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Do we really need regional innovation agencies? Some insights from the experience of an Italian region

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Do we really need regional innovation agencies? Some insights from the experience of an Italian region*

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Abstract

Increasing globalization, if properly exploited, can provide interesting opportunities for regional economies. Nevertheless, when they are not managed with a far-sighted approach, regions, and particularly those at an intermediate level of development, can lose their comparative advantages compared to regions of developing countries. Innovation is the main instrument for improving and ensuring competitiveness to enterprises and growth opportunities to local economies. The aim of this paper is to discuss the importance of public policies in reinforcing regional innovation systems, and the role of regional innovation agencies. With this in mind, we describe the policies implemented by the *Regional Agency for Technology and Innovation* (ARTI) of Apulia, a region in Southern Italy. We also provide the first assessment of ARTI's activities and provide some suggestions on how to improve regional R&D policies.

JEL: O18; O38; R58

Keywords: public policy; innovation; regional innovation system; regional competitiveness

1. Introduction

In the world today, societies and economies are experiencing an increasing integration process. Globalisation promotes the development of countries: the most integrated economies grow faster, thanks to better access to international markets of goods and services, and to an increase in labour productivity. Nevertheless, even in the globalisation process there are winners and losers, for both countries and individuals. Some individuals end up paying the short-term costs of the globalisation process: trade liberalization generates redistributive effects, favouring some and penalizing others.

Therefore, globalisation leads to challenges more difficult than those in the past, in particular for less developed regions and for the firms located there. Productive systems based on relatively small enterprises and/or with few medium/large companies and relatively low-tech productions, - conditions that can be replicated at a lower cost in developing countries - face increasing difficulties. Improved technology, the free movement of capital and goods, and, in most cases, the ease of access to codified knowledge at the global level, together with the need to quickly respond to international competition, lead communities to choose between making themselves ready for the new scenario or experiencing economic decline.

In this context, innovation in a broad sense (i.e., including not just "radical" new products or processes but also incremental changes in products and processes as well as new organisational tools) is the route to increase the competitiveness of the regions and to achieve long-term national growth (Romer, 1986; Lucas, 1988; Aghion and Howitt, 1992). For less developed regions there are two main guidelines. On one hand, more innovation in traditional manufacturing sectors: first and foremost, the ability to modify products, but also processes and organisation (employing new technological opportunities) to allow growth and internationalisation. On the other hand, along with traditional firms and productions, new

technology-intensive firms and innovative services and productions must arise that can differentiate themselves from the products of developing countries. To be successful, this process has to start by valorising existing actors and skills. Recent studies confirm that regions can succeed in competing in major global industries thanks to region-specific assets, even in industries that are characterized by intense international competition. Proximity, specialisation and concentration prove to be a significant source of region-specific advantages, and also ensure the essential links between R&D institutions and firms as innovation becomes an increasingly open process. Competitive advantages in the global economy are often, as outlined by Porter (1990), "local" and are derived from concentration in a given region of highly specialised skills and knowledge, institutions, connected productive sectors and a qualified local demand, along with learning processes and shared social values (Maskell and Malberg, 1999; Landry et al., 2002).

This is the reason why the strengthening of the regional innovation system is required. Recent works on innovation systems indicate that the region is a key level at which innovative capacity is shaped and economic processes coordinated and governed (Cooke et al., 2004). Starting in the 1990s, the concept of Regional Innovative System (RIS) has become a widely used approach to explain innovation processes and patterns (Asheim et al., 2003)[1]. It comes from the perception that innovation is an interactive process "linked" to the territory, stimulated and influenced by many actors, leading to the generation, use and dissemination of knowledge, thus facilitating learning dynamics. Innovative capacity is a complex phenomenon: it involves several actors and institutions and it is the result of human intelligence, of application and accident, of resources applied to research in numerous different ways. Spending on research and development is a decisive input, but it is not the only factor that matters. The institutional structure as a whole plays a role in transforming the

resources employed in research into innovation, increase of productivity and, finally, increased wealth.

The concept of RIS emphasizes the importance of geographical proximity as a technological development catalyst, and of benefits deriving from localization and spatial concentration. However, mere presence of local actors, even if heavily committed to innovation, is not always sufficient to start a long-run process of sustainable growth. Often, on the contrary, the development and implementation of appropriate *public policies* is necessary in order to overcome market failures that hinder the full deployment of potential development factors and to start a RIS with prospects of success. This is especially true in regions at an intermediate level of development, where factors capable of triggering processes of cumulative growth may be lacking. In the design and/or the implementation of regional innovation policies, the role of *intermediary agencies* - which operate as a sort of institutional bridges among all the actors involved in the RIS, helping to define a shared vision and acting as a coordinating body – is crucial.

The aim of this paper is to discuss the rationales for public intervention in the innovation process and to illustrate which policies can be adopted to reinforce regional innovation systems. Combining Neo-Marshallian and "innovation systems" approaches allows for a greater role for public policies and for new thinking regarding the focus of policy making: a shift from the traditional firm-oriented perspective towards a more system-centred approach of innovation policy. A crucial role in rethinking the mode of policy intervention and the tasks of policy actors is played by regional innovation agencies. We present an example of these kinds of intermediary agencies: the *Regional Agency for Technology and Innovation* (ARTI) of the Apulia Region, in Southern Italy. In particular, the paper is structured as follows: Section 2 is devoted to examining the public policies to reinforce a RIS. The role of intermediary agencies and the economic situation of Apulia are introduced, respectively, in

Section 3 and 4. Section 5 reports the experience of the Regional Agency for Technology and Innovation and a provides a first attempt to assess the results of its initiatives. Section 6 is the conclusion.

2. Public policies to reinforce regional innovation systems

Regions at an intermediate level of development cannot compete with newly industrialized countries in terms of costs; they have to compete on innovation with advanced countries and regions. It is essential to generate knowledge-based, creative, innovative products, and to be able to determine one's competitive advantages on global niches and on international markets. This implies the introduction of increasing innovation contents in traditional sectors: the ability to modify and to differentiate products, to improve process efficiency, to refine the organisation to use new technological opportunities. At the same time, this means developing new companies and new productions of innovative, technology-intensive goods and services, starting from the stock of skills and competences characterizing each region[2].

The capacity to innovate and to assimilate innovation is a key factor to improve the economic dynamism of any territory. Although there is a broad consensus on this concept, the link between research, innovation and economic growth appears less clear.

Modern theoretical developments stress the systemic character of innovation (Edquist 1997, 2005). Innovation has to be seen as an evolutionary, non-linear and interactive process, requiring intensive communication and collaboration between different actors, both within companies as well as between firms and other organisations such as Universities, innovation centres, educational institutions, financing institutions, standard-setting bodies, industry associations and government agencies. Moreover, other important features include the

existence of interdependencies and complementarities between multiple and multidimensional factors (scientific disciplines, etc.) and the non-simple feedback mechanisms and iterations between technology, science, production, market demand, and institutions.

All these factors are related to the context in which innovation takes place and, therefore, we can consider innovation as a territorially-embedded process.

In this perspective, in order to favour the generation of innovation, it is fundamental for any territory to strengthen its regional innovation system. In the literature several factors have been detected as crucial for the emergence and sustenance of a competitive RIS: (*i*) the presence of high-tech industries, potentially oriented towards international markets; (*ii*) relationships between firms and University system; (*iii*) a specialized labour market and labour force, with readily available, highlyskilled human capital; (*iv*) a local traditions of cooperation and entrepreneurial approach; (*v*) supporting agencies and organizations (Asheim and Isaksen, 2002); (*vi*) the presence of social capital: shared norms, values, and trust, which facilitate relationship and mutual understanding and learning (Lorenzen, 1998; Landry et al., 2002), and (*vii*) financial capacity.

All these factors are generally present in the "central" regions, i.e., the more advanced ones. These conditions are not (or less) present, instead, in the "peripheral" regions, and market mechanisms are not enough to produce them due to the existence of market and "system" failures.

Rationales for public intervention in the innovation process can be derived from different economic theories.

The neoclassical view justifies the need for intervention based on the notion of market and information-transmission failures. Public intervention is justified by the need to promote higher levels of private investment in R&D and innovation. The market will otherwise invest less in innovative activities than would be socially desirable (Nelson, 1959; Arrow, 1962).

There are five principal reasons why this might occur: knowledge spillovers; financial market failures; skilled labour shortages; imperfect information and public good nature of knowledge. This view is associated with the "linear model" of the innovation process whereby basic research leads to applied research and to inventions, that are then transformed into innovations, which, in turn, lead to greater growth. The emphasis is, therefore, on promoting the supply of scientific and technical knowledge and information and on a positive promotion of R&D and the formation of "human capital". With regard to policy instruments, subsidies and tax incentives to R&D and investment in advanced technology infrastructures are generally associated with market failure rationale[3].

A significant limit of the neoclassical view is that it disregards the spatial dimension of innovation process[4].

Neo-Marshallian views take account of social and institutional conditions at the regional level, as well as technological and learning issues, in explaining economic dynamics of territorial agglomeration. The territory is depicted as an agent of change and not as a "recipient" of economic processes. This approach emphasizes the relevance of geographical proximity not just because of the reduction of physical distance and associated transport and location costs, but also because it facilitates information exchange, lowers uncertainty, increases the frequency of interpersonal contacts, facilitates trust and diffusion of common values and beliefs, and promotes learning.

In particular, social capital (i.e., encouraging the formation of trust-based relationships between regional actors) has been shown to play an important role in facilitating innovation, by increasing levels of collaboration and improving the efficiency of such engagements. A number of authors (Cooke and Morgan, 2000; Djankov et al., 2003) have unpacked the role of social networks in promoting information dissemination across these activities, from searching for technical partners, employees, and finance to facilitating collaboration and

gathering critical information on markets. Empirical research suggests that there is a positive association between trust and economic growth (Knack and Keefer, 1997; Zak and Knack, 2001; Beugelsdijk et al., 2004; Knack, 2003).

According to the "innovation systems" approach (Freeman, 1987; Lundvall, 1992; Edquist, 1997; Nelson, 1993) motives for innovation policies are not just market failures, but also systems failures such as "organisational thinness", "lock-in" and "fragmentation". Systemic failures arise where connections and linkages of the system are poor or not sufficiently conducive to knowledge generation. The "systems failure" rationale implies that public intervention can promote collective learning and that the relationships of the system with its components, coherence and possible dysfunctions can be acted upon, institutionally coordinated and perhaps even constructed (Rondé and Hussler, 2005).

Combining Neo-Marshallian and "innovation systems" approaches leads us to consider that competitive advantages can be more consciously and pro-actively constructed in a way that accounts for sectoral and regional specificities. This allows for a greater role for public policies and for new thinking regarding the focus of policy making: a shift from the traditional firm-oriented perspective towards a more system-centred approach of innovation policy (Nauwelaers and Wintjes, 2003). This means that innovation policy should deal with (*i*) improving systemic performance by helping to overcome institutional inertia and to promote institutional configurations that stimulate learning, adaptive behaviour, interactions and associations between actors; (*ii*) enhancing social capital; (*iii*) the need for transcending traditional sector policies in favour of platform policy; (*iv*) sustaining the key actors for strengthening the regional innovation system: Universities, talents, highly specialised and knowledge-intensive firms.

In the following subsections we focus on principal policies to ease perceived constraints on the more important factors for a successful RIS.

2.1. Policies to facilitate the creation of clusters

Industrial clusters agglomerated in specific geographic zones and operating in specific industrial sectors have been proven to have possibilities of reaching and maintaining good positions on international markets, thanks to their capacity to innovate in terms of production processes and product qualities (Andersson et al., 2004).

The trend towards concentrating innovative activities in specific geographic areas is explained by the advantages enjoyed by firms located in industrial concentrations, in terms of both supply and demand. Porter (1990), in his analysis, focused on territorial factors that can affect firm' performance and, subsequently, on local competition, which can create further incentives to innovate (Porter, 1998). Moreover, he linked the strengths of competition with the virtues of selective co-operation. Indeed, this last element has proved to be the key factor behind the success of accomplished clusters, considering, for example, the importance of "closely knit social-cultural links" and "willingness to cooperate" as firm strategies associated with competitive advantage. The literature frequently points out that innovation is closely related with tacit knowledge exchanges, which are difficult to obtain from afar, and are thus one of the advantages of agglomeration; they are of fundamental importance in regional clusters thanks to the value of innovation-based competitive advantage (Malmberg and Maskell, 1997; Cooke and Morgan, 1998).

In order to promote effective public policies for establishing a cluster at the local level, it is necessary to create a social context where firms are encouraged to co-operate with other firms, operating in formal or informal networks (Cooke et al., 1997), and taking advantages of the external economies of scope and scale typical of this industrial aggregation. In addition, firms also should be persuaded to form stable relationships with Universities, research institutes, technology-transfer agencies, and business associations in relevant sectors. The

inevitable competition between firms and/or actors operating in the same industrial sector and/or engaged in innovative processes could prevent the establishment of such networks. In a regional innovation system, therefore, it becomes necessary to implement policies where trust-building is of paramount importance: a governance system should aim to favor the accumulation of social capital. As Cooke et al. (1997) showed, not all regions have this capability - notwithstanding their economic competencies - as it depends on their structure of governance; this is especially evident in the peripheral regions.

The critical point about the creation of a technological cluster (technological district) is to trigger a process which, starting from the available set of specialised skills, can transform public and private investment flows into endogenous factors, and can enhance the regional attraction of external activities. Public policies have to provide public goods and other forms of non-market coordination, essential for the starting of agglomeration processes. The policy makers have to create context conditions to make innovation processes faster and less uncertain, in order to let private investments increase; that is, to create positive externalities in a dynamic perspective: public intervention helps to create learning and uncertainty reduction processes.

2.2. Policies to foster cooperation between universities and firms

The role of universities in regional innovation systems has witnessed great changes in the last two decades: if the innovation systems approach focused predominantly on the knowledge spillovers generated by the activities performed by universities on the regional territory, universities are also currently assigned a third function for regional economic and social development, beyond their traditional teaching and research role (Etzkowitz and Leydesdorff, 1997; Goddard and Chatterton, 1999). According to the engaged university approach

(Chatterton and Goddard, 2000; Holland, 2001), universities are seen as adaptive organizations to external signals, increasingly involved in activities of regional networking and institutional capacity building, thus engaging with their home regions. In the learning economy, universities have proven to play a fundamental role as collaboration partners for the local industry and as a "match-maker" between business and the education sphere.

It is necessary, therefore, to spur public policies aimed at fostering collaboration between universities and firms. Linkages between universities and firms can be in terms of flows of knowledge and information, flows of investment funding and in informal arrangements (networks, partnerships, etc.). This collaboration is especially important in regions with a manufacturing base made of small and medium-sized enterprises specialized in low-tech or traditional sectors.

To activate the take-off of regional development, it is crucial that firms increase their share of spending on R&D. But, especially for SMEs, there may be insurmountable problems due to under-sizing of R&D. Furthermore, as always when research activities are concerned, there is the problem of the difference between private and public returns of expenditure in R&D, so that firms could be distracted from considering the investment itself. The policies generally adopted to favour R&D expenditure by firms consist of incentive polices, which may take different forms. Despite the good intentions of legislators in different countries, such policies have often been ineffective, turning out to be mere funding to businesses (Cefis and Evangelista, 2007). Therefore, it seems preferable to turn to policies that foster collaboration between enterprises and universities, also seeking more rewarding criteria. Public authorities could also pursue a less bureaucratised educational and training system in order to build closer links between universities and the productive system.

2.3. Policies to encourage the creation of spin-off and the ability of academic researchers to register patents

In recent years, increasing attention has been paid to the use of academic research results for commercial purposes (valorisation, application, appropriability). In the previous subsection, we discussed the supporting role that universities can play in strengthening the regional innovation system by actively cooperating with regional firms. We now examine the way universities can exploit the research results they obtained practicing their traditional roles.

Often, researchers are not willing to invest part of their time to enhance the economic impact of research. This is due to the specific nature of academic careers, which are usually advanced by obtaining "pure" research results (generally, through publications in refereed journals), without taking into account other outcomes, such as the registration of patents.

Public policies can be effective in this case as well, if they can overcome some of the difficulties that hinder the full realization of entrepreneurial development activities by universities.

Spin-offs are new, highly technological companies exploiting the findings of a research group at a university (or other public research institutions). They contribute to the development of new technologies and are often the first to use and exploit them (Christensen, 1997); thus, they play a key role in economic renewal and technological progress (Bollinger et al., 1983; Kirchhoff, 1994). Their importance is well documented, especially with regards to the emergence and success of some sectors, especially IC technology (Saxenian, 1996) and biotechnology (Orsenigo, 1989). Generally, success stories have been more frequent in the United States than in Europe, since US universities have a different institutional nature, as evidenced, among other things, by the pervasiveness of incubators and science parks.

The importance of encouraging the patenting of inventions stemming from academic research comes from the contribution that university researchers can give to innovation and economic growth. However, academic research results need further development to reach the commercialization stage. In this context, it is clear that supporting researchers' patenting activities is an important requirement for attracting industrial partners willing to pay the huge costs necessary to bring the invention to the market.

Useful policies in this regard include the simplification of bureaucratic and administrative procedures for registering patents by academic researchers for establishing of spin-offs, and providing grants to cover related costs, especially in the starting phases[5]. Moreover, policies can aim to train professionals in managing this process (for example, promoting the establishment of Technology Transfer Offices), and they can attempt to encourage an entrepreneurial spirit among researchers, who often lack adequate management skills in spite of their scientific competence. Finally, formal and informal networks should be strengthened at various levels. All the services supplied to companies should have a high relational content: networking between researchers and firms, tutoring, testing infrastructures, and a set of interventions at the firms' start-up stage (scouting, business plan editing, training for the new entrepreneurs).

2.4. Policies to facilitate the creation of new innovative firms

In an innovation system, the financial sector is of strategic importance, especially in the starting phase (Cooke et al., 1997). Financial relationships between lenders and borrowers are often hindered by a typical information asymmetry, since lenders may lack crucial information about new projects and business plans. In the case of new innovative firms, this asymmetry is further exacerbated by the inherent risks of a new business, and it can be said

that the greater the degree of innovativeness of the new company, the greater the risk. This can lead to severe financial constraints, especially with new technology-intensive firms, which are not easily valuable by external investors. Therefore, regional policies to aid financing for new innovative firms should primarily aim to facilitate relationships by minimising uncertainties: information flows between actors involved should be favored. In addition, regional policies should also provide for specialised financial formulas; in particular, interventions to support the start-up of new companies should be focused on seed capital and venture capital.

The importance of innovative finance for innovation processes is in policy reflections[6]. To break the inefficient equilibrium on the venture capital market, it is necessary to operate from different sides, with systemic and coordinated policies. A fundamental part of these policies is the creation of a large *seed capital* market. Seed capital investments are characterized by severe uncertainty and ambiguity, since they are intended to finance the launch of a new activity. The seed capital market is placed approximately under the threshold of € 500.000 per investment. Under this level the European Union accepts the assumption of market failure, since in no private dealer in Europe operates in that range, and therefore it is possible to observe a direct involvement of public actors. Public actors should implement the following measures: ensuring exit mechanisms for investors so that they can readily realise their investments; constructing a network of technology transfer offices and already-existing business angels to help generate deal flows and spread best practices; ensuring publicly-supported co-investment schemes to encourage private investments; finally, creating a more vibrant entrepreneurial culture starting with schools.

The experience of the US economy has showed that the ready supply of early-stage risk capital, from public as well as private sources, to finance the most promising applications of

emerging technologies has been a distinctive feature of growth (Florida and Kenney, 1988; Edwards, 1999).

2.5. Policies to ease the brain circulation

The importance of human capital as a key source of innovation and economic growth is widely acknowledged by both economists and policymakers (Lucas, 1988; Romer, 1990). Regional integration of labour markets may increase workers' incentive to spatially relocate, in particular from peripheral to central regions. This is explained by the action of agglomeration forces: human capital migrates from where it is scarce to where it is abundant, rather than vice versa (Lucas, 1988). Migration of talent is a growing phenomenon (Solimano, 2008). The importance of the mobility of highly skilled individuals stems from its contribution to the creation and diffusion of knowledge and from its dynamic effects related to knowledge flows, R&D and creativity.

While mobility is often measured and discussed at the national level, it is at the regional level that its effects may be felt most strongly. Through their choice of location, highly skilled migrants can help create, strengthen or weaken existing "centres" and "peripheries" of economic activity. They can contribute to innovation-related activities; in particular, patent applications and the creation of engineering and technology firms (Wadhwa et al., 2007b; Wadhwa et al., 2007a).

But what is the effect on their regions of origin? Of interest here is the influence highly skilled migrants may have on knowledge flows and knowledge accumulation.

The starting point is that a realistic response to increasing migration is to abandon the brain drain approach of trying to keep highly skilled people at home and instead adopt a diaspora model. The diaspora provides a source for building networks and a means for keeping in

contact with emigrants. The diaspora can contribute to knowledge creation and diffusion by acting as a conduit for knowledge and information flows back to the country of origin (Agrawal et al., 2006; Kerr, 2008). A possible outcome of this kind of network is to increase international research collaboration, thus bringing benefits to the countries of origin (regions). There is evidence of linkages between highly skilled migrants and their countries of origin as shown by internationally co-authored articles (Regets, 2007). Mobility of talent is, therefore, not necessarily a zero-sum game: both sending and receiving regions can benefit from the mobility of highly skilled individuals.

The reasons behind the decision to emigrate of high skilled individuals are to some extent different from the reasons that explain migration in general. In addition to economic incentives, talent mobility has additional and complex aspects relating to research opportunities, work conditions (work with "star scientists" or in prestigious institutions), quality of life and access to infrastructure. Can governments have an influence on mobility? And what is the rationale for public intervention? The rationale for this policy centres on potential positive externalities from knowledge spillovers and issues of information asymmetries. Most countries offer a range of policies focused on assisting and encouraging mobility, but very few countries have a strategy for maintaining contact with their high skilled migrants. From the point of view of a region at an intermediate level of development, government should explore ways to facilitate networks and contact between mobile researchers and home-based institutions and colleagues. Governments may see scope to act, for example, to improve information provision reducing the costs of collecting them.

3. The role of intermediary agencies

The main distinctions that emerge among the economic theories have clear policy implications, but they have also consequences on the territorial dimension of public policies. The fundamental theoretical background of the traditional neoclassical factor-based theory and the new endogenous growth theory suggests that innovation policies tend to be national. In the Neo-Marshallian and "innovation systems" approaches, instead, self-reinforcing and differentiated local processes tend to emphasize the regional dimension of policies.

There are several reasons to assume that regionalizing innovation policy may have advantages[7]. The fundamental role that history, context, institutions, sectoral dynamics and temporal interdependences play in the innovation process, as emphasised by the literature on RIS, justify the regionalization of innovation policy.

Cooke and Morgan (2000) argue that the regional scale is essential for the formal governance institutions. Even if regions (in the administrative sense) are not necessarily "bearers of meaning" and even if they are sometimes less consistent than a "functionally defined territory", they have "political density": they are located at a level where governance can act in an effective manner to favour innovation.

Institutionalist theories indicate that having a high density of closely-knit institutional networks is a key condition for economic development (Amin and Thrift, 1995; Healey, 1998). The greater the density of complex institutional networks within a given territory, the greater the potential for higher growth and development (Amin and Thomas, 1996; Morgan, 1997; Cooke and Morgan, 1998). This approach clearly indicates the need for policies and institutional forms that are tailored to specific territories, and which take into account their unique social structures, networks, norms, and actor rationalities (Amin, 1999).

Policy and performance of the government bureaucracy are the fundamental channel through which institutions determine economic outcomes (Tabellini, 2005; Acemoglu et al., 2004). A way to improve the efficiency of government bureaucracy in pursuing the objective of strengthening regional innovation system is to create *ad hoc* agencies with the responsibility to operate as a institutional bridges of sorts.

A body of innovative organizations, research supporting institutions and public administrations operating within one administrative region is not enough to create a regional innovation system. A collection of agents is not - in itself - a system. We need lasting, well-oriented and innovation-oriented relations between involved actors. Especially for regions at an intermediate level of development, a shared vision is of paramount importance for creating a critical mass than can coordinate and steer activities toward a common objective. Intermediate agencies can play a crucial role in rethinking the mode of policy intervention and the role of policy actors. Interactive modes of state intervention and associational forms of governance are seen as being superior to traditional top-down policy strategies (Cooke and Morgan, 1998; Morgan and Nauwelaers, 1999; Nauwelaers and Wintjes, 2003). Policy formulation and implementation have to be the result of intensive communication, close interaction and consensus building between all regional stakeholders in policy networks. Consequently, these agencies can (*i*) encourage learning and innovation through promoting regional dialogue and building up social capital by lowering uncertainty and information costs; (*ii*) shape the sets of incentives and disincentives that contribute to establishing an "adequate" balance between coordination and competition among local economic actors, hence facilitating the learning process (North, 1995); (*iii*) help territories to adjust and react to change, generating a degree of "adaptive efficiency" that highlights the willingness and capacity of local actors to adopt new knowledge and to engage in innovative and creative

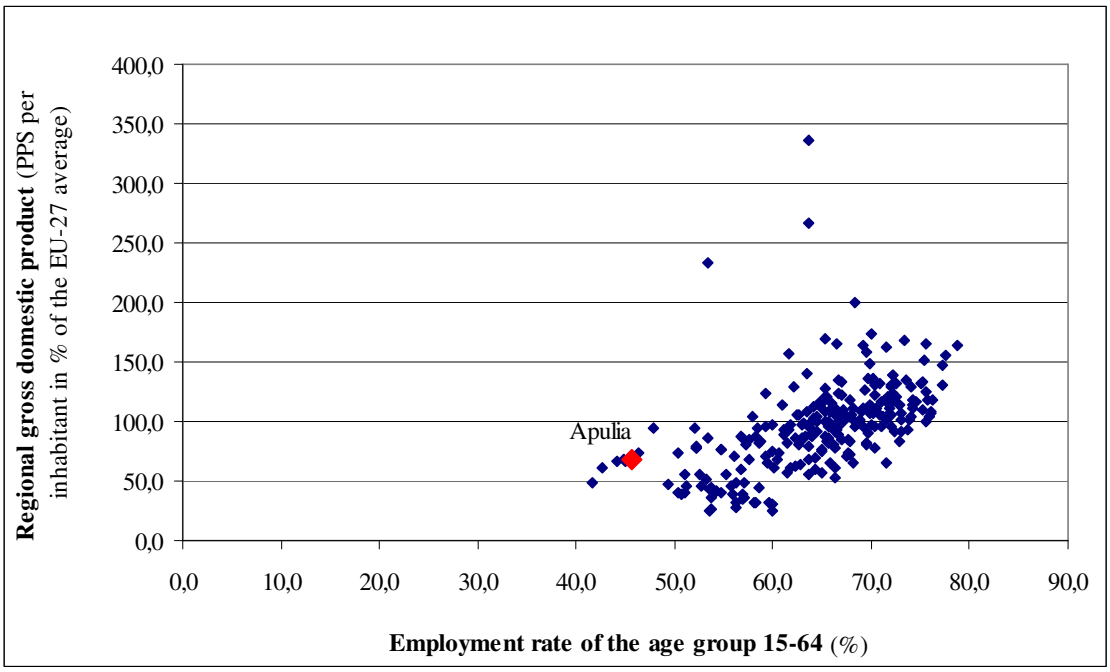
activities (North, 1990). In other words, they can run the policies described in the previous section which are suitable for the regional level.

4. Apulia: a region at an intermediate level of development

Before describing the experience of Regional Agency for Technology and Innovation and assessing the very first results of its initiatives, we want, briefly, to highlight some weaknesses of the innovative system of Apulia, an Italian Southern region.

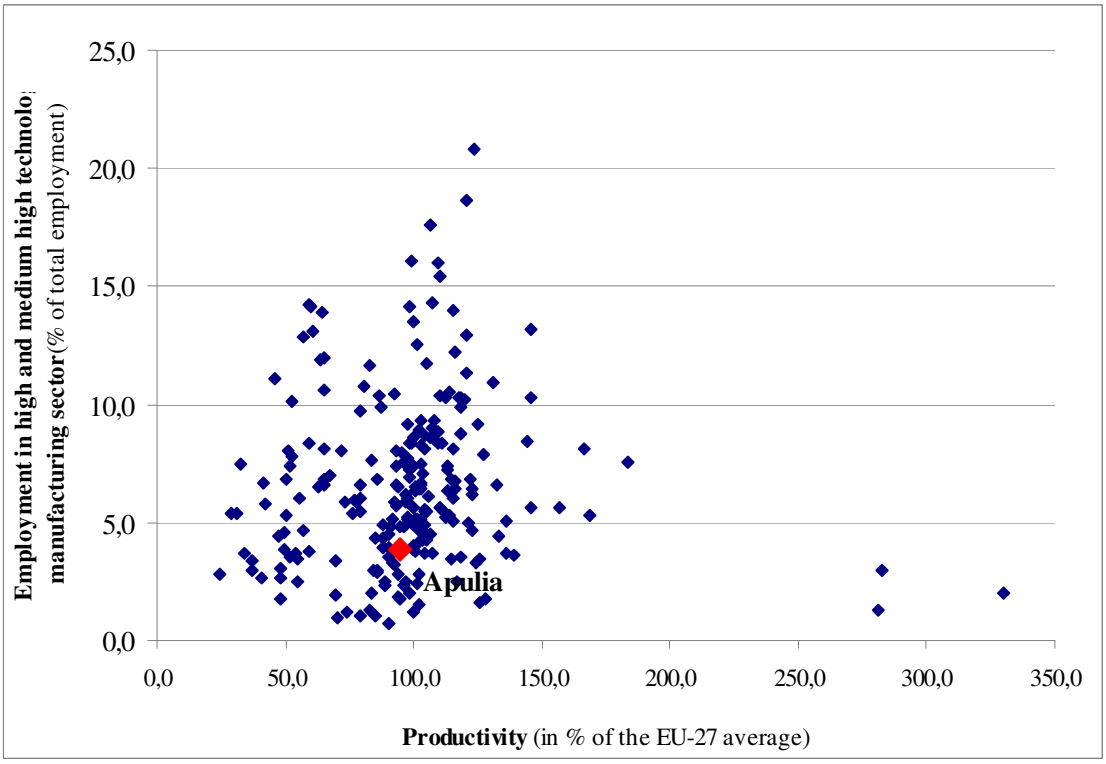
Apulia is a region at an intermediate level of development, as shown by the economic indicators in the figures below and confirmed by some peculiar characteristics of its economic structure: the presence of many small firms alongside a few medium-sized firms; prevailing specialisation in traditional sectors; the presence of few multinational firms; a low degree of internationalisation[8].

Figure 1 - Regional gross domestic product per inhabitant and employment rate of the age group 15-64 by NUTS II regions – 2006



Source: authors' calculation on Eurostat data

Figure 2 - Employment in high and medium high technology manufacturing sector and productivity by NUTS II regions – 2006

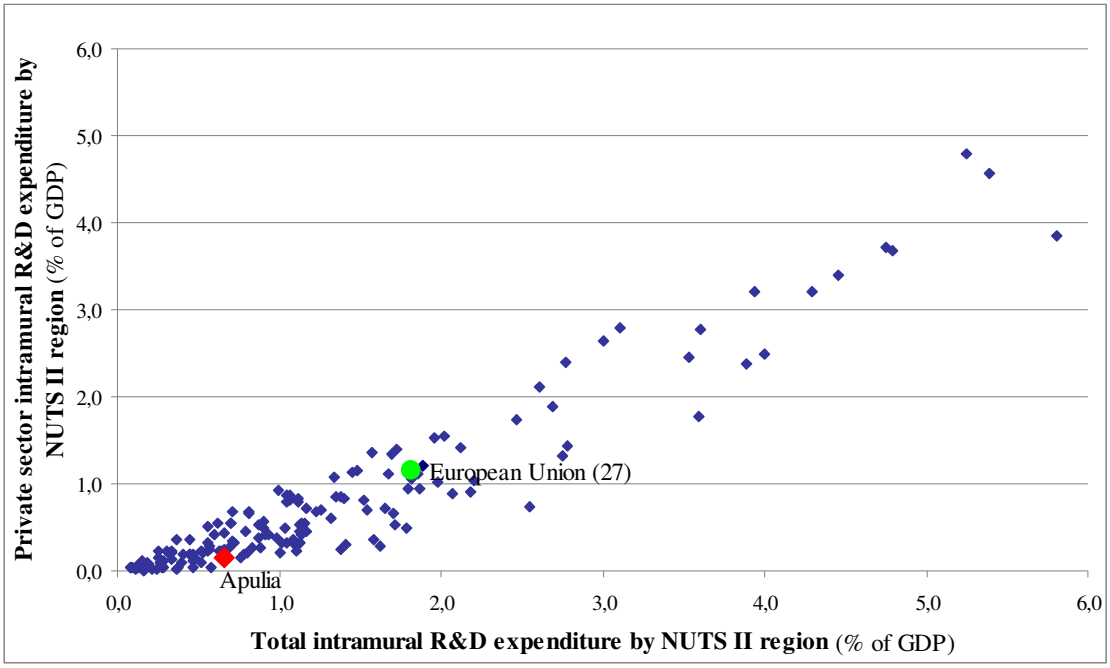


Source: authors' calculation on Eurostat data

The weaknesses of the Apulian innovative system can be summarized as follows: (*i*) low level of R&D expenditure (even lower role of the private sector); (*ii*) low innovative activity output; (*iii*) few innovative firms; (*iv*) scarce availability of finance for innovative firms; (*v*) a limited (although growing) degree of cooperation between universities and firms; (*vi*) brain drain; (*vii*) limited critical mass in technological sectors.

Spending on research in Apulia is low (figure 3). Additionally, R&D activities are carried out essentially by universities and public institutions, while private firms appear to play a negligible role, mainly due to the prevalence of small firms.

Figure 3 - Intramural R&D expenditure by sectors of performance and NUTS II region – 2005



Source: authors' calculation on Eurostat data

The number of patents is an effective way to measure innovative output, while the number of spin-offs can capture the presence of innovative agents. We analyze the performance of Apulian universities with regards to these two indicators, in consideration of the relevant role of academic institutions in regional innovation systems[9]. As far as the first feature is

concerned, a low number of Apulian EPO (European Patent Office) patents are registered by universities. Nevertheless, numerous university researchers have taken out patents individually or for private firms. Our data show that only 31 Apulian inventors are university researchers (a percentage slightly greater than 6% of the total number of Apulian inventors) and are responsible for 37 patents (5% of overall number of Apulian EPO patents) (table 1). It seems that the patent production of university researchers is not matched by their academic institutions' capacity to valorise them.

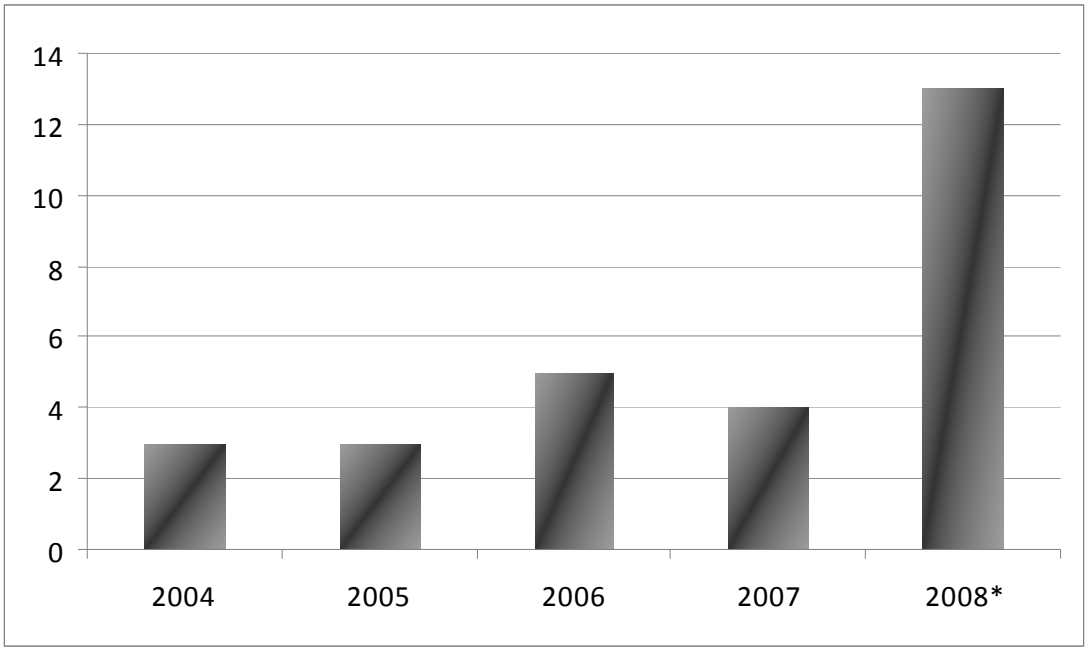
Table 1 - Distribution of University patents by type of applicant (1978-2004)

Applicant	Number	Percentage
Universities	4	10,8
Private and public research centres	6	16,2
Individuals	5	13,5
Firms	22	59,5
Total	**37**	**100,0**

Source: authors' calculation on ARTI data

Another noteworthy feature confirming the difficulty of valorisation of university research is the relatively low number of spin-offs. The figure below shows the evolution over time of the number of academic spin-offs: a modest increase over time which becomes particularly relevant after 2007 (13 of the total number of firms are yet to be constituted).

Figure 4 - Number of spin-offs in Apulia



* We include in this column both spin-offs constituted in the 2008 and spin-offs that are to be constituted.

Source: authors' calculation on ARTI data

Another weakness of the regional innovation system we are analysing is the low number of innovative firms. In Apulia, in the 2002-2004 period, there were 1,705, equal to a bit more than 20% of the overall number of firms in the region. Making a comparison with the situation at the national level, we find that the share of innovating firms as a percentage of the overall number of firms is almost 10 percentage points less than the Italian average.

One possible explanation for this situation is the difficulty that new innovative firms face in obtaining financing, due to severe uncertainty and ambiguity associated with this type of business. In these cases, venture capital, which may have an effect on innovative activity, plays an important role. As numerous empirical works show, financial development – even in the local dimension – may be an important factor affecting innovation introduction (Benfratello et al., 2008). Data on the availability of venture capital for Apulia are somewhat disappointing: investment in risk capital (in the seed and start up phases) is very low and the trend is declining in the recent years.

Another critical feature is the resurgence, since the mid-1990s, of migrants from Apulia towards other Italian regions and foreign countries. Apulian migrants are characterized by a high degree of human capital: particularly evident is the propensity of graduates to abandon their own region. This phenomenon is negative since very few graduates from other Italian regions work in Apulia: there are 2,700 more Apulian graduates working elsewhere in Italy than there are graduates from other Italian regions working in Apulia and (table 2).

Table 2 – Movements of graduates across Italian regions

	Total graduates of the region	Not working	Working in the region	Working abroad (a)	Graduates of other Regions working in the region (b)	Difference (b-a)
Piemonte	15,452	5,799	8,336	1,317	1,141	-176
Liguria	5,859	2,466	2,636	757	495	-262
Trentino Alto Adige	3,05	1,183	1,573	294	353	59
Friuli Venezia Giulia	4,921	1,546	2,822	553	369	-184
Veneto	19,416	7,366	10,732	1,318	1,339	21
Emilia Romagna	14,88	6,234	7,847	799	2,78	1,981
Toscana	13,44	5,957	6,691	792	1,444	652
Abruzzo	7,673	3,668	2,786	1,219	309	-910
Molise	1,747	880	441	426	67	-359
Basilicata	2,724	1,313	977	434	102	-332
Puglia	16,214	8,975	4,323	2,916	217	-2,699
Sicilia	15,799	9,356	5,003	1,44	97	-1,343
Sardegna	6,957	3,768	2,57	619	17	-602

Source: calculations on Almalaurea and Ministry of Education, University and Research data (table in Viesti 2005)

5. The experience of the Regional Agency for Technology and Innovation

To be competitive on international markets, European regions at an intermediate level of development, such as Apulia, need a new growth model focused on bringing innovation to traditional manufacturing systems and by the development of high-tech sectors through the valorization of existing actors and competences. This model has to be based on strengthening

the interactions between demand and supply of innovation and, *de facto*, implies the building and the reinforcing of a regional innovation system.

Intense and intelligent public intervention needs to support and facilitate this transformation process, making it faster and more flowing.

A crucial role in supporting the transition of Apulia towards this new model of productive specialization is played by the Regional Agency for Technology and Innovation (ARTI), a public body created by the regional government. Established in 2004, it has been fully operational since fall 2005.

The policies carried out by the Regional Agency for Technology and Innovation aim to reinforce the regional innovation system, and overcome the market failures that hinder the full deployment of potential development factors. In the light of the main weaknesses of the Apulian innovative system, described in the previous section, these policies define and implement initiatives to achieve the critical mass of skills and competences necessary to launch agglomeration processes and facilitate the creation of clusters in technological sectors. Second, they try to strengthen the actors of the regional innovation system (for example, promoting the valorisation of academic research results for commercial purposes in the form of patents) and to enable new actors (through measures to encourage the creation of spin-offs and new innovative firms). Third, they attempt to promote collaboration among the key actors: firms, universities, talents.

Below, we describe the main initiatives carried out by ARTI and we provide an initial assessment of these initiatives.

As we have shown, there is a lot of empirical evidence on the importance of clusters in promoting the economic growth of regions, and on the role of public policies in creating a social context where firms are encouraged to co-operate with other firms and with research institutions in formal or informal networks, enhancing systemic innovation capacities.

Regional policies focus on those value-added sectors in which Apulia has some scientific or technological expertise at the international level, and that provide good opportunities for future development. They thus contribute to specializing the regional innovation system.

One of the main results of ARTI's activities is the creation of the Apulian Mechatronics District. The District was born in the first half of 2007, and its main promoters included with multinational industrial groups (Bosch, Getrag, Fiat) and some local innovative medium enterprises, all located near Bari, the capital of Apulia, the Bari Polytechnic and the University of Bari. Its mission is to pull together the best scientific and industrial skills in the region and to create the conditions to promote new investment in research, development, and production in the mechatronics field, increasing the competitiveness of the cluster. ARTI has supported the constitution of this technological district by facilitating dialogue among the different actors involved, constructing long term scenarios, and fostering effective interactions between the demand and supply of innovation, especially through pre-feasibility and feasibility studies concerning technological district. The first concrete results of the District's creation are, research projects involving academic institutions and industry that are about to be carried out.

The integration of the regional system of innovation, facilitating the exchange of knowledge and human resources between industry and academia, and fostering the transfer of research results to the market, is another objective of ARTI's activities. This objective is pursued by means of the "Industrial Liaison Offices" (ILO) regional network. ILO projects include activities addressed to favour the international extension of Apulian universities' patents and to encourage the birth of new spin-off enterprises and support the growth of recent spin-offs.

Patent vouchers are an important form of financial support to patenting activity. Its aim is to overcome the inadequate capacity of Apulian academic institutions to valorize the outcome of their research for commercial purposes, due both to a lack of financial resources and a lack of

managerial skills. The results are very encouraging: 28 University patents, in 2008, benefited from financing. The measure has, therefore, contributed to increase the number of university patents applications at the international level.

Table 3 shows the distribution of university patents by technological class and Apulian university: most of them are in the biotech sector; five are on chemistry in the materials sector. Interestingly, there are numerous examples of co-ownership of patents among universities.

Table 3 - Distribution of patents vouchers by University and by technological class - 2008

	University of Bari	University of Salento	University of Foggia	Polytechnic of Bari	Total
Pharmaceutical/Biotech	16	1	2	-	**19**
Instruments	4	-	1	2	**7**
Chemistry of Materials	3	2	-	-	**5**
Electronics	-	1	-	-	**1**
Total	**23**	**4**	**3**	**2**	**32**

Source: authors' calculation on ARTI data

Other very interesting results were achieved by the measure implemented to encourage the creation of spin-offs. Through vouchers, the Regional Agency for Technology and Innovation supports the establishment and the consolidation of academic innovative firms "created to valorize research results. The voucher is financial contribution that funds services necessary for the starting and developing new firms. Thanks to this measure, 11 new university spin-offs have been created and other 7 pre-existing spin-offs have benefitted from the vouchers (table 4). Looking at the distribution by technological sector, much like for the patents, the biotech and chemistry sectors prevail.

In brief, the data on the number of international patents and on the new spin-offs seem to indicate that the measures implemented have been effective in overcoming some of the

difficulties that hinder the full realization of entrepreneurial development activities by universities.

Table 4 - Distribution of spin-off vouchers by University and technological class - 2008

	University of Bari	University of Salento	University of Foggia	Polytechnic of Bari	Total
Mechanics/Electronics/ICT	1	-	1	5	**6***
Agro-Biotech	2	1	2	-	**4***
Environment/Geology	4	-	-	-	**4**
Chemistry / Innovative Materials/Energy	1	1	-	1	**3**
Cultural Heritage	-	-	1	-	**1**

* A spin-off in the mechanics sector and one in the agro-biotech sector have been created by researchers from different Universities, for this reason the sum of values in the columns are not equal to the total number of spin-offs.

Source: authors' calculation on ARTI data

The market entry of new innovative firms is a crucial element for helping local economies shift from a specialization in low-tech sectors to one in high-tech sectors. One of the factors preventing the creation of these types of firms is the scarce availability of venture capital resources. As we have seen, data on the supply of venture capital for Apulia are somewhat disappointing; at the same time, there is low demand on the part of new entrepreneurs. In order to balance this peculiar inefficiency, a coordinated approach is necessary and, therefore, there is scope for public intervention. To overcome this problem ARTI is coordinating the creation of a seed capital fund aimed to support the start up of the new innovative firms. The fund works very simply: it enters in the social capital of the company (without sharing the administration) and at the same time the entrepreneur binds himself to refund the money within 3-5 years without any form of guarantee at a fixed price. The fund will be organized in a straightforward and flexible way to minimize operating costs. Given the involvement of the public sector, the fund is not aiming for a market rate of investment but rather for refunding the risk capital after the payment of the costs. Moreover, the choice of the projects to be

funded should be guided not by their attractiveness in terms of capital gains but by the potential growth of the new firms.

While strengthening existing actors and enabling new actors is important to improve the competitiveness of a RIS, it is also crucial to implement policies promoting collaboration among the key actors. The "Research Strategic Projects" are an interesting example of a measure designed to push cooperation among universities and firms and to create a close and stable network among them. The regional administration finance research project submitted by Universities in association with firms is characterized by an adequate critical mass in terms of competences and by interdisciplinarity. In 2006, ARTI performed the *ex ante* evaluation of the research proposals. At the end of evaluation process, 53 projects were selected (table 5).

Table 5 - Distribution of "Research Strategic Projects" by technological areas and University

	Biotech	ICT and high technologies	Mechatronics	Other	Total
University of Foggia	5			2	7
University of Bari	8	3		1	12
Polytechnic of Bari	3	4	2		9
University of Salento	6	1	5	1	13
Other public research centres	6		6		12
Total	**28**	**8**	**13**	**4**	**53**

Source: authors' calculation on ARTI data

Finally, a very novel measure is the so called "Talents network", which is a possible, realistic response to increasing migration by adopting a diaspora model. Under this initiative, the following activities are carried out: (*i*) the creation and regular updating of a database of Apulian talents (scientists, researchers, academicians and managers) living and working outside the region; (*ii*) the promotion and facilitation of exchange of experiences, knowledge

and expertise between highly skilled migrants and their region of origin; (*iii*) the involvement of the members of the network in all the others ARTI activities.

The expected effects of the "Talents network" is to strengthen the relationships between Apulian talents living and working outside the region and the actors of the regional innovation system, and those among network members. These talents can act as a conduit for knowledge and information flows back to the sending region and can increase international research collaboration. So far this initiative has produced interesting results. As of June 2009, the network includes 470 Apulian individuals working in the field of research, management and culture. Almost 70% of them work in other Italian regions, while 115 are in foreign countries.

6. Conclusions

In this paper we tried to answer to the following question: "Do we really need regional innovation agencies?". We think that the answer is: "Yes, we do".

The new international scenario leads to challenges more difficult than those of the past, in particular for regions at intermediate levels of development. To cope with growing competitive pressures these regions need a new development model: innovation is the route to increased competitiveness. Market mechanisms are not enough to produce a change in the development model of a region. Public policies are required to support and facilitate transformation processes, to make them run faster and smoother. In this context, intermediary agencies, such as regional innovation agencies, can play a crucial role. They can be effective in implementing policies suitable for the regional level that can strenghten the regional innovation system and overcome the market and system failures that hinder the full deployment of potential development factors.

The experience of the Regional Agency for Technology and Innovation is an interesting case that demonstrates the importance and the usefulness of this kind of agenciy in strengthening the innovative capacity of a territory. The results presented have clear implications for the local economy under analysis, but, in our opinion, they are also useful for regions facing similar circumstances, such as many peripheral regions across Europe.

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[1] Besides the theoretical framework of RIS, alternative models have been proposed in the regional development literature (MAILLAT, 1998; CREVOISIER and CAMAGNI, 2001; BECATTINI, 1981; SCOTT, 1988; ENRIGHT, 1994; MORGAN, 1997).

[2] Following ARCHIBUGI and LUNDVALL (2001) we recognise the increased importance of knowledge creation in all segments of society and economy, including traditional industries, services, and emerging sectors such as creative industries.

[3] Several papers have provided detailed overviews of the literature on the impact of government subsidies, tax incentives and public research programmes (DAVID et al., 2000; KLETTE et al., 2000; GARCIA-QUEVADO, 2004). There is little consensus as to the effectiveness of subsidies and research programmes.

[4] Empirical analysis sheds light on the importance of local socio-economic conditions for the genesis and assimilation of innovation and its transformation into economic growth across European regions (RODRÌGUEZ-POSE and CRESCENZI, 2008).

[5] The creation of a spin-off requires a complementary activity of financial and service brokerage. On this aspect see the next subsection.

[6] Recent contributions (HELMANN and PURI, 2000; KORTUM and LERNER, 1998; KAPLAN and STROMBERG, 2004) underline the positive correlations between the quantity of financial instruments provided by investment funds specialised in seed investments, start-up, early development and the growth of the technological innovation rate with reference to a given national system.

[7] On this topic see papers published in a special issue of *Research Policy*, vol. 34, 2005.

[8] Apulia is eligible for funding under the Convergence objective of the European cohesion policy.

[9] Apulian Universities, which excel in their traditional teaching and research roles (measured by scientific publications), are lagging behind in terms of supporting industry and knowledge formation and valorisation.