	7	70,0
	1 to 3 years	3	30,0
	Total	10	100,0
Legal form of the firm	Private limited company	8	80,0
	Sole proprietorship	1	10,0
	Private limited company	1	10,0
	Total	10	100,0
Number of company employees	Up to 3 employees	8	80,0
	From 4 to 9 employees	1	10,0
	More than 10 employees	1	10,0
	Total	10	100,0

Note: The "Biotechnology sector" includes 1 - Environment biotechnology, 2 - industrial biotechnology; The "Other sector" includes 3 - Software developmen, 4- Sales and Distribution, 5- Consulting, 6 -Food production

Nine companies are micro enterprises, where 88.9% of them have up to 3 employees, the same share of enterprises is private limited companies. These data confirm the previously observed trend and show the general situation with micro enterprises in Portugal (Marques et al., 2010), of which this class for 2016 corresponds to 96.2% of

the total number of firms in the country. Along with this, a few of employees can be explained by the young age of the incubation firms (from one to three years), which, however, predict an increase in staff by an average of 17 people (information from 4 companies).

Analysis of the presence of R&D activity is also the subject of our study. For this purpose, the main activity of each subject was investigated and results are represented in Table 3.3.

Table 3.3 R&D activities of the sample companies

General features		No. of companies (N=10)	%
Main activity of the firm	R&D in biotechnology (DNA/RNA)	1	10,0
	Agriculture	1	10,0
	Software development	1	10,0
	Consultancy	3	30,0
	Sales and Distribution	3	30,0
	Other	1	10,0
	Environment biotechnology	1	10,0
	Food production	2	20,0
R&D activities presents	No R&D	5	50,0
	Full-time	2	20,0
	Part-time	3	30,0
	Total companies	10	100
Type of R&D activity (N=5)	Applied research	2	40,0
	Experimental development in:		
	- New product development	4	80,0
	- New process development	1	20,0
	- Improving of existing products	1	20,0
Intensity of R&D activity (no. of employees involved), just for the companies that use full/part-time R&D activity (N=5)	Up to 2 employees	4	40,0
	From 3 to 5 employees	1	10,0
	More than 6 employees	0	

Three companies are involved in sales and distribution (30% of the total sample), but for all of them this activity is not the only one: the one is directly engaged in R&D in

the field of biotechnology (DNA / RNA), the other - in agriculture (mining) and other (land register). The similar number of companies are involved in consulting activities (3 firms of the total sample).

At the same time, five companies don't have any R&D activities, while the share of companies with part-time consists 30%, and two companies have full time R&D activity. As for the types of R&D activities, most of the companies are in the area of "experimental development", focusing on the "development of new products" that were mentioned by 4 companies (80% of the firms engaged in R&D activity), which confirms previous conclusion that KTT to SMEs is more often problem-oriented, than based on fundamental research (Marques et al., 2010).

Was identified one firm with full-time R&D activity, where the intensity was measured by number of employees involved R&D in quantity of 3 (which is equal to the total number of employees of this company). In two other companies the number of employees involved in R&D did not exceed two.

3.2. Cooperation between firms located at HIESE and University (types, intensity)

Given the statement by Ranga, Debackere and Tunzelmann (2003) that the types and intensity of the U-I interactions determine the effective return on investment in research, technology commercialization, job creation and improved quality of life, as well as strengthening the entrepreneurial spirit – we studied this question.

In general, among the 10 companies that were interviewed, 7 indicated the presence of cooperation links with universities, which corresponds to 70% of total sample and 3 companies have no links.

Table 3.4 gives the aggregate pattern of U-I cooperation links with subdivision to formal R&D links, human resources links and informal types of links.

Formal links were indicated by 5 companies. "University academic staff as part-time consultants" cooperation links were most often quoted (3 firms, which is 42.9% of the pointed formal ties), intensity of which varies from low to high for each firm. Another type of link among the formal, which were mentioned less, is "joint research of university-firms", which is referred by 2 companies (28.6%), that occurs ones a month.

"R&D contract" collaborative link was pointed only by one company (14.3%) that is operating in the field of environmental biotechnology, and this cooperation was

emphasized with high intensity that contrast with Marques et al. (2010) assumption that formal links by their nature require organizational skills and structuring in which should be manifested with less intensity.

Table 3.4 The U-I cooperation links and their intensity

Cooperation links and their intensity	No. of firms (N=7)	%	Intensity					
			High		Medium		Low	
			N	%	N	%	N	%
A) Formal R&D links:								
R&D contracts	1	14,3	1	100	0	0	0	0
Joint research of university-firms	2	28,6	0	0	2	100,00	0	0
Firms' access to university's laboratory analyses, design, tests, and assessments	1	14,3	0	0	1	100,00	0	
University academic staff as part-time consultants for firms	3	42,9	1	33,33	1	33,33	1	33,33
Firm as supplier of university goods/services	0	0	0	0	0	0	0	0
Other:	0	0	0	0	0	0	0	0
B) Human Resources links:								
Recruitment of recent university graduates	3	42,9	1	33,33	1	33,33	1	33,33
Students' involvement in projects	1	14,3	1	100,00	0	0,00	0	0,00
Recruitment of more experienced engineers and scientists	0	0,0	0	0,00	0	0,00	0	0,00
Training given by university to firm's employees	0	0,0	0	0,00	0	0,00	0	0,00
Formally organized training of firm's personnel at university	0	0,0	0	0,00	0	0,00	0	0,00
Other:	2	28,6	0	0	1	50,00	1	50,00
C) Informal links								
Personal contact with university staff	4	57,1	0	0	4	100,00	0	0
Firms' access to specialized university literature	0	0	0	0	0	0	0	0
Firms' access to university equipment	1	14,3	1	100	0	0,00	0	0,00
Firms' access to university's department research	4	57,1	1	25,00	1	25,00	2	50,00
Attendance at seminars and conferences, general education/training programs	3	42,9	0	0,00	1	33,33	2	66,67
Other	0	0,0	0	0	0	0	0	0

Note 1: High frequency (1 or more links/week) - Medium frequency (1 link/month) - Low frequency (3 links per year or less)
Note 2: The percentages which relate to the intensity of the cooperation links are calculated for the number of companies which indicate each type of connection.

Among the human resources links “recruitment of recent university graduates” has the most significant weight and was pointed by three companies (42.9% of total). The impact of these types of links on the development on business in the region, they are aimed at helping to meet the needs of qualified employees in local companies, as well as support and promote the potential of existing human resources in the Penela (Marques et al., 2010). Regarding the frequency of these links, there is no certainty, it varies from low to high for each of the firms. To the “other” type of the human resources links referenced 2 firms (28.6%). Nevertheless, this type of linkage is residual in nature, when the companies included some specific circumstances of each case and cooperation that could not be displayed in informal and formal types of links.

The third type of least cited references (1 company – 14.3%) is “students’ involvement in projects”. The company is developing this type of links in order to support joint R&D research, which in the future can have positive results for the company.

Our finding supports a widespread picture of previous studies, according to which informal links were indicated as the most common type of U-I interaction (Bakouros et al., 2002; Marques et al., 2010; Schwartz & Hornych, 2010; Vedovello, 1997), which were mentioned by 7 companies.

Similar to the Vedovello’s approach we conditionally divided such category of links into two groups: that requires less structured organizational approach (“personal contact with university staff”, “access to specialized university literature”, “attendance at seminars and conferences”) and more structured (“access to university equipment”, “university’s department research”, “attendance at general education/training programs”). The “personal contact with university staff” was the type of references cited by 4 companies, that representing 57.1% of total interviewed companies among these types of links, and they were mostly based on earlier relationships. Similar to the results of Marques et al. (2010), these relationships are characterized by medium intensity (on average once or several times a month), since its informal nature does not require high organizational capacity.

Similar to the previous cooperation links, firms also often indicated the possibility of “firm's access to the university's department research” (4 companies), however 50% of such references occur at a rather low frequency (3 links per year or less). The essence of these links is to be aware of the research programs that are held at university departments in a specific field of knowledge and the possibility of their application to the company itself.

The third type of link in this category is “attendance at seminars and conferences, general education/training programs”, was pointed by three firms 42.9% but with low intensity of use. “Firm's access to university equipment” was noted by 1 firm (14.3% of total) with one or more link for week. For this particular company, such kind of link is important in exploring advanced materials, new methods and tools.

Relatively significant number of companies in the total sample 30% (3 companies) stated that they do not have any cooperation links with universities. The main reasons for the lack of cooperation are given in Table 3.5, among which the most common is “lack of opportunity” that was mentioned by 66.7% companies that don’t have links. However, in our research, these reasons do not correspond with the assumptions of Marques et al. (2010) about the lack of awareness and, as a consequence, lack of information on the possibilities of cooperation with the university; rather, this factor is explained by the fact that during the survey companies that indicated these reasons worked in the market for a short period, however, they stressed that in the future they are considering the possibility/necessity of developing ties with universities. As well, one company without links indicated such reason as “R&D is not a priority for us” as it works in consultancy field.

Table 3.5 Reasons for the non – existence of cooperation with universities

Reasons for the non - existence of U-I cooperation links	No. of firms (N=3)	**%**
Lack of opportunity	2	66,7
Not included in the firm’s mission	0	0,0
No interest from University side to firm’s project	0	0,0
R&D is not a priority for us	1	33,3
Other reasons	0	0,0

3.3. Forms of knowledge/technology transfer between firms and university (types, benefits, effects)

In the course of our research, firms have chosen various forms of KTT that flow from the links of cooperation and are represented in the Table 3.6.

An analysis of these data shows that 57.1% of companies recognize that the main form of KTT is “simple transfer” similar to results of Marques et al. (2010), which is mainly related to informal types of links, such as “firm's access to university’s department research”, “attendance at seminars and conferences” and human resource contacts such

as “recruitment of recent university graduates” and “other”. In this case, the university contributes to the business activities of firms through the provision of information and training in human resources, rather than innovation (Marques et al., 2010).

Less significant is the “license agreement”, which was mentioned by only two companies (28.6%). One firm (14.3%), which works in the field of industrial biotechnology, notes the “acquisition/sales” as a channel for KTT. The same is about “license agreement after patent registration”.

Table 3.6 Forms of KTT resulting from cooperation links

Main forms of knowledge/technology transfer resulting from cooperation links	No. of firms (N=7)	**%**
License agreement after patent registration	1	14,3
License agreement	2	28,6
Acquisition/Sales	1	14,3
Simple transfer	4	57,1
Other forms of transfer	0	0,0

The next important issue of our study was to determine the benefits of the companies that they receive as a result of establishing links with universities. According to the Table 3.7, which is an aggregate form of all the advantages pointed by firms the leading position belongs to “chance of acquiring know - how”, which was indicated by 4 firms (57.1% of the firms). The possibility of “continuous technological updating”, “benefiting from university credibility and R&D experience” was chosen by 3 firms for each of the items, which is 42.9% of total companies that receive advantages. In addition, the two firms emphasize “qualifying human resources” (28.6% of companies) benefit, “low - cost access to technology” was mentioned by one firm.

Table 3.7 Benefits to firms after cooperation

Benefits for companies after cooperation	No. of firms (N=7)	%
Chance of acquiring know - how, scientific knowledge, technical expertise	4	57,1
Low - cost access to technology	1	14,3
Benefiting from university credibility and R&D experience	3	42,9
Continuous technological updating	3	42,9
Qualifying human resources	2	28,6

Also, the evaluation of the benefits that the university receives from cooperation with the industry was also made on the basis of the firms’ opinions, the results of which are

provided in the Table 3.8. The leading position takes benefit of “chance of applying scientific knowledge in organizations”, which was indicated by 5 firms (50% of total sample). Next three benefits record similar absolute and relative values, they are: “chance of applied research projects”, “possibilities of obtaining R&D funding” and “practical training of human resources”. Each of such types of advantages was indicated by 4 firms.

Table 3.8 The universities’ benefit from cooperation

The universities’ benefit from cooperation	No. of firms (N=10)	%
Chance of applied research projects	4	40,0
Chance of applying scientific knowledge in organizations	5	50,0
Possibilities of obtaining R&D funding	4	40,0
Practical training of human resources	4	40,0
Other	0	0,0

The other main objective of our research is identification of the final results of the KTT occurring as a result of links, to determine the practical effects in which it can be materialized.

A review of the Table 3.9 shows that 85.7% of companies from the sample with links of cooperation consider as the final results “product and/or process innovation”. This seems to be the justified result, given the mostly formal nature of the main types of links such as “joint research of university-firms”, “R&D contracts” “university academic staff as part-time consultants for firms” and informal in case of “personal contact with university staff” and “firm’s access to university’s department research”. Further in equal proportions (14.3% for each) were noted “improving existing product and/or process”, “building prototypes of new goods/ equipment/ software tool” and “training of human resources”.

Table 3.9 The final results of knowledge/technology transfer

Final results of cooperation links with the university	No. of firms (N=7)	%
Product and/or process innovation	6	85,7
Improving existing product and/or process	1	14,3
Building prototypes of new goods/ equipment/ software tool	1	14,3
Training of human resources	1	14,3
Written and non - written advice, technical consultancy	0	0
Other results	0	0

3.4. Relationship between tenants of HIESE Incubator

Based on the statement that internal networks between tenants are equally important as their external ties, determine the success of firms (Stephens & Onofrei, 2012), and their synergies can be crucial for innovation (Bakouros et al., 2002; Schwartz & Hornych, 2010), we evaluated such relationships and their importance (Table 3.10).

The physical proximity that the incubator provides for its tenants is the main catalyst for the constant interaction of companies and the development of personal relationships (Bollingtoft, 2012; Cooper et al., 2012).

Our results demonstrate a low level of interaction within tenants - only 40% of firms have some connections with other tenants that confirmed previous findings of Bakouros et al. (2002). The content of inter-cooperation was focused mainly on commercial or social interaction - 20% of the sample, followed by "joint research" and "other" types of interaction and others (10%). In other words, ties are related to more informal, personal character that confirms previous date (Bollingtoft, 2012; Cooper et al., 2012). Nevertheless, the surveyed companies noted that these types of links are "very" or "absolutely" important, and they plan to develop them further.

The main reasons for the absence of ties were the young age of the company and short period of placement in the incubator (less than 1 year), that earlier was also stressed by Cooper et al. (2012) and lack of knowledge about other tenants (Pettersen et al., 2015). However, no company indicated the absence of such connection due to fear of disclosing commercial secrets and fear of loss its competitive advantage, unlike the existing information in the literature (Akçomak & Taymaz, 2007; Cooper et al., 2012; McAdam & Marlow, 2007; Pettersen et al., 2015).

Table 3.10 Cooperation links between tenants of the HIESE Incubator

Cooperation links between firms within the Incubator	No. of firms (N=10)	%
Commercial transaction	2	20,0
Social interaction	2	20,0
Joint research of tenants	1	10,0
Other	1	10,0
No exist interaction with other tenants	6	60,0

3.5. Relationship between local authority and HIESE Incubator

The beginning of the relationship between the Municipality of Penela and HIESE Incubator was officially launched in 2006 with the adoption of local strategy plan - PD-ICE program, that was based on innovation, competitiveness, and entrepreneurship. Within the framework of this strategy, 14 mobilization projects were identified, one of which was the HIESE incubator - the fruit of Triple Helix dynamics of the University of Coimbra and the IPN, Polytechnic Institute of Coimbra and Municipality of Penela aiming to strengthen intellectual capital and build a regional economy based on knowledge (Marques et al., 2006), promoting the creation and development of business. R&D strategy of the region is realized through HIESE incubator and it is linked to rural innovation and aim on specific economic sectors listed above. Thanks to the interview, the following reasons were found that motivated Penel's municipality to develop U-I cooperation through HIESE, which can help to solve problems which are typical for the area with low-density, namely:

- stimulating and strengthening the local economy;
- fixing of citizens by creating new jobs in the municipality area;
- upbringing of young qualified resources;
- increase synergy in the local economy due to interaction of new companies on HIESE base.

In fact, the implementation of the HIESE project leads to an increase of the local budget only by 2.2% in the investment component, because the incubator was funded by the European funds through Centro 2020. While, the costs of maintenance are covered with incomes from rent space. In turn, the municipality spends, on average, 2% of the local annual budget for innovative and entrepreneurial programs in the region, of which the incubator accounts for almost 40%. Therefore, we can conclude that local investment to Penela Incubator has minimal impact on the local budget but represents high value on the local economy (taking into consideration motivations of HIESE establishing) and the municipality acts as an interested sponsor of the development of the incubator.

Besides, Penela Municipality, with the direct participation of the mayor conducts the active intangible actions such as: the sessions of "The Rural Open Days" for promoting contacts between companies and entrepreneurs in the rural world; the competition of business ideas "Smart Rural Contest"; representing of Smart Rural and HIESE at the Entrepreneurial Forums of the other Municipalities; workshops organization.

4. Influence of U-I-G cooperation on Penela agricultural and biotechnology sector development

The growth of the global population leads to the need for a significant increase in food production - this is problem for the future of the agro-industrial complex, and the problems of changing climatic conditions, environmental pollution, aging in the Penela region and reducing its rural population should not be neglected. The solution of these problems due to the search in various fields (biotechnology, chemistry, electronics, robotics, communication) using advanced technologies and considerable efforts based on scientific and technical knowledge. The practical application of the Triple Helix model through the HIESE incubator in the rural community of Penela has served as a tool to stimulate U-I-G collaboration and is essential for technology transfer in rural community.

According to the analysis in the agricultural sector Penela, which was conducted during a case study, the region can benefit from a bet on its endogenous products (Rabaçal cheese, olive oil, honey Serra da Lousã, nut and wine Vinho Terras de Sicó), that highlight the quality and specific characteristics on regional level and, in the future, provide an opportunity to identify new products/areas in which they can be applied for example, pharmacognosy, dietology, etc. in connection with the application of scientific and technological research activities.

Given that the companies placed in the incubator are mostly young, as the incubator itself, and despite the lack of recent statistical data the benefits/future benefits to agriculture and biotechnology sectors are apparent.

Among the companies located in the incubator, special attention should be paid to the spin-off EcoXperience, which works directly in environmental biotechnology (processing of cooking oil into a cleaning agent). Thanks to the constant cooperation with the university through - R&D contracts and other types of connections, the company all the time continuous technological updating and help resolve the region problem of olive oil recycling. In addition, with the expansion and launch of the industrial line, new jobs will be created in the region.

Webervas plans to produce (on the HIESE rural platform) plant extracts - raw materials for food additives, cosmetic and pharmaceutical industries, and, in the future, supply

them to Portuguese and European markets. Due to collaboration with university staff, the firm plans to diversify the food industry with food additives production.

Q/snack will grow up quinoa and produce a non-allergenic food in Portugal, after conducting additional research. Also, the activities of Segmento Figurado, Unip. Lda in the food industry is based on the use of traditional Portuguese gastronomy, and the addition of innovative products (due to joint research with the university) from entirely Portuguese products from small local producers.

The feed industry will benefit from the implementation of BugLife's innovative project for the production of insecticides of protein feed that is especially important for aquaculture due to its high protein content and essential amino acids.

The innovative development of Wise Shape brings technological innovations to the Penela region wine industry, which affect the quality of wine during its vinification and aging. The use of this material can be diversified and extended to other industries.

Also important is the contribution of core projects that are currently under development:

- The Toal project aims to transform by-products of the cheese (whey), fruit and vegetable industries into healthy eco-drinks. In this case university supplies knowledge for innovation and HIESE helps to promote innovation, which will allow dosing and diversification of products available at Terras de Sicó.
- Based on the results of collaboration with various research organizations and universities, the Reddish project plans to clean (control and eliminate wild populations) and commercialize red crayfish “Procambarus clarkii”.

In summarise, the agro and biotechnology business benefits consist in the creation and development of cooperation relations with the university that provide access to additional knowledge that may be required but not available to the company during at inicial phase; use of regional endogenous resources as an exclusive advantage of the region; attracting highly qualified workers to the region; the creation of new jobs for the purpose of civil fixation in the Penela rural region (at the time of the study, several companies predicted an increase in the number of jobs by 15 people).

CONCLUSION

Nowadays, knowledge is an important output for universities, as well as is important for industries in order to supply innovative products (or processes) thereby gaining competitive advantages.

In order to promote the most efficient innovations, knowledge should be generated from a triple helix perspective, which considers interaction among university, industry, and government as the key to improving the conditions for innovation and sustainable development in a knowledge-based society (Dzisah & Etzkowitz, 2008). These interactions tend to result in a grid of communications, networks, and organizations among the spirals (Etzkowitz & Leydesdorff, 2000), in our case it leads to the HIESE incubator creation. Business incubation, as an example of Triple Helix, is part of a global knowledge and technology management model for regional and national development (Etzkowitz, 2002), and aims to support the establishment and development of SMEs, providing space for entrepreneurial activity, consulting and other basic services, also stimulating internal networks and sharing knowledge among tenants (Bollingtoft, 2012; Kitagawa & Robertson 2012; Petterson et al., 2016; Sá & Lee 2012). The creation of new companies and their successful incubation are crucial factor in the growth and development at the economic and social levels of the regional/national economy, which is a key element in solving the problem of unemployment, increasing competitiveness and hindering the destruction of rural regions.

The aim of this work was to evaluate the ways of interaction between the main participants of innovations (university, industry, government) in expectation that the Penela incubator works as the important KTT mechanism (Marques et al., 2006) that dynamizes U-I cooperation and promotes science, technology, innovation, entrepreneurship and accelerates the process of technology commercialization (Mansano & Pereira, 2016; Wonglimpiyarat, 2016).

This study is designed to provide detailed and clear information that allows to get the most in-depth knowledge about the relationships between micro / small companies located in the Penela incubator and universities, and to evaluate the effectiveness of this interaction in impact on the development of agriculture and the biotechnology industry in the region. For this, the basic theoretical concepts were first considered: the concept

of science, technology, research and development, innovation, the concept of KTT and BI.

It has been shown that the dynamics of relations between academia (the University of Coimbra, Polytechnic Institute of Coimbra and the Pedro Nunes Institute), industry and local government body (Municipality of Penela) led to the emergence of the HIESE incubator, which has attracted the interest and contribution of firms in the following sectors: agro-industry, forestry, environmental services, clean energy, communication and electronic technologies for social services, tourism products and services. Many other organizations are also involved (CTCV; UTAD; LNEG; School of Hospitality and Tourism of Coimbra; University of Minho; The Polytechnic of Leiria), as all wants to take their dividents.

The local government wants to take the benefits from stimulating and strengthening the local economy, from creation of new jobs in the municipality and solving the fixing of citizens in the region, upbringing young qualified resources, attracting new businesses into the local economy and increasing synergies due to the interaction of new companies based on HIESE. Universities also can benefit from the creation of favorable conditions to promote academic spin-offs, the possibility of commercializing technologies developed within institute and R&D. Also, university staff/students who are involved in incubator projects can transfer the knowledge and know-how they receive back to their university laboratories (Rothschild & Darr, 2005).

The main motivational factor for locating firms in the incubator, which was determined during the study, is the benefit of the rented space, and the image/prestige from the HIESE incubator that confirmed previous researches (Bakouros et al., 2002; Hewitt-Dundas, 2015; Marques et al., 2010; Salvador, 2010) in case of incubator's perception as prestigious real estate case, rather than an opportunity to develop R&D networks with university. The fact that there is only one university firm was discovered, confirms the previous statements (Marques et al., 2010; Stal et al., 2016) that the participation of universities in incubation activities does not necessary make transfer of results of academic research through spin-offs. Despite current confirmation of the trend that spin-offs are not a significant source of employment (Clarysse et al., 2007; Salvador, 2010; Zhang, 2008), HIESE spin-off (EcoXperience) aims to launch an industrial line which, hypothetically, will increase in staff.

Relative to the economic activity sector the companies installed in HIESE belong to the following sectors: biotechnology dominates (environment and industrial) and consists 30% among all companies, which confirms previous studies (Marques et al., 2010) that universities are interested in knowledge-intensive firms, especialy in case of spin-off (Salvador 2010; Shane 2005). Then follows agriculture (10%) and other sectors (60%) such as: energy, trade of gross wood and derivative products, food industry, service sector, software development, sales, and distribution. The belonging of firms to these sectors of activity is consistent with the sectoral orientation of the incubator. Most of the companies are micro enterprises (80%) that correspond to general situation in Portugal (Marques et al., 2010), where this class for 2016 corresponds to 96.2%.

In general, among the 10 companies were interviewed 7 indicated the presence of cooperation links with universities, which corresponds to 70% of total sample and 3 companies have no links reflecting 30% of total. Informal links are considered by a lot of researchers (Bakouros et al., 2002; Marques et al., 2010; Schwartz & Hornych, 2010; Vedovello, 1997) the most common type of interaction between universities and industry, which is also confirmed by our results. Among other the "personal contact with university staff" was the type of references cited by 4 companies that representing 57.1% of total interviewed companies with U-I links. Despite the active work of the incubator on awareness of the possibilities of cooperation with the university, in contrast to the results of Marques et al. (2010), 30% of companies now do not have such an opportunity, mainly due to their short stay on the market.

An analysis shows that 57.1% of companies that have U-I links recognize that the main form of KTT was "simple transfer", which is mainly related to the informal types of links, such as "firm's access to university's department research", "attendance at seminars and conferences" and human resource contacts such as "recruitment of recent university graduates" and "other". Similar quantity of firms determines possibility to "chance of acquiring know - how" as a main benefit as a result of establishing links with universities. This confirms earlier study of Marques et al. (2010), in which it is emphasized that the university's contribution to the entrepreneurial activities of developing firms is more concerned with the provision of information and training in human resources, rather than with innovation.

In spite of the widespread opinion of promoting the development of relations between tenants through incubator physical proximity (Bollingtoft, 2012; Cooper et al., 2012)

and the recognizing of importance of such synergies (Schwartz & Hornych, 2010), that determines the success of new firms (Stephens & Onofrei, 2012), our results demonstrate a low level of such interaction (only 40% of firms have connections) the same as previous research of Bakouros et al. (2002). The most common are social and commercial operations (20% of the sample), which generally correspond to findings of previous studies (Bollingtoft, 2012; Cooper et al., 2012). However, the main reason for the lack of cooperation was not the fear of losing commercial secrets (Akçomak & Taymaz, 2007; Cooper et al., 2012; McAdam & Marlow, 2007; Pettersen et al., 2015), but the short period of incubation and lack of knowledge of other tenants (Cooper et al., 2012; Pettersen et al., 2015).

With the adoption of PD-ICE regional program for the development of innovative and entrepreneurial ecosystems, the Municipality of Penela starts to follow Triple Helix strategy, where the HIESE incubator is an important KTT mechanism (Marques et al., 2006) which helps to region solve typical rural areas problems with low density and increase entrepreneurial activity.

Thanks to the efforts of the HIESE Incubator and the interaction of the main regional stakeholders (U-I-G), at the moment it is already possible to talk about the positive impact of this partnership on agriculture and biotechnology in using of local endogenous products (Rabaçal cheese, olive oil, Serra da Lousã honey, walnut, and wine -Vinho Terras de Sicó) and not only.

New companies were launched and already existing firms were attracted, which: introduce technical innovations in the wine industry; produce innovative high protein feed product for aquaculture; diversify the food industry with the introduction of innovations in the restaurant business, create a non-allergenic product from quinoa, start the process of commercializing red crayfish, produce eco-drinks based on the transformation of cheese / fruit / vegetable by-products, produce raw materials (plant extracts) for food additives, cosmetics, industry; develop an innovative approach in environmental biotechnology through the transformation process waste cooking oil into cleaning products, etc. In addition, there were noted: the growth in the number of jobs in these industries, the involvement of highly qualified specialists, the growth of local trade.

LIMITATIONS

As for the general conclusions, it should be understood that they are made with some limitations in the study:

- lack of statistical data to estimate the impact of the HIESE operation on the local economy and agriculture;
- not possible to evaluate HIESE effectiveness of return on investment and analyze its performance;
- the opinion of the universities representatives about assessing the existing U-I-G cooperation was not taken into account.

FUTURE STUDIES

Taking into account the attractiveness and relevance of the topic of BI, it is necessary to note some points that should be further studied in the future:

- to conduct new research after 5 years to assess the survival, market stability and performance of firms;
- to expand the circle of participants through a university survey;
- to deepen the study of the process and the relevant criteria of selection projects/ companies to be incubated;
- to develop criteria for assessing the incubator, make analysis of the performance and create methodology that can assess the real return on investment, as there in literature are some doubts (Bruneel et al., 2012).

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LIST OF ANNEXES

Annex I – (Chapter 1)

Types of production in Portuguese agriculture

Annex II – (Chapter 2)

Taxonomy of U-I cooperation links

Annex III – (Chapter 2)

Taxonomy of general characteristics HIESE Incubator

Annex IV (Chapter 2)

Taxonomy of general characteristics of companies

Annex V – (Chapter 2)

Interview Script 1: For Manager of Incubator

Annex VI – (Chapter 2)

Interview Script 2: For Directors of Firms Based on Business Incubator

Annex VII (Chapter 2)

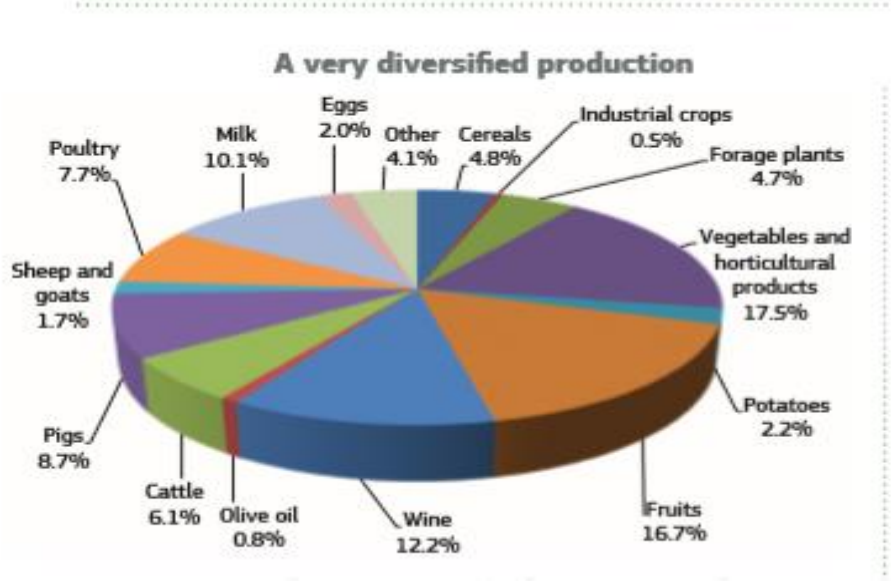
Interview Script 3: For the People Responsible for Defining U - I Cooperation Policy and Strategies in the Local Government (Municipality of Penela)

Annex VIII (Chapter 3)

Incubation and co-work space price table

Annex I

Types of production in Portuguese agriculture



Source: European Commission (2016).

Annex II

Taxonomy of U-I cooperation links

Cooperation links
A) Formal R&D links:
R&D contracts
Joint research of university-firms
Firm's access to university's laboratory analyses, design, tests and assessments
University academic staff as part-time consultants for firms
Firm as supplier of university goods/services
Other:
B) Human Resources links:
Recruitment of recent university graduates
Students' involvement in projects
Recruitment of more experienced engineers and scientists
Training given by university to firm's employees
Formally organized training of firm's personnel at university
Other
C) Informal links
Personal contact with university staff
Firm's access to specialized university literature
Firm's access to university equipment
Firm's access to university's department research
Attendance at seminars and conferences, general education/training programs
Other

Source: Marques et al. (2010).

Annex III

Taxonomy of general characteristics HIESE Incubator

General characteristics of HIESE	
1	Incubator age
2	Legal form of the Incubator
3	Sector orientation
4	Creators of the incubator
5	Financing source
6	Statutory situation
7	Shareholding in the Incubator capital
8	Incubator's promoting and/or associated entity
9	Services and activities provided by HIESE

Source: Marques et al. (2010).

Annex IV

Taxonomy of general characteristics of companies

General characteristics of Companies	
1	Firm's origin
2	Sector of economic activity
3	Time of being placed in HIESE Incubator
4	Legal form of the firm
5	Firm size (no. employees)
6	Main activity of the firm
7	R&D activities presents
8	Type of R&D activity
9	Intensity of R&D activity
10	Educational level of employees
11	Availability of technically unique patents

Source: Marques et al. (2010).

Annex V

Interview Script 1: For Manager of Incubator

I. The Incubator identification and its characteristics

1. What is the name of the Incubator? ___

2. What was the year of foundation (first operational company)? ___

3. What is the legal form of the Incubator?

- Private non – profit organization: ____
- Private limited company: ____
- Public limited company: ____

Other: ____

4. The institution was born on the initiative of:

- Coimbra University (Faculty / Department): ____
- Other Universities: ____
- Associated companies: ____
- Other reasons: ____ which ones?

5. What was the origin of funding for the setting up of the Incubator:

- EU: ____
- National: ____
- Private: ____
- Others: ____

6. Has your Incubator any sector orientation defined in the statute?

- No: ____
- Yes: ____ Which?

7. Shareholding in the Incubator capital (state all shareholders (number), and their capital shares)?

8. Which university is the Incubator's promoting entity and/or associated entity?

9. Presence of other institutions of research and development within the Incubator (if yes, list them): ____

10. What is the total area and occupied area: ____

11. In whose ownership is the land on which the Incubator is located? ____

12. How many companies are located in the Incubator at the moment?

13. What is a target group?

14. What are the origins of current tenants (please, include the number of companies):

- Start-up: ____
- Other R&D institutions spin-offs: ____
- Relocated firms: ____
- Universities spin-off: ____
- Branch of existing firm: ____
- Other: ____

15. What is the sector of activity of enterprises located in the Incubator?

- Consultancy: ____
- Biotechnology: ____
- ICT and related: ____
- Testing/analysis: ____
- Agriculture: ____
- Others: ____

16. What is the quantity of employees of the Incubator at the moment?

17. How many workplaces were created during the operation life of the Incubator?

18. What was the reason for the companies to left the Incubator (please, name the company and reason), if there such that have already left:

- Bankruptcy: ____
- Fusions: ____
- Acquisitions: ____
- End of incubation period according to contract: ____
- Others: ____

II – The Incubator management and financing

19. Who are the management bodies of the Incubator (please state the composition of the management committee)? Management is different from ownership?

20. What is the professional background of the management team? Consider the administrative, executive and operational members?

21. Does Management have an annual plan of activities, what is the direction? Is there a strategic plan?

22. What are the Incubator funding sources? Considers the current sources of funding to be sufficient? ____

- Rent income: ____
- Income from services rendered: ____
- "Business angels" investments: ____
- Venture Capital: ____
- Community funding: ____
- University funding: ____
- Local, regional, and central government grants: ____
- Other: ____

23. Whether the Incubator has already reached the level of self-sufficiency? (Yes, if 80% of operating expenses aimed at supporting innovative business is financed by the Incubator itself, no if less).

- No: ____
- Yes: ____ Which?

24. Does the Incubator have any performance self-assessment criteria? If yes, which?

25. How would you define success of a business incubator?

26. Is there any survival statistics for start-ups?

27. Who acts as an investor for startups?

III – Services and activities provided by the Incubator

28. What are the services the Incubator provides the based enterprises with?

- management support: ____

- administrative support: ____
- access to venture capital: ____
- training: ____
- special services in agricultural and biotechnology direction: ____

29. What conditions are necessary to become an incubation start-up?

IV – Cooperation assessment between University-Firm

30. Does the Incubator management actively support or stimulate the co-operation between employees of tenant companies and the university? Or among the companies?

31. What are the reasons leading the Incubator to support and motivate firms to establish cooperation links with the university?

32. How do you evaluate the present cooperation between the university and the based firms? What are the reasons for the non - existence of links in some of the firms?

33. Regarding the firms with cooperation links, do you think these links are relevant to their success in the market?

- Yes: ____
- No: ____ Why?

34. How do you ensure, if at all, that knowledge is transferred from the University to the companies? Do you have any kind of measurement for this?

35. Would it be possible to give the present list of firms based on the Incubator and their contacts? Which firms have had cooperation links with the university?

36. Would it be possible to give the statute and regulations of the Incubator?

Annex VI

Interview Script 2: For Directors of Firms Based on Business Incubator

I – General Identification of the firm

1. What is the name of the firm?

2. When was it founded?

II - Firm's characteristics

3. Firm's origin:

- University Spin-off firm: ____
- Other firm's spin-off: ____
- Start-up: _____
- Already existing firm: _____
- Subsidiary of already existing firm: _____
- Other: _____

4. Sector of economic activity:

1- Biotechnology (Including: 1 – Agricultural biotechnology; 2- Industrial biotechnology; 3 – Environment biotechnology; 4 - Other): ___
2- Agriculture: ___
3- Other sectors (Including: 4 - Computer Software; 5- Consultancy; 6- Tourism; 7 - Other sectors): ___

5. How long has your firm been in this Incubator?

- Less than 1 year: ___
- 1 to 3 years: ___

6. Legal form of the firm:

- Private limited company: ____
- Public limited company: ____
- Sole proprietorship: ____
- Other: ____

7. Firm size (no. employees in total working on firm):

- Up to 3 employees: ____
- From 4 to 9 employees: ____
- More than 10 employees: ____

8. Main activity of the firm:

- R&D in biotechnology (1 - DNA/RNA; 2 - Proteins and other molecules; 3 - Cell and tissue culture and engineering; 4 - Process biotechnology techniques; 5 - Gene and RNA vectors; 6 – Bioinformatics; 7 – Nano biotechnology; 8 – Other): ____
- Agriculture: ____
- Software development: ____
- Consultancy: ____
- Testing and laboratory analysis: ____
- Agriculture
- Sales and Distribution: ____
- Other: ____

9. R&D activities presents:

- No R&D: ____
- Full-time: ____
- Part-time: ____
- 10. Type of R&D activity?
- Basic research: ____
- Applied research: ____
- Experimental development in:
- New product development: ____
- New process development: ____
- Improving of existing products: ____
- Improving of existing processes: ____
- Other: ____

11. Intensity of R&D activity (no. of employees involved), just for the companies that use full/part-time R&D activity:

- Up to 2 employees: ____
- From 3 to 5 employees: ____
- More than 6 employees: ____

12. What is educational level of employees engaged R&D activity prevails?

- Upper secondary education: ___
- Bachelor's degree: ___
- Licentiate degree: ___
- Master degree: ___
- Ph.D.: __

13. Total value of firm sales/revenues for the last year from activity: ___

- Up 20 thousand euros: ___
- From 20 to 50 thousand euros: ___
- More than 50 thousand euros: __

14. R&D spending within the firm for the last year: ___

- Up 5 thousand euros: ___
- From 5 to 10 thousand euros: ___
- More than 10 thousand euros: ___

15. How many technically unique patents does your:

- Firm already have: ____
- Firm has applied: ____

III – University – Industry cooperation

16. What are the cooperation links between your firm and the university?

Formal R&D links:

- R&D contracts: ___
- Joint research of university-firms: ___
- Firm’s access to university’s laboratory analyses, design, tests and assessments: ___
- University academic staff as part-time consultants for firms: ___
- Firm as supplier of university goods/services: ___

- Other: ___

Human Resources links:

- Recruitment of recent university graduates: ___
- Students' involvement in projects: ___
- Recruitment of more experienced engineers and scientists: ___
- Training given by university to firm's employees: ___
- Formally organized training of firm's personnel at university: ___
- Other: ___

Informal links:

- Personal contact with university staff: ___
- Firm's access to specialized university literature: ___
- Firm's access to university equipment: ___
- Firm's access to university's department research: ___
- Attendance at seminars and conferences, general education/training programs: _
- Other: ___

No links: ___

17. What is the frequency (intensity) of links referred to in the previous question?

- High frequency (1 or more links/week): ___
- Medium frequency (1 link/month): ___
- Low frequency (3 links per year or less): ___

18. Reasons for the non - existence of cooperation links with the university (in case if there are no links at all of any kind):

- Lack of opportunity: ___
- Not included in the firm's mission: ___
- No interest from University side to firm's project: ___
- R&D is not a priority for us: ___
- Other reasons: ___

IV – Assessing the localization in the Incubator and the relationship with the university

19. What were the reasons for installing your firm in this Incubator?

- To develop R&D links with the university: ____
- To benefit from the prestige and image from the Incubator: ____
- To benefit from the rented space: ____
- To benefit from technical, management and financial support: ____
- To access funding sources: ____
- To benefit from the access to knowledge and contacts in the agricultural and biotechnology area: ____
- To access national markets: ____
- To access international markets: ____
- To access contacts with other firms: ____
- Other: ____ Which?

IF YOU HAVE CHOSEN NO COOPERATION LINKS IN QUESTION 16, THE INTERVIEW FOLLOWS TO QUESTION 25.

20. What are the final results of cooperation links with the university?

- Product and/or process innovation: ____
- Improving existing product and/or process: ____
- Building prototypes of new goods/ equipment/ software tool: ____
- Training of human resources: ____
- Written and non - written advice, technical consultancy: ____
- Other results: ____

21. Main forms of knowledge/technology transfer resulting from cooperation links:

- License agreement after patent registration: ____
- License agreement: ____
- Acquisition/Sales: ____
- Simple transfer: ____
- Other forms of transfer___

22. Benefits to firms after cooperation:

- Chance of acquiring know - how, scientific knowledge, technical expertise:____
- Low - cost access to technology: ____
- Benefiting from university credibility and R&D experience: ____
- Continuous technological updating: ____

- Qualifying human resources: ____
- Improved profitability: ____
- Increased market share (external/internal): ____
- Increased productivity: ____
- Meeting customers' needs: ____
- Other Benefits: ____

23. Do you consider the results obtained through links to cooperation were successful? Why?

24. In your opinion, what does the university benefit from cooperation?

- Chance of applied research projects: ____
- Chance of applying scientific knowledge in organizations: ____
- Possibilities of obtaining R&D funding ____
- Practical training of human resources: ____
- Other: ____

25. Do you think that the cooperation between university and industry is beneficial to both parties? Why? ___

V – Relationships with other tenants

26. What are the cooperation links between your firm and other firms within Incubator?

- Joint research of tenants: ___
- Sharing of equipment: ___
- Commercial transaction: ___
- Social interaction: ___
- Other: ___

No exist interaction with other tenants: ___

27. Do you consider that interaction links with other firms are important?

- Not important: ___
- Quite important: ___
- Very important: ___

Annex VII

Interview Script 3: For the People Responsible for Defining U - I Cooperation Policy and Strategies in the Local Government (Municipality of Penela)

1. Is technology transfer a national economic strategy of your country/region?
2. What is the main Research and Development strategy for the region in which HIESE Incubator is located?
3. Is there a strategic reason of Municipality of Penela for the sponsoring of this Incubator?
4. Are there any regulatory mechanisms or government support for the development of the Incubator?
5. The economy of the region is mainly what industries are?
6. Is there a diversification of the local economy with the advent of the Incubator?
7. How does Municipality of Penela understand the mission and objectives of the Incubator in the present context of a global knowledge - based economy?
8. Observing whether the stimulation of the region's economic growth over the past 5 years? If so is it related to the launch of the Incubator?
9. Does your municipality have statistics how change amount of qualified personnel over past 5 years and its structure?
10. Whether the appearance of the Incubator affected the increase in the local budget?
11. What are the main reasons for the Municipality to develop University - Industry cooperation links?
12. What does Municipality of Penela benefit from cooperation?
13. What are the average annual expenses on R&D of the municipality in region, and the Incubator in particular?
14. How it is possible to evaluate public perception of agriculture and biotechnology?

Annex V

Incubation and co-work space price table

The spaces available for physical incubation have areas of 24, 25 and 35 m2.

Space	1º Year		2º and 3º Year		4º and 5º Year		Post-Incubation	
	Price/m^2	Value Monthly	Price/m^2	Value Monthly	Price/m^2	Value Monthly	Price/m^2	Value Monthly
24 m^2	5,00 €	120,00 €	6,00 €	144,00 €	8,00 €	192,00 €	10,00 €	240,00 €
25 m^2	5,00 €	125,00 €	6,00 €	150,00 €	8,00 €	200,00 €	10,00 €	250,00 €
35 m^2	5,00 €	175,00 €	6,00 €	210,00 €	8,00 €	280,00 €	10,00 €	350,00 €

The virtual incubation has the following values:

Modality	Value Monthly
Virtual Start Incubation	25,00 €
Virtual Incubation Follow-up	25,00 €

Co-work space price table

Modality	Weekly Value	Value Monthly
Co-work	8,00 €	30,00 €

To all the mentioned values plus VAT at the legal rate in force on the date of the payment.

Source: HIESE (2018).