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One size fits all?

**Towards a differentiated policy approach with respect to regional
innovation systems**

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Towards a differentiated policy approach with respect to regional innovation systems

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Abstract

The knowledge economy, learning and innovation have moved to the foreground both in regional and industrial policies in the past decade. Concrete policies were shaped in the past by the linear innovation model (focus on R&D and technology diffusion), and more recently, by “best practice models” of interactive innovation derived from high tech- and well performing regions. These were often applied in a similar way across many types of regions. In this paper an attempt was made to show that there is no “ideal model“ for innovation policy. Empirical investigations demonstrate that preconditions for innovation, innovation activities and processes, as well networks differ strongly between central, peripheral and old industrial regions. The RIS approach allows to take such differences into account by analysing the strengths and weaknesses of the various subsystems, clusters and the interdependencies within the respective region and beyond. In the present paper we are going to analyse different types of regional innovation systems with respect to their preconditions for innovation, networking and innovation barriers. Based on this classification different policy options and strategies are developed and discussed. Besides high performing regional innovation systems with well developed and dynamic clusters we will deal with situations which are characterised by low levels of clustering, a weak endowment with relevant institutions, fragmentation and “lock in“. We argue that policy approaches will differ – amongst other dimensions – with respect to the weight given to the stimulation of incremental/radical innovations, the orientation on endogenous/exogenous companies and knowledge sources, and the fostering of internal/external networking.

1 Introduction

There is a widespread agreement in academic literature that knowledge, learning and innovation are the key to economic development and competitiveness for firms, regions and nations. Innovation is also ranking on the top of policy agendas today both in the fields of industrial and regional policy. Until the 1990s the linear model of innovation policy was dominating, leading to a focus on R&D infrastructure provision, financial innovation support for companies, and technology transfer. These policies emphasised the supply of innovation inputs and of support instruments, often neglecting the absorption capacity of firms and the specific demand for innovation support in less favoured regions. Also, behavioural characteristics and management and organisational deficits of companies, in particular of SMEs, were not sufficiently taken into account (Lagendijk 2000). Instruments were usually addressed to individual companies and applied in a rather uncoordinated way (Asheim et al. 2003).

More recently attention has shifted to innovative regions and milieux (Camagni 1991, Ratti et al. 1997, Crevoisier 2001), high-tech-areas (Keeble and Wilkinson 1999, 2000), clusters of knowledge based industries (Cooke 2002) and knowledge spillovers (Audretsch and Feldman 1996, Bottazzi and Peri 2003). These studies concentrate on the analysis of well-performing regions, dealing with the questions of why such industries concentrate in particular locations, which kinds of linkages and networks exist, and to which extent knowledge spillovers can be observed. Based on this literature, a new policy model has emerged in the field of innovation and regional policy, often stressing the following elements:

- focus on high-tech, knowledge-based or “creative” industries;
- building up of research excellence;
- attraction of global companies and
- stimulation of spin-offs.

Basically, such an approach is based on the latest concepts of the discipline as it draws on the key insights of new growth theory (Romer 1986, Lucas 1988, Krugman 1991), the cluster approach (Porter 1990, 1998, Steiner 1998, Swann et al. 1998, Enright 2003), the knowledge economy (Nonaka and Takeuchi 1995) and the literature on knowledge spillovers (Jaffe et al.

1993, Audretsch and Feldman 1996, Anselin et al. 1997). It has without doubt many good and interesting elements. The problem is, however, that it is often used in an undifferentiated manner for all kinds of regions. The specific strengths and weaknesses of regions in terms of their industries, knowledge institutions, innovation potential and –problems are frequently not sufficiently taken into account. Furthermore, regions are often dealt with in an isolated manner, i.e. the interrelationships with other regions and with higher spatial levels (national, international) are left out of consideration.

The main argument of this paper is that there is no one “best practice” innovation policy approach (see also Cooke et al. 2000, Isaksen 2001, Nauwelaers and Wintjes 2003) which could be applied to any type of region. Policy conclusions which are drawn from the analysis of “success stories” are only of limited use for less favoured regions, as their innovation capabilities deviate in many respects from these role models. This does not mean that no policy lessons can be learnt from leading dynamic regions. Nevertheless a call for more differentiated innovation policies, dealing with specific innovation barriers in different types of regions, seems to be necessary.

The regional innovation system approach (Autio 1998, Braczyk et al. 1998, Cooke et al. 2000) provides a useful framework for such a differentiated approach. It addresses attention to the firms, clusters and institutions of an innovation system, to the interdependencies within the region and to higher spatial levels. In the present paper we want to analyse different types of regions with respect to their preconditions for innovation, networking and innovation barriers. Based on this analysis, specific policy options and strategies will be developed. In the following, we deal less with high performing regional innovation systems characterised by well developed and dynamic clusters but, in accordance with Isaksen (2001) and Nauwelaers and Wintjes (2003), more with situations which are characterised by

- low levels of clustering, a weak endowment with relevant institutions (“organisational thinness”),
- a lack of interaction and of networks (“fragmentation”) and
- situations of “lock in“.

We argue that policy approaches for such regions will differ – amongst other dimensions – with respect to the weight given to the stimulation of incremental / radical innovations, the orientation on endogenous / exogenous companies and knowledge suppliers, and the fostering of internal / external networking. The paper is organised as follows: Section 2 provides the theoretical background, summarising the new understanding of the nature of innovation processes, the respective role of regions and the rationale of policy action. Then, section 3 is dealing with regional differences in innovation performance. It analyses three types of problem areas and their RIS deficiencies, highlighting the main factors behind their weak innovation capacity and learning capabilities. In section 4 for each type of problem region possible innovation policy responses are discussed. The final section summarises important findings and draws some conclusions.

2 Regional innovation systems and innovation policy

In the following we deal briefly with the new understanding of innovation, the systems of innovation concept and the rationale for innovation policy based on this new understanding.

2.1 The nature of the innovation process

In the past decade a new understanding of the nature of innovation processes has emerged. Major contributions in this respect have been made by the systems of innovation approach. Traditional concepts like the linear model of innovation or the Schumpeterian view of firms innovating in isolation have been replaced by modern theoretical developments stressing the systemic character of innovation. The systems of innovation approach (for an overview see Edquist 1997, 2001, 2003) argues that innovation should 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 centers, educational institutions, financing institutions, standard setting bodies, industry associations and government agencies. Inspired by the institutionalist school of thought (see e.g. Hodgson 1988, 1999, Johnson 1992, Edquist and Johnson 1997), beyond “hard“ or formal institutions (i.e. organisations and laws) also the role of “soft“ institutions (practices, norms and routines) shaping the behaviour of actors and the interaction between them has been analysed.

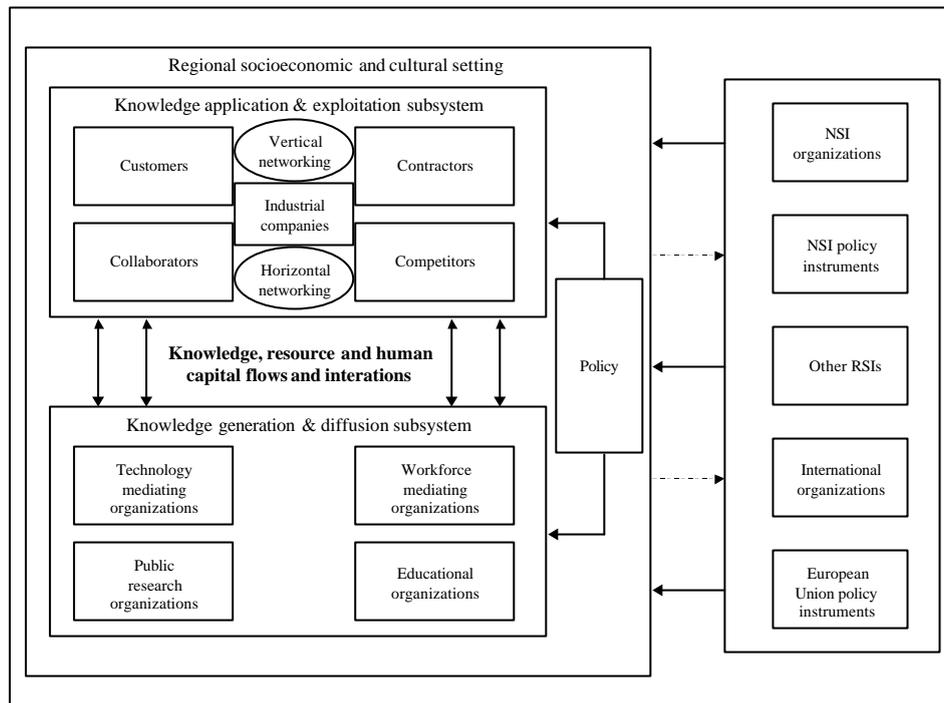
Initially, the concept of innovation system has been applied to the national level (Lundvall 1992, Nelson 1993, Niosi et al. 1993, OECD 1999). The national innovation system literature has demonstrated that there are huge differences between countries in such attributes as economic structure, R&D base, institutional set-up and innovation performance (Edquist 2001). In the 1990s also other specifications of systems of innovation emerged: Carlsson and colleagues have analysed “technological systems“, arguing that systemic interrelationships are unique to technology fields (Carlsson and Stankiewicz 1991, Carlsson 1994, Carlsson and Jacobsson 1997). Other authors emphasise the importance of a sectoral approach and examine how groups of firms develop and manufacture products of a specific sector and how they generate and utilise the technologies of that sector (Breschi and Malerba 1997, Mowery and Nelson 1999, Malerba 2002).

2.2 The concept of regional innovation systems

In the recent past a growing interest in regional innovation systems emerged (Autio 1998, Brazczyk et al. 1998, de la Mothe and Paquet 1998, Howells 1999, Acs 2000, Cooke et al. 2000, Mytelka 2000, Doloreux 2002, Bathelt and Depner 2003, Fornahl and Brenner 2003). Whilst not denying that national (as well as international), technological and sectoral factors are essential, these authors have argued convincingly that the regional dimension is of key importance. There are several reasons supporting this view: First, regions differ with respect to their industrial specialisation pattern and their innovation performance (Howells 1999, Breschi 2000, Paci and Usai 2000). Second, it was shown that knowledge spillovers, which play a key role in the innovation process, are often spatially bounded (Audretsch and Feldman 1996, Anselin et al. 1997, Bottazzi and Peri 2003). Third, the ongoing importance of tacit knowledge (Polanyi 1966) for successful innovation has to be mentioned (Gertler 2001, Howells 2002). It is now well understood that its exchange requires intensive personal contacts of trust based character which are facilitated by geographical proximity (Storper 1997, Maskell et al. 1998, Morgan 2001). Finally, policy competences and institutions are partly bound to subnational territories (Cooke et al. 2000).

Autio (1998) provides a schematic illustration of the structuring of regional innovation systems (see figure 1). According to Autio a RIS is made up by two sub-systems embedded in a common regional socioeconomic and cultural setting:

Figure 1: Main structures of Regional Innovation Systems (RIS)



Source: Own modification of Autio 1998, p. 134

- The knowledge application and exploitation sub-system comprises the companies, their clients, suppliers, competitors as well as their industrial cooperation partners (i.e. the dominating regional clusters). Ideally, these firms are linked by horizontal and vertical networking.
- The knowledge generation and diffusion subsystem as the second main building block of a RIS consists of various institutions that are engaged in the production and diffusion of knowledge and skills. Key elements include public research institutions, technology mediating organisations (technology licensing offices, innovation centres, etc.) as well as educational institutions (universities, polytechnics, vocational training institutions, etc.) and workforce mediating organisations.
- Additionally, we include the regional policy dimension neglected in Autio's model. Policy actors at this level can play a powerful role in shaping regional innovation processes, provided that there is sufficient regional autonomy (legal competencies and financial resources) to formulate and implement innovation policies (Cooke et al. 2000, Cooke and Memedovic 2003).

In the ideal case, there are intensive interactive relationships within and between these subsystems facilitating a continuous flow or exchange of knowledge, resources and human capital. Conceptual clarity requires to emphasise that RIS overlap with but are different from clusters: As shown in figure 1, clusters are central elements of the knowledge application and exploitation subsystem, whilst the RIS is a wider concept in the sense (1) there are usually several clusters and many industries in a RIS and (2) institutions play a larger role. As already mentioned above, institutions in this context refer to innovation-relevant organisations, rules and behavioural characteristics of firms and actors.

Regional innovation systems are far from being self-sustaining units. Normally they have various links to national and international actors and innovation systems. We may distinguish between two important dimensions in this context: First, with respect to the innovation networks of firms, there is a widespread consensus nowadays that local connections do not suffice to sustain innovativeness. In the context of intensifying international competition and accelerating technological change extra-regional contacts which complement local ones are of key importance. External links provide access to ideas, knowledge and technologies, which are not generated within the limited context of the region (Camagni 1991, Oinas and Malecki 1999, 2002, Mytelka 2000, Bunnell and Coe 2001). Second, in terms of public intervention it becomes apparent that regional, national and European policy actors and organisations can shape the development and dynamics of regional innovation systems (multi level governance). Regarding the distribution of concrete competencies between these levels there exist considerable differences (with varying degrees of political autonomy for regions) within Europe (see Cooke et al. 2000). Nevertheless a pattern can be found indicating a complex division of labour (Cooke et al. 2000): At the regional level we can often identify competencies for the lower and medium levels of education, incubation and innovation centers, transfer agencies and, more recently, cluster policies (Boekholt and Thuriaux 1999). At the national level in many cases we find competencies for universities, specialised research organisations, and funding for R&D and innovation (OECD 1999). At the European level there are the structural funds, the RIS/RITTS program, and the framework programs for R&D and technological development (Oughton et al. 2002, Landabaso and Mouton 2003).

2.3 The rationale for policy making reconsidered

For a long time, reference to the “classical“ concept of market failure has dominated the innovation policy debate, i.e. underinvestment in R&D due to the existence of uncertainties, externalities and knowledge spillovers have been identified as rationale for public intervention. From the perspective of the systems of innovation approach additional types of failure have to be taken into account (Lundvall and Borrás 1999, 2003, OECD 1999, Smith 2000, Edquist 2002, Lundvall 2002). Governments should also “ ... address systemic failures which block the functioning of the innovation system [and] hinder the flow of knowledge and technology“ (OECD 1999, p. 63). Edquist (2002) identifies three levels in an innovation system, where such failures can make their appearance: These are (1) the organisational level (inappropriate or missing organisations), (2) the institutional level (inappropriate or missing institutions) and (3) the network level (inappropriate or missing interaction or links between the elements of an innovation system). According to the OECD (1999), systemic failures mainly encompass mismatches between the elements of an innovation system leading to a lack of communication and networking and institutional rigidities. Smith’s (2000) concept of “systemic failures” includes failures in infrastructural provision and investment, “lock-in failures”, and institutional failures. Lundvall and Borràs (1999), in addition, put emphasis on three types of trade-offs or dilemmas to outline policy concerns from an evolutionary perspective. There is an exploitation-exploration dilemma (pursuit of too narrow trajectories and neglect of radically new innovations and directions of change), an integration-flexibility-dilemma (lack of innovation networks, problems of too strong ties) and diversity-harmonising dilemma (necessity of both diversity and standardisation). In sum, the work discussed here provides a sound basis to justify policy intervention in innovation systems and offers implications for the scope, objectives and methods of innovation policy. In the following sections we will deal with some of these systemic failures and policy dilemmas and discuss them for different types of regions.

3 Regional differences in innovation performance and types of RIS

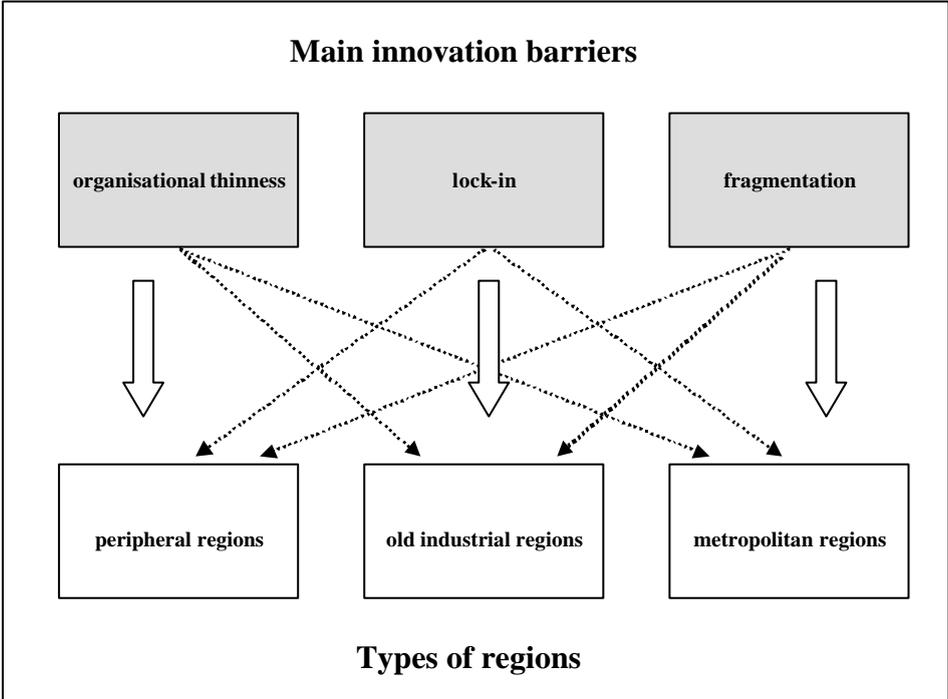
In the past years many studies have investigated spatial differences of the innovation process (Tödting 1992, 1994, Audretsch 1998, Baptista and Swann 1998, Feldman 1994, Fritsch 2000, 2003, Fischer and Fröhlich 2001, Gehrke and Legler 2001, European Commission 2003). The following patterns were identified:

- R&D activities, patenting and major product innovations are usually highly concentrated in larger agglomerations (Brower 1999, Feldman and Audretsch 1999, Fischer et al. 2001, Gehrke and Legler 2001, Simmie 2003).
- Knowledge spillovers can be observed in industrial clusters and agglomerations and they are constrained to a certain geographical distance from these centers (Jaffe et al. 1993, Audretsch and Feldman 1996, Baptista and Swann 1998, Bottazzi and Peri 2002, Baptista 2003).
- There is still a debate in the literature whether specialised (Marshall/Arrow/Romer) or diversified (Jacobs) agglomerations are more conducive for innovation. While some authors (Porter 1998, Baptista and Swann 1998, Fritsch and Franke 2004) argue in accordance with Marshall for innovation advantages of specialisation, others state in accordance with Jacobs that diversification is more favourable (Tichy 2001). Feldman and Audretsch (1999) are more specific in this context by stating that innovation is stimulated in particular by the presence of complementary industries sharing a common knowledge base.
- Peripheral regions are regarded as less innovative in comparison to agglomerations: they have less R&D intensity and lower shares of product innovations. Innovation here is more focussed on incremental and process innovations (Tödting 1992, Feldman 1994, Fritsch 2000).
- Also old industrial areas have been identified as being less innovative with a focus on incremental and process innovation due to a predominance of mature industries and externally controlled firms (Tödting 1992, Cooke 1995, Tichy 2001).

Other recent studies have investigated such differences in the framework of regional innovation systems (Braczyk et al. 1998, de la Mothe and Paquet, 1998, Tödting and Kaufmann 1999, Cooke et al. 2000, Sternberg 2000, Asheim et al. 2003). These studies have

related the innovation performance of firms to the character of their networks and to institutional factors. In this context also several typologies of RIS have been developed (for an overview see Thomi and Werner 2001, Doloreux 2002). Since our focus is on the weak innovation capabilities of less favoured regions we follow the typology presented by Isaksen (2001) and Nauwelaers and Wintjes (2003). We differentiate according to the main deficiencies in regional innovation systems between “organisational thinness”, “lock in” and “fragmentation”. As shown in figure 2 these RIS deficits may be assigned to specific types of problem regions, such as peripheral regions (organisational thinness), old industrial areas (lock-in) and some metropolitan regions (fragmentation).

Figure 2: RIS deficiencies and types of problem regions



It is important to note, that there is no exclusive correspondence between these types of innovation problems and types of regions. On the contrary, in many cases regions face a mix of these deficiencies. Nevertheless, we suggest that there are some predominant innovation problems in each of these types of regions, which require more attention than others. In the following we are going to analyse the main innovation system problems of these areas in more detail. Table 1 summarises for each type of region the most important characteristics and factors underlying their weak innovation capability.

Table 1: Problem areas and RIS deficiencies

	TYPE OF REGION		
	peripheral regions (organisational thinness)	old industrial regions (lock-in)	fragmented metropolitan regions
PROBLEM DIMENSIONS			
Firms and regional clusters	clusters often missing or weakly developed SME dominance	often specialised on mature industries large firm dominance	many industries /services but high profile and knowledge based clusters often missing
Innovation activities	low level of R&D and product innovation emphasis on incremental and process innovation	narrow technological trajectories domination of incremental and process innovation	R&D in headquarters of large firms and in high-tech companies product innovation and new firm formation often below expectations
Knowledge generation and diffusion			
Universities / research organisations	few or low profile	often oriented on traditional industries / technologies	many and high quality often weak industry links
Education / training	emphasis on low to medium level qualifications	emphasis often on technical skills; managerial skills and “modern“ qualifications often missing	large variety of schools and other educational organisations
Knowledge transfer	some services available but in general “thin“ structure; lack of more specialised services often too little orientation on demand	many and specialised organisations but weakly coordinated	in general a high density of such services, mostly commercialised
Networks	few in the region due to weak clustering and “thin“ institutional structure	often characterised by technological and / or political lock-ins	market links dominate, often few cluster and innovation related networking

3.1 Peripheral regions

A main characteristic of many peripheral regions is that important RIS prerequisites are weakly developed as there is a lack of dynamic firm clusters and of support organisations (“organisational thinness”). In these areas, innovation activities are generally at a lower level in comparison to more central and agglomerated regions (Tödtling 1992, Feldman 1994, Fritsch 2000, European Commission 2003). Partly due to the dominance of SMEs and/or branch plants, in particular R&D activities, patenting and product innovations new for the market are below average. This does not rule out that there are innovative companies in such regions, but often the critical mass for a dynamic cluster development is not reached (e.g. Isaksen 2001 for the Arendal region in Norway). If there are clusters they are often in traditional industries with little R&D and innovation activities. The emphasis is on incremental innovation and on process innovations (examples are the cases of Centro and Friuli in the REGIS study, Cooke et al. 2000). The low level of R&D does not only hamper the internal innovation activity in the region, it leads also to a low absorption capacity of the regional firms (Cohen and Levinthal 1990). As a consequence, interregional knowledge spillovers as well as public innovation funds cannot be absorbed to a sufficient extent in such regions (Maurseth and Verspagen 1998, Oughton et al. 2002). The low level of clustering and agglomeration implies also a “thin” and less specialised structure of knowledge suppliers and educational institutions. Although low and medium level qualifications may be readily available, the more specialised qualifications are rare. Also networks are rather weakly developed in particular those to more specialised knowledge suppliers such as universities and research organisations (Landabaso and Mouton 2003). Technology transfer organisations have often been set up in the past in order to improve the situation, but they are frequently not effective. In many cases they did not reach the companies or they did not meet their demand well enough (Hassink 1996, Lagendijk 2000, Asheim et al. 2003, Landabaso and Mouton 2003).

3.2 Old industrial regions

Old industrial regions represent another type of problem area where learning and innovation has been insufficient, despite of signs of renewal in recent years (Cooke 1995, Rehfeld 1999, Tödtling and Trippel 2004). In contrast to peripheral regions, where the lack of clusters appears

to be an important development barrier, old industrial regions face the opposite problem of too strong clustering as they are overspecialised in mature industries experiencing decline (Tichy 2001). These regions have been confronted with the negative side – or as Enright (2003) put it, the “failure modes“ – of clustering, as their strong specialisation in specific industries led to a loss of regional competitive advantage and innovation capacity. This could be observed in areas hosting heavy industries like the Ruhr area in Germany (Grabher 1993), the Austrian province of Styria (Tödting and Trippel 2004), Wales (Cooke 1998, Henderson and Thomas 1999) and North East England (Hudson 1994) but also in regions specialised in other branches as e.g. the watch making industry in the Swiss Jura Arc (Glasmeier 1994, Maillat et al. 1996). Innovation activities in old industrial areas often follow narrow technological trajectories and are of an incremental character. Also, process innovation dominates over systematic efforts to introduce (radically) new products into the market (Tödting 1990, Cooke 1995, Tichy 2001). Old industrial regions often have a highly developed and specialised knowledge generation and diffusion system (Cooke et al. 2000). What appears to be problematic is the fact, that it is usually oriented on the traditional industries and technology fields (Cooke et al. 2000, Kaufmann and Tödting 2000). Furthermore, a supply oriented approach of technology transfer can often be found which reaches larger firms better than the smaller ones (cases of Ruhr Area in Heinze et al. 1998, Styria in Kaufmann and Tödting 2000, Wallonia in Asheim et al. 2003). The demand of SMEs often is not well met and interactive learning is rarely achieved (Asheim et al. 2003). With respect to the “relational assets” of old industrial areas, it was found, that a key feature of these regions is that they suffer from various forms of “lock-in“ (Grabher 1993, Hudson 1994, Hassink and Shin 2003), which seriously curtail their development potential and innovation capabilities. Analysing the adaption and innovation problems of the Ruhr area, Grabher (1993) identified functional lock-ins (too rigid inter-firm networks), cognitive lock-ins (homogenisation of world views), and political lock-ins (strong, symbiotic relationships between public and private key actors hampering industrial restructuring). We may expound the problems of too strong ties both in the economic and political spheres (Morgan and Nauwelaers 1999, Wößman 2001, Hassink and Shin 2003). Phenomena like these have been observed in many old industrial regions in Europe.

3.3 Fragmented metropolitan regions

In general, metropolitan regions are regarded as centers of innovation, benefitting from scale and agglomeration economies. Leading research organisations and universities, business services, as well as headquarters of international firms and high tech companies are often concentrated in agglomerations (Moulaert and Tödtling 1995, Keeble and Wilkinson 1999). As a consequence, R&D activities, patenting and major product innovations are clearly above average in these regions (Brower 1999, Feldman and Audretsch 1999, Fischer et al. 2001, Gehrke and Legler 2001, Simmie 2003). However, not all metropolitan regions are such centers of innovation. Some are lacking dynamic clusters of innovative firms, despite the fact that individual technology companies, R&D activities and research organisations may exist. These areas usually have a highly developed organisational infrastructure of public research and educational institutions and a dense supply of (often commercialised) knowledge transfer services. However, the problem of fragmentation, i.e. the lack of networks and interactive learning seems to represent an important innovation barrier in such regions. The two RIS subsystems of knowledge generation and application tend to operate separately, as university-firm links are often at a low level. Also, innovation networking among local companies may be below average (Fritsch 2003), even if market links among firms exist. As a consequence, the development of new technologies and industries as well as the formation of new firms are often below expectations. Examples here could be agglomerations such as Vienna (Tödtling 2002), Frankfurt (Schamp 2001) or the region of South East Brabant in Holland (Eindhoven: Cooke et al. 2000) which show some of the stated features. Schamp (2001) provides an interesting case study for Frankfurt showing that weak regional networking and a continuing erosion of innovative functions could be observed in particular for the more established and internationalised industries chemicals and automobiles, while better developed innovation networks could be identified for the new sectors biotechnology and financial services.

So far we have observed considerable differences between the investigated types of regions with respect to their innovation activities and their preconditions for learning. In the following we deal with possible policy approaches and innovation strategies for these different problem situations.

4 Innovation strategies and policy approaches for different types of problem areas

The analysis of the main innovation barriers in different types of problem regions has clearly shown that there is no single “best practice” innovation policy approach applicable everywhere. Instead a plea for a “tailor-made” innovation policy approach addressing the specific challenges, problems and opportunities found in each type of region has to be made. Nevertheless, there are – derived from past policy experiences and new innovation theories – some basic principles concerning innovation policy which are of relevance for all three types of regions. We are going to outline some key issues of such an emerging new innovation policy paradigm before we turn to the issue of specific innovation strategies and policy measures suitable to the innovation system deficiencies of the three regional problem types discussed above.

- There is a new thinking regarding the focus of policy making. As it is interorganisational arrangements (innovation systems, networks and clusters) that shape innovation processes and that compete in global markets, a shift from the traditional firm-oriented perspective towards a more system-centred approach of innovation policy is required (Amin and Tomaney 1998, Bratl and Trippel 2001, Nauwelaers and Wintjes 2003) .
- A broad view of the innovation process is seen as being essential when it comes to design political initiatives adequate to foster learning processes. This means that focussing only on R&D and on the technological aspects of innovation alone is often not enough (Legendijk 2000, Asheim et al. 2003, Cooke and Memedovic 2003, Lundvall 2004). As Cooke et al. (2000) put it, policy makers should also deal with the organisational, financial, educational and commercial dimensions of innovation. Similarly, Nauwelaers (2001) noted that innovation policy should not only be about providing physical capital (R&D and technology infrastructure) but should also deal with enhancing human capital (training of workers) and social capital (i.e. encouraging the formation of trust-based relationships between regional actors). There is a growing optimism among academics that social capital as key ingredient of a well-functioning RIS can be enhanced by public policy efforts (Morgan 1997, Morgan and Nauwelaers 1999, Storper 2002).

- It is argued that a rethinking of the mode of policy intervention and the role of policy actors is of utmost importance. Interactive modes of state intervention and associational forms of governance are seen as being superior to traditional top-down policy strategies (Mayntz, 1997, Cooke and Morgan 1998, Messner, 1998, Morgan and Nauwelaers 1999, Nauwelaers and Wintjes 2003). Policy formulation and implementation, then, is the result of intensive communication, close interaction and consensus building between all regional stakeholders in policy networks. Policy makers are just one actor amongst others in these networks. Consequently, the key role governments play in encouraging learning and innovation shifts from direct intervention towards stimulation, intermediation, brokering, promoting regional dialogue and building up social capital (Nauwelaers and Morgan 1999).
- Moreover, in terms of the selection of projects and locations to be supported by policy schemes a move towards competitive bidding can be observed (examples are the BioRegio and InnoRegio contests in Germany and the Life Science programs, competence and innovation centres in Austria). In general, this implies a “picking the winner” strategy, strengthening those actors and regions with the strongest potential to compete and innovate.
- Finally, the necessity of good co-ordination within the political system is stressed. On the one hand, the linking of different policy arenas (horizontal co-ordination) is vital (Mytelka 2000). On the other hand, there is a need for co-ordination and collaboration between regional, national and European policy hierarchies (vertical co-ordination: Cooke et al. 2000).

Comparative analysis of various European regions (Braczyk et al. 1998, Nauwelaers and Morgan 1999, Cooke et al. 2000, Asheim et al. 2003) has demonstrated that in practice innovation policy is often far from reaching these principles. It was found that many regional policy makers have limited experience in designing adequate innovation strategies. One main outcome of these studies was that in many regions political instruments and tools do not fit the needs of the firm. Innovation policies were found to be still characterised by a firm-centred perspective and a strong focus on the technological aspects of innovation alone. Also a lack of a clear vision and innovation strategy and barriers for good coordination between regional and national public authorities have been observed.

Which kind of specific policies can be suggested for the investigated types of regions and RIS problems? Table 2 gives an overview about key elements of such a differentiated approach. The policy recommendations summarised in Table 2 are basic guidelines which have to be further developed and adapted to the specific local context.

4.1 Peripheral regions

For peripheral regions the main policy agenda usually is the strengthening and upgrading of the regional economy. Given the innovation deficits of firms (mostly SMEs), innovation policy should give priority to organisational and technological “catching up learning” (introduction of “up to date” management technique, organisational practices, product and process technologies) and should target SMEs and their innovation weaknesses (Tödtling and Kaufmann 2002, Asheim et al. 2003). This implies also behavioural changes such as the stimulation of innovation attitudes (Landabaso and Mouton 2003).

- To strengthen potential clusters in the region may be an important step to overcome low levels of innovativeness (Legendijk 2000, Rosenfeld 2002, 2003). As the endogenous potential is weakly developed, to attract innovative companies from outside and, most important, to anchor them to the cluster or the regional innovation system is often a key element of such an approach in peripheral regions. This does not mean that policy makers should rely solely on inward investment as motor of growth and innovation. To support new firm formation and enhance the innovation capabilities of existing companies may be important too. However, in many cases an approach combining endogenous and exogenous elements seems to be useful. This includes the attraction of innovative firms from abroad and linking regional firms to business partners and knowledge sources both inside and outside the region.

Table 2: Types of problem regions and innovation policy approaches

	TYPE OF REGION		
	peripheral regions (organisational thinness)	old industrial regions (lock in)	fragmented metropolitan regions
Strategic orientation of regional economy	strengthening / upgrading of regional economy	renewal of regional economy	improve position of regional economy in global knowledge economy
innovation strategy	“catching up learning“ (management, organisation, technology)	innovation in new fields / trajectories	science based and radical innovation, new ventures
	improve strategic and innovation capabilities of SMEs	product and process innovation for new markets	enhance interaction between industry and knowledge providers
firms and regional clusters	strengthen potential clusters in the region	support clusters in new / related industries or technologies	support emerging clusters related to region’s knowledge base
	link firms to clusters outside the region	restructuring of dominant industries	develop specialisation advantages to achieve synergies and international visibility
	attract innovative companies	diversification	attract related FDI
	new firm formation	new firm formation attract cluster related FDI	support start ups and spin-offs in knowledge based industries
knowlede providers	attract branches of national research organisations with relevance to the regional economy	set up research organisations and universities in new relevant fields	expand and set up high quality universities and research organisations in relevant fields
education / skills	build up medium level skills (e.g. technical colleges, engineering schools, management schools)	build up new skills required (technical colleges, universities)	set up universities /schools for highly specialised qualifications and skills required
	mobility schemes (e.g. “innovation assistants” for SMEs)	attract new skills	
networks	link firms to knowledge providers and transfer agencies inside the region and beyond, demand-led approach	stimulate networking with respect to new industries and technologies on regional, national and international levels	promote regional networks among firms, encourage local research-industry interfaces

- Given the often weak endowment of peripheral regions with innovation support organisations, “institution building“ is an indispensable element of a proper innovation policy for these areas. In order to improve the regional knowledge infrastructure, branches of national research institutions or research centers, which could match the needs of the regional economy, could be attracted. Regarding education and training a focus on medium level skill provision (for example by establishing technical colleges, engineering schools, management schools, etc.) and mobility schemes (e.g. “innovation assistants” for SMEs) seems to be adequate for peripheral areas.
- Finally, policy measures to improve the network dimension and to enhance social capital are central (Morgan and Nauwelaers 1999, Landabaso and Mouton 2003). Firms should be supported actively to build up relationships with regional knowledge suppliers and transfer agencies, whereby it should be secured that knowledge transfer is designed in a demand-led way (Asheim et al. 2003). Even more important than fostering local ties seems to be to link firms to knowledge sources (firms, research organisations) outside the regions, i.e. to help them to “import“ ideas and knowledge not available in the region. This requires not just brokering activities, but also a strengthening of the “absorption capacity” of regional firms, i.e. strengthening their internal R&D activities.

4.2 *Old industrial regions*

Development measures for old industrial areas should be strategically oriented on breaking path dependency and facilitating the renewal of the regional economy. Institutional unlearning is a crucial point in this respect (Maskell and Malmberg 1999, Lagendijk 2000, Hassink and Lagendijk 2001, Wolfe 2002). Innovation policy in this context is about encouraging transition to new fields and trajectories and stimulating product and process innovations for new markets. Key elements of an innovation strategy specified in this way are the following:

- In the area of cluster initiatives, core issues for policy include both the restructuring / revitalisation of “old“ industries and the development of clusters in new or related industries or technologies (Grote Westrick and Rehfeld 2003, Tödtling and Trippel 2004). There is little evidence so far that old industrial regions can “leapfrog“ successfully into high tech sectors (Cooke 1995, Braczyk et al. 1998). Policy should

support diversification and modernisation activities of existing firms and the formation of new enterprises (Cooke 1995, Rehfeld 1999). However, such an endogenous approach may often not be sufficient to foster structural change in old industrial regions. Thus, policy attention should also move to attract and even more important to embed foreign direct investment (Cooke 1998, Legendijk and Charles 1999) bringing complementary knowledge into old and new clusters.

- Beyond cluster-based policies efforts should be made to induce institutional change within the RIS subsystem of knowledge generation and diffusion. Such a process includes the reorientation of existing support organisations and the creation of new ones. In particular the latter point is central. To establish universities and research centers backing business activities in new industrial and technological fields and to build up providers of new skills (universities, technical colleges, etc.) are important steps to rebuild the region's knowledge base (Heinze et al. 1998, Tödting and Trippel 2004).
- Finally, in old industrial areas policy-makers face the challenge to induce and support the transformation of the region's network structure (Morgan 1997, Morgan and Henderson 2002). This is a complicated task, encompassing endeavours aiming at the "opening up" and renewal of traditional networks as well as the rise of new ones (Grabher 1993, Rehfeld 1999, Tödting and Trippel 2004). It seems important that policy stimulates networking with respect to new industries and technologies not only on regional but also on national and international levels.

4.3 Metropolitan regions

For fragmented metropolitan regions the key development goal is to overcome their low level of integration and to position themselves in the global knowledge economy. Innovation policy can be a powerful tool in this respect provided that it contains two core elements: First, there should be a focus on the generation of new ventures and radical innovations in science based industries. Second, policy makers should tackle the problem of fragmentation by enhancing the level of communication and cooperation among firms and between industry and knowledge providers.

- To adopt an explicit cluster strategy seems to be a crucial step in this context (Cooke 2002, Tödtling 2002). Relevant policy actions are to identify newly emerging regional complexes of related industries which have a strong local knowledge base in the region and to promote their growth and dynamic development. In order to enhance the synergy potential in the rising clusters and to improve their international visibility measures directed towards the development complementary activities along a common knowledge base are asked for. Attracting innovative firms from abroad may be an important stimulus for the further growth of the emerging cluster(s). At the same time the endogenous potential should be strengthened by assisting business start ups and spin offs in knowledge intensive economic branches.
- With respect to the RIS subsystem of knowledge generation and diffusion, policy should be directed at closing gaps and the further improvement of the institutional infrastructure. Establishing research centres with high level, specialised expertise and setting up educational organisations which could provide specific, high level skills in the respective economic and technological fields become important tasks in this respect.
- The main role of policy makers in fragmented metropolitan regions, however, becomes the improving of the systemic innovation capabilities of the RIS. As the crucial weakness of these regions lies in the low level of interactive learning, policy instruments geared to promoting innovation networks among firms and encouraging local university-industry partnerships are of crucial importance (Tödtling 2002).

5 Conclusions

The knowledge economy, learning and innovation have moved to the foreground both in regional and industrial policies in the past decade. Concrete policies were shaped in the past by the linear innovation model (focus on R&D and technology diffusion), and more recently, by “best practice models” of interactive innovation derived from high tech- and well performing regions. These were often applied in a similar way across many types of regions. In this paper an attempt was made to show that there is no “ideal model“ for innovation policy. Empirical investigations demonstrate that preconditions for innovation, innovation activities and processes, as well networks differ strongly between central, peripheral and old industrial regions. The RIS approach allows to take such differences into account by

analysing the strengths and weaknesses of the various subsystems, clusters and the interdependencies within the respective region and beyond. According to the innovation systems approach motives for innovation policies are not just market-, but also systems failures such as “organisational thinness”, “lock-in” and “fragmentation”. Although regions often have combinations of such innovation problems and -barriers, some become more dominant than others in specific types of regions:

- In peripheral regions the main problems are a low level of R&D and innovation due to a dominance of SMEs in traditional industries, weakly developed firm clusters, few knowledge providers and a weak endowment with innovation support institutions. Critical thresholds for innovation networks are often not reached. Public policies should focus here on attracting external companies and attempting to embed them into the region. Furthermore firms should be linked to external clusters and knowledge providers and to higher spatial innovation systems (national, European).
- In “old industrial” regions there are many firms, dominant clusters and relevant organisations, but they are often too strongly oriented on old industries and technological trajectories. The main challenge is to overcome various forms of “lock-in”, such as too strong business and policy networks, cognitive blockades due to common world views, and a too narrow orientation of knowledge providers on existing trajectories. Policy should focus on the reorganisation of firms and networks, the attraction and generation of new firms, and the establishment of new research organisations. The challenge is, furthermore, to stimulate more radical innovations and the development of new industries, which, however, should be related to the existing knowledge base.
- Also in metropolitan regions there may be reasons for innovation policy. Although they are usually regarded as centers of innovation, not all of them are able to fulfil this function. Despite the concentration of companies and knowledge organisations, a specialized industrial pattern including complementary knowledge bases and innovation networks may be lacking. Policy intervention should be about stimulating more radical innovations, encouraging the growth of knowledge based clusters and securing the presence of a high quality institutional infrastructure. Moreover public authorities should draw attention to the fragmented state of the RIS by developing policies to enhance communication and interactive learning within the system.

The reflections on the weak innovative capacity of different types of problem regions and on possible policy responses presented here may be an important contribution to avoid the pitfalls of an innovation policy approach drawing its inspiration from ideal type regional innovation systems. The proposals outlined above should be considered as basic guidelines for the design of a more differentiated innovation policy approach. To be sure, each region must further develop and adapt these strategies to its own circumstances. In order to formulate and implement interventionist actions successfully, policy makers must possess a detailed knowledge about the RIS specificities and the factors undermining its dynamics. Additionally, they face the challenge to overcome old routines and practices of policy making and to learn to adopt new approaches, governmental roles and new types of intervention tools. Such policy learning processes, however, are still a rather rare phenomenon.

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