Chapter 9
Academic Entrepreneurship Framework: The Best Practices of Bragança Polytechnic Institute

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1 Introduction

Academics in the fields of entrepreneurship and innovation studies have long been interested in the entrepreneurial behaviour of higher education researchers and in the entrepreneurial activities of higher education institutions more generally (Chrisman et al. 1995; Stuart and Ding 2006; Rothaermel et al. 2007). Some academics are in agreement that the contribution of academic researchers to business activities solves some imperfections in the transmission of knowledge, and motivates researchers to undertake projects with greater economic and social relevance (Gittelman and Kogut 2003; Etzkowitz 2004).

Academic spin-offs are increasingly seen as important means of enhancing local economic development and encouraging successful researchers to become innovators. Enterprises created by academic researchers are crucial contributors to economic development and societal wealth (Nerkar and Shane 2003); it is also important to say that entrepreneurship is concerned with the discovery and exploitation of profitable opportunities (Shane and Venkataraman 2000). Thus, it is important that higher education institutions have a significant role in creating economic wealth both locally or regionally.

The literature on university–industry technology transfer defines an academic entrepreneur as a university scientist who engages in the commercialisation of the

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results of their research, principally by patenting and setting up a business. In the context of academic entrepreneurship, identification of a commercial opportunity is frequently equated with invention admission to university technology transfer offices and with academic patenting (Jensen and Thursby 2001; Colyvas et al. 2002; Lubango and Pouris 2007).

Although the core activities of any higher education institution are focused on training, this does not invalidate the process of downstream development of other initiatives that promote the inclusion of graduate students in the labour market, creating self-employment initiatives, whether these initiatives are technology based or not, as well as the creation of solutions that meet the needs of the economic, social and cultural development of the regions in which they operate.

In this regard, the Bragança Polytechnic Institute (IPB) made the strategic choice of creating an Innovation and Entrepreneurship Office, to promote the employability of students, to carry out internal entrepreneurship initiatives and to support the transfer of innovation and technology to the business world. These innovative experiences play an important role in the technological, economic and social development of the Bragança region. The lower the index of regional development, the greater the importance and responsibility of institutions of higher education to make an effective contribution to local and regional development, which at the European level is defined through the NUT (Territorial Unit Nomenclature). It should be noted that this region of Bragança is catalogued as NUT III, belonging to the group of less-developed regions of the European community and where the local municipalities, the Hospital Centre and Bragança Polytechnic Institute are assumed to be the main regional employers.

In connection to this, the present chapter is concerned with the issue of cooperation in higher education at regional and local development level mainly as regards the role that this type of educational institution must adopt in order to contribute efficiently to this propose. Therefore, this research aims to present the best practices developed within the Innovation and Entrepreneurship Office of the Bragança Polytechnic Institute, particularly in relation to a more effective contribution to the development of the socio-economic environment.

This chapter is structured as follows: after this Introduction, we present the methodological Academic Entrepreneurship Framework in Sect. 2. Section 3 specifies the conceptual model that integrates the most promising principles of a theory of learning, with the "demands" of entrepreneurial development, and summarises these in a multidimensional model. Sections 4 and 5 present our discussion and findings illustrated with examples from practice, and finally, the last section draws the conclusions of this study.

2 Framework

In the present context marked by the economic crisis, one particular concept is gaining in importance and relevance: higher education institutions as well as knowledge centres of excellence must develop new practices that result in a more

effective contribution to creating work and wealth. However, seeking the best formula to relate knowledge, work and wealth is not a recent concern, despite the fact that it is now more pertinent than ever. The dynamics of knowledge, work and wealth are complex as development agents relate to complementary interests often with different objectives. The complexity associated with the problem of economic development of regions requires a systemic approach.

It is believed in the present research that a systematic approach can be used as a tool in the search for best practices for addressing regional development and especially the potential contribution which higher education institutions can provide if they have an integrated view of the same.

The systemic approach is not a science, not a theory, nor a discipline, but rather a methodology to gather and organise knowledge, with a view to more effective action (Rosnay 1975). The methods and instruments used form a reference framework, in view of the discovery and study of systems, and can be easily applied by people of different cultures and education levels. The choice of a systemic approach in order to develop theoretical support for this work is due mainly to the fact that this is presented as a method especially directed towards dealing with uncertainty and complexity.

Bertalanffy (1984) defines a system as an entity that maintains its existence through the mutual interaction of its parts. That theory, around which great expectations were born a few decades ago, creates a galaxy of concepts, whose spectrum extends to the extreme mathematical formalism of sound forms, such as "the whole is more than the sum of its parts", "the whole is less than the sum of its parts", "the whole is more than the whole" (Morain 1982). These concepts have been promoted by biologists, neurologists, psychiatrists, computer experts, etc. The most general definition of the system was enunciated by Klir and Valach (1965) and is as follows:

$$S = \{U, C\},$$

where S is a system, U the universe of the system, and C is the system features.

According to the above, it can be concluded that any system is a result of the interaction of a set of components that share a common purpose, and it also can be defined, as an approach to problem solving, as viewing problems as parts of an overall system. Therefore and in order to frame the issue of this research, any socio-economic system can be modelled mathematically, as a three-dimensional function whose purpose is the production of wealth.

The mathematical formulation of the problem, on the basis of the theoretical foundations of the systemic approach, called attention to the systematic interaction of three basic components: higher education institutions, companies and people, towards the creation of knowledge, work and wealth, and consequently improvement of socio-economic conditions of the regions. Accordingly it is possible to write the follow mathematical expression:

$$\begin{aligned}\text{socio-economic system} &= f(\text{higher education institutions},\ \text{companies},\ \text{people}) \\ &\Downarrow \\ &\text{wealth generation}\end{aligned}$$

Fig. 9.1 Framework academic entrepreneurship

They thus released the fundamental postulates for the construction of the theoretical framework that should guide a set of practices developed in the education system, towards a more effective contribution to improving the socio-economic conditions of populations.

The Academic Entrepreneurship Framework results from an integrated view of the roles that different players in a socio-economic system should develop in order to achieve synergies. According to Brennan and McGowan (2006), the academic entrepreneurship may occur at the level of individuals or groups of individuals, acting independently or as part of a university system, which create new organisations, or instigate renewal or innovation within the university or outside the university via science and technology parks, university-owned corporate firms or research centres.

The synergies that potentiate economic development of regions and countries result from the cooperative interaction of different agents of this development (Fig. 9.1). Businesses, drivers of wealth generation, need competent people for excellence to look forward to innovative processes and products that will bring them competitive advantage over their competitors. People need work that allows them to sustain themselves, whether as an employee or on their own, in which case they opt for entrepreneurial practices that lead to the creation of their own business. The higher education institutions look to creating technically competent workers to ease their integration into the labour market. In this sense they create downstream of the formation process, models of action that promote employability and entrepreneurship, while trying to help companies to innovate. It's this set of dynamics that, if well done, results in corporate profits, jobs and success for higher education institutions (Fig. 9.1). Of course, Higher Education Institutions, companies and people are not alone in this process. The State through its various institutions is primarily responsible for supporting these key players, particularly with regard to

the granting of support to train people, the integration of graduates in the labour market, creating incentives for companies, and supporting Research Development and Innovation (RDI) activities.

Finally, the entrepreneurial university links its three primary missions: education, research and serving society. Institutionally that has meant having in a university structure besides traditional education and research functions, a technology transfer office and active patenting of own research results by the university (Baldini 2006).

3 Conceptual Model

On the basis of the theoretical framework proposed, a model of action was developed that is consistent with it. The conceptual model presents, especially, the areas of interaction of the framework where the Higher Education Institutions can make its contribution to solve this problem and it is important to know that it's based on a systemic approach.

The results of the proposed model, materialise in the design and conception of products or services, processes, organisational models and innovative marketing practices, the creation of new businesses or in achieving employment for graduates from the higher education systems (Fig. 9.2).

This framework provides an overview of the different dynamics generated in the context of the different drivers of performance. These, in turn, have their own dynamics which also becomes important to describe matter immediately. So, the next paragraphs will introduce and describe the various steps and players that integrate the model.

3.1 Technology Transfer

Potential technology financial support does remix some of the elements in interesting ways. Disruptive innovation is a revolutionary form of innovation that is changing the game which often requires a large infrastructure investment that is often supported by the public sector. The development of the Internet, computing, and space flight are examples of disruptive innovation. Disruptive innovation is often developed with government, foundation, or university support (Schulman and Rogoff 2011).

The process of technology transfer between Higher Education Institutions, research centres and companies is closely related to the concept of innovation. Innovation, while a creative process, adds a series of steps that go from idea to final product. The stages of any innovation process, according to the Oslo Manual, break down into three different moments, which are research, development

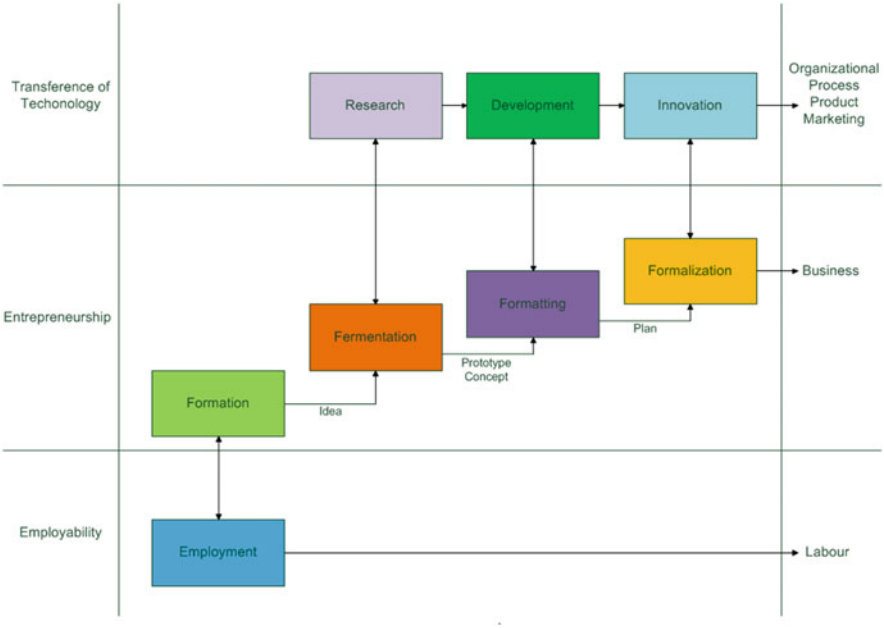

Fig. 9.2 Conceptual model

and innovation itself. Logically speaking, innovation processes are presented sequentially in the stages of research, development and innovation usually referenced by R + D + I or simply RDI.

The developmental step typically refers to the construction of a prototype of a pilot installation, a marketing concept or a new organisational approach; though not necessarily a process of research this is the time of practical realisation of an innovative idea. This step, a constructive step, is intended primarily to validate the objective of innovation, particularly in terms of operability and functionality.

This is the time at which the product, called a "proof of concept", is refined according to the assumptions of the target market. The final step in a process of innovation is related to the inclusion of the subject innovation into the market.

The object, be it product, process, new marketing concept or organisational practice, will have to be innovative, necessarily, to enjoy market acceptance. However, one should not confuse market acceptance and commercial success. Whatever the objective of innovation this will only be considered as such if it is directed towards the satisfaction of certain needs for a latent or eminent market. It will not necessarily be a commercial success, nor serve the needs of a large target market. Alternatively, the subject of marketing and innovation that allows you to enjoy the status of innovation lies in its licensing or registration. There are several registers of property in its most varied forms, and patents that were never marketed. However, they are not for that reason considered objects of innovation.

3.2 *Entrepreneurship*

Entrepreneurship is one of the main levers of the economy in modern societies and gained even greater importance with the current crisis in financial markets that emerged in the middle of 2007 and now extends to various parts of the economy. Throughout the world has focused on promote entrepreneurship. Such efforts are the result of relationship between this process and economic progress (Ferreira et al. 2010). Thus, academically entrepreneurial universities can play a high impact role in revitalising economies affected by the global economic crisis facing the world at this time.

In the literature, authors such as Schumpeter, Baumol, and Wennekers consider entrepreneurship as an important mechanism for economic development through employment, innovation and welfare effects (Acs and Amorós 2008). The dynamics of entrepreneurship can be immensely different depending on institutional context and level of economic development (Naudé et al. 2008). Some studies show that opportunity entrepreneurship has a positive and significant effect on economic development (Hall 2007).

Entrepreneurship offered many things that other economic development interventions did not. First, entrepreneurship is a local- and regional-level activity, and new firms can immediately begin to create benefits for their host locations, where for this reason, the idea of entrepreneurship was a perfect complement to an increasing focus on community-based economic development; second, economic development interventions focused on building hard infrastructure often neglected to consider how the infrastructure would be used, whereas entrepreneurship can work without a perfect system of hard infrastructure and often with minimal other resources (Etzkowitz and Klofsten 2005; Van Stel et al. 2007).

According to Van Stel et al. (2007), economic development depends on successful entrepreneurship combined with the force of established corporations. However, the beneficial value of this mechanism varies with the national income, as measured by GDP per capita. At low levels of national income, self-employment provides job opportunities and the possibility of market creation. As GDP per capita income increases, the emergence of new technologies and economies of scale allows larger and established firms to satisfy the increasing demand of growing markets and to increase their relative role in the economy (Van Stel et al. 2007).

To ensure the increase of GDP, are the new and small businesses that generate more jobs. However, the positive effects of entrepreneurship in society are not limited to job creation but also to its contribution to innovation. The new businesses generated in academic environments generally impose new technology-based standards of competition among established companies forcing them to improve processes and products, to be more efficient, effective and flexible in adopting new technologies and methods.

Entrepreneurship is understood, in the context of the present work, as the centre of action, from which it can leverage the remaining dimensions of the model adopted under the procedures developed at the Innovation and Entrepreneurship

Office of Bragança Polytechnic Institute. The proposed model of entrepreneurship is understood from the perspective of a value chain that integrates four distinct levels (4F: Formation, Fermentation, Formatting and Formalisation) that will be presented in the follow points.

3.2.1 Formation

Training refers to the entire educational process that is developed in institutions of higher education. Along with basic education, achieved through the undergraduate, masters and doctoral programs we are also interested now more than ever in promoting the acquisition of entrepreneurial skills, and promoting a culture and entrepreneurial spirit among the student population. The promotion of entrepreneurship will certainly motivate the development of projects, theses and research that are more practical, more applied, and more suited to market needs.

3.2.2 Fermentation

In general, the ideas generated in an academic context have a substantial technological load, needing to be worked on from the point of view of research. This is the stage where ideas are worked on, and especially concerns creativity. Despite the practical guidance that sustains this stage, at this point we are not concerned with the commercial interest, but rather with the mental conception or with the creation of prototypes.

3.2.3 Formatting

Having carried out a proof of concept, the functionality of the prototype or pilot installation measured against the aims of the project acquires new concerns. The phase of formatting submits the product to a market test in order to analyse the potential economic and financial benefits. This is the stage in which the business plan is drafted and one assesses the financial indicators, such as IRR (Internal Rate of Return), NPV (Net Present Value) and ROI (Return on Investment).

3.2.4 Formalisation

Formalisation is the stage of setting up and financing the business and results in the formal establishment of a company. The legal formalities and bureaucracy associated with the process of registration and licensing of businesses earn particular importance at this stage. Another aspect that is very important at this stage is to search for financing to establish the business either via equity or debt, to which you want to link incentives and external support.

3.3 Employability

Employability refers to the professional capacity to adapt to the new needs and new dynamics of labour markets. With the arrival of new technologies, globalisation of production, the opening of economies, the internationalisation of capital, and the constant changes that are affecting the environment of organisations, there is a need to adapt to such factors on the part of entrepreneurs and professionals (Minarelli 1995).

The conventional practices of employability need to be revised to the extent that the paradigm of employment has changed radically. The current reality of labour markets has become very volatile and insecure. To circumvent this problem, higher education institutions should define the strategic suitability of their study plans to the realities of labour market needs and develop strategies to facilitate and promote the inclusion of its graduates in the market place. The objectives at this level must include:

- To facilitate and promote the entry of new graduates in the labour market;
- Assist students in the process of training so that they can ensure the continuity of work;
- Develop training courses to update knowledge in order to promote continuous employment.

Nowadays, in order to get a job conventional processes include sending a CV, registering with an employment agency, doing interviews and similar procedures, but these are not at all effective. The latest developments which have occurred at the IT level, including social networking platforms typical of the Web 2.0 technology environment, are indispensable tools in that they facilitate the inter-relationship of employers and employees, in this way facilitating communication and access to information.

In conclusion of this point we present some real examples based on work carried out in 2011, but first a brief description and practical application of the 4F model is needed. On average 115 students, coming from different schools of IPB (ESTiG—School of Technology and Management; ESA—School of Agriculture; ESE—School of Education and EsACT—School of Public Management, Communication and Tourism), attend workshops and modules relating to entrepreneurship. These modules are taught by professors from different schools and specialists in the topics of the modules, and take place in the first semester of each academic year. This is the first stage of the model—formation. Thereafter in the fermentation stage, students are challenged to submit ideas and business plans to a competition, which are evaluated and defended publicly in the presence of a jury; in 2011 the competition included 17 business plans. Note that of these 17 business plans, five plans were asked to follow the remaining steps of the 4F model, where the ideas and business plans were consolidated and given "legs for walking", through the conviction of the students and the need to verify that there is satisfactory economic and financial viability to achieve the constitution and implementation of a business—the formatting stage. The idea/business plan that won first place was challenged to

submit the business plan to the national Portuguese competition 7.º Poliempreende (2010), and came in second place in the national competition (it was the 3DTech Pro company). Finally we have the last step—formalisation, which requires the business to be implemented under formal conditions and includes an appeal for financing through different means (Table 9.1 summarises the information of the last two stages of the 4F model).

4 Presentation of Results

In this section, we intend to present the work developed within the Innovation and Entrepreneurship Office at IPB, based on the theoretical framework and methodological process presented in the previous section. Note that all the work carried out in this office, over the last 3 years, has been seen as a success in the internal and external environment of the IPB and the Office, since it is unable to obtain satisfactory results for the different players. Thus, the description of the activities and results will be divided according to the three pillars of the Academic Entrepreneurship Framework (Transfer of Technology, Entrepreneurship, and Employability).

4.1 Transfer of Technology

In the context of technology transfer, the Innovation and Entrepreneurship Office at IPB fits especially the activities towards the provision of technical and scientific services in the context of the search for solutions to regional needs, requiring therefore an intermediate position between researchers and users, so that the processes of research are likely to generate innovations and added value to the region.

The proposed model related to the strategies and practices of RDI in IPB is currently being adjusted to fit the requirements of NP 4457:2007. The objective is related to the subsequent development of an electronic platform to support the processes of RDI.

The definition of policies in line with the real needs of the region and the need to create tools that facilitate interaction between academia and companies are critical factors that are worthy of greater attention by the responsible Innovation and Entrepreneurship Office at IPB within the redefinition of processes in progress.

It is hoped in the future to be able to provide remote support services to businesses in the region that have been provided with the platform to be developed, particularly regarding issues related to the management interfaces, surveillance technology, and market.

It is expected that the challenge of keeping both the research community of the IPB and companies informed of the latest scientific and technological developments,

Table 9.1 Results of applying the 4F model

Real name of company (formal register date)	Branch of activity	Investment	Financing	Situation	IPB schools	Jobs created
Eurico Alves (February 2011)	Collection of used cooking oil for biodiesel production	€35,148.00	–	Under appreciation	ESTiG	1
3DTech Pro (April 2011)	Prototyping	€186,534.00	–	Under appreciation	ESTiG	2
Anselmo Rodrigues (February 2011)	Production of spirituous liquors	€24,980.00	€12,490.00	Approved by PRODER[a]	ESA	1
Touchflowers, Lda (August 2011)	Production and processing of aromatic and medicinal plants	€186,846.00	€148,338.40	Approved by PRODER[a]	ESA	2
Pragamatico Aromas, Lda (August 2011)	Nursery aromatic and medicinal plants	€116,917.00	€110,817.80	Approved by PRODER[a]	ESA	2
Total		€550,425.00	€271,646.20	–	–	8

[a]Obs.: *PRODER* Programa de Desenvolvimento Rural/Rural Development Programme

both inside and outside the institution, in several areas of knowledge, will lead to a greater interest in the development of new products or services with commercial interest.

The work underway in this regard focuses on the design of processes and their supporting technology platform and should be completed in the middle of 2013.

One of the most emblematic projects of technology transfer in the area of electronic commerce carried out in Portugal was named RuralNet and was developed within the Ph.D. project of one of the authors of this chapter (Pires 2001).

The RuralNet Project has given rise to an academic spin-off, which was developed by a group of teachers and students of the Polytechnic Institute of Bragança. This project promoted the creation of an alternative distribution channel for marketing products and high-quality food. The basis of this project was the concept of business process reengineering, particularly in terms of commercial aspects, which were promoted by the creation of an alternative distribution and sales channel for regional producers. The service was later commercialised in the form of e-commerce and widely disseminated within the scientific community in the form of articles in journals, and through conferences and seminars (Pires et al. 1999, 2000). Afterwards, there followed the provision of consulting services to companies and the RuralNet trademark was registered.

In the context of technology transfer, processes have been developed and applications approved for Community funding for four projects to the amount of €1,718,000.00.

Academic spin-offs have been shown to be an important means of transferring technology from academia to companies (Prodan and Drnovsek 2010).

4.2 Entrepreneurship

The set of defined processes, with a view to achieving the above objectives, refers to four key activities, designated internally by the 4F model: formation, fermentation, formatting and formalisation of business.

The formation/training processes, as its name indicates, refers to the transfer of a set of basic skills in the fields of organisation and company management to the final year students of different graduations and fields of knowledge, wishing, or not, to create their own company/business.

Fermentation is a process associated with work done at the final stage of the graduations and corresponds to the phases of research and development in view of the RDI. The aim of all activities that are part of this process is directed towards the creation of a spin-off and its protection in terms of intellectual or industrial property, where appropriate.

Formatting covers the whole range of activities undertaken to assess the potential economic and financial business benefits of the concepts developed and is embodied in the design of the respective business plan.

The Formalisation step corresponds to the formal creation of the enterprise, the licensing and registration of the brand, domains, etc. It also includes the financing aspect of the business. In this sphere the IPB should carry out the creation of a regional network to promote entrepreneurship, with the participation of regional players with different responsibilities in terms of economic development, including: local authorities, state institutions (such as IAPMEI, IEFP, and CACE of Mirandela), banks, microcredit societies, banking associations, business angels, etc.

During the three year period of activity of the Innovation and Entrepreneurship Office at IPB the following results were obtained up to now from the aspect of entrepreneurship: 15 companies constituted, creating 45 direct work posts with an investment amount of around €1,029,023.00.

Thus, academically entrepreneurial higher education institutions can play a high impact role in revitalising economies and lead them out of the global economic crisis which the world is faced with at this moment.

4.3 Employability

The processes of promoting employability through actions developed in the context of the Innovation and Entrepreneurship Office at IPB are currently certified under the standard NP EN ISO 9001:2008.

Employability refers to the set of actions taken to promote and facilitate the entry of students into the labour market, preferably at a regional level, to ensure the inclusion of qualified human resources that contribute to the improvement of regional competitiveness.

With the purpose of improving the integration of students into the labour market, we are proceeding with the building of an electronic platform whose primary purpose is to facilitate communication between employers and students looking for their first job. This platform also serves to manage the curriculum vitae of individual students, enabling them to record the activities listed in the individual portfolio with the automatic generation of a digital document in PDF format, according to European standards of writing a curriculum vitae. The community platform IPB is found at www.comunidade.ipb.pt, dated 1 December 2011, with approximately 1,017 students and 92 registered companies. There are currently 102 pending job offers in the portfolio. According to the figures presented it is possible to say that the results, to date, are satisfactory.

5 Conclusions

Many scientific publications and government reports show quite clearly the impact that the use of knowledge generated in universities can have on the economy of a region or country. So a change in the model from university teaching/research to

university teaching/research/entrepreneurship seems inevitable. The capacity to adapt to these changes, absorbing, learning and stimulating entrepreneurship will be extremely important to higher education institutions over the coming decades.

International, national, regional and local competitiveness, innovation and economic growth depend on being able to produce future leaders with entrepreneurial skills and attitudes in their professional lives, whether they create their own companies or innovate in larger organisations. Academic entrepreneurship perhaps is the first and questionably most important step for embedding an innovative culture.

The aim of this work was to report the strategies and best practices adopted by the Innovation and Entrepreneurship Office at Bragança Polytechnic Institute, during its short three years of existence. Consequently, in order to reach a better understanding of the entrepreneurial process, we redefined the traditional linked university/industry knowledge transfer process by creating a new entrepreneurial process solution. The developed model deals with a conceptual framework for triumphant entrepreneurial learning in terms of how higher education institutions can facilitate knowledge growth in this area and thereby become more entrepreneurial. The results indicate that the academic entrepreneurship framework and model is an original and valuable contribution to the study of this phenomenon and the knowledge generated in this academy is now more focused towards the social and economic interests in the region.

It is important to note that the employability of students is promoted by processes developed in the context of actions taken by the Innovation and Entrepreneurship Office of IPB that are currently certified under ISO 9001:2008. The processes of employment promotion include employees assisting with the admission of students into the labour market, and entrepreneurship which promotes self-employment. In the context of the current economic crisis these processes are increasingly difficult to achieve, especially in an economically depressed area with a weak business environment, for example Trás-os-Montes and Alto Douro, Portugal. Accordingly, the group of services provided by the Innovation and Entrepreneurship Office of IPB are focused on three fundamental objectives, namely: stimulation of an entrepreneurial culture within the academic community of the institution, stimulation of business start-ups involving students and teaching staff, and boosting the competitiveness of businesses by provision of technical services relating to financial consulting, quality, and RDI.

In conclusion, academic entrepreneurship and entrepreneurial development not only contribute to organisational growth, profitability and wealth creation in the institution of higher education but will also impact on the external environment and economy as a whole by increasing productivity, improving best practices, creating new industries and enhancing international competitiveness, therefore strongly contributing to the growth and development of the economy and society.

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