

# Dynamics of Innovation, Entrepreneurship and Competitiveness

## Multiple Case Studies

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### Abstract

Globalization has revealed significant competitive pressures in economies. Innovation and entrepreneurship initiatives are seen as fundamental to the competitiveness, as a driver of job creation and wealth. Collaborative networks of Industry-Academia-Government (A-I-G) are assumed to be the basis for success, facilitating access to information and resources, while still allowing synergies and cost. The dynamics of interaction (A-I-G) and the emergence of new hybrid organizations play a key role in competitiveness through the transfer of knowledge and technology, human resources and ensuring productive, secure funding and policy options. To contribute to the enrichment of the literature, this study develops a model built on conceptual interpretive theory. The proposed model seeks to clarify, through the analysis of multiple case studies, the impact of innovation and entrepreneurship in competitive economies, in a collaborative perspective between institutional spheres.

### Introduction

Globalization has caused significant competitive pressures in economies, making urgent the emergence of innovations, in terms of products, technology and processes, or organizational and marketing level, leading to the redefinition of the organizations strategy and business models (Boschma, 2004; Chesbrough, 2007; Groot *et al.*, 2007; Mitchel & Coles, 2003; OECD, 2005).

Innovation has become a major challenge for global competitiveness. Companies must be able to harness the power of location in creating and commercializing new ideas (Porter and Stern, 2001).

The interactions of Academia-Industry-Government (A-I-G) are the key to innovation in knowledge-based societies, helping students, researchers and policy makers to respond to some questions: how do we strengthen the role of the Academia in economic and social development? how can governments encourage citizens to take an active role in promoting innovation? how can firms collaborate with academia and government? (Etzkowitz, 2008).

The focus of innovation has shifted in recent years from centers of R&D of large firms to clusters and start-up technology, persisting large companies as integral parts of wider networks, broad companies from different sectors, academic entities and other organizations (Etzkowitz *et al.*, 2005).

Starting from the central question of the study: the dynamic interaction of Industry-Academia-Government related to innovation and entrepreneurship, contribute positively to the development and competitiveness of regions?, we propose the development of a model,

which will serve as a basis for defining research propositions, which we intend to conduct empirical verification using the typology of interpretive research through case study.

In this context, this paper aims to reinforce a new interface between innovation, entrepreneurship, and competitiveness of economies, from the perspective of collaborative networks among institutional actors: A-I-G.

The paper is structured into six main sections: introduction; literature review; proposed model, case studies, results, and conclusions.

## **Literature review**

### **Innovation and entrepreneurship**

The measurement framework for innovation emphasizes the driving forces of innovation, the importance of product and process, marketing and organizational practices, the role of networks and diffusion of innovation, as an innovation system, intending to increase the competitive performance of organizations, often combined with uncertainty about their results (OECD, 2005; Porter & Stern, 2001). Innovation enhances the increase in demand for the company's products, reducing unit production costs and/or improves the company's ability to innovate (OECD, 2005).

Industrial policy and technological development are linked through the concepts of innovation and competitiveness (Clark et al., 2011). Generally, it has been shown by governments, a growing interest in maintaining the competitiveness of their economies by establishing policies to encourage advances in science and technology (Clark et al., 2011).

Entrepreneurship includes the creation of new business and developing new opportunities in existing organizations, contributing to the creation of a dynamic entrepreneurial culture, capable of progression in the value chain, in a context of global economic environment (GEM, 2010; Kelley et al., 2011). The creation of new companies is very important for economic growth, and the facilitators of entrepreneurship, people who create, build and boost business and social enterprises, thus helping the economic and social regeneration (Gries & Naudé, 2009; Thompson, 2010; Valliere & Peterson, 2009).

The technological entrepreneurship involves the creation of new businesses based on the exploitation of opportunities offered by technological innovations. Promote technological entrepreneurship has become an important goal for political leaders. The role of the spin-off has been the subject of numerous investigations in the field of entrepreneurship, particularly in the area of technological entrepreneurship, with emphasis on the creation of spin-offs from research institutions, technology parks and incubators, or even in terms of academic spin-offs and spin-outs (Gilsing et al., 2010).

### **Collaborative networks and Competitiveness**

The networks of cooperation in R&D are assumed to be a reality organizational and economic context where companies join other institutions (firms, research centres, universities, etc), creating regional, national or international networks, to develop technological projects that could positively affect competitiveness. Also here are part public institutions aimed at promoting the development of their technology policies, in some cases supported by public programs, to promote the establishment of collaborative networks for R&D projects development (Arranz & Fdez. de Arroyabe, 2008; Semlinger, 2008).

International competitiveness is the degree to which a country can, under free and fair market, produce goods and services that meet the test of international markets while simultaneously maintaining and expanding the real incomes of people in the long term (OECD, 2005).

While one might have tried to believe that regions develop naturally and business groups, its suppliers and distributors will emerge spontaneously, perhaps also the presence of key resource persons of a strategic vision, revealing substantial differences in activity and entrepreneurial attitude among the nations and regions (Bosma & Schutjens, 2011; Thompson, 2010). The overall development includes economic growth, social progress and the improvement of living conditions of people (Aloysius, 2002).

### **Proposed Model**

Starting from the central research question: the dynamic interaction of Industry-Academia-Government, related to innovation and entrepreneurship, contribute positively to the development and competitiveness of the regions? From the literature review, we propose the development of a study model, which will serve as a basis for defining research propositions, which we intend to conduct empirical verification using the typology of interpretive research through multiple case studies.

Collaborative networks usually represent cooperation agreements aimed at achieving competitive advantage among partners (Elmuti, Abebe, & Nicolosi, 2005; Lazzarotti et al., 2011).

Globalization emerges in a decentralized way, through networks between universities, firms and governments (Etzkowitz, 2003; Etzkowitz, 2008; Etzkowitz & Dzisah, 2008).

Given the above, is defined the research proposition # 1: (P1) - Collaborative networks A-I-G directly and positively contribute to improve the competitiveness.

The interrelationships between firms, technology and territory in an economic system have been considered as a “*holy trinity*” in the perspective of regional development studies (Leydesdorf et al., 2004).

Holistically, business networks and cooperation are universally assumed to be the key to success, where firms and other public and private organizations join together in networks, with a view to achieving new standards of competitiveness, getting through these, the access to hitherto inaccessible resources or to reduce costs by sharing (Arranz & Fedez. De Arroyable, 2008; Awazu, 2006; Semlinger, 2008).

In this connection is established the research proposition # 2: (P2) - *In the A-I-G dynamics, the political decision positively contributes to competitiveness.*

The competitiveness is based on growth of intellectual capital and to support institutions such as academia, research centres, incubators and science parks in order to add value to resources, from agriculture to the different sectors of activity, including knowledge economy (Etzkowitz & Dzisah, 2008).

Entrepreneurship results from the creation of new businesses, but also developing new opportunities in existing organizations, seeking the prosperity of the economy, by contributing to the creation of value and increase organizational performance within competitive environments (Bagheri & Pihie, 2011; GEM, 2010; Gries & Naudé, 2009; Kelley, et. al, 2011; Thompson, 2010; Walzer, 2011). In terms of the attractiveness of entrepreneurial activity, Universities can also facilitate entrepreneurship through spin-offs (Baltzopoulos & Broström; 2011).

In this context, it is formulated the research proposition #3: (P3) - *The role of the University associated to innovation and entrepreneurship positively contributes to competitiveness.*

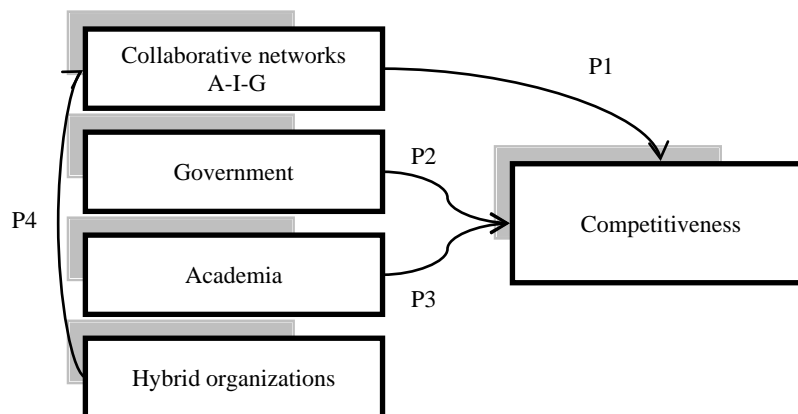
Competitiveness is defined by a set of institutions, policies and factors that establish the ability to generate wealth in an economy, the ability to return on invested capital and growth in economic activity, justifying even the ability to attract financial and human capital (Schwab, 2010).

From A-I-G interaction also results a new set of hybrid organizations that identify themselves as facilitators of knowledge transfer and technology (science and technology parks, incubators, laboratories, etc.) (Etzkowitz, 2003; Etzkowitz, 2008; Etzkowitz & Dzisah, 2008). The dynamics of entrepreneurship are an important mechanism of competitiveness both derive from spin-off's academics, supported by science and technology parks or incubators, or arise from the creation and expansion of new businesses (Salvador, 2010). It should, above all, emphasize job creation and wealth (Gilsing et al., 2010; Nordqvist, 2010).

It is therefore determined the research proposition# 4: (*P4*) - *The hybrid organizations have a positive impact on A-I-G collaborative networks.*

Supported in the literature review on innovation, entrepreneurship and competitiveness, and according to the propositions formulated, we propose the following conceptual model (Figure 1) aiming to demonstrate the strong impact of innovation and entrepreneurial initiative on competitiveness through A-I-G interaction .

Figure 1 – Conceptual model



Assuming the collaborative interaction A-I-G as facilitators of knowledge transfer and technology, human capital and productive, and committed financing and policy options, the proposed conceptual model, aims to reinforce the importance of collaborative networks between different organizations of private and public capital, and new hybrid organizations (technology parks, business associations, incubators, research and development centres, ...), through its role of innovation, entrepreneurial dynamics, reflected in the creation of new jobs and wealth, vital for the competitiveness of economies.

### Case studies

In this section, we present three case studies, resulting from the A-I-G interaction on the development of a harvesting machine in continuous olive, a project R&D in the development of biofuel 2<sup>nd</sup> Generation, and a spin-off of University of Beira Interior, Portugal.

### Methodology

This empirical study falls within the paradigm of qualitative research through case study using the interview, based on the analysis of A-I-G interactions in Portugal, trying to contribute in some way to increase the scientific knowledge in this field.

The interviews support for this study took place between 15<sup>th</sup> July and 8<sup>th</sup> October 2012.

## Unit of analysis

The first collaborative project (case I) is the result of a strategic alliance between the University of Évora (located in the Alentejo region in Portugal), the SME firm VICORT - Vitor Cardoso, Ltd., leading of forestry machinery in Portugal (located in Castelo Branco, Beira Interior region) and Portuguese Innovation Agency (Adi), while government agency responsible for managing of public funds.

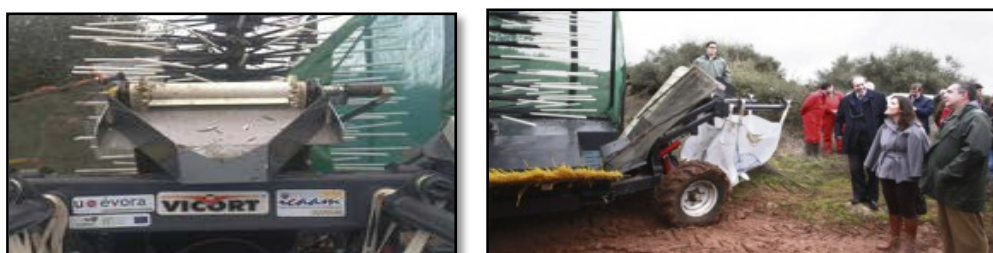
The second project (case II) is developed in collaboration between the portuguese company Galp Energia (located in Lisbon), the University of Évora, the Higher Institute of Agronomy, of Technical University of Lisbon (ISA), the Polytechnic Institute of Portalegre (IPP) (located in the Alentejo region, Portugal), VICORT (harvester), Reynolds Engineer Domingos de Sousa (debarking machine), with financial support from the Fund Innovation Support (FAI) of the Directorate General for Energy and Geology / Energy Agency (ADENE).

In addition, are still analysed the perspectives of a leading member of two hybrid organizations (case III), the Business Association of Castelo Branco region (NERCAB) and Agribusiness cluster Association (INOVCLUSTER), both located in the town of Castelo Branco, Portugal), and heard the entrepreneur and leader of an Academic Spin-Off at University of Beira Interior (Covilhã city, Portugal).

## Results

The Prototype Machine for Continuous Harvesting Olives (Figure 2), presented in December 2011, in the Farm "Torre das Figueiras" in Monforte, Portalegre, in the Presence of Ms. Minister of Agriculture, Sea, Environment and Spatial Planning, conducted in partnership between the company VICORT, and the team of agricultural mechanization in the Department of Agricultural Engineering, of University of Évora, funded by the Portuguese Strategic Reference Framework (QREN) through the Innovation Agency (Adi), is a good example of cooperation strategy to transfer knowledge and technology (ICAAM, 2011).

Figure 2 – Prototype Machine for Continuous Harvesting Olives



Source: (ICAAM, 2011).

Based on a strong component of product innovation and process, it is present an entrepreneurial intention from the series production of the invention. In this perspective the Minister of Agriculture of Portugal, considered this project *"an example of innovation in agriculture. A national project that links between businesses and universities by relying on knowledge (...) crucial for the future of agriculture in Portugal"* (ICAAM, 2011).

The second project results in the signing of contracts with the partners of the project "Development of 2nd generation biofuels" under the Technology Program R&D Galp Biofuels *Jatropha Curcas* Linn. (JCL) on the sustainable production of biofuels in support of ongoing operations in Mozambique in search of diversification of sources of supply and

production of renewable energy through non-food raw materials, in areas without significant use (ISA, 2011).

Interviewed the Management of VICORT and after document analysis, it is concluded that the contracts are signed yet results in the context of the second phase of the project, the intention of conception and construction of machine harvesting Jatropha Continuous and Machine Peel of Jatropha (Debarker), developed by the company VICORT and entrepreneur Domingos Reynolds de Sousa, respectively, in partnership with Galp Energia (responsible for planning, management and control of the project), the Department of Agricultural Engineering of University of Évora (scientific and technical consulting), culminating with respective patent application process under industrial property resulting from the conception and development of this project. The third stage of the project will be part of the Extraction Process and Quality Oil for Biodiesel Production in cooperation with the Department of Agribusiness of ISA and IPP, entities that are also present in the collaborative process of the fifth stage - Treatment, production and test Biodiesel obtained by extracting oil from JCL (Galp Energia, n.d.; ISA, 2011).

One of the roles of universities and research centres is to transfer the knowledge to companies, leaving him still function for dissemination of knowledge by producing quality students capable of interacting with businesses through programs of cooperation (Eom & Lee, 2010). To achieve the stages I and IV of the project (plant breeding and production techniques, production and testing of biodiesel), is involved the Portuguese scientific system, with its own research teams and doctoral students. This phase will also be part of the strategic alliance cooperation, the University of Trás-os-Montes e Alto Douro (UTAD), through the Centre for Animal and Veterinary Sciences (ISA, 2011).

After reviewing the literature, and through documentary analysis of these case studies, we confirmed the proposition #1: *(P1) - Collaborative networks A-I-G directly and positively contributes to improve competitiveness.*

Under the Technology Program of R& D Galp Biofuels JCL, it is emphasized that the work eligible are estimated at about two million euros, financed by 50% by the FAI and 50% by Galp Energia, being included funds for the development of PhD programs in ISA and UTAD (ISA, 2011). The steps of the project will be eligible for co-financing undertaken in partnership with: (i) the University of Évora, through its Department of Rural Engineering - II stage of development and construction of machine harvesting and debarking continuous and simultaneous, for JCL. In its proposal, the partners are also included VICORT and Domingos Reynolds de Sousa; (ii) the ISA in partnership with IPP - phase III development of the extraction process and quality of JCL oil for biodiesel production; and (iii) IPP, in collaboration with the ISA, treatment, testing and production of JCL biodiesel in engines.

Given the above, we have support for the proposition # 2: *(P2) - In the A-I-G dynamics, the political decision contributes positively to competitiveness.*

Universities are organizations that perform a key role in contemporary societies, educating large proportions of the population and generating knowledge (Perkmann et al., 2012). The University should also promote the participation of representatives of industry, its faculty and advisory boards. A special emphasis should be placed on the institutionalization of innovation and the role of SME, promoting its transformation into effective catalysts for change (Saguy, 2011).

Open innovation is one of the most popular paradigms for improving innovation processes of companies, based on collaborative creation and development of ideas and products. The main feature of this new paradigm is that knowledge is explored collaboratively flowing not only from internal sources, but also from other external stakeholders such as customers, partners, etc. (Carbone, Contreras, Hernández, & Gomez-perez, 2012).

The emergence of programs to support entrepreneurship initiatives in universities has become a theme topic of many studies (Bjerregaard, 2010; Coduras et al., 2008).

When the President of NERCAB and Vice-President of INOVCLUSTER, Dr. António Trigueiros of Aragão, was interviewed he argues:

*"The interaction of the Academy with the companies could prove important. However it must be a strategy of cooperation. The companies do not expect that universities invest separately in innovation and technology and transfer them to Industry. Companies should be open to the integration of the University, through the stages of acceptance, openness to conduct research and specific studies that help businesses solve concrete problems. To this end, the University may have to rethink their curricula courses(...)"*.

Telling the personal story of an entrepreneur born of a spin-off of the University of Beira Interior (UBI), the entrepreneur António Pires reveals:

*"In the final of project discipline of my degree, I developed with another colleague of class, a computer application for Management of Industrial Maintenance, and we went with this project winners of the Innovative Ideas Competition in 2002, promoted by CIEBI - Centre Business Innovation in Beira Interior, and the National Award Ideas and Entrepreneurs in 2003, in the innovative Project category, sponsored by IAPMEI - Institute to Support Small and Medium Enterprises and Innovation "*.

About his entrepreneur live, António Pires adds:

*"The recognition obtained with these awards unleashed an entrepreneurial vein and creation of new businesses, and founded in 2003 the ConsisPro - Diagnosis and Conception Computer Systems, Ltd., a company that I located in Parkurbis - Park of Science and Technology of Covilha . In 2006, I acquired another company, Omnisys - Information Technologies Ltd., also based in Parkurbis. In 2009, I sold all the shares it held in companies and ConsisPro and Omnisys, to the Group I.Zone, and I played several roles in different companies of this group, including functions of Business Developer in Omnisys and Criavision, and Account Manager and Coordinator of the Pole of I.Zone group at Covilhã. At the beginning of year 2012, I abandoned all functions in the I.Zone group, and I started a new project, Collectivus Ltd., also located in Parkurbis. "*

According to respondents, the relationship between the University and the Companies may prove important. The academy itself supports the creation of spin-off's that once awarded the awards of merit in the field of innovation; enhance the awakening of the "vein" entrepreneurial. By themselves, innovation and entrepreneurship leads to competitiveness of the economies and regions.

When he was asked to "wear the sweater entrepreneur" and was concerned to the relationship of entrepreneurship to the competitiveness of economies, Dr. António Trigueiros de Aragão added:

*"The reasons leading to entrepreneurial competitiveness of economies and developing regions pass through the observation of at least one of the following factors: emotionality; regional attributes, and positive discrimination (...)"*.

This interpretive logic, resulting in the acceptance of the proposition#3: (P3) - *The role of the University associated with innovation and entrepreneurship contributes positively to competitiveness.*

Most of countries and regions, aim under the interactions A-I-G, perform an innovative environment, from the creation of academic spin-off's, trilateral initiatives for the development of knowledge economic, and strategic alliances between firms operating in different business areas with different levels of technology, government laboratories and academic research (Etzkowitz & Leydesdorff, 2000).

Grounded in the experiences of industrial districts in Italy, clusters have become nowadays a major focus of industrial policy and regional levels in many industrialized

countries (Isaksen, 2012). New perceptions have emphasized the role of non-local networks, allowing companies to improve their learning and ability to innovate (Kesidou & Snijders, 2012).

Regarding the role of hybrid organizations in collaborative networks, Dr. António Aragão adds:

*"The role of associations and clusters through the clarification, ensuring relevant information about the facts; coordination of efforts among members, private and public institutions and other players in the market, by creating synergies, and above all, ensure economies of scale determinants for competitiveness."*

Still on the same topic, António Pires shared:

*"The hybrid organizations, including the Technology Parks and Parkurbis in particular, which is the park I know most closely, have as main objective to promote a culture of innovation and entrepreneurship by supporting innovative ideas and technological base coming from institutions of higher education, private sector and R&D projects in consortium with industry"*

In this perspective, it becomes possible to confirm the proposition #4: (P4) - *The hybrid organizations exert a positive impact on A-I-G collaborative networks.*

## Conclusions

This paper aims to contribute to the scientific debate about the interface of innovation, entrepreneurship and learning, in a perspective of collaborative networks while facilitating the development and competitiveness of economies.

This article is based on qualitative research paradigm, the interpretive theory while recurrent research methodology alternative, based on the case study, using the interview to explore the dynamic nature of A-I-G.

The A-I-G interactions, coupled with innovative initiatives and entrepreneurship, potentiate the increase of competitiveness of organizations by satisfying new market needs by developing new products and new technology, not forgetting the important role in this context of hybrid organizations (business associations, clusters, technology parks, incubators, ...), in terms of support to entrepreneurs and development of new businesses created (start-up). Based on the literature review, the confirmation of the propositions associated to the conceptual model proposed, shows that there is a direct and positive impact of collaborative networks A-I-G on competitiveness, as well as a positive contribution to the University, associated with entrepreneurship and innovation initiatives, and of Government decisions on the competitiveness of regions. The conclusion is still a positive contribution of hybrid organizations for the dynamics of A-I-G collaborative networks.

For future lines of research, these issues should be addressed through a quantitative survey in order to improve and extend the research model here presented: What indicators should be used to evaluating and measuring the dynamics of A-I-G collaborative networks?

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