UNEK, an Academic Entrepreneurship Maturity Model for Technological Faculties

UNEK, un Modelo de Madurez de Emprendimiento Académico para facultades tecnológicas

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Abstract: Academic entrepreneurship has become one of the main challenges of higher education institutions all over Europe, having evolved from individual non-interconnected activities developed by academic institutions to a more structured and systematic need. Historically, activities have been in place across Europe but efforts are fragmented and often driven by external actors instead of by the education system itself. Few universities in Europe have academic entrepreneurship activities based on an entrepreneurship strategy with clear objectives and measurement that really focus on the local needs and context. Therefore, higher education institutions require an adequate and cohesive framework that encompasses the various dimensions of entrepreneurship education. In order to deal with this situation, the Polytechnic College of Donostia - San Sebastián (UPV-EHU), the School of Engineering Tecnun (University of Navarra) and Mondragon University's Faculty of Engineering, financed by Gipuzkoa Provincial Council, developed a project called UNEK. The main objective of the project was to analyse the academic entrepreneurial situation of Gipuzkoa's technological faculties, providing them with an entrepreneurial maturity model proposal.

Keywords: Entrepreneurial University, Entrepreneurial Maturity Model, Entrepreneurship education, University–Industry Cooperation

Resumen El emprendimiento académico se ha convertido en uno de los principales retos de las instituciones de educación superior de toda Europa. Pocas universidades en Europa tienen actividades de emprendimiento académico basadas en una estrategia de emprendimiento, con objetivos claros. Por ello, se requiere de un marco adecuado y cohesivo que abarque las diversas dimensiones de la educación emprendedora. Para hacer frente a esta situación se ha desarrollado un proyecto llamado UNEK. El objetivo principal del proyecto es analizar la situación de emprendimiento académico de las facultades tecnológicas de Gipuzkoa, aportándoles una propuesta de modelo de madurez de emprendimiento.

Palabras clave: Universidad Emprendedora, Modelo de Madurez de Emprendimiento, Educación en Emprendimiento, Cooperación Universidad-Empresa

1. Introduction

The most developed and competitive countries base their strategies linking Uni-versity-Industry-Government in order to promote innovation, knowledge transfer and commercialisation, and entrepreneurship among students and academics. In addition, these entrepreneurial activities contribute effectively to the economic development and the creation of employment through relationships with companies (Robles and Ballina, 2012). In order to follow these strategies, for at least two decades, academia has been talking about the Entrepreneurial University (Etzkowitz and Viale, 2010; Tuunainen, 2005).

Indeed, universities' first mission was described as education for cultural and technological citizenship (Delanty, 2002). Afterwards, the second mission that most universities embraced was to do research. Until recently, it was assumed that universities were guided solely by so-called "pure" academic criteria and had only these two missions: high-level research and transmission of knowledge (Laukkanen, 2003). Moreover, it was increasingly expected that universities, in addition to those basic tasks, play major roles in regional innovation and economic growth, often helping to turn around regions in distress. In this new division of labour, referred to as universities' third mission, academia was seen as a key provider of new technologies and

business ventures, as a regional development engine. Thereby, after this second academic revolution, universities were transformed into Entrepreneurial Universities.

The assumption of this last role was the latest step in the evolution of the university from its original purpose of conservation of knowledge. Furthermore, although universities became entrepreneurial, they did not give up their previous functions of teaching and disinterested research (Etzkowitz, 2003). In this line, although it is evident that entrepreneurship within the university augurs well for the host institution and for its external environment (Meyers and Pruthi, 2011), what constitutes this Entrepreneurial University? There are several views on what constitutes an Entrepreneurial University, but there is still a lack of agreement about its core components (Guerrero et al., 2011; Guerrero et al., 2016; Rothaermel et al., 2007).

In order to deal with this situation, the Faculty of Engineering from Mondragon University in collaboration with Tecnun, the School of Engineering from University of Navarra, and the University of the Basque Country developed a research project called UNEK. In the following lines the objectives that UNEK pursued are shown, in addition to the methodology followed and the results obtained.

2. Objectives

The project UNEK aimed to analyse and enhance academic entrepreneurial activities in Gipuzkoa's technological faculties, providing a Technological Academic Entrepreneurial Maturity Model and its corresponding evaluation tool, a Good Practices Handbook and a Territorial Report. Furthermore, this objective is reached by fulfilling the next four technical objectives: (i) to define, develop and test a Technological Academic Entrepreneurial Maturity Model, (ii) to analyse Gipuzkoa's technological Higher Education Institutions (onwards HEI) current entrepreneurial situation, (iii) to gather a well-defined set of academic entrepreneurship activities based on HEI Good Practices Handbook and (iv) to design, develop, implement and test an Entrepreneurship Academic Website.

3. Methodology

UNEK project took nine months long and the methodology followed was designed in order to assure each technical objective. Therefore, three phases were followed within the project:

In order to achieve the first technical objective, to de-

fine, develop and test a Technological Academic Entrepreneurial Maturity Model, three consecutive activities were developed:

1. To develop the state of the art; the objective was to study the state of the art referred to entrepreneurship research, paying special attention to the factors and subsequent activities that affect the entrepreneurial capacity on technological academic institutions and to the entrepreneurial management models defined.
2. To design the model and the evaluation tool; the objective was to design a Technological Academic Entrepreneurial Maturity Model and its corresponding evaluation tool, which will work as a guide tool for identifying and increasing the entrepreneurial capacity of HEI.
3. To implement and test the tool; the objective was to validate the evaluation tool by testing it among the academic partners of the project.

Afterwards, so as to reach the second technical objective, to analyse Gipuzkoa's technological HEIs current entrepreneurial situation, the main activity developed was to spread the evaluation tool within all Gipuzkoa's technological faculties and analyse the obtained results; developing a Territorial Report. Accordingly, two consecutive activities were developed:

1. To spread the evaluation tool; the objective was to spread the evaluation tool within all Gipuzkoa's technological faculties; specifically, within eight technological faculties.
2. To analyse the information gathered and develop a Territorial Report; the objective was to analyse the information gathered through the evaluation tool, using the SPSS (Statistical Package for Social Science) software in order to conduct a descriptive statistics analysis and develop the Territorial Report which gathered the Entrepreneurial level diagnosis of Gipuzkoa's technological faculties.

Regarding the third objective, to gather a well-defined set of academic entrepreneurship activities based on HEI good practices, structured interviews with Gipuzkoa's technological HEIs high level staff were developed. Consecutively, an entrepreneurship Good Practice Handbook was developed.

Finally, to reach the last objective, a project website was designed, developed, and implemented. Furthermore, this website had a double objective: on the one hand to share information within the project partners and on the other hand to disseminate the project results.

4. Results

UNEK project sought to provide higher education governing bodies and managers with frameworks and set of tools that assure systematic approach to institutional managers as only decision makers can decide on the outcomes. UNEK provided an entrepreneurial management model (management framework), an evaluation tool for measuring this model, a Territorial Report that gathered the Entrepreneurial level diagnosis of Gipuzkoa's technological faculties and a Good Practice Handbook on Entrepreneurial Activities.

Based on all the deliverables developed within the project, this section shows the management framework developed in order to analyse technological faculties' entrepreneurial level, the evaluation tool developed and a descriptive statistical analysis of the information gathered from the eight technological faculties that composed the sample. On the figure below (Figure 1), the entrepreneurial management model (management framework) is shown.

Figure 1 Entrepreneurial management framework

In fact, the entrepreneurial management model is composed by thirteen factors and they could be grouped together into three general groups: (i) those related to the environmental context, (ii) those related to the faculty's resources and (iii) the ones related to the facul-

ty's processes. The selection of the factors is based on Markuerkiaga (2014)'s doctoral dissertation, where a literature review regarding the main factors that made up an Entrepreneurial University is done. Figure 2 shows all the sub-factors of each factor.

	CONTEXT		RESOURCES			PROCESS								
FACTORS	Institutional Context		Funds for Entrepreneurship	Staff Development in Entrepreneurship	Industry Presence in Curriculum D&D	Mission & Strategy	Management Support	Organisational Design	Policies	Entrepreneurship Education	University support through the whole entrepreneurship process	Active Teaching Methodologies	Internationalisation	
SUB-FACTORS	Legislation	Financing												
	Infrastructure	Financing												
	Technological Level	Emergent sectors												
	R&D Budget													
	Funds for Teaching and Research in Entrepreneurship													
	Funds for Entrepreneurship Programmes													
	Seed Capital													
	Technological Transference													
	Spin-off creation													
	Entrepreneurship Training													
	Participation in the Board of Directors													
	Participation in Development and Delivery													
	Guest Lecturers													
	Presence in the Mission													
	Objectives													
	Strategy related to Technology Transfer													
	Strategy related to University Business Collaboration													
	Strategy related to Entrepreneurship													
	Monitoring Results													
	Supports Entrepreneurship													
	Incomes for Entrepreneurship													
	Presence in the agenda													
	Connection between Teaching and Research													
	Decentralised Decision Making													
	Bottom-Up Structure													
	Income													
	Policies related to Technology Transfer													
	Policies related to University Business Collaboration													
	Policies related to Spin-off creation													
	Curriculum													
	Programs for Entrepreneurs													
	Research													
	Awareness on Entrepreneurship													
	Opportunities Identification													
	Business Plan Development													
	Spin-off creation													
	Material Development													
	Learning by Doing													
	Participation of Entrepreneurs													
	Shared Degrees													
	Research													
	Income													

Figure 2 Sub-factors of the Entrepreneurial University

Regarding the evaluation tool, all factors were measured using a three level scale; indeed, each faculty on the sample had to establish itself in one of these levels.

Figure 3 shows a piece of this evaluation tool; indeed, the it shows the sub-factors that made up the factor called Institutional Context.

SUB-FACTOR	LEVEL 1				LEVEL 2					LEVEL 3			
LEGISLATION	No legislative changes in order to create the necessary conditions to promote entrepreneurship.				Legislative changes are taking place in order to create the necessary conditions to promote entrepreneurship.					There is legislation in order to create the necessary conditions to promote entrepreneurship.			
	0	10%	20%		30%	40%	50%	60%	70%	80%	90%	100%	
FINANCING	There are not public programs that provide financial incentives to promote entrepreneurship.				Public programs that provide financial incentives to promote entrepreneurship are being established.					There are public programs that provide financial incentives to promote entrepreneurship.			
	0	10%	20%		30%	40%	50%	60%	70%	80%	90%	100%	
INFRASTRUCTURE	There are no physical infrastructure (incubators, business and innovation centers, technology parks ...) for the promotion of entrepreneurship.				Physical infrastructure (incubators, business and innovation centers, technology parks ...) for the promotion of entrepreneurship are being developed.					There are physical infrastructure (incubators, business and innovation centers, technology parks ...) for the promotion of entrepreneurship.			
	0	10%	20%		30%	40%	50%	60%	70%	80%	90%	100%	

Figure 3 A piece of the evaluation tool

As it has been mentioned before, eight technological faculties from Gipuzkoa were analysed and a statistical analysis was carried out in order to develop a Territorial

Report. In the following lines the main results regarding the thirteen factors are shown. Figure 4 shows the average of each analysed factor.

Figure 4 General overview of Gipuzkoa's technological faculties

Indeed, there are two factors, Staff development in Entrepreneurship and Funds for Entrepreneurship which are at the lower level. This means that nowa-days Gipuzkoa's technological faculties are not providing the appropriate training for all the staff in the area of technology transfer, in new venture creation, neither in entrepreneurship. In addition, these faculties are not providing resources to fund entrepreneurship teaching, research and business creation. Due to this lack of economic resources, faculties are not proving support through the whole entrepreneurial process. Nevertheless, there is a factor, the Organisational Design, which is at the higher level of the entrepreneurial management model. This means that Gipuzkoa's technological faculties provide a connection between teaching and research, they facilitate and support bottom-up entrepreneurial and innovative behaviour and they facilitate decentralised decision making.

In addition, in order to identify any pattern within the eight Gipuzkoa's technological faculties a Cluster analysis was used. A two-step approach was followed, first a hierarchical procedure (the Ward method) was used as an exploratory methodology to determine the

desired number of clusters and then a non-hierarchical method (k-means method) was used. As a result, the eight faculties are clustered into two different groups: Cluster 1 composed by five faculties (a. Tecnun, School of Engineering at the University of Navarra; b. Higher Technical School of Architecture (UPV/EHU); d. Dual Engineering University School IMH; g. Faculty of Chemistry (UPV/EHU); and h. EPS-MU, Mondragon Unibertsitatea's Faculty Of Engineering) and Cluster 2 composed by three faculties (c. Eibar Industrial Engineering College (UPV/EHU); e. Engineering College of Gipuzkoa (UPV/EHU); and f. Faculty of Informatics (UPV/EHU)).

Figure 5 shows the differences between both clusters, however not all the factors are significantly different. An ANOVA analysis was developed in order to confirm the difference between both clusters and five out of the thirteen factors are significantly different between both clusters. Indeed, faculties from Cluster 1 obtain better results than Cluster 2 on Institutional Context, Industry Presence in Curriculum D&D, Mission & Strategy, Organizational Design and Entrepreneurship Education.

Figure 5 Academic Entrepreneurial level of both clusters

Regarding the third objective, the HEI Good Practices Handbook, seven good practices were identified and collected within the handbook. All of them followed the same structure and were based on a different factor.

Finally, with respect to the last objective, the project website was developed (<http://unek.mondragon.edu/es>) where all the deliverables of the project were up-loaded in order spread the results generated.

5. Conclusions

Academic entrepreneurship has become one of the main challenges of higher education institutions all over Europe, having evolved from individual non inter-connected activities developed by academic institutions to a more structured and systematic need. Few universities in Europe have academic entrepreneurship activities based in an entrepreneurship strategy with clear objectives and measurement that really focus on the local needs and context. Attending the results of the research in reference to the faculties in Gipuzkoa, the main conclusion that can be obtained from the analysis is that they have much work to do to reach the entrepreneurial university's paradigm. Start-

ing from the development of activities aligned with their entrepreneurship strategy, which is the real lever of the Entrepreneurial University.

In addition, the Cluster analysis shows how Gipuzkoa's technological faculties are on different academic entrepreneurship maturity levels, as many authors stated (e.g. Berács (2014) Bronstein and Reihlen (2014)) there is not a unique typology of Entrepreneurial University; each of them has different characteristics and seeks different objectives. For example, Tijssen (2006) identified three phases for university's transformation into an Entrepreneurial University; in the first phase, the university becomes more aware of the potential for commercialisation, the second phase is characterised by identifying opportunities for commercialisation, and the third phase by developing commercialisation opportunities.

Through the outputs of this project Gipuzkoa's technological faculties will have the necessary tools to develop, test and validate their Academic Entrepreneurial approach and strategy, based on a diagnosis tool, that will provide them with an entrepreneurial maturity scoring or level, and giving some recommendations (the Good Practice Handbook) to evolve and get to a higher maturity entrepreneurial level.

In addition, it has to be highlighted that UNEK project has a big limitation which is the sample size used (eight technological faculties). Although the 100% of Gipuzkoa's technological faculties are analysed within the project, it does not allow a more rigorous statistical analysis. Furthermore, the technological faculties are not the single higher education institutions that develop academic entrepreneurship activities, therefore nowadays the second part of the project is being carried out: UNEK. The objective of this project is to redesign and adapt the entrepreneurial management model and the evaluation system for any higher education institution and to analyse the overall situation of Gipuzkoa's academic entrepreneurship level.

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