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The role of academic spin-offs in entrepreneurial innovation and regional development. *The Apulia case.*

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ABSTRACT

In a recession context, characterized from a slowing down of the productive activity and from an increment of the unemployment rate, regional development policies of local authorities should consider initiatives apt to stimulate enterprise creation. This paper focuses on the role of academic spin-offs in generating entrepreneurial opportunities for regional development. After an introduction about the importance of networks among universities for technology transfer and development of academic spin-offs and definition of relevant literature on entrepreneurship and processes of identification, evaluation and exploitation of entrepreneurial opportunities to create new business, the paper moves to the analysis of the enabling conditions for promoting the birth of new academic spin-offs. In particular, we investigate how business innovation could take place from patents and research at the university level, in order to contribute to the economic development of a region. Academic spin offs represents an important mechanism for technology transfer from universities and research institutions to the real economy. The paper highlights the results obtained in Apulia Region, which started in 2007 a network called "Rete ILO Apulia" (where ILO stands for Industrial Liaison Office), with the aim of putting together the efforts of Apulia universities and research institutes (ENEA and CNR), providing them a set of resources and capabilities for technological transfer and entrepreneurial innovation. This project has financed the birth of several spin-offs academic from 2007 to 2012, which have been examined at the end of the paper. The main hypothesis of the paper is that the sustainable growth of academic spin offs in this region contributed to the development of the Apulia area and entrepreneurial innovation.

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1. INTRODUCTION

Higher education plays an increasingly critical role in the economic competitiveness of local, state and national economies and is the basis for continuous innovation (Lane & Johnstone, 2012). The many economic impacts of universities are specific and sustained, both for a direct impact in strengthen workforce skills and indirect impact on the symbiotic relationship of campus and surrounding communities (faculty, staff, student, visitors, companies, public administration, and so on). Higher education is a key actor in the revitalization of urban

communities, in the development of responses to declining economies in rural areas, and to the competitive strategies of regions, states and nations (Trani & Holsworth, 2010). According to Porter (1990), the Competitive Advantage of Nations would no longer be tied to abundant natural resources and cheap labor, rather would be increasingly based on creative and scientific innovations. This new paradigm of economic development positioned universities as primary engines of economic growth (Romer, 1990). As a matter of fact, governments increasingly adopt comprehensive strategies designed to improve their competitiveness in the global economy. In this new environment, governments have begun to realize that higher education institutions are important "anchoring tools" as they help to attract and retain students and alumni. Governments also recognize that such institutions drive innovation and industry development, and have begun to invest in research institutions, research parks and research programs. Beyond the engagement in educating students, much of the economic development contributions derived from higher education come through partnerships with the government as well as the local community and industry. As countries move into more advanced economic stages, higher education becomes increasingly important. Countries with factor-driven economies gain competitive advantage based on what is available within the nation, primarily natural resources and unskilled labor. As stated before, in this stage, the most important factors in the GCI are institutions, infrastructure, macroeconomic framework, health and primary education. Moving into an efficiency-driven economy, wages tend to increase and productive economies need to figure out ways to support the increased wage demands and further improve quality of life. They do this by enhancing the efficiency of the production process and quality of products. The competitive advantage of nations at this stage is driven by quality and accessible higher education institutions, efficient and well-developed markets, and the ability to effective use technology. Moving from an efficiency driven economy to an innovation-driven economy requires a nation to produce and take advantage of new products. A nation must be able to both create and utilize innovation. This requires a research infrastructure and entrepreneurial culture that can foster innovation as well as an educational infrastructure to support knowledge acquisition, skill development and critical thinking among the nation's workforce. In the globalized knowledge society, the competitiveness of a region depends on local strengths and innovation. The future success will come to those areas that can meet global standards and join global networks and markets. Due to these considerations, the EU is encouraging universities to focus more on their 3rd role, on the way towards the entrepreneurial university. Basically, the University must take care that all about technology transfer is understood as the

set of actions that are carried out by taking responsibility to manage and enhance the products resulting from its institutional activities, research and teaching. This responsibility could be the beginning of a chain of innovation , being able to identify the search results, select them and give them a fair value for transfer through various forms that can be licensing out, the creation of enterprise agreements and structures joint research and development and accordingly proceed to define policies, procedures and tools. The university is focused on two core activities: higher education and scientific research activities related and inseparable. Other tools that, by virtue of Technology Transfer, to be evaluated are the patent, the creation of new business activity and joint research between universities and industry. These instruments have a certain logic connected to the time of development, the objectives and targets reference. The short-term objectives are the basis for those of medium-long term that are building a select portfolio of patents, contracts and / or agreements for commercial exploitation, of new start ups that can bring to market the property intellectual generated . One of the tools by which the University can bring to the market the results of scientific research, have an economic return derived from these results, creating opportunities for skilled employment and economic wealth tied to highly innovative activity is the creation of academic spin-off. The opportunities related to that instrument are many, from the creation of a network or cluster of companies linked to the University (opportunities of collaborations and research contracts) to a useful contribution to the development of the territory. The role of the network among the universities in a regional area has been central for regional development and networking, especially for shared commitment to playing a transformative role in the regions. Through educational and research contributions to regional economic, social, cultural and environmental development, this network could play an important and distinctive role in advancing the regional prosperity, productivity and identity. As key sources of knowledge, research and innovation, professional skills and regional development capacity, the member universities play a central role in building strong regions. Regional strength drives national success.

2. THE IMPORTANCE OF EXTERNAL ENVIRONMENT TO PRODUCE ENTREPRENEURIAL OPPORTUNITIES

What we have just outlined is a key element at the base of a larger argument in terms of entrepreneurship, specifically in the context of entrepreneurial opportunities and their

determinants. In this field, Schumpeter offered one of the major contributions in terms of entrepreneurship and managerial skills, in 1934. According to the Austrian economist, the entrepreneur is constantly looking for economic opportunities, evaluating situations that allow introducing innovation factors. This entrepreneur is distinguished by a business director as it aims to introduce new combinations of production factors over the process, where the manager simply seeks to organize the factors efficiently on the basis of technical possibilities dates. For Schumpeter, entrepreneurial innovation can occur in at least five ways: a new product or a new quality of the product, a new method of production, a new form of organization, a new market, a new source of raw materials. In Schumpeter's model, the key to economic development is represented by the profit belonging to the entrepreneur in relation to innovation made. The Schumpeter's work was taken up and deepened in numerous studies, identifying the entrepreneur as a person who takes advantage of opportunities to become competitive imbalance agent equilibrium (Kirzner, 1973), describing the different types of entrepreneur in relation to innovations (Abernathy & Clark, 1985), clarifying the main sources of entrepreneurial opportunities (Drucker, 1985). In any case, the function that seems to characterize the entrepreneurial function is innovation, which calls into question the process by which individuals identify and pursue opportunities that take into account the resources are not necessarily owned by them (Stevenson & Jarillo, 1990), but whose employment in a new venture allows an exploitation (Shane & Venkataraman, 2000). Opportunities, for Shane, are objectively given, ones that individuals can seize by generating business ideas that are interpretations "of how to recombine resources in a way that allows pursuit of that opportunity" (Shane, 2012). An essential role, in entrepreneurship theory and research, is covered by the external environment. The concept of external environment is intended to include those forces and elements external to the organization's boundaries that affect and are affected by an organization's actions as well as more general economic, sociocultural, political-legal, and technological forces which provide the broader context for the organization's operations (Covin & Slevin, 1991). Several scholars have developed theories and conducted research that demonstrates the inseparability of the external environment from the entrepreneurial process. In this sense it is possible to understand how the different environmental conditions can encourage or hinder entrepreneurial activity (Bruno & Tyebjee, 1982) and as they affect the impact of fiscal and regulatory environments (Kent, 1984), noting that political-legal forces can have a great impact on the pervasiveness and success of new ventures (Covin & Slevin, 1991). About environmental factors, particular attention was paid to government policies such as subsidies, public funding and policies that

support firms, characteristics of local contexts such as the presence of infrastructure and active investors, the role of innovation in the social context, cooperation between industry, universities and research institutions, the possibility of interacting with actors from other backgrounds (Lerner, 1999; Fini, Grimaldi, Marzocchi, & Sobrero, 2012). So, explanations for entrepreneurial discovery have evolved primarily around two perspectives: 1) the searching for and obtaining of information leading to new inventions and 2) the recognition process by which new discoveries are made (Alvarez & Barney, 2001). These two phases allow to individuals to identify and develop new opportunities that others tend to overlook or choose not to pursue. The discovery of opportunities is dependent on the possession of prior knowledge necessary to identify an opportunity and cognitive abilities of individuals ((Shane, Prior knowledge and the discovery of entrepreneurial opportunities (Shane, 2000; Shane & Venkataraman, 2000). Any given entrepreneurial opportunity is not obvious to all potential entrepreneurs; rather any given entrepreneur will discover only those opportunities related to his or her prior knowledge (Ren & Guo, 2008). Individual's personality traits, social networks, and prior knowledge identify an antecedents of entrepreneurial alertness to business opportunities (Ardichvili, Cardozo, & Ray, 2003).

3. THE ACADEMIC SPIN-OFF AS A DRIVE FOR INNOVATION

If we consider the growth of this phenomenon at the international level, we see that these actually grow faster where there is a relational context in which aspiring entrepreneurs are able to acquire academic assistance, advice, contacts, information, and funding necessary to undertake a difficult path of entrepreneurship. There are different definitions to describe the academic spin-off, in fact it's referred to a phenomenon in a growing phase, but it is characterized by various interpretations: economic nature and legislative nature. We move from a restrictive definition in which reference is made to firms established on the basis of intellectual property generated within universities, in which the public body of research is directly present with share capital to a more general definition in which identify themselves as academic spin-offs firms set up on the basis of competence and results obtained in the course of research programs, but which are not necessarily the subject of intellectual property rights transferred by the public to search the nascent enterprise. We analyze mainly the goal that is pursued further exploitation of the research results in the University. Historically, the primary objective of the academic environment provided for the formation of human capital and the

creation of new knowledge, to these objectives, it was joined yet another, mainly focused on the exploitation of research results in order to proceed with the processing of such results in industrial applications. Through the pursuit of these objectives, the university has become a "knowledge factory, a factory specialized human capital, a factory dedicated to technology transfer, as well as a factory with the mission of territorial development, through the promotion and management of projects for territorial innovation (Lazzeroni & Piccaluga, 2003) and despite in Anglo-Saxon countries the experience of universities in the exploitation of the research results was fairly established, in the regions of Southern Europe of guidelines they began to realize only in the second half of the nineties. Specifically, in Italy, the first regulations by the Italian legislation in respect of Academic Spin-off took place in 1999, through Legislative Decree number 297 of 27 July 1999 concerning the "Reorganization of the discipline and the simplification of procedures for the support of scientific and technological research, the dissemination of technology, to the mobility of researchers. " This decree was an attempt to create the basis for promoting the activities of scientific and technological research by giving universities the possibility of interventions aimed at the creation of spin -offs, defined in such a condition as " a new high-tech economic initiative aimed industrial use of research results " with the aim of promoting technology transfer. A second important step was taken the following year, with the enactment of the Ministerial Decree number 593 of August 8, 2000 by means of which they were made operational the provisions contained in Legislative Decree 297/99 (although this Ministerial Decree became effectively operational February 17, 2001 following the publication in the Official Gazette No. 14 of 18 January 2001). With this decree were identified criteria for the allocation of state funding for these initiatives by identifying the business in the category of persons admitted to such interventions only universities and EPR that are equipped of university regulations containing the rules of the authorization procedures set out in Legislative Decree no. 297 / 1999. Furthermore the D.M. 593/ 00 ruled that such actions would have been financed by the Research Grants Fund (FAR). Anyway, the main targets of the spin-off are definitely to promote contact between the university research facilities, the world production and local institutions, to support research and disseminate new technologies with a positive impact on industrial production and social well-being of the territory. In an era of knowledge-based competition, technology transfer from university to firms is a key issue of the wealth of nations and regions. The creation of academic spin-off companies is one of the ways through which such a technology transfer process (TTP) can be pursued. Although in Italy this form of

TTP has become more and more popular in recent years (Netval 2008), the gap compared with other EU countries remains significant (Parente & Feola, 2013).

4. A COMPREHENSIVE PROCESS MODEL

In the first part of the paper we have analyzed some sources of regional development, linking these concepts in the second place to notions of entrepreneurship opportunities and external environment, this to identify in the field of entrepreneurship, the conditions at the base of regional development that may lead to growth results. A tool perfectly compatible with the concepts of entrepreneurial opportunities and external environment is definitely one of the Academic spin-off that represents the value of the array of academic and scientific innovations in the real competitive environment, so the right balance between seizing the business opportunities provided by an external environment that stimulates, through incentives and by making its facilities available to develop entrepreneurship phenomena. A process model which highlights the interrelationship between logical and linear variables analyzed until now can be expressed as follow.

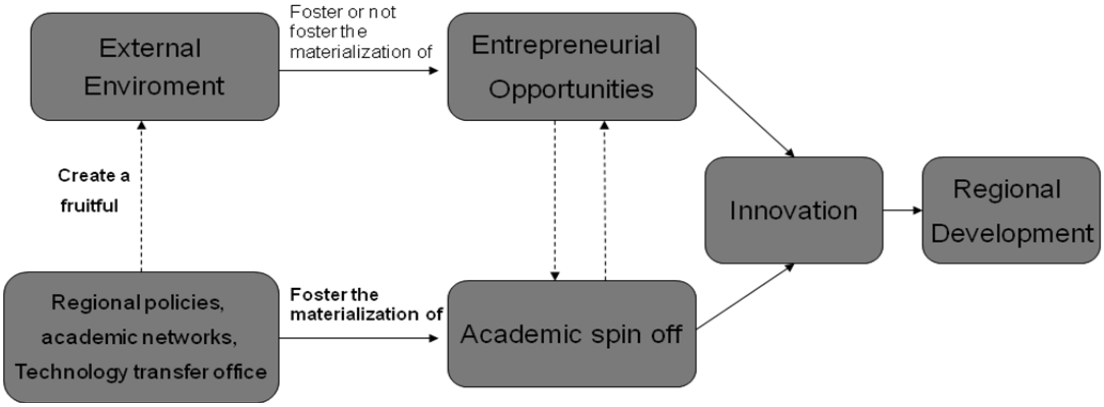

Figure 1: The paper process model

Several scholars have developed theories and conducted research that demonstrates the inseparability of the external environment from the entrepreneurial process. In this sense it is possible to understand how the different environmental conditions can encourage or hinder entrepreneurial activity (Bruno & Tyebjee, 1982). A key role, in this context, is covered by the network among the universities in a regional area that has been central for regional

development and networking, especially for shared commitment to playing a transformative role in the regions. Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and academic staff. Through educational and research contributions to regional economic, social, cultural and environmental development, this network could play an important and distinctive role in advancing the regional prosperity, productivity and identity. As key sources of knowledge, research and innovation, professional skills and regional development capacity, the member universities play a central role in building strong regions. Furthermore, over and above economic, socio-cultural, political-legal, and technological forces that provide the broader context for the organization's operations, the University have one of the tools by which can bring the results of scientific research to the market, have an economic return derived from these results, creating opportunities for skilled employment and economic wealth tied to highly innovative activity is the creation of academic spin-off. Academic entrepreneurship by way of university spin-offs is an emerging field of research focusing on the process of creating, discovering, and exploiting technological opportunities created by university research (Van Burg, Romme, Gilsing, & Reymen, 2008). The opportunities related to that instrument are enormous, from the creation of a network or cluster of companies linked to the University (opportunities of collaborations and research contracts) to a useful contribution to the development of the territory.

5. THE APULIA CASE

In Italy, in particular the Apulia region in the last decade part of the programming has been directed to the incentive of these phenomena with the measures that we explain below. A first step was taken in 2004, the year in which, thanks to the Regional Law n. 1 of 07/01/2004, was born the Regional Agency for Technology and Innovation (ARTI). The stimuli underlying the establishment of this institute are represented by the presence, in public research, substantial wealth of skills, knowledge and results still undervalued in the industrial and economic, so that universities Apulia, were in a less developed stage from the point of view of the organization of technology transfer, unlike other Italian universities that instead could already boast an extensive network of offices for the management of technology transfer processes with human and economic resources. Another aspect that distinguishes universities in Apulia

concerned the small number of international patents resulting by a poor utilization of research results, as well as missing all the research agreements with companies. In this climate all focused on a downward trend, in any case, we started to record an increase in the creation of and participation in science-based startups and incubators, noting 22 academic spin-off firms located in Apulia. Having recognized the importance of coordination in the management of technology transfer activities, Apulian public universities began to take part in the inter-university project co-funded by the Ministry of Education called "Network of Industrial Liaison Office" (NILE) therefore began to strengthen innovation policy favoring the creation of technology clusters, specifically inter-university competence centers and offices for technology transfer. For this reason ARTI Apulia decided to make available to the region of stable structures, operating within the districts with the aim of making university technology transfer operations through the establishment of high-tech districts, incubators, regional competence centers. And so, in November 2006, ARTI Apulia received by the Department of Economic Development of the Region of Apulia, in the area of the Framework Program of the Ministry of Economy and Finance and the Ministry of University with the use of the funds arising from the Fund for Underdeveloped Areas, commissioned to carry out a project that had as objects the identification of a measure dedicated to the birth and development of the Apulian Network of Industrial Liaison Office with the involvement of universities in Apulia namely: the University of Bari, the University of Salento, the University of Foggia and LUM Jean Monnet University. The result of this assignment was the stipulation of an agreement protocol for the start of activities with the five universities in the Apulia region. With the signing of this protocol, in July 2007, took the measure officially start "Regional Network of the ILO" converted "Intervention co-financed by the European Union under the POR Apulia 2000-2006 - Measure 3.13. The project essentially aims were: to equip five Apulian universities offices for the stable development of its scientific heritage (ILO - Industrial Laison Office), use the wealth of research already available in universities and untapped for product innovations, growth of new business and employment in sectors with a high content of knowledge through patents, licenses and spin-off and thus increase the impact of the costs of university research on the overall economic and entrepreneurial development of Apulia and improve collaboration between public facilities.

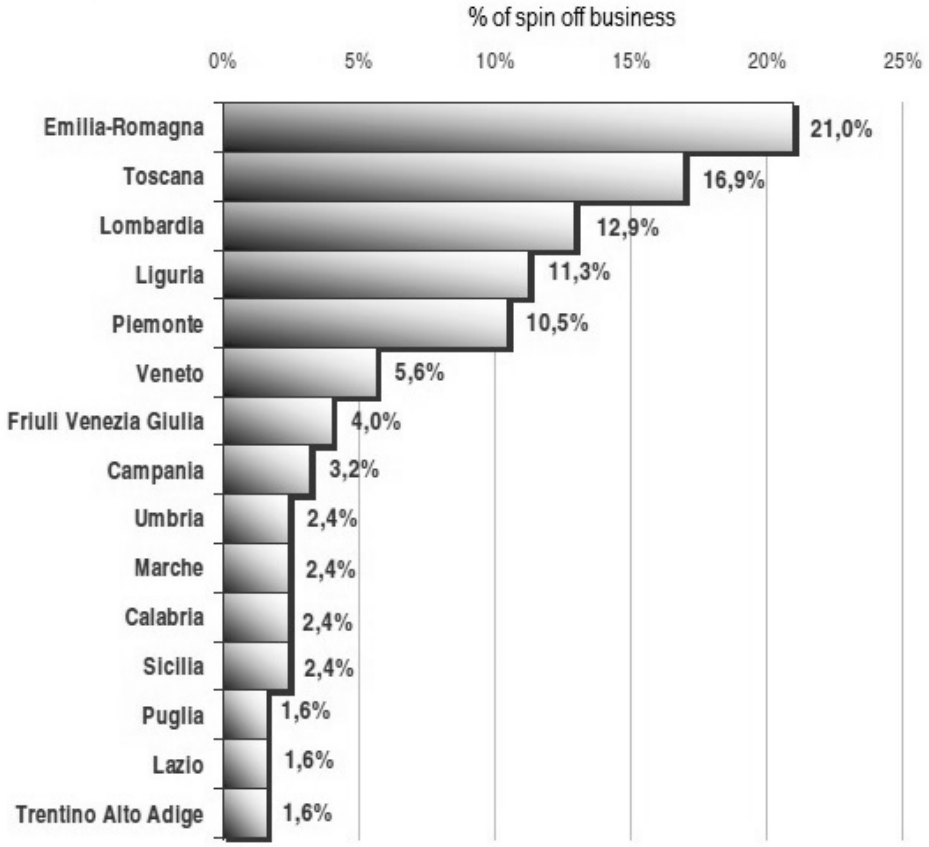

Figure 2: Regions of localization of spin-off business (no. 454

Source: Netval (2007)

The project is organized accordingly in various activities relating to the internal and external organization of the offices, the licensing and operation of spin-offs, as well as some cross-cutting activities, in particular, the project activities are expected to create industrial liaison office (or Office for Technology Transfer, whatever you want) in the universities of Apulia with full capacity management and operational processes of valorization of research and technology transfer and ensure the effectiveness and sustainability over time, these offices provide the system of negotiable instruments and operational tasks to achieve technology transfer from research to the market, encourage the creation of new spin-off companies as well as the growth of the newly established and to promote the extension of patent. The resources made available (Speech co-financed by the European Union under the POR Apulia 2000-2006, Measure 3.13) in the period from 24 July 2007 to 31 December 2008 amounted to 3 million € and the resources available for the consolidation phase (Action 1.2.3 of the PPA

Axis I, ERDF OP 2007-2013) from 15 April to 31 December 2013 amounted to 6 million €. Consideration of the foregoing, it is clear how the external environment had been created from 2007 onwards as a result of regional planning and the European Union, has encouraged the development of the scientific heritage of universities through transversal technology transfer among universities, and through the creation of spin academic off. The results of five years speak for themselves. In 2005, the number of academic spin-offs in Apulia amounted to 7, with a percentage of the total number of Italian spin-off of 1, 6% as the graph (Netval, 2007). In order to identify the consequential events, following the creation of an external environment fruitful for growth from the point of view closely related to the number of spin-offs, that contain in a number the incentive structure of the university system and regional research, substantiated in part as follows (data sources Annual Reports NETVAL and mapping ARTI). According to the data analyzed shortly before, our region boasts 85 research spin-off businesses with a percentage share of 8% on a national basis with an average life of 5 years, but if we turn to consider the data provided by the European Innovation Scorecard European Commission in 2009, the performance of our region is analyzed from the point of view of innovative companies and on the basis of a wider system of indicators, assumes a position of the head relative to those of the South and is placed in the median group at the national level.

Table 1: The Apulian academic Spin Off

Years	**Spin off no.**		**% Total Italian Spin off**	**% Variation**
	Absolute Value	***% Variation***		
2005	**7**	**-**	**1,6**	**-**
2011	**79**	**+ 1.029**	**8,0**	**+ 400**
2012	**85**	**+ 7,59**	**8,0**	**0**

Source: Annual Reports NETVAL and mapping ARTI

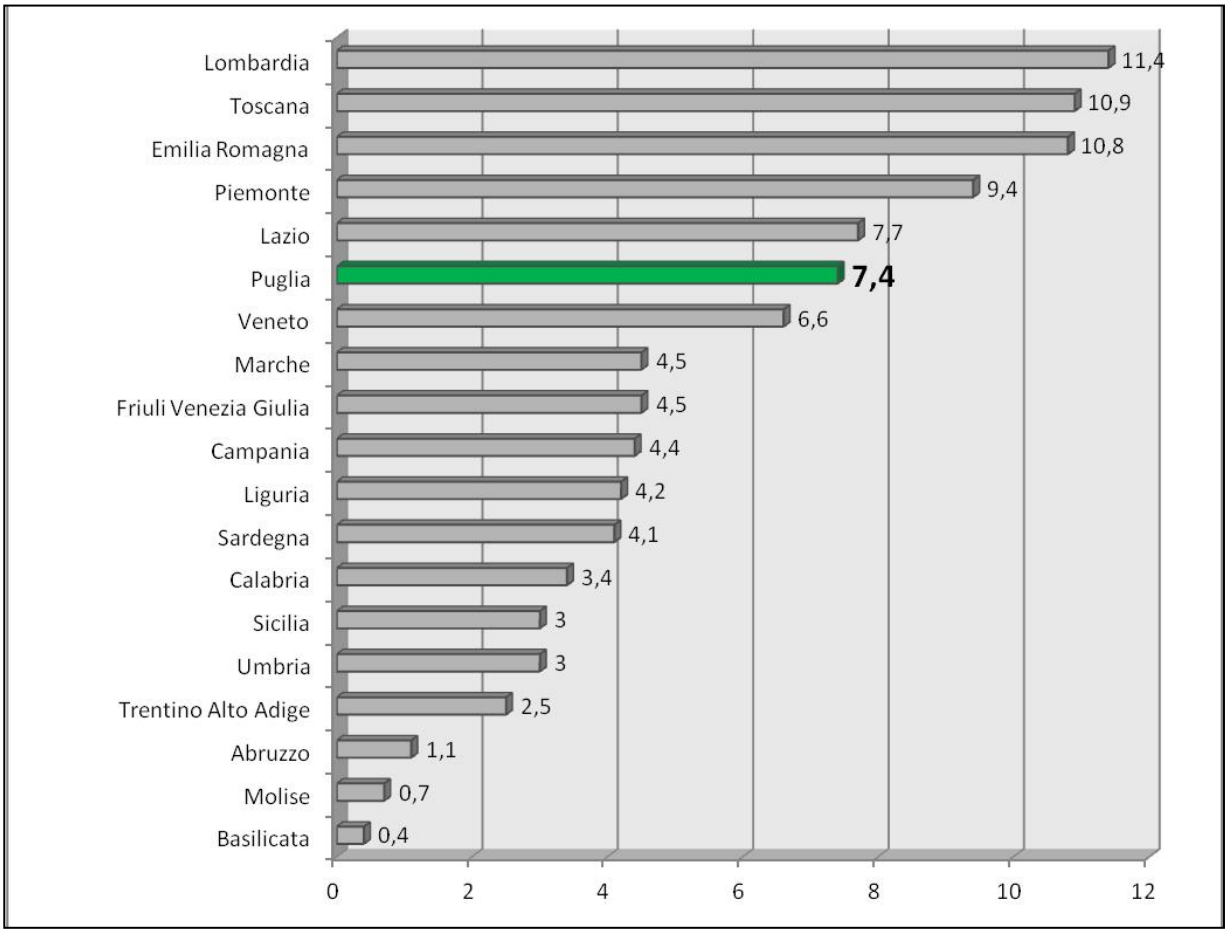

Figure 3: Regions of localization of spin-off business (no. 1082) – 31.12.2012

These results are the fruit of a path focused on the enhancement of entrepreneurship within the ILO research and academic institutions active support mechanisms in favor of academic spin-offs, mechanisms focused on the establishment of links between the university system and the regional national networks of reference specifically refers to the association of university incubators and the association of UTT, also brought to the attention of investors and financial intermediaries experiences of high-tech startups from Apulia. So, In order to compare the graph of the regions of localization of academic spin-offs at 31 December 2012 (n = 1,082) with the graph about the 2005, it is clear that the development of the Apulia region has gone from being the third last with 1,6% of spin-off active at a 7.4% occupying the first position among the regions of Southern Italy and the sixth position at the national level, after Lazio at 7.7%, 9.4% in Piedmont, Emilia Romagna 10.8%, 10.9% Tuscany and Lombardy 11.4%. Furthermore, the Apulia innovation grade after the introduction of NILO

has increased from *medium-low* in the period 2004-2006 to average in only two years the Apulian, as shown the Figure 4.

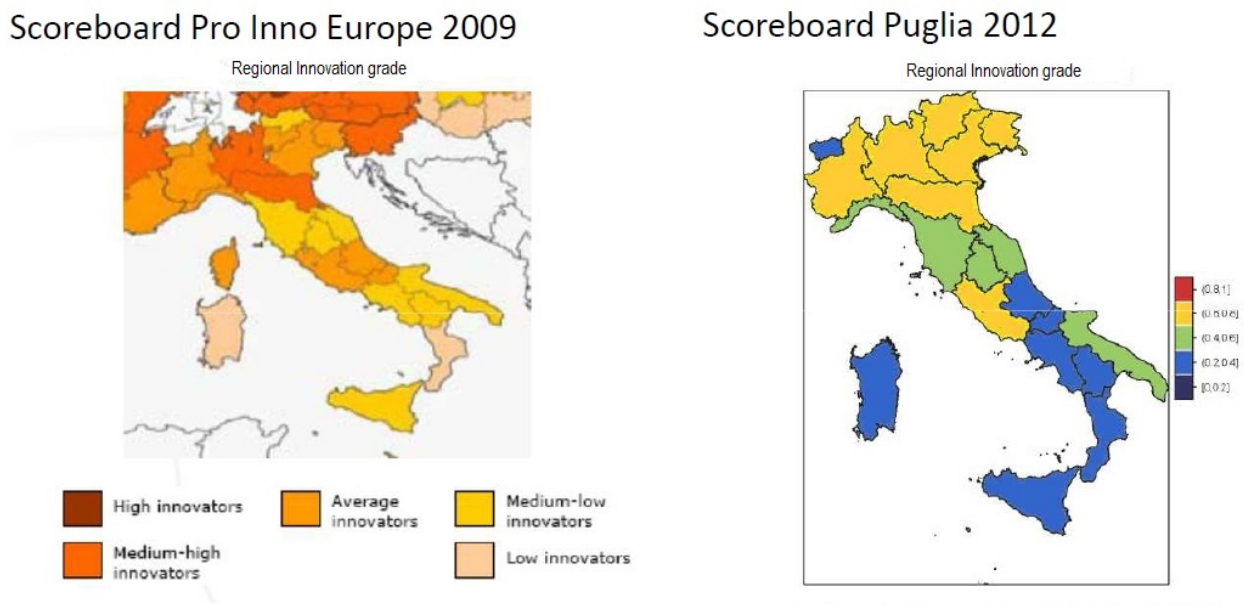

Figure 4: Comparative regional innovation grade 2004-2006 and 2006-2008

6. CONCLUSION AND LIMITATIONS

Innovation is one of the most important drivers of regional development (Florentina, 2013) and innovation speed - the time it takes to commercialize a technology – depend upon TTO resources, competency in identifying licensees, and the participation of faculty-inventors in the licensing process (Markman, Phan, Balkin, & Gianiodis, 2005).

In this paper has been highlighted the role of academic networks and academic spin-off as a drive for innovation and regional development, as endorsed by the results of the analysis of the case of the Apulia region (Italy). The institutional role of the Region in the2007-2012 planning has created an environment favorable to entrepreneurial opportunities, by fostering the creation of academic spin-offs and taking advantage of patents and research streams already developed at a university level but not really exploited as market opportunities. As a result, many innovative startups were founded starting from entrepreneurial ideas of researchers and students, bolstering the number of startups and innovation in that period of observations.

The limits of these observations are related to the absence of a real quantitative measurement of data relating to individual spin-offs and the real growth of the region that can document the importance of individual relationships.

This position paper aims to substantiate the relationship among the variables analyzed with the final outcomes. After the explaination of each variable and after have shown the case evidence, we can say that the relation between variables and outcomes is clear, and for a significant demonstration we leave the field open to possible quantitative analysis on the data pertaining to academic spin-offs.

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