Regional Innovation Patterns and the EU Regional Policy Reform: Towards Smart Innovation Policies

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16.1 Introduction

In the recent EU regional policy debate, two main documents captured the interest of experts: the EU Report *Europe 2020* (European Commission 2010a), which presents the general context in which Europe will act in the next decade, and the Barca Report to Commissioner for Regional Policies, Danuta Hubner (Barca 2009), paving the way towards a reformed regional policy. The first Report proposes a strategy based on three pillars—namely, smart, sustainable and inclusive growth.[1] The second report discusses and proposes a new process of EU Regional Policy Reform, launched in preparation of the new programming period 2014–2020; in particular, the rationale, economic justification, conditionality, process design and delivery style of regional policy itself are discussed, supplying wide material for institutional and political decisions.

At the cross-yard of these two streams of reflections, an interesting policy debate was launched, related in particular to the 'smart growth' pillar, stressing the need to conceptually integrate the tasks put forward by the *Europe 2020* report and the new cohesion policy reform into a common framework. On the one hand, *Europe 2020*

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[1] These pillars may look relatively autonomous, touching the challenges of the knowledge society, of the environment and of the equitable society, but in fact are integrated with each other and "mutually reinforcing". Sustainable growth is pursued not just per se, but as a possible driver for "resource efficiency" and consequently "competitiveness"; inclusive growth is requested for the sake of social equity but also as a means for the "acquisition of skills", social cohesion and social capital.

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is seen as lacking a more explicit territorial dimension, a way through which to engage all potential and dispersed actors to contribute to the Agenda with their decision processes, in a bottom-up way (Camagni 2011). On the other hand, the EU policy reform should be conceptualized in a way to be able to contribute to the achievement of the three pillars (smart, sustainable and inclusive growth) of *Europe 2020* Agenda; in particular, the latter might become the occasion for re-launching a knowledge-intensive growth model for Europe on a regional base, supplying operational answers to the request of one of its 'flagship initiatives', namely 'Innovation Union'.

The EU official document *Regional Policy Contributing to Smart Growth in Europe* (EC 2010b) is a first official move in this direction, calling for the need to identify sectors and technological domains on which regional policies should be tailored to promote local innovation processes in these specialization fields. The document fully subscribes to the 'smart specialization' (RIS3 - Regional Innovation Smart Specialization Strategy) strategy suggested by the 'Knowledge for Growth' expert group advising to former European Commissioner for Research, Janez Potocnik (Foray 2009; Foray et al. 2009), advocating for a consistent matching between investments in knowledge and human capital and the present industrial and technological "vocations" and competences of territories. "Strategies have to consider the heterogeneity of research and technology specialization patterns" (Giannitsis 2009, p. 1).

This paper is a contribution in the same direction. It enters the debate on smart specialization strategy by stressing the need to overcome the simplistic dichotomy between core and periphery in the Union, between an advanced 'research area' (the core) and a 'co-application area' of general purpose technologies (the periphery)—present in the original but also in subsequent contributions. A slightly more complex but similar taxonomy was also proposed by OECD, pointing out a threefold partitioning—'knowledge regions', 'industrial production zones' and 'non-S&T driven regions' (OECD 2010, 2011). The geography of innovation is much more complex than a simple core-periphery model: the capacity to pass from knowledge to innovation and from innovation to regional growth is different among regions, and the identification of specific 'innovation patterns' (Capello 2012) is essential to build targeted normative strategies, well beyond what is proposed by the smart specialization model. Regional 'innovation patterns' may be found empirically in the way knowledge and innovation are developed inside the single regions according to the nature of their traditional knowledge base and productive specificities, and/or are captured from other regions via cooperation, scientists and professionals mobility, market procurement and trans-regional investments.

In this paper 'smart innovation policies' are advocated. They are defined as those policies able to increase the innovation capability of an area and to enhance local expertise in knowledge production and use, acting on local specificities and on the characteristics, strengths and weaknesses of already established innovation patterns in each region.

The two key concepts of 'embeddedness' and 'connectedness'—put forward in the recent debate on RIS3—are starting concepts around which smart innovation policies could be designed: policies have to be embedded in the local reality, in local assets and strategic design capabilities, and have to guarantee the achievement of external knowledge through strong and virtuous linkages with the external world (McCann and Ortega-Argilés 2011). However, this is not enough: a 'smart innovation' strategy goes a step forward, taking into consideration the R&D element but adapting the two concepts of 'embeddedness' and 'connectedness' to the specificities of each 'pattern of innovation'. Smart innovation policies look for targeted interventions—appropriate for each single territorial innovation pattern—with the aim to reinforce regional innovation process, to enhance the virtuous aspects that characterize each pattern, and to upgrade and diversify the local specialization into related technological fields (ESPON 2012).[2]

The paper is organized as follows. The debate on smart specialization is illustrated in Sect. 16.2 together with a reflection on its acceptability in a regional policy context. The need for the identification of territorial elements supporting innovation patterns to build a sound and efficient regional taxonomy of innovative regions is presented in Sect. 16.3. The new workable conceptual framework on which regional innovation policies should be developed is built in Sect. 16.4. Smart innovation policies are then presented (Sect. 16.5), leading to some concluding remarks (Sect. 16.6).

16.2 The Smart Specialization Debate: Embeddedness and Connectedness

The smart specialization approach was developed with the aim to find an explanation—and a consequent rational strategy—for the large R&D gap between Europe and some key trading partners. The most straightforward reason for the knowledge gap was outlined in the smaller share of European economy composed of high-tech, R&D intensive sectors. A second reason of the gap was pointed out in the spatial dispersion of the limited R&D efforts, generating insufficient critical mass and investment duplications, inefficient resource allocation, and consequent weak learning processes (Pontikakis et al. 2009).

On the basis of this diagnosis, a rational and concrete proposal was put forward by the "Knowledge for Growth" expert group. It advocates differentiated policies for 'core' and 'periphery' regions, the former able to host laboratories and research activities on general purpose technologies (GPT), the latter oriented towards the identification of their 'knowledge domain' in which to specialize and towards co-operation with external R&T providers ('co-application of innovation') (Foray et al. 2009; Foray 2009; Giannitsis 2009).

The advantages of such a strategy are strongly underlined in the smart specialization debate, namely:

[2]Most of the ideas presented in this work were elaborated by the authors within the ESPON KIT Project. For the final report of KIT, see http://www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/kit.html

– the possibility to achieve at the same time a "polarization" and a "distribution" of research activities in space. GPT research activities would achieve the critical mass of financial and human resources necessary to their efficient development, reinforcing the idea of a European Research Area (ERA); peripheral areas would not be penalized, taking advantage of financial resources to support the application of technological advances to their specific specialization fields;
– the achievement of a more productive use of the potentials of each region—defined in terms of traditional competence and skills, tacit knowledge and specific innovation processes—that would be reinforced by investments in human capital and research able to match each region's innovation profile;
– the development of cumulative learning in advanced R&D activities and the consequent exploitation of increases in R&D productivity;
– the creation of synergic effects between GPT and co-applications, thus increasing the size of GPT markets and the returns on R&D investment, enlarging at the same time the potential for technological adoption, adaptation and diffusion.

An important caveat is stressed concerning the achievements of the above mentioned advantages: the RIS3 approach makes the strong assumption that an area is able to discover new specialization fields inside its 'knowledge domain', i.e. well defined innovation niches on the basis of its present competences and human capital endowment, in which it can hope to excel in the future also thanks to synergetic policy support (Pontikakis et al. 2009). Some members of the group are explicit in this sense: "the concept of smart specialization (. . .) assumes that there are criteria to judge which specializations, and consequently which policy targets are smart" (Giannitsis 2009, p.4). In other words, a consistent matching between investments in knowledge and human capital and the present territorial 'vocations' represents a difficult and crucial challenge, inpinging on a creative and by no means mechanistic decision process.

On this particular aspect, the RIS3 argument is very clear: the search and discovery process around the traditional specialization has to be a bottom-up process, in which local entrepreneurs are identified as the leading actors, being the main knowledge and creativity keepers, interested in efficiently exploiting existing cognitive resources and driving their re-orientation towards new innovative but related fields. For the same reasons, the smart specialization expert group warns against the use of a top-down approach for the identification of specialization, which could be disruptive for an otherwise efficient policy strategy.

Besides specialization and embeddedness in the local knowledge domain, the RIS3 calls for particular attention to the connectedness among different geographical areas and knowledge domains; cooperation linkages represent the main potential for learning, either through the integration of different knowledge bases, a general purpose and an applied one, or through best practice of innovation application.

The main policy message of the smart specialization argument is the inappropriateness of the 'one-size-fits-all' policy which could be derived from a fast and superficial reading of the *Lisbon 2000* and *Europe 2020* agendas. When a regional perspective is adopted, in fact, an aggregate policy goal of 3% of the EU GDP to be invested in R&D/innovation shows its fragility in supporting the increase of the innovation capacity of each region; on the other hand, different evolutionary specializations based on specific local competences and vocations call for differentiated and region-specific innovation policy targets (Pontikakis et al. 2009).

What is acceptable and what is not in the smart specialization argument from a regional science and regional policy perspective? In answering to this question, one has to keep in mind that the RIS3 discourse was born in a sectoral, national and industrial policy context, nurtured mainly by industrial economics specialists, and that only very recently their argument was assumed into a regional policy context.

The main ideas behind the strategy—namely specialization, embeddedness and connectedness—are for sure fully acceptable and welcome. As the main literature in the field of regional innovation suggests—from the *milieu innovateur* theory to the regional innovation system approach and the learning region (Camagni 1991; Lundvall and Johnson 1994; Tödtling and Trippl 2005)—the way in which regions evolve and innovate is deeply rooted into slow localised learning processes, fed with information, interaction, long-term production trajectories, appropriate investments in research and education. Like all learning processes, they are inherently localised and cumulative, as they embed in human capital, interpersonal networks, specialized and skilled labour markets, local governance systems; therefore they are highly selective in spatial terms and require ad-hoc local policy interventions to be adequately supported (Camagni 2001; Quévit and van Doren 1997; Camagni and Maillat 1995). Thanks to the smart specialization approach, the inadequacy of a 'one-size-fits-all' policy for innovation at regional level is decisively transferred from the scientific literature into the institutional debate.

The need for connectedness is also stringent in modern times and widely acknowledged: since knowledge has more and more a complex nature, cooperation and networking with selected external competence sources is necessary for the attainment of complementary pieces of knowledge, avoiding lock-in with respect to local historical specializations (Camagni 1991).

Also the RIS3 proposition concerning the nature of the search and discovery process about the appropriate differentiation and upgrading strategy of local specialization fields looks particularly interesting, as it touches two relevant theoretical points:

– the collective nature of the learning processes inside those special places, characterized by intense local synergies and interpersonal interactions that are the industrial districts/milieus and the cities, where the learning process embeds into the dense fabric of SMEs and into the local labour market (Camagni 1991; Capello 1999; Keeble and Wilkinson 1999; Camagni and Capello 2002);
– the similar role played by the local milieu—fostering co-operation, collective action, incremental innovative solutions to technological and market problems, fast diffusion of innovation inside the local territory—with respect to the role of von Hayek's market as 'social spontaneous order' and 'discovery process' (von Hayek 1978): local knowledge and strategic capability is inherently dispersed in

a host of local actors whose decisions and entrepreneurial creativity have to be coordinated in a self-organized way and eventually supported by pro-active and smart policies.

The remarks made by the RIS3 literature about the necessity of achieving a critical mass for R&D spending are more than convincing. Polarisation of research activity in space is not only necessary to provide sufficient support in restricted budget conditions, but it is requested if investment in research has to be efficient, since not all regional contexts are able to take advantage from R&D or human capital investments. Areas in which a very limited amount of knowledge and endogenous innovative activities are present do not receive any advantage from additional, but limited, R&D spending. On the other side, dispersion of knowledge also in remote places following the principle of providing an 'inclusive and smart growth' to all Europe is a political necessity, as well as a forward looking economic strategy.

For all these reasons, the smart specialization approach looks highly valuable, appropriate and a good starting point for further reflections. However, as rightly pointed out (McCann and Ortega-Argilés 2011), the translation of a sector policy, like innovation policy, to a regional setting is not a simple task, and this is where an additional effort can be done.

16.3 The Need for a Territorial Approach to Innovation Policies

While the general philosophy behind the smart specialization argument is widely acceptable, its direct application in regional development policies is questionable. Its pure sectoral logic; its concentration on R&D as the only source of knowledge and innovation; its dichotomous perception of regional innovation processes and patterns are all aspects that have to be overcome or improved in a theoretical, empirical and normative sense.

When utilised in a regional context, the sectoral logic presents two main limits. The first refers to the idea that formal knowledge is the only source of innovation. Instead, different sources of knowledge exist in local economies, with similar importance, appropriateness and positive effects. They mainly concern informal knowledge creation and development, such as creativity, craft capability, practical skills—often embedded in long-standing competence and production tradition in a host of niche specializations—which have recently been labelled as synthetic and symbolic knowledge (Asheim et al. 2011). The second limit is that, starting from formal knowledge in order to identify the degree and capability of each region to innovate, the sectoral logic ignores the variability of regional paths towards innovation itself, on which innovation policies should carefully focus.

Regional innovation paths strongly depend on territorial elements, rooted in the local society, its history, its culture, its typical learning processes. In fact:

(a) knowledge creation is the result of the presence of a combination of material and non-material elements, formal and informal sources. The material elements, like presence of universities and research centres, are for sure important assets, but what makes the difference in knowledge creation are more and more intangible aspects linked to creativity, culture, taste, that represent for local communities a fertile ground for the development of specialized and skilled labour markets, qualified human capital, continuous learning processes, local interpersonal cooperation networks;

(b) invention, innovation and diffusion are not necessarily intertwined. Firms and individuals which are leading inventors are not necessarily also leaders in innovation or in the widespread diffusion of new technologies. The real world is full of examples of this kind: the fax machine, first developed in Germany, was turned into a worldwide success by Japanese companies; similarly, the anti-lock brake system (ABS) was invented by US car makers but became prominent primarily due to German automotive suppliers (Licht 2009). If the distinction between factors enhancing development of new knowledge and those stimulating innovation holds at the national level, it is even more stringent at the local level where specificities in learning processes, quality of human capital, knowledge externalities are present with different intensity. It is certainly true that basic knowledge is created in some regions where most of inventions take place; however, there are also regions developing inventions and product innovations in their specialization fields, either using off-the-shelf general purpose technologies developed elsewhere, or acquiring some crucial knowledge from outside (patents, scientific or technological skills), or establishing inter-regional co-operation networks (as in the RIS3 model of co-invention of applications). Last but not least, there are regions able to imitate, with limited adaptation on innovations that already exist, therefore even lacking any kind of knowledge but being in a measure to find their space on markets;

(c) the existence and importance of knowledge spillovers is widely acknowledged since some decades (Jaffe et al. 1993; Acs et al. 1994). But this reminds us about the importance of proximity and spatial conditions in the dialectic between knowledge creation and knowledge receptivity. Over time, proximity has been interpreted less in terms of geographical space and more and more in terms of cognitive and social space, deriving from similarities/differences in stocks of social and relational capital among regions (Basile et al. 2012). The capacity of an economic system to get advantage from knowledge created elsewhere is again dependent on its culture, creativity and openness to external stimuli; in a word, on its ‘cognitive and social space’ (Boschma 2005; Capello 2009). Different regions develop different ‘cognitive and social spaces’ and this explains the degree of their virtual connection, their receptivity and, consequently, the potential knowledge spillovers they may benefit from;

(d) economic growth is not necessarily linked with cognitive or technological catching-up. The strong economic performance of New Member countries up to 2008 is certainly not related to growth of the knowledge economy, as these countries (and their regions) have witnessed a weak performance in scientific indicators, both of input (R&D) and of output (patenting activity) (ESPON 2012). Of course, if some forms of technological or knowledge advancement had taken place, economic growth in these countries could have been more robust or continuous. But these advancements should not have taken the form of a traditional, generic investment in R&D, but rather the form of knowledge spillover generation from large multinational plants into the local fabric of SMEs, supported by public/private bargaining and agreements (the equivalent of the old-established practice of agreements on 'local content') and creatively utilized by local potential entrepreneurs;

(e) what is really meant by referring to the importance of local territories is the fact that, while some important production factors like financial capital, general information, consolidated technologies and codified knowledge are today readily available virtually everywhere, the ability to organize these factors into continuously innovative production processes and products is by no means pervasive and generalised, but instead exists selectively only in some places where tacit knowledge is continuously created, exchanged and utilized, and business ideas find their way to real markets (Camagni and Capello 2009).

For all these reasons, the translation of a sectoral policy—like innovation policy was intended to be, traditionally—into a regional spatial setting is not an easy task, and calls for a *territorial approach*, considering all the specificities of the single regions. The preconditions for knowledge creation, for turning knowledge into innovation, and for turning innovation into growth are all embedded in the territorial culture of each region. This means that each region follows its own path in performing the different abstract phases of the innovation process, depending on the context conditions: its own 'pattern of innovation', in our terminology.

On the other hand, following the RIS3 model, a dichotomous regional taxonomy emerges. In fact, the way in which the model suggests to target regions with different innovation policies leads to a simplified partitioning of the European research territory into a core and a periphery. Regions hosting high-tech sectors and top R&D activities are considered as 'core' regions, leading new knowledge creation and the transformation of the economy, drivers of Europe into the international technological competition. All other regions are assigned the role of adopters/adapters of technological frontier inventions into their 'knowledge domain', on the basis of their production specificities (Foray 2009; Foray et al. 2009; Giannitsis 2009; Pontikakis et al. 2009). But the ways in which knowledge may be created, acquired, utilised and transformed into innovation are far more complex when regional conditions are taken in full consideration.

As said before, the Commission's Report *Regional Policy Contributing to Smart Growth in Europe* (EC 2010b) shares this simplified vision of a twofold typology of regions. A similar typology, based on the intensity of knowledge produced locally, was recently proposed also by the OECD (2010, 2011), distinguishing 'knowledge regions, industrial production zones, non-S&T driven regions'; similar doubts may be raised.

Other empirical research works on regional innovation, developed for the DG Enterprise and Industry (the *Regional Innovation Scoreboard*) and the DG Regio, end up with multivariate taxonomies of regions, going far beyond the dichotomous typology presented by the RIS3 model (JRC-Merit 2009; UNU-Merit 2010). Important and interesting results are achieved, but methodologies employed merge together indicators as diverse as innovation performance, knowledge inputs like R&D, sectoral structure, presence of spatial innovation enablers, with no clear conceptual expectations on the linkages among the different variables, in a purely inductive way. Our own goal, on the other hand, is to detect regional 'patterns' based on a clear conceptual definition of the different phases of any innovation process, and of the context conditions that are expected to support the different phases of the innovation process.

Still other approaches, even if coming from a regional science milieu, do not really accept the conceptual possibility of differentiation in regional innovation patterns. The Regional Innovation System (RIS) approach (Trippl 2010) claims that any RIS is constituted by two sub-systems: a sub-system of knowledge generation and diffusion (knowledge infrastructure dimension) and a sub-system of knowledge application and exploitation (business dimension), made up of the companies located in the region. It identifies local success conditions in the intense interactions and circulation of knowledge, human capital and resources within and between these sub-systems, for any type of regions. We see here a contradiction: even if regional specificities are considered, as embedded in the two subsystems, at the same time any RIS is supposed to need both subsystems, despite the variability in local capabilities, knowledge sources, knowledge intensity and typology of innovation. Our claim is that in some cases a sub-system of knowledge generation may be present, in some other not, and knowledge could be acquired from outside; for regions belonging to this latter case, the suggestion of developing and reinforcing the knowledge subsystem (Tödtling and Trippl 2005) looks somehow misplaced and it is probably not what their innovation mode requires.[3]

New thematically and/or regionally focused innovation policies require the identification of context specificities in the knowledge-to-innovation process, in a similar way as a 'place-based' approach is postulated for a renewed EU regional development policy (Barca 2009). To achieve such a goal, a theoretically, and empirically sound regional innovation taxonomy is required, to be tested on the European space.

[3]If we do not agree with the idea of developing R&D facilities with the same intensity everywhere, for the same reasons we do not agree that knowledge sub-systems and the business sub-system have to be present everywhere with the same intensity.

16.4 Territorial Patterns of Innovation

16.4.1 An Operational Definition

Sound innovation policies should be linked to the characteristics of already established 'innovation patterns' in each region, defined in terms of the ways in which the different phases of an abstract innovation process are present, are performed and interlinked in reality. In fact, it is possible to consider alternative situations where innovation may build on an internal knowledge base, or on local creativity even in absence of local knowledge, or on innovative applications of a knowledge developed elsewhere and acquired via scientific linkages, or finally on imitative processes. In order to proceed in this direction, an operational definition of territorial patterns of innovation is needed: a territorial pattern of innovation is defined as a combination of *context conditions* and of *specific modes of performing the different phases* of the innovation process.

For what concerns the different phases of the innovation process, a logical sequence between knowledge, innovation and economic performance may be drawn as in the abstract but consistent 'linear model of innovation'—even if heavily criticized as unrealistic and rooted in the idea of a rational and orderly innovation process (Edgerton 2004). In fact, we strongly believe that: (1) in many cases scientific advance is a major source of innovation, as the ICT paradigm and trajectory indicate; (2) an alternative model of full complexity, where 'everything depends on everything else', does not help in conceptualizing and interpreting the systemic, dynamic and interactive nature of innovation; (3) self-reinforcing feedbacks from innovation to knowledge and from economic growth to innovation and knowledge play an important role in innovation processes. The impact of science on innovation does not merely reside in the creation of new opportunities to be exploited by firms, but rather in increasing productivity of, and returns to, R&D through the solution of technical problems, elimination of research directions that have proven wrong and the provision of new research technologies (Nelson 1959; Mowery and Rosenberg 1998; Balconi et al. 2010). We therefore strongly support the concept of a 'spatially diversified, phase-linear, multiple-solution model of innovation', in which the single patterns represent a linearization, or a partial block-linearization, of an innovation process where feedbacks, spatial interconnections and non-linearities play a prominent role.

For what concerns the *territorial specificities (context conditions)* that are behind each phase of the innovation process, we take advantage from the vast and articulated literature that takes territorial elements into consideration in innovation processes, namely:

– *concerning knowledge creation*: human capital and education in general, universities and R&D activities, presence of an urban atmosphere have been considered, in a variety of approaches, as the territorial preconditions for endogenous knowledge creation in the vast literature that was developed during the 1980s. In this period, innovation was interpreted as a production of high-tech goods or services, assuming an immediate link between invention and innovation taking place inside individual firms (or their territories) operating on advanced sectors (Malecki 1980; Saxenian 1996). When many knowledge-based advances were actually introduced by 'traditional' sectors—such as textiles and car production—in their paths towards rejuvenation, it became evident that it was not only a matter of sectoral specialization, but of functional specialisation. Conceptual efforts were made to explain the different regional capacities in generating knowledge (MacDonald 1987; Massey et al. 1992; Monk et al. 1988; Storey and Tether 1998). Cities were identified as the most natural location of R&D and higher education facilities, taking advantages of urban externalities;

– *concerning knowledge diffusion and the role of 'proximity'*: in the 1990s, a new debate was launched on the way knowledge spreads within and between regions. Spatial proximity was at first seen as the main reason explaining the channels through which knowledge spreads around: moving in a certain sense back to the original contributions on innovation diffusion of the 1960s (Hägerstrand 1967; Metcalfe 1981), the pure likelihood of contact between a knowledge creator (an R&D laboratory) and a potential recipient (a firm, a university, another R&D centre) was seen as the main vehicle for knowledge transmission, in a pure epidemic logic (Acs et al. 1994; Audretsch and Feldman 1996; Anselin et al. 2000). The simplicity of this approach soon became evident, and a large debate was developed on the necessity to enrich the concept of spatial proximity with cognitive aspects, able to differentiate the absorptive capacity of different actors within regions;
– *concerning evolutionary paths of knowledge/innovation diffusion*: knowledge creation and innovation are described as the outcome of creative, evolutionary search processes implemented around existing competencies, inside specific domains or paradigms and along specific trajectories (Dosi 1982; Nelson and Winter 1977; Antonelli 1989; Foray 2009); as a result, the cognitive base of actors and organizations and their potential for learning differ substantially across space. In order to understand regional evolutionary processes, different concepts of proximity, from social to institutional, cultural and cognitive proximities, were added as interpretative elements in knowledge spillovers, enriching the conceptual tools interpreting knowledge diffusion (Boschma 2005; Rallet and Torre 1995; Capello 2009). In particular, Boschma interprets intra-regional cognitive proximity via the concept of related variety (Boschma 2005), while more recently a similar concept is employed to interpret cross-regional cognitive proximity and scientific co-operation potential (Capello and Caragliu 2012; Basile et al. 2012), as it will be shown later;
– *concerning knowledge utilization and receptivity*: the presence of entrepreneurship is another way of explaining an intra-regional capacity to translate knowledge into innovation. In this respect, the knowledge filter theory of entrepreneurship put forward by Acs and Audretsch envisages an explicit link between knowledge and entrepreneurship within the spatial context, where entrepreneurs are interpreted as the innovative adopters of new knowledge. This theory posits that investments in knowledge by incumbent firms and research organizations such as universities will generate entrepreneurial (innovation) opportunities because not all of the new knowledge will be pursued and commercialized by the incumbent firms. The knowledge filter (Acs et al. 2004)

refers to the extent that new knowledge remains un-commercialized by the organization creating that knowledge. These residual ideas are those that generate the opportunity for entrepreneurship. The interesting aspect of this theory is that the capabilities of economic agents within the region to access and absorb the knowledge and ultimately utilize it to generate entrepreneurial activity is no longer assumed to be invariant with respect to geographic space, contrary to what has been always thought. In particular, diversified areas, in which differences among people that foster appraising a given information set differently, thereby resulting in different appraisal of any new idea, are expected to gain more from new knowledge;

– *concerning innovation enhancing elements*: local interaction and co-operation in order to achieve reduction of uncertainty (especially concerning the behaviour of competitors and partners) and of information asymmetries (thus reducing mutual suspicion among partners); trust, sense of belonging, place-loyalty and social sanctioning in order to reduce opportunistic behavior, are all territorial elements, typical of the innovative milieus, that increase the capacity of a region to speed up innovation and take full advantage of collective learning processes (Camagni 1991), as confirmed by many regional economics schools (Bellet et al. 1993; Rallet and Torre 1995; Cappellin 2003).

The territorial innovation patterns concept stresses complex interplays between phases of the innovation process and the territorial context; by doing so, it adds three new elements with respect to the previous theoretical paradigms. First of all, it definitely separates knowledge from innovation as different (and subsequent) logical phases of an innovation process, each phase requiring specific local elements for its development. This approach refuses the generalization of an invention-innovation short-circuit taking place inside individual firms (or territories), as that visible in some advanced sectors, as well as the assumption of an immediate interaction between R&D/high education facilities on the one hand and innovating firms on the other, thanks to pure spatial proximity. Secondly, the concept of 'patterns of innovation' identifies the different necessary context conditions, both internal and external to the region, that may support the single innovation phases and that generate *different modes of performing and linking-up the different phases of the innovation process*. These context conditions become integral parts of each territorial pattern of innovation. The third new element concerns the overcoming of a purely geographic concept of proximity to interpret inter-regional knowledge spillovers, moving towards a concept of 'cross-regional cognitive proximity'. This concept links knowledge spillovers to the presence of a common technological domain inside which cumulative search processes and inventions can be performed through inter-regional co-operation (Capello and Caragliu 2012).[4]

[4]Empirically, the common technological domain is approximated by a common specialization of pairs of regions into the same technological class (1 digit) of patents; potential for advancements is approximated by differentiation and complementarity in terms of specialization in sub-classes of patents (2 digits) (Capello and Caragliu 2012).

Among all possible combinations between innovation modes and territorial elements, the 'archetype' ones may be indicated in the following, each of which reflects a specific piece of literature on knowledge and innovation in space:

(a) *an endogenous innovation pattern in a scientific network*, where local conditions fully support the creation of knowledge, its local diffusion and transformation into innovation and its widespread local adoption. Given the complex nature of knowledge creation nowadays, this pattern is expected to show a tight interplay among regions in the form of international scientific networks. From the conceptual point of view this advanced pattern is the one considered by most of the existing literature dealing with knowledge-and-innovation creation and diffusion (Fig. 16.1);
(b) *a creative application pattern*, characterized by the presence of creative economic actors interested and curious enough to look for knowledge outside the region—given the scarcity of local knowledge—and creative enough to apply external knowledge to local innovation needs. This approach is conceptually built on the literature on regional innovation adoption/adaptation, as also proposed by the RIS3 model (Foray 2009; EC 2010b) (Fig. 16.2);
(c) *an imitative innovation pattern*, where the actors base their innovation capacity on imitative processes, that can take place with different degrees of adaptation on an already existing innovation. This pattern is based on the literature dealing with innovation diffusion (Fig. 16.3).

Conceptually speaking, these three patterns represent by-and-large the different ways in which knowledge and innovation can take place in a regional economy. Each of them represents a different way of innovating, and calls for different policy styles to support it. An R&D support policy can be extremely useful for the first kind of innovation pattern; incentives to co-invented applications, enhancing the ability of regions to change rapidly in response to external stimuli (such as the emergence of a new technology) and to promote upgrading of present specializations or shifting from old to new uses, is a good policy aim for the second pattern. The maximum return to imitation is the right policy aim of the third innovation pattern, and this aim is achieved through an adaptation of already existing innovations in order to reach particular market niches or specific territories.

As shown in the three figures, the complexity of the different patterns is much higher, and the territorial processes are much richer with respect to the apparently similar dichotomy proposed by the RIS3 model.

16.4.2 A Regional Innovation Taxonomy of European Regions

An empirical analysis has been performed on EU regions in order to identify whether and how the territorial patterns of innovation presented above actually exist in the reality. Based on a list of indicators able to cover all aspects of the

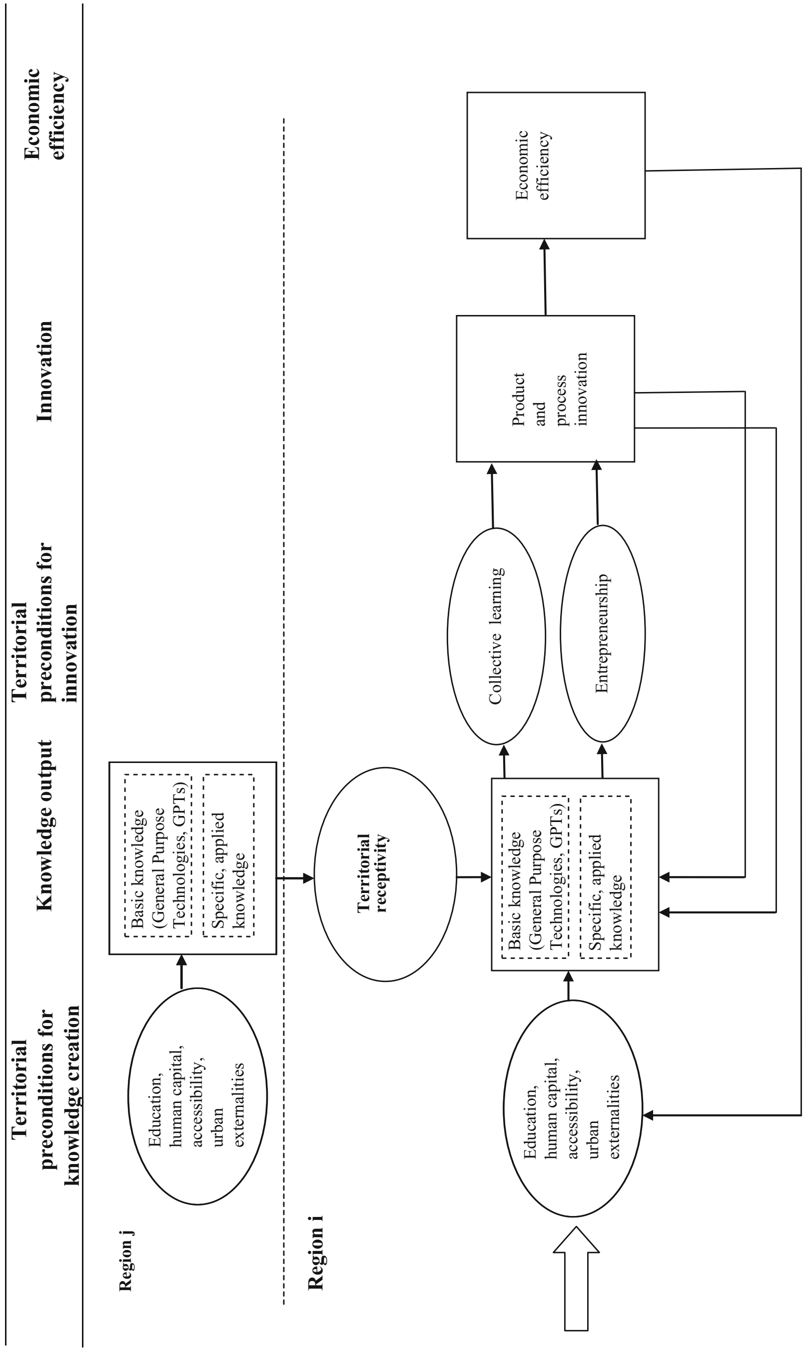


Fig. 16.1 Endogenous innovation pattern in a scientific network

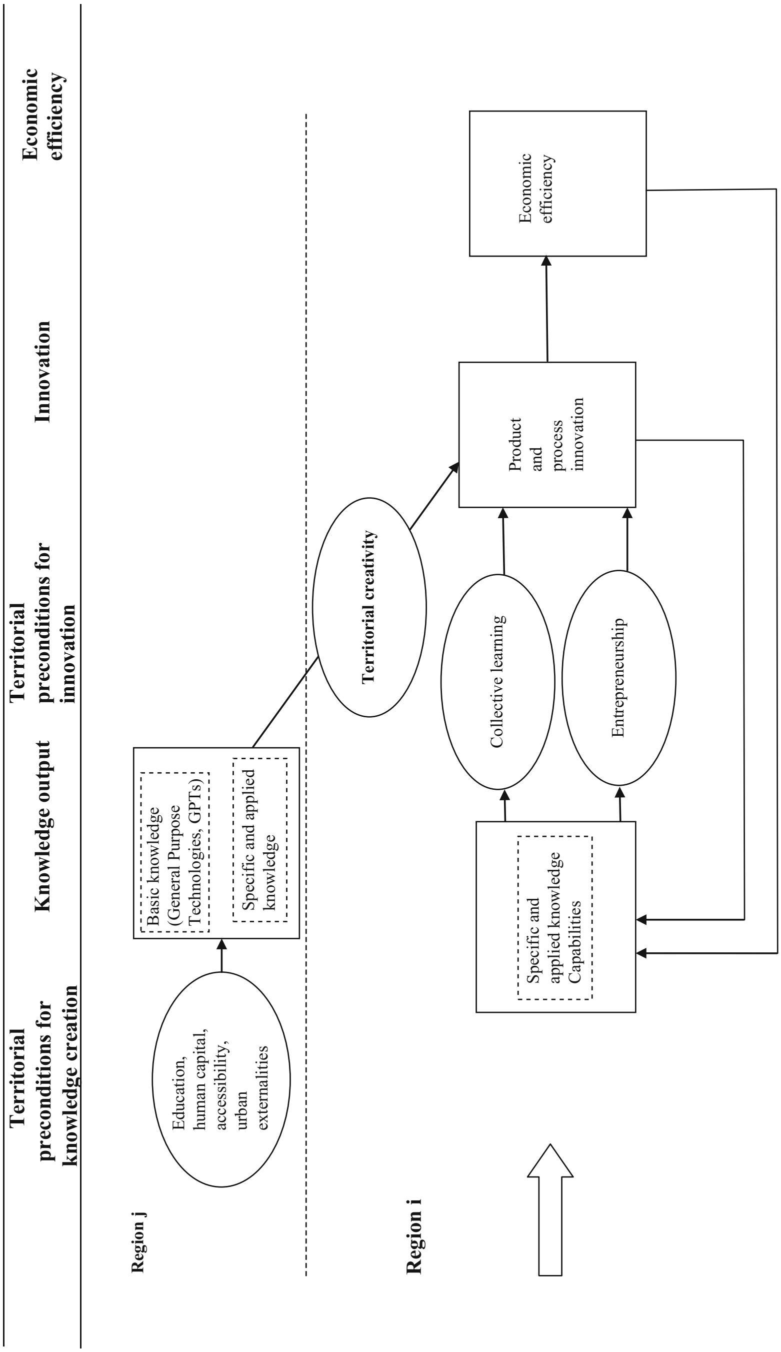


Fig. 16.2 Creative application pattern

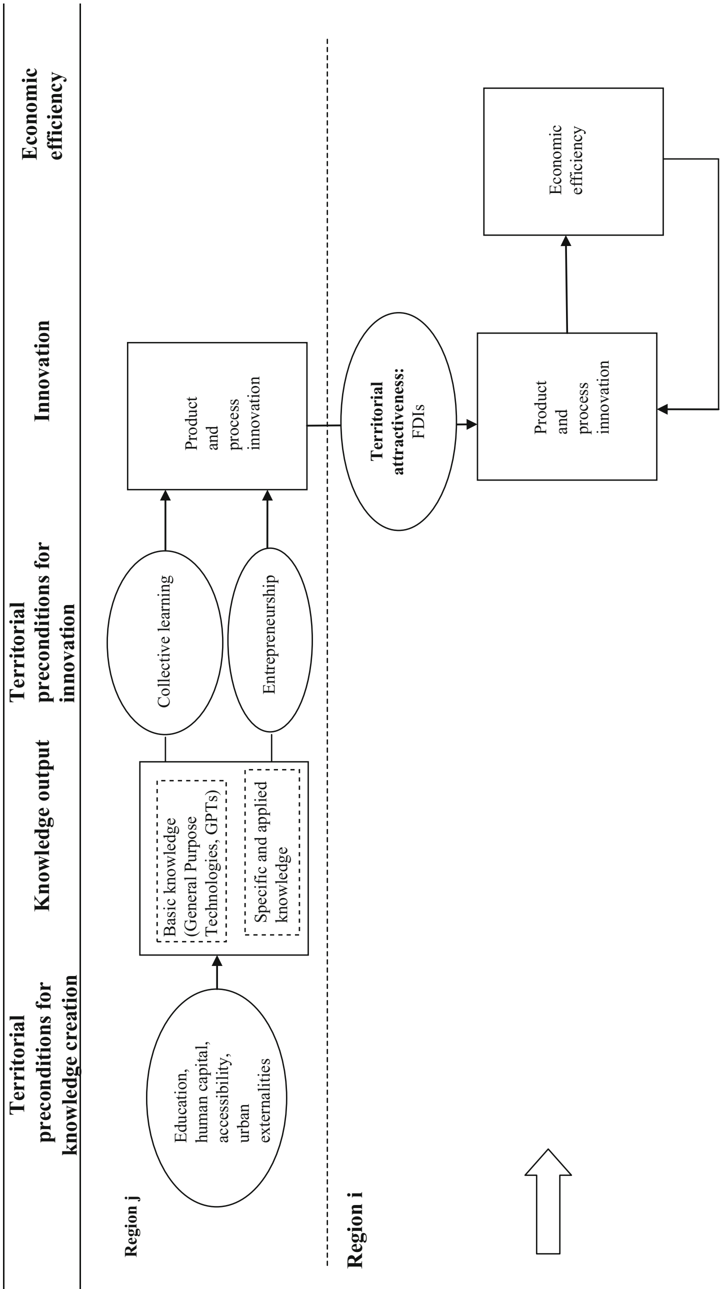
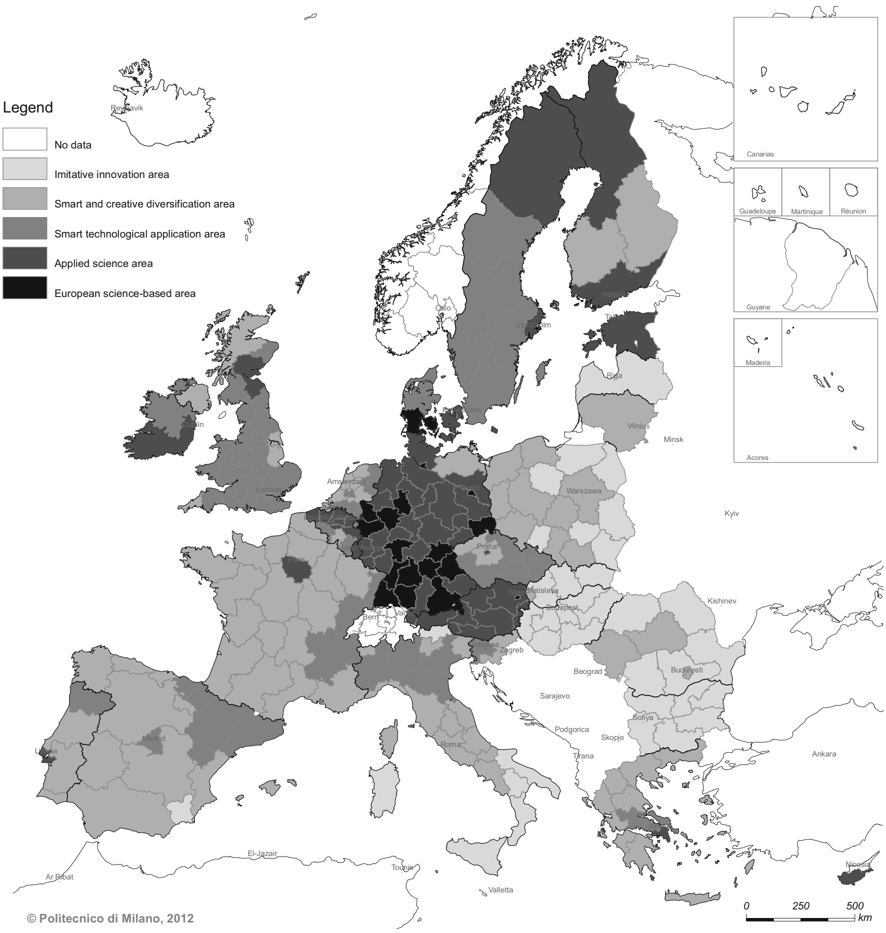


Fig. 16.3 Imitative innovation pattern

complex knowledge-innovation chain and a newly built data-base on regional innovation performance (ESPON KIT 2012), a cluster analysis was run in order to identify the existence of innovative behaviours that could be associated to the territorial patterns of innovation previously described (Capello and Lenzi 2012).

The empirical results show a larger variety of possible innovation patterns than the ones conceptually envisaged, still consistent with the theoretical underpinnings presented before. Two clusters can be associated to our first conceptual Pattern depicted in Fig. 16.1, albeit with some relevant distinctions between the two; two clusters can be associated to the second Pattern depicted in Fig. 16.2, again with some important differences, and one cluster can be associated to the third Pattern. Interestingly, the five groups show sizeable differences in the variables considered in the clustering exercise, namely (Map. 16.1):

- *a European science-based area* (Pattern 1), characterised by regions with a strong knowledge base and fast innovation processes, specialized in general purpose technology, with a high generality and originality of local science-based knowledge and a high degree of knowledge inputs coming from regions with a similar knowledge base. R&D activity is high. These regions are mostly located in Germany, with the addition of Wien, Brussels, and Syddanmark in Denmark;
- *an applied science area* (Pattern 2), made up of strong knowledge producing regions characterized by applied science, with a high degree of knowledge coming from regions with a similar knowledge base. R&D activity is high in this cluster of regions too. These regions are mostly agglomerated and located in central and northern Europe, namely in Austria, Belgium, Luxembourg, France (Paris), Germany, Ireland (Dublin), Denmark, Finland and Sweden with some notable exceptions in Eastern countries (Praha, Cyprus and Estonia) and Southern countries (Lisboa and Attiki);
- *a smart technological application area* (Pattern 3), in which a high product innovation rate is registered, with a limited degree of local applied science and high creativity and receptivity which allow to translate external basic science and applied science into innovation. R&D endowment is much lower than in the previous two cases. The apparent target of this group of regions is to achieve specialized diversification across related technologies in diversified technological fields of competence. This group of regions includes highly urbanized regions in North-eastern Spain and Madrid, in Northern Portugal and Northern Italy, Lubliana, the French Alpine regions, in the Netherlands, Czech Republic, Sweden and the UK;
- *a smart and creative diversification area* (Pattern 4), characterized by a low degree of local applied knowledge, some internal innovation capacity, high degree of local competences, which suggest that the not negligible innovation



Map 16.1 Territorial patterns of innovation in Europe. Source: Capello and Lenzi (2012)

activities carried out in the area mainly rely upon tacit knowledge embedded into human capital. Moreover, regions in this area are strongly endowed with characteristics such as creativity and attractiveness that help to absorb knowledge and to adapt it to local innovation needs. These regions are mainly located in Mediterranean countries (i.e. most of Spanish regions, Central Italy, Greece, Portugal), in agglomerated regions in Slovakia and Poland, a few regions in northern Europe, namely in Finland and the UK;

– *an imitative innovation area* (Pattern 5), showing a low knowledge and innovation intensity, low entrepreneurship and creativity, a high attractiveness of FDI and a good innovation potential. Most of these regions are in New Member Countries such as Bulgaria and Hungary, Latvia, Malta, several regions in Poland, Romania, and Slovakia, but also in Southern Italy.

These empirical results show that the pathways towards innovation and modernization are differentiated among regions according to local specificities. The variety of innovation patterns explains the failure of a 'one-size-fits-all' policy to innovation, like thematically/regionally neutral R&D incentives. Innovation patterns typical of each specific area have to be identified: on these patterns the smart specialization concept can find a sounder conceptual basis and more appropriate, targeted innovation policies can be drawn.

16.5 Towards 'Smart Innovation Policies'

The five—conceptually differentiated—innovation patterns detected by the ESPON Project KIT (Knowledge, Innovation and Territory) (ESPON 2012) and presented above may pave the way towards a renewed, spatially sound inclusion of the smart specialization strategy in R&D policies into an appropriate regional innovation policy framework, along similar lines of the Reform of the EU Regional Development Funds, explicitly intended—as a "key means of turning priorities of Innovation Union Flagship Initiative into practical action on the ground" (EC 2010b, p. 2). The logical pathway towards 'smart innovation' policies is drawn in Fig. 16.4.

'Smart innovation' policies may be defined as those policies able to increase the innovation capability of an area by boosting effectiveness of accumulated knowledge and fostering territorial applications and diversification, on the basis of local specificities and the characteristics of already established innovation patterns in each region.

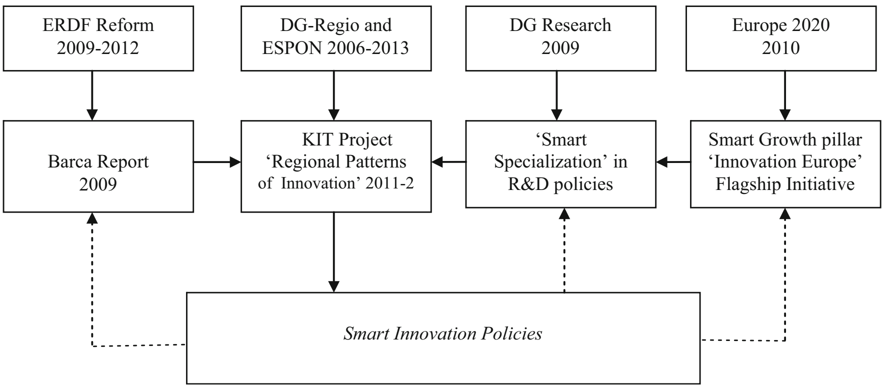


Fig. 16.4 Logical pathway and contributions to Smart Innovation Policies

The two key concepts of 'embeddedness' and 'connectedness'—put forward in the recent smart specialization debate—are a useful starting point. However, smart innovation policies adapt the two concepts to the specificities of each pattern of innovation, and look for ad-hoc interventions, appropriate for each single territorial innovation pattern, with the aim to reinforce the virtuous aspects that characterize each pattern, and increase each pattern's efficiency (Table 16.1).

This general policy strategy is by no means open to doubts or criticisms concerning the possible risk of locking-in regions into their traditional specialization, jeopardizing their specific resilience in a fast changing economic environment.[5] In fact, the smart innovation strategy assumes, in its application to each regional innovation pattern, an evolutionary attitude, targeting, suggesting and supporting local learning processes towards the detection of new needs, new creative applications and diversification of established technologies, new forms of blending knowledge advancements and local specialization, the discovery, and possibly the orientation, of future technological trends. Even 'jumps' over a different innovation pattern might be foreseen in some regional cases, even if, given the responsibility in the management of public money, policy makers should better stick to strengthening the upgrading and diversification processes inside each single innovation pattern—the least risky process, and the most likely successful one.

Regional innovation policies for each pattern should differ first of all in terms of policy goals:

(a) the maximum return to R&D investments is the right policy goal for regions belonging to the 'European science-based' and the 'Applied science' patterns, characterised by a sufficient critical mass of R&D endowment already present in the area. Regions belonging to these two innovation patterns can in fact exploit the indivisibilities associated to research activity and take advantage from additional R&D funding coming from joint and integrated efforts of regional, national and EU bodies. Given their different research specialization, the two patterns can reinforce their efficiency when innovation policies take in full consideration the regional research specificities: in the 'European science-based area' the maximum return of R&D spending is obtained through policy actions devoted to R&D spending in GPTs, and a strong specialization is fundamental to achieve a critical mass of research. On the other hand, applied scientific fields of research should absorb much of the R&D funds in the 'Applied science area', diversifying efforts in related sectors of specialization;

(b) support to basic research is not the most natural policy goal for the 'Smart technological application' and the 'Smart and creative diversification' patterns. In these areas the relatively low R&D endowment does not guarantee the presence of a critical mass of R&D in order to exploit economies of scale in knowledge production: returns to R&D of such kind of policy are modest.

[5] A similar criticism was in fact addressed to the RIS3 strategy. See: Cooke (2009).

Table 16.1 Smart innovation policies by territorial innovation pattern

Policy aspects	Territorial patterns of innovation: European science-based area (Pattern 1)	Applied science area (Pattern 2)	Smart technological application area (Pattern 3)	Smart and creative diversification area (Pattern 4)	Imitative innovation area (Pattern 5)
Policy goals	Maximum return to R&D investments		Maximum return to applications and co-operation in applications		Maximum return to imitation
Policy actions for local knowledge generation (Embeddedness)	Support to R&D in:		Support to creative application, shifting capacity from old to new uses, improving productivity in existing uses, through:		Fast diffusion of existing innovation Enhancing receptivity of existing innovation
	New basic fields General Purpose Technologies	Specialized technological fields Variety in applications	Incentives to technological development and upgrading Variety creation	Identification of international best practices Support to search in product/market diversification Support to entrepreneurial creativity	Support to local firms for complementary projects with MNCs Support to local firms for specialized subcontracting
Policy actions for exploitation of knowledge spillovers (Connectedness)	Incentives to inventors attraction and mobility Support of research cooperation in:		Incentives for creative applications through:		Incentives for MNCs attraction
	GPT and trans-territorial projects (ERA)	specific technologies and trans-territorial projects (ERA), in related sectors/domains; encouraging of labour mobility among related sectors/domains	co-operative research activities among related sectors; co-operative search for new technological solutions	participation of local actors to specialized international fairs; attraction of "star" researchers even for short periods; work experience in best practice Knowledge creation firms of the same domains	bargaining on innovative 'local content' procurement by MNCs

(continued)

Table 16.1 (continued)

Policy aspects	Territorial patterns of innovation				
	European science-based area (Pattern 1)	Applied science area (Pattern 2)	Smart technological application area (Pattern 3)	Smart and creative diversification area (Pattern 4)	Imitative innovation area (Pattern 5)
Policy style	Reach a critical mass in R&D activities through concentration of public support; priority to triangular projects by Universities-Research Centres-Enterprises; peer assessment of R&D research programmes; support to knowledge and technological transfer mechanisms to related sectors; thematical/ regional orientation of R&D funding:		Ex-ante careful assessment of innovation and differentiation strategies and projects; continuity in public support, subject to in-itinere and ex-post assessment of outcomes; support to bottom-up identification of industrial vocations, by raising awareness on local capabilities and potentials ('strategic industrial planning'); thematical/regional orientation of innovation funding, in order to:		Favour local spill-overs of managerial and technological knowledge from MNCs; support to co-operation projects between MNCs and local firms.
	in general purpose technologies	in specific fields of research and technological specialization of the area	strengthen present formal and tacit knowledge through co-operation with strong external partners in the specialization sectors	enhance local technological receptivity, creativity and product differentiation capability in specializ. sectors	support to technological transfer and diffusion
Beneficiaries	University, research centers, large local firms		Local firms	Local entrepreneurs	Local firms

Innovation policy aims in these patterns can be found in the maximum return to new applications and to inter-regional co-operation in applications, deeply linked to the ability of regions to change rapidly in response to external stimuli (such as the emergence of a new technology) and to realize creative search processes concerning product and market diversification.

To achieve such a goal, support to creative application, shifting capacity from old to new uses, improving productivity in existing uses, are the right policy tools for maximising the return to co-inventing application. In a word: support to 'D', and to co-operative 'D' rather than to 'R'.

In the first case (Pattern 3) policy actions for the achievement of such goals can take into account incentives to technological projects that foresee new and creative use of existing scientific knowledge; in the second case (Pattern 4), support and incentives to search in products/markets diversification and to entrepreneurial creativity look more appropriate;

(c) finally, in the 'Imitative innovation' area attention has to be devoted to the achievement of the maximum return to imitation, through fast diffusion of already existing innovation, strengthening of local receptivity to innovation (or reducing social/psychological or institutional barriers to change) and supporting favourable negotiations between local firms and MNCs on complementary projects and innovative, specialized subcontracting.

Beyond the previous policy recommendations aiming at fostering the creation of local knowledge, policy interventions should also aim at knowledge acquisition from outside the region, what has been called 'connectedness'. As for the case of embeddedness, also in this case implementation varies according to the specificities of the different patterns of innovation:

(a) in the first two patterns, the appropriate policy tools to attract external knowledge are incentives to inventors attraction and mobility, and support to research co-operation: in GPT and trans-territorial projects in the 'European science-based area', and in related sectors belonging to specific fields of technological specialization in the 'Applied science area'. This suggestion is in line with the creation of the European Research Area (ERA) put forward by the European Commission, an area composed of all research and development activities, programmes and policies in Europe which involve a transnational perspective. The 'Applied science area' could also be favoured by the encouragement of regional and inter-regional labour mobility between related sectors, which makes skills and experience moving around and blending with each other across sectors and regions;

(b) policy tools for knowledge acquisition in the third and fourth area are incentives for creative applications. For such a purpose, cooperative research activities in related sectors in those regions where a little applied science base exists are an efficient policy tool for the 'Smart technological application area'. On the one hand, participation of local actors to specialized international fairs, the attraction of "star" researchers even for short periods of time, or support for work experiences in best practice knowledge-creation firms in related sectors are right incentives to stimulate innovation in the 'Smart and creative diversification' area whose innovation capacity lies in the brightness of local entrepreneurs to find outside the area the right applied science on which to innovate and move towards a specialized diversification in related sectors;

(c) the traditional incentives to attract MNCs remain the most efficient tool to attract new knowledge in areas with very limited—formal or informal, scientific or technical—knowledge. Traditional bargaining on 'local content' in MNCs' procurement could also be used, with enhanced attention to co-operation in specialized subcontracting.

The policies suggested require renewed styles in their design-to-delivery phases in order to enhance efficiency and effectiveness (Camagni 2008; Camagni and Capello 2011). As in more general regional development policies, a strong attention should be devoted to the following elements:

– transparency, which means clear justification of the spatial allocation of funds in the different measures, from spatial concentration in some cases (reaching a critical mass in R&D, particularly in Innovation Patterns 1 and 2) to spatial pervasiveness in others (tapping local creativity, diversification and adoption capabilities: Patterns 3 to 5);
– control on local strategies followed, in order to avoid rent seeking attitudes by local élites (in politics, in the economy, but also in the high education and research fields). This means favouring active co-operation among main local actors: universities, research centres and firms. The internal strategies of the single actors in the research and innovation fields, perfectly lecit, may not be the best ones for the entire regional community, or the most appropriate in terms of risk assumption by the public sphere; therefore, programmes and projects presented jointly by all three main actors should be solicited and given high priority (especially in Patterns 1 and 2);
– peer ex-ante assessment of main R&D and innovation projects presented to public support;
– knowledge transfer, knowledge diffusion through inter-sectoral and inter-regional co-operation and general knowledge dissemination should be favoured, in order to boost productivity of the publicly supported R&D;
– favour continuity over time in public support decisions—a crucial precondition for local learning processes—at the condition of fair and effective intermediate and ex-post assessment of outcomes;
– build a formalized, but flexible, organizational model for supporting the identification of regional specializations, in R&D and production, and for strengthening the search process of new thematic application fields and diversification areas, inside and outside the present technological and production domains: a local, participatory model that could be labelled as 'strategic industrial planning';

– favour creativity and entrepreneurial spirit in all regional conditions. This means, on the one hand, to detect and support present local skills, traditions, social values, positive attitudes towards the environment and local culture, solidarity and cultural diversity (especially in Patterns 3 and 4); on the other hand, to create an innovation-friendly business environment, reduce barriers or resistance to change, enhance receptivity to external stimuli and opportunities, discover new local potentials through the engagement of insufficiently utilised local resources (in Patterns 3, 4 and especially 5);
– favour the strengthening of local spillovers from large firms and MNCs present in the different regional contexts, in the field not just of technical knowledge and research potential but also in the field if production organization and managerial styles and practices, mainly through local subcontracting and co-operation with local firms.

New key-words, complementing embeddedness and connectedness, should be *justification* of the spatial allocation of funds, *tripartite co-operation* (universities, research centres, firms), *peer assessment* of R&D programmes and projects, *continuity* in public support subject to *in-itinere* control, tapping *creativity and entrepreneurial spirit*, informal but also lightly structured *local search* processes.

The 'patterns of innovation' taxonomy previously identified supplies precise rationale and potential operationality to the above-mentioned policy goals, actions and styles, assigning differentiated priorities to each regional condition in the knowledge-to-innovation process.

Beneficiaries of these policy recommendations differ among patterns. University, research centres and large R&D laboratories of private firms are the natural beneficiaries in Patterns 1 and 2—the 'European science-based area' and of the 'Applied science area. Local firms are the natural recipients in Pattern 3, namely the 'Smart technological application area'; entrepreneurs and small firms are the natural recipients of policies in the 'Smart and creative diversification area' (Pattern 4) and the 'Imitative innovation area (Pattern 5).

The previous policy suggestions are meant to increase the efficiency and effectiveness of innovation processes inside each single pattern. However, within each pattern, regions exist that are more advanced than others, and that potentially could move to a different pattern. For these regions, 'evolutionary policies' can be foreseen, devoted to the achievement of an upgrading of innovation processes.

Figure 16.5 shows the relative position of each pattern in terms of the elasticity of GDP to R&D, coming from a recent empirical analysis developed by the authors (ESPON KIT 2012). First of all, it shows how R&D activities require a certain critical mass in order to become effective; and this evidence supports the general suggestion concerning the necessary spatial concentration to R&D support, in the direction of already endowed area. Secondly, Fig. 16.5 represents the potential dynamic trajectories that the most efficient regions belonging to each Pattern could follow in order to achieve superior efficiency rates—and the associated policies supporting these trajectories.

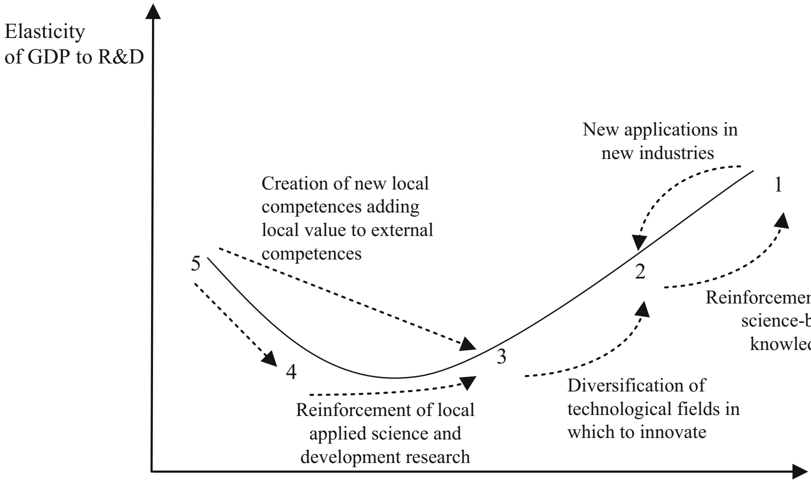


Fig. 16.5 Evolutionary trajectories and policies by patterns of innovation. Legend: *1* European science-based area, *2* Applied science area, *3* Smart technological application area, *4* Smart and creative diversification area, *5* Imitative innovation area

The most efficient regions in the 'Imitative innovation area' (Pattern 5) could jump either into a 'Smart and creative diversification area' (Pattern 4) or a 'Smart technological application area' (Pattern 3) through the creation of new local competence and entrepreneurial spirit, adding local value to external knowledge. The case study on the automotive industry in Bratislava, developed inside the empirical analysis (ESPON KIT 2012) is a telling example in this respect: following the creation of local suppliers with specific competences, main local innovation processes moved away from an imitative pattern, building on the knowledge that local subsidiaries and subcontractors had cumulated through strong interaction with the parent company. The innovation pattern in this area is increasingly approaching a 'Smart technological application' pattern (P3).

The most efficient regions in Pattern 4 could be supported in order to move towards Pattern 3 ('Smart technological application') through the reinforcement of local applied science and development research.

The 'European science-based area' (Pattern 1) could be stimulated to avoid some evidence on decreasing returns of R&D activities in terms of knowledge creation[6], by diversifying research into new application fields in new industries, merging aspects of the 'Applied science area' (Pattern 2). On the other hand, some regions belonging to the latter area could strengthen their science base in GPT fields, if already present with some critical mass, moving towards the first Pattern, namely the 'European science-based' one.

[6]There is significant econometric evidence of decreasing returns of knowledge creation (patenting) to investments in R&D in European regions: see ESPON KIT (2012).

Finally, efficient regions belonging to the 'Smart technological application area' (Pattern 3) could overcome the low returns of R&D activities, limited to some tiny specialization sectors, by diversifying the technological fields in which to invest and innovate, acquiring some characteristics of Pattern 2.

Engagement in these kinds of 'evolutionary' strategies and policies should be carefully assessed and controlled, in order to avoid misallocation of public resources, backing impossible local dreams. In fact, this possible engagement requires: (a) the identification of the most efficient regions within each pattern; (b) the presence of some context precondition typical of the targeted pattern, and in particular of a sufficient critical mass in existing activities (R&D, technological knowledge, production know-how, managerial competences); (c) the presence of reliable (new) local actors, capable of managing new crucial functions; (d) the presentation of credible and well-assessed research and innovation projects. Only at these conditions would evolutionary policies find a fertile ground on which to produce virtuous effects.

If it is true that in some—textbook—cases innovation is the result of unforeseeable events, of totally unexpected creative 'jumps' and breaking-up of existing technological trajectories, it is also important to remind the systemic, complex and incremental character of the bulk of innovation processes, based on necessary slow, smooth and 'localized' learning processes. Therefore, it is rational to claim that regional innovation policies, managing public funds, should mainly stick to clearly defined innovation trajectories, based on existing context conditions and capabilities, presenting reasonable risks and the highest expected returns for the entire regional economy.

16.6 Conclusions

The present debate on regional policy design to fit the Europe 2020 Agenda calls for additional reflections on the way sectoral policies can be translated appropriately into a regional setting. In particular, policies addressed to the achievement of the *Smart Growth* goal have the evident problem of matching the sectoral dimension—knowledge excellence, R&D support, technological innovation—to the regional scale.

This paper is an attempt in this direction, and presents the rationale for a regionalised conception, design and delivery of innovation policies. If these policies have to support modernization and innovation processes in *all* European regions, they have to diversify their approach in order, first, to comply with the specificities and potentials of the single regions, and secondly to avoid the opposite risks of dispersion of public resources in un-differentiated ways, or conversely to concentrate all resources in a few regions where the traditional policy action, namely R&D support, is due to grant the highest returns.

In order to build 'smart innovation policies', the present regional models of innovation have to be identified, resulting from the different modes of performing the different phases of the innovation process—knowledge production/acquisition, invention, innovation, growth—according to territorial specificities. In some cases, a policy of support to R&D can turn to be extremely useful, namely when a critical mass of research activities is already present, while it could produce no effect in regions where the path to innovations is not based on the development of an internal, formal knowledge base.

Five ‘Patterns of Innovation’ are conceptually and empirically defined in the case of European regions, going from cases in which the full ‘linear’ model of innovation—from R&D to innovation—is present to cases in which external knowledge is applied with differentiated local creative contributions to innovation, to cases in which innovation is mainly the effect of imitative processes.

The general concepts of embeddedness and connectedness, put forward in the recent debate on ‘smart specialization’, are right policy principles also for ‘smart innovation policies’. However, these latter policies call for the adaptation of the two principles to the specificities of each Pattern of Innovation, and call for ad-hoc interventions with the aim of supporting, strengthening and diversifying the virtuous aspects of each regional innovation process.

Beyond the necessity to fully embed policy strategies into regional specificities through a bottom-up search process involving knowledge and project design capability of local actors, and to strengthen inter-regional co-operation in knowledge creation and transfer, new policy styles are requested by the new policy model. They refer to justification of the spatial allocation of funds and of differentiation of policy tools, tripartite co-operation between universities, research centres and firms in main R&D projects, peer assessment of R&D programmes and projects, continuity in public support subject to intermediate and ex-post assessment of outcomes, tapping creativity and entrepreneurial spirit, definition of informal but also lightly structured local processes of ‘strategic industrial planning’.

Innovation policies should mainly operate inside each Innovation Pattern, intended as the natural and more likely successful way of supporting regional innovation processes. But in some special cases, some regions could be able to ‘jump’ over different and more advanced Innovation Patterns; ‘evolutionary’ policies could support these paths, with extreme attention and careful assessments, provided that context conditions and reliability of actors and strategies/projects could reduce risks of failure.

‘Smart innovation policies’, designed according to these principles and guidelines, could supply a conceptually and operationally sound answer to the need of renewed policy tools fit to attain the goals of *smart growth* and *Innovation Union*, consistent with the ‘smart specialization’ strategy proposed by DG Research and the necessary place-based reform of the EU regional policy advocated by the Barca Report and the recent documents of DG Regio.

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