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Cross-Border Regional Innovation Systems

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Abstract

In the past decade, the literature on regional innovation systems (RIS) has considerably enhanced our understanding of the critical role played by geographical proximity and local institutional conditions for the production of new knowledge and its economic exploitation. Regional innovation systems have been investigated for different types of regions, including high-tech centres, old industrial zones, and peripheral areas. In most cases, however, both theoretical and empirical work has focussed on RIS situated within a national context. Little research has been done so far on cross-border RIS. This paper is a first attempt to explore conceptually whether the theoretical approach of regional innovation systems can be applied to cross-border settings. We will investigate some critical conditions for the emergence of transfrontier innovation systems and argue that cross-border areas differ enormously regarding their capacity to develop an integrated innovation space.

1 Introduction

Due to the combined effects of ongoing globalisation tendencies and the acceleration of technological change continuous learning and innovation have become a core strategy for sustaining competitiveness, growth and prosperity. In the last years, a substantial body of research has shown that the regional level plays a key role for the generation of new knowledge and its economic exploitation. Essential contributions in this respect have been made by the regional innovation systems (RIS) approach, which highlights the crucial importance of spatial proximity and favourable institutional structures at the regional level for innovation activities. The RIS concept has been applied to different types of regions, including high-tech centres, old industrial zones, and peripheral areas (Cooke et al. 2000, 2004, Tödting and Tripl 2005). Apart from a few exceptions (see, for example, Maskell and Törnqvist 1999, Coenen et al. 2004), however, both theoretical debates and empirical studies have dealt with RIS that fall within national borders. Little research has been carried out so far on cross-border RIS. This paper is a first attempt to address this issue by examining in a conceptual way whether the theoretical approach of regional innovation systems can be applied to cross-border settings.

Cross-border areas – i.e. regions which stretch over one or even several national boundaries – have grown considerably in number and importance in the recent past. Some observers such as Ohmae (1993, 1995) even claim that such regional formations experienced a transformation into prominent socio-economic entities in the age of economic globalisation. The rise in importance of cross-border regions is the outcome of various factors, including strong regionalisation tendencies in many parts of the world, the political collapse in Central and Eastern Europe, and the continuing enlargement of the European Union (Maskell and Törnqvist 1999, Blatter 2004).

The aim of this article is to investigate the prospects and challenges for the emergence of innovation systems in cross-border areas. More specifically, we will deal with the following main questions:

- What are the specific features, potentials and constraints of cross-border RIS?
- Under which conditions can a cross-border RIS emerge and evolve dynamically over time?
- What is the role of the state in promoting the development of cross-border RIS?

The paper is structured as follows. Section 2 provides a brief review of the literature on RIS. Section 3 examines the prospects and challenges for building a transfrontier RIS and identifies a set of factors that inhibit or favour the establishment of an integrated innovation space. Finally, Section 4 draws some implications for policy makers and outlines a preliminary agenda for further research activities on cross-border RIS.

2 Regional Innovation Systems

In the following we will briefly outline some key assumptions of the innovation system (IS) approach and provide an overview of the basic structuring of regional innovation systems (RIS). We are going to identify the main elements of a RIS and specify its embeddedness into innovation systems at higher spatial scales. The overall purpose of what follows is to lay the foundation for a discussion of cross-border regional innovation systems in the next section.

2.1 The systems of innovation approach

In the past decade the systems of innovation approach has substantially enhanced our knowledge about the nature of the innovation process. By stressing the systemic character of knowledge production, it has challenged and subsequently replaced traditional theories such as the linear innovation model or the Schumpeterian view of firms innovating in isolation. The IS approach highlights that innovation is an evolutionary, non-linear and interactive endeavour that requires intensive communication and cooperation between firms and other organisations such as universities and other public research facilities, technology centres, educational establishments, financing institutions, standard setting bodies, industry associations and government agencies (Edquist 1997, 2005). Furthermore, the IS literature draws heavily on the institutionalist school of thought and its line of reasoning (Hodgson 1988, 1999; Johnson 1992; Edquist and Johnson 1997), emphasising the impact of formal and informal institutions on innovation activities. Initially, the concept of innovation systems has been applied to the national level (Lundvall 1992; Nelson 1993; OECD 1999; Groenewegen and van der Steen 2006)¹. The literature on national

¹ In the 1990s also “non-territorial” specifications of innovation systems emerged, including technological innovation systems (Carlsson 1994) and sectoral innovation systems (Breschi and Malerba 1997; Malerba 2002). The scholars favouring the technological approach argue that systemic interrelationships are unique to technology

innovation systems (NIS) has shown that countries differ enormously with respect to their economic structures, R&D bases, institutional set-ups and, consequently, innovation performances (Edquist 2001). Nations, however, can exhibit huge disparities in innovation across regions. This insight has provoked a growing interest by academic scholars in regional innovation systems (RIS).

2.2 Regional innovation systems: key elements and crucial dimensions

In the meantime there exists a considerable body of both theoretical and empirical work on RIS (Autio 1998; de la Mothe and Paquet 1998; Howells 1999; Acs 2000; Cooke et al. 2000, 2004; Doloreux 2002; Fornahl and Brenner 2003, Asheim and Gertler 2005; Doloreux and Parto 2005; Tödting and Trippel 2005; Asheim and Coenen 2006). There are several reasons underscoring the relevance of the regional level as an adequate unit of analysis for studying innovation:

- *Innovation activities exhibit a very distinctive geography:* There is strong evidence that innovative activities are unevenly distributed across the geographical landscape. Several authors have shown that there are marked differences between regions regarding their pattern of industrial specialisation and innovation performance (see, amongst others, Howells 1999; Breschi 2000; Paci and Usai 2000).
- *Localised knowledge spillovers:* Research indicates that knowledge spillovers, which are ascribed to play a crucial role in the innovation process, are often spatially bounded (Jaffe 1989; Jaffe et al. 1993; Audretsch and Feldman 1996; Anselin et al. 1997; Bottazzi and Peri 2003).
- *Tacit knowledge and trust based relationships:* Notwithstanding increasing codification tendencies of knowledge (David and Foray 2003) tacit knowledge (Polanyi 1966) remains important for successfully carrying out innovation activities (Howells 2002; Gertler 2003). The exchange of tacit knowledge presupposes trust and personal contacts which are essentially facilitated by spatial proximity (Storper 1997; Morgan 2004).

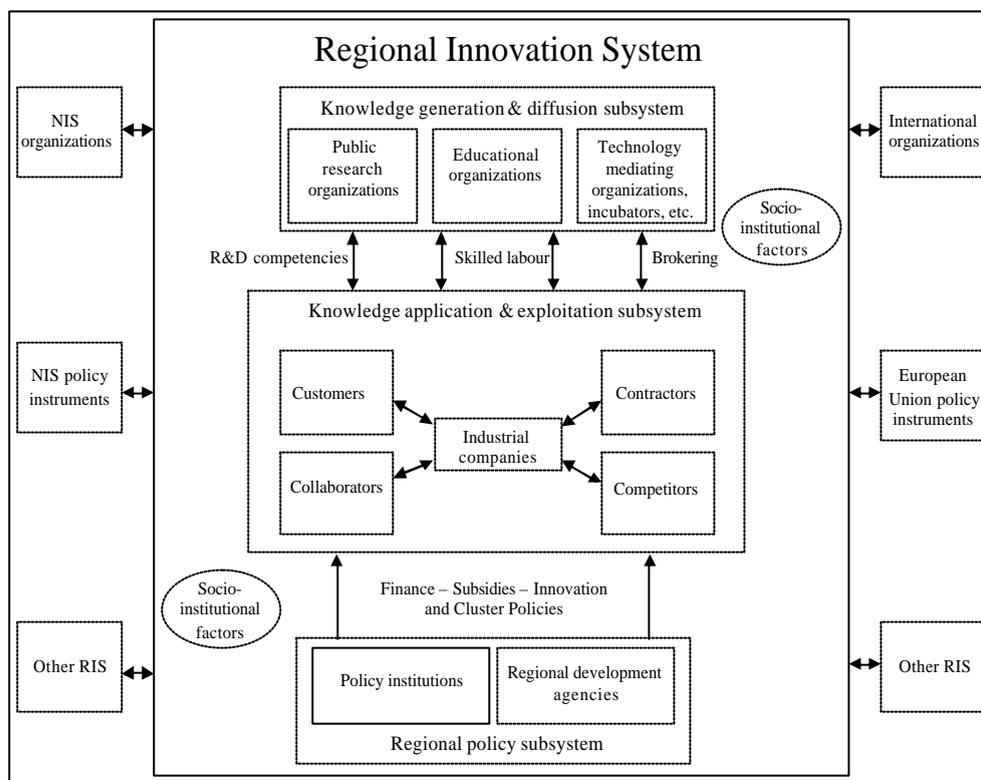
fields. The protagonists of the sectoral approach examine how groups of firms develop and manufacture products of a specific sector and how they generate and utilise the technologies of that sector.

- *Policy competences and institutions:* Comparative studies on the governance of innovation have shown that sub-national territories differ strongly in their institutional setting and political decision making-abilities (Cooke et al. 2000).

The architecture of a RIS is of a complex nature. Based on the work of Autio (1998) we propose to grasp the structuring of a RIS by focussing on the following subsystems and crucial dimensions (see also Figure 1).

- *Knowledge generation and diffusion subsystem:* The knowledge generation and diffusion subsystem – or the knowledge infrastructure dimension of a RIS – is made up of all those organisations that are engaged in the production and diffusion of knowledge, expertise and skills. Key actors are public research institutions, technology mediating organisations (technology licensing offices, innovation centres, etc.) as well as educational bodies (universities, polytechnics, vocational training institutions, etc.) and workforce mediating organisations.
- *Knowledge application and exploitation subsystem:* The knowledge application and exploitation subsystem reflects the firm or business dimension of a RIS. It comprises the companies, their clients, suppliers, competitors as well as their industrial cooperation partners, i.e. the industrial clusters located in the region.
- *Regional policy subsystem:* The regional policy subsystem includes public authorities, regional development agencies and other policy agents engaged in formulating and implementing innovation policies and cluster strategies. The policy dimension of a RIS deserves closer examination particularly in those areas where policymakers are capable to shape local innovation processes and, thus, to influence the region's competitiveness and its long-term development. "Policy capability" in this context hinges on the existence of a sufficient level of autonomy (legal competencies and financial resources) at the regional level.
- *Local interactions:* In the ideal case there are different types of relations within and between the RIS subsystems enumerated above, which facilitate a continuous flow of knowledge, resources and human capital. The relational dimension of a RIS is of key importance. Intensive local knowledge interactions and transfer processes are at the heart of dynamic regions, giving rise to systemic innovation activities.

Figure 1: Key elements of regional innovation systems



Source: Own modification of Autio (1998)

- Socio-institutional factors*: The specific socio-institutional and cultural setting prevailing in a region plays a significant role as regards the formation of a RIS. The focus is on both “hard” or formal institutions (such as laws, regulations, etc.) and “soft” or informal institutions (values, practices, routines, etc.). Institutions matter, because they shape the behaviour of actors and the relations between them. Factors such as prevalent patterns of behaviour, values and routines, culture of cooperation, and attitudes towards innovation and technology constitute key factors of a region’s distinct institutional endowment.

Having disentangled the internal structuring of a RIS it is important to note that more often than not a RIS is inserted into a complex web of relations to national and international organisations and innovation systems. As we have argued elsewhere (Tödtling and Trippl 2005) it is meaningful to draw a distinction between two relevant dimensions in this respect: The first dimension refers to the inflow of international knowledge and expertise,

brought about by the extra-local contacts of regional firms and knowledge providers (Bunnett and Coe 2001; Oinas and Malecki 2002; Maskell et al. 2006). The second dimension is related to political governance and its multi-level character. Policy interventions and actions undertaken at the national and European levels can constitute important external impulses, influencing the development and dynamics of a RIS (Cooke et al. 2000; Asheim et al. 2003)².

Recent research contributions include amongst others the identification of different types of RIS and elaborations on specific policy implications (Cooke et al. 2000; Isaksen 2001; Thommi and Werner 2001, Nauwelaers and Wintjes 2003; Tödtling and Trippel 2005), the nature and geography of knowledge linkages in RIS and clusters (Gertler and Wolfe 2005; Malmberg and Maskell 2006; Tödtling and Trippel 2007b), reflections on various forms of knowledge bases (Asheim and Gertler 2005, Asheim and Coenen 2006, Tödtling et al. 2006) as well as the transformation of RIS (Tödtling and Trippel 2007a, 2007c). In the meantime the functioning of RIS that fall within the geographic limits of a particular nation is well understood. Only few efforts, however, have been made so far to explore the question whether and under which conditions a RIS can transcend national borders.

3 Cross-Border Regional Innovation Systems

This section examines as to what extent the RIS concept can be applied to cross-border areas. It seeks to outline the conditions under which cross-border regional innovation systems can emerge and aims at scrutinizing the main characteristics and specific features of such regional formations. Cross-border areas are defined here as spaces that consist of neighbour territories which belong to different nation states. Such settings come in many shapes and sizes. They can stretch over several nation states and can include a larger number of regions such as the Central European Region

² With respect to the distribution of competencies between the regional, national, and European level enormous differences (with varying degrees of political autonomy for regions) within Europe have been detected (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 centres, 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 programme, and the framework programmes for R&D and technological development (Landabaso and Mouton 2003; Oughton et al. 2002).

“Centropole” (Bergman 2006), or they can comprise only two adjacent areas such as the Dutch-German EUREGIO cross-border region (Perkmann 2005). They can be characterised by high levels of economic inequality and innovation disparities as it could be observed in the US-Mexican border region (Scott 1999) and in areas formed by parts of old and new EU member states; or they may display similar levels of economic development and innovation capabilities such as the Öresund region (Maskell and Törnqvist 1999). Finally, they may have a common culture, history and identity (an example would be the Basque region in the French-Spanish borderland) or there can be marked differences in terms of identity and social and cultural institutions as they have been found in the German-Polish border area (Krätke 1999, Zillmer 2005). Consequently, it is not only political-administrative borders that divide these areas. Economic, cultural and social borders might also exist, reflecting many dimensions of difference, inequality, asymmetry (Anderson and O’Dowd 1999) and causing internal fragmentation. Cross-border regions might benefit enormously from dismantling these barriers and constructing an integrated innovation space at the transfrontier level. The emergence of a cross-border RIS could constitute an increase in the exchange of goods and knowledge, labour mobility and direct investments, offering opportunities for mobilisation of synergies and shared growth effects. These can result from a bundling of scientific and economic strengths, complementary expertise and innovation capabilities.

3.1 Towards cross-border innovation systems

Based on the insights into the regional foundations of innovation we will now analyse the prospects and challenges for the emergence of innovation systems in cross-border areas. The main building blocks and crucial dimensions of RIS (see Section 2) will serve as a basis for discussing this issue.

Scientific base and innovation infrastructure

Research on RIS has helped to clarify the eminent role played by the regional knowledge infrastructure for continuous innovation. The set-up of organisations forming the knowledge generation and diffusion subsystem, and its capability to produce and transfer scientific expertise, competencies and skills have a strong bearing on the innovation dynamics of the respective area. Also for a strong cross-border RIS to emerge, it seems to be of utmost importance that the cross-border region hosts an advanced scientific base and a well-developed innovation related infrastructure or pursue at least strategies to create and further develop these assets. A

cooperative combination and complementarities rather than the mere aggregation of the scientific bases and innovation infrastructures are essential in order to reap benefits from the integration process. In other words: To mobilise synergies and to amplify the combination of capabilities in knowledge generation and diffusion, various forms of partnerships between research organisations, educational bodies and transfer agencies from adjoining areas are necessary. It should be acknowledged, however, that the mere existence of an excellent knowledge infrastructure is not sufficient to trigger innovation and growth at the regional level. An intensive knowledge flow from the academic to the industrial world preconditions that the knowledge generation and diffusion subsystem is characterised by a strong orientation on the needs of the regional economy and its main clusters. Whilst this condition holds true for all types of RIS, the knowledge infrastructure of a cross-border RIS faces the additional challenge to overcome what might be termed “institutional distance”. The key point to be made here is that the innovation related infrastructure usually exhibits a rather vigorous adjustment to the regional and national contexts, and is thus ill-equipped to transfer competencies across borders. These claims can be substantiated by reference to empirical work. Koschatzky’s (2000) study is telling in this respect. He revealed that the service offer provided by research organisations and transfer institutions in the German region of Baden is strongly adapted to German framework conditions and German legislation regulations, resulting in limited innovation contacts between these actors and firms in the adjoining Alsace area. Consequently, to “implant” more flexible structures in the knowledge infrastructure, to accumulate knowledge about the institutional context of neighbour regions and to establish mechanisms and specialised bridging organisations that promote the diffusion and sharing of technologies, expertise and skills across borders turn out to be central steps for the creation of a cross-border RIS.

Firm strategies, cross-border clusters and knowledge bases

Innovative firms and clusters with strong learning capabilities transforming knowledge assets into commercial success are at the heart of dynamic RIS. Analogously, a cross-border RIS will only emerge, if the companies on both sides of the border pursue innovation strategies in order to sustain their competitive position. A “high road” development path resting on continuous innovation should be a characteristic feature of all local economies forming a cross-border region. However, it must be kept in mind that in particular in cross-border areas “regional unity may derive from the use of the border to exploit, legally and illegally, funding opportunities or differentials in wages, prices and institutional norms on either side of the border” (Anderson and

O'Dowd 1999, p. 959). But a transfrontier innovation system can in the long run definitively not be built on a situation where the development of a cross-border region is driven by the exploitation of internal price-cost differentials (Krätke 1999), reinforcing a "low road" path in one of its sub-areas by reproducing its dependency on low level production functions and low wage export processing industries. Such a division of labour is typical for cross-border areas which include Eastern European regions, which are still in a catching-up situation. Embarking on a "low road" strategy might represent a sound undertaking for these regions at the beginning of the integration process, enabling them to attract foreign direct investment and create income on the basis of existing resources. In the long term, however, these areas face the challenge to switch to the innovation path in order to increase wages and income and to sustain competitiveness in the age of globalisation. It is, however, not only the innovation capabilities and competitive strategies pursued in different parts of a cross-border region that matter. Additionally, a certain degree of similarities in the industrial structures, specialisation profiles, and knowledge bases of the areas forming a cross-border region appears as a necessary condition for the emergence of a cross-border RIS. Too strong differences regarding the main branches and knowledge bases signal a lack of synergies and complementary assets and should therefore be regarded as a crucial hindrance for transfrontier collective learning. The best prospects for the formation of an integrated innovation space might exist in those areas which host one or several cross-border clusters or exhibit at least a potential to develop them. Cross-border clusters such as the biotechnology sector in the Öresund region (Coenen et al. 2004, Moodysson et al. 2005, Tödting et al. 2006) can be acknowledged to constitute a key element of a cross-border RIS as they reflect high levels of economic integration and innovation-related intersections.

Transboundary innovation interactions

As accentuated above there is a widespread consensus amongst researchers in innovation studies that intense localised knowledge flows between various actors constitute a crucial "building block" of regional innovation systems. There is no doubt that economic relations and processes of collective learning should also be regarded as an indispensable condition for the rise and dynamic evolution of cross-border RIS. A lack of knowledge interactions and innovation-related ties would reflect a situation of fragmentation, and, consequently, a rather low capacity for systemic innovation. Asymmetrical relations where one side of the border thrives on a divide of income and wage levels between adjacent areas (Krätke 1999) display serious problems of cross-border interactive learning, whereas knowledge interactions are key manifestations of dynamic

interrelationships. Thus, it can be argued that the extent and the precise nature of trans-border linkages matter in a fundamental way when it comes to evaluate the development potential and future prospects of cross-border RIS. Several empirical studies on knowledge links and interactive learning in cross-border regions, however, offer a rather sobering picture. Research on various Euroregions, for example, indicates that transboundary economic contacts have developed only to a limited degree in these areas (Van Geenhuizen et al. 1996, Perkmann 2005). Looking specifically at transfrontier technology cooperations Reger and Hassink (1997) have shown for the Euregio Maas-Rhine that such interactions remain limited. Similar results are provided by Krätke (1999), who examines the intensity of economic relations in the Oder-Neisse border area. He demonstrates that no trans-border integrated economic German-Polish region has developed so far, as the intensity and quality of inter-firm cooperation is rather weak in this regional formation. Koschatzky (2000) analysed the pattern of cross-border innovation networking between the neighbouring regions Baden (Germany) and Alsace (France) and found almost no indications of inter-firm contacts and relations between research institutes and companies. Scientific cooperations between research organisations, in contrast, seem to be more developed in this area. Also investigations of the relational dimension of the Öresund region suggest relatively low levels of economic integration (Lundquist and Winther 2003) and cross-border knowledge collaboration (Coenen et al. 2004). Based on the literature review carried out so far it has to be stated that cross-border innovation linkages seem to be more the exception than the rule. This applies even to regional formations that share high potential levels for industrial integration and innovation networking. The level and quality of integration in cross-border regions hinges on a number of critical factors. As Anderson and O'Dowd (1999, p. 597) put it: "A border area's comparative standing with regions and institutions in the neighbouring state has a particularly crucial bearing on the nature and extent of its cross-border relations. They may have very similar or very different economies and levels of development. Degrees of cross-border difference, complementarity or asymmetry – in terms of economic in/equality, political in/compatibility, and cultural and national identities – determine the potential for different types of cross-border relations that are affected, in turn, by the degree of 'openness' of the border concerned". A key factor explaining the weak evidence for collective learning in cross-border regions might be the specific socio-institutional conditions prevailing in many of these areas.

Socio-institutional factors

A growing body of thought argues that geographical proximity is not enough for facilitating an intense knowledge transfer and systemic innovation activities. Cultural, social, cognitive, institutional, and relational forms of proximity (Gertler 2003, Coenen et al. 2004, Boschma 2005, Malmberg and Maskell 2006) are also recognised to influence the intensity of collective learning in substantial ways. This understanding of the socio-cultural and institutional underpinnings may lead to a more sceptical assessment of the chances to create a cross-border RIS. Against the background that the exchange of tacit knowledge is propelled under conditions where actors share a common history, language, beliefs, values, and identical jurisdictional order, many cross-border regions appear to represent rather unfavourable innovation environments. This holds in particular true for those cases, where attempts are made to promote the integration of two or more RIS, which are clearly distinguishable in terms of their institutional, social and political characteristics. Strong differences of a linguistic, cultural, ethnic, institutional or political nature between adjoining regions could cause various types of incompatibility and distance, resulting in impediments to industrial integration and transfrontier innovation interactions. Furthermore, it must not be ignored that regions that constitute a cross-border RIS remain institutionally embedded in their respective national innovation systems. Hence, to construct a cross-border RIS does not only mean a “coupling” of RIS but also a potential “clash” of NIS. National institutions and regulatory frameworks continue to matter in a crucial way. Consequently, there is a strong need for creating effective “bridging institutions” (Heidenreich 1999) enabling further integration. There is, however, no reason to be too optimistic regarding such endeavours. Political administrative borders as well as tariff and non-tariff barriers can be dismantled rather easily, but – as several authors remind us (Maskell and Törnqvist 1999, Zillmer 2005) – mental and cultural borders are far more difficult to change and continue to have a separating function. Gualini (2003, p. 43) even supposes an increase in their significance: “Yet the more borders are crossed – for instance, through the process of eastern EU enlargement – the more they are produced along other dimensions: linguistic, cultural, symbolic, as well as along differentials in abilities and power.” Several empirical studies dealing with the nature of socio-cultural impediments and their impact on transboundary relationships underline our arguments. Van Houtum (1998), for example, has identified mental distance³ as key factor for explaining the frequency and number of cross-border economic relations. Kraetke (1999) found out that amongst other

³ In this study mental distance is defined as the perception of differences between a foreign country and the home country with respect to business formalities and conventions and the perception of the consequences of these differences (see van Houtum 1998).

factors communication barriers, fears of competition and a low trust environment are main obstacles to interaction in the German-Polish cross-border area and Koschatzky (2000, p. 429) concludes from his analysis of the low level of innovation links between the contiguous regions Baden (Germany) and Alsace (France): “Although spatial distance does not matter, cultural and institutional distance does. The neighbouring region is not looked at as a significant knowledge source for firms in both regions. Despite technological and economic internationalization, for many firms innovation-relevant learning still takes place mainly within their own national and regional system of innovation. For the two regions under review, the Rhine is still a cultural and institutional barrier which needs more networking bridges to be crossed.” The aforementioned empirical evidence, thus, adumbrates the existence of various types of obstacles, constraining transfrontier innovation processes in many cross-border regions. The question emerges as to which extent such barriers can be overcome through deliberate policy efforts and interaction (e.g. Interreg activities, economic relationships). On the one hand there is a trend of homogenisation of (formal) institutions within the European Union, which might lead to a reduction of specific types of institutional distance. On the other hand, several authors have argued that trust is not just a precondition but also the result of networking (Sabel 1992; Powell 1996) and that trust can be “built” even in regions characterised by conflicts and antagonism, for instance, through proactive policy actions geared towards enhancing contacts and creating relations among actors (Sabel 1992; Morgan 1997; Storper 2002).

Innovation policy and public governance

The recent literature on innovation policy has demonstrated that the innovation performance of regions is shaped by the activities of policy makers at the regional, national and European level, pointing to a multi-level nature of public governance. This calls for efficient vertical policy coordination and cooperation (Cooke et al. 2000). Additionally, departing from a broad view of the innovation process (which covers beyond R&D and technological aspects also the organisational, financial, educational and commercial dimensions of innovation; see Lagendijk 2000, Asheim et al. 2003, Lundvall 2004) accentuates the need of horizontal coordination by linking different policy arenas (Mytelka 2000). To construct a cross-border RIS implies a further increase in complexity, as it means to “add” an additional layer to the governance system, brought about by the need for mechanisms of cross-border policy co-operation. Several authors have shown that in the 1990s transnational policy initiatives and institutions of cross-border public governance have grown considerably, a process which

has been heavily promoted by EU programmes such as Interreg, Phare or Tacis (Scott 1999; Gualini 2003; Perkmann 2003, 2006a, 2006b). It is beyond the scope of this paper to review the multi-faceted literature that has emerged on cross-border regionalism in the last years (for essential contributions see Church and Reid 1999; Perkmann 1999, 2003, 2005, 2006a,b; Scott 1999; Blatter 2003, 2004; Gualini 2003). We single out one point from the discussion on transnational governance, the relevance of the administrative-institutional context in which a cross-border region operates (see, for instance, Perkmann 2005). It can be stated that federalist political systems offer better conditions for creating innovation policy networks than centralist ones. To put it differently: To establish cross-border governance mechanisms for innovation and to form strategic innovation coalitions preconditions that the involved regions enjoy a sufficient degree of political autonomy and a broad set of responsibilities. The governance of transfrontier innovation can take different levels of intensity, ranging from a casual co-operation for specific purposes to the development and implementation of a coherent innovation strategy for the whole cross-border arena. Arguably, the latter approach seems to be the most favourable one for the creation of a cross-border RIS. Its realisation is often inextricably tied to a far reaching institutional change, as in most countries policies promoting innovation are overwhelmingly national and regional in nature. Another issue that deserves further discussion is the mode of state intervention and the related role of policy agents in this process. To design and implement a joint innovation policy cannot be done in a top-down manner but requires associational forms of governance that allow for intensive communication and consensus building between all stakeholders of a cross-border region. Cross-border policy networks and negotiation systems might represent effective institutional forms or arrangements in this respect. It can be suggested that there is a need of institution building in order to stabilise cross-border cooperation initiatives (Gualini 2003; Perkmann 2003) in the field of innovation.

3.2 Hindering and favouring factors for the development of cross-border RIS

A key conclusion that can be drawn from the reflections in Section 3.1 is that there are significant variations between cross-border regions regarding their capacity to form an integrated innovation space. Based on the arguments raised above we might identify a set of hindering and favouring factors for the development of cross-border RIS.

Table 1: Key determinants for the development of cross-border RIS

	Factors inhibiting the development of a cross-border RIS	Factors favouring the development of a cross-border RIS
Knowledge Infrastructure Dimension	Deficits regarding research organisations, educational bodies and transfer agencies	Advanced set-up of research organisations, educational bodies and transfer agencies
	Weak orientation on the needs of the regional economy and its main clusters	Strong orientation on the needs of the regional economy and its main clusters
	Exclusive adaption to the own regional / national context	Adaption to multiple institutional contexts
Business dimension	Dominance of a “low road” development path based on low wages and costs in one or more areas forming the cross-border region	Dominance of a “high road” development path based on continuous innovation in all areas forming the cross-border region
	Low level of complementarities / low degree of similarities in the industrial structures and knowledge bases	High level of complementarities / high degree of similarities in the industrial structures and knowledge bases
	Low potential to develop cross-border clusters	High potential to develop cross-border clusters
Relational dimension	Dominance of asymmetric transboundary relationships	Dominance of symmetric, transboundary relationships
	Low levels of cross-border knowledge interactions	High levels of cross-border knowledge interactions
Socio-institutional dimension	Strong cultural and institutional distances between the neighbour regions	Weak cultural and institutional distances between the neighbour regions
	Strong differences between NIS	Weak differences between NIS
Governance dimension	Centralist political systems	Federalist political systems
	Casual cooperation for specific purposes	Coherent innovation strategy
	Lack of governance mechanisms / loosely-coupled governance settings	Stabilised institutional governance settings

As it is revealed in Table 1, the emergence and dynamic evolution of a cross-border RIS depends on a number of critical factors and their interplay. It requires very specific conditions and cooperative development efforts in various areas. We might conclude that only a few cross-border areas will represent favourable environments for establishing a strong cross-border RIS.

4 Policy Implications and Agenda for Future Research

This final section is devoted to a discussion of policy implications and the identification of some issues for further research.

4.1 Policy implications

As we have outlined above, governance processes in cross-border areas are a complex endeavour. The innovation performance in such regional settings is influenced by the activities of a multitude of organisations at different spatial scales. In the following we intend to be more specific with respect to the role of policy makers in fostering the development of cross-border RIS. What are the key tasks of the state in promoting transfrontier innovation and what are the most critical areas of intervention in this respect? On the one hand, all those policy instruments and measures that are used to boost innovation in “conventional” RIS are also of relevance for enhancing the innovation capacity of cross-border regions. These comprise issues such as R&D funding, continuous upgrading of the knowledge infrastructure, stimulation of new firm formation or support for innovation activities in firms. On the other hand, specific types of barriers can make their appearance in cross-border RIS, calling for an extension of the traditional policy repertoire. As we have argued above, such obstacles to cross-border learning and innovation can take different forms, including amongst others a lack of common identity, cultural distance, various forms of institutional mismatch, and low levels of social capital, knowledge interactions and innovation networks. Taking these potential barriers as point of departure, we can compile a preliminary list of “additional” policy tasks for promoting innovation in cross-border RIS:

- *“Signalling” the importance of cross-border RIS:* A key policy issue is to “signal” to society that the creation of a cross-border RIS is crucial for attaining and sustaining competitiveness and prosperity.

- *Identity building:* Policy makers should actively promote the emergence of a regional identity at the level of the cross-border area. This is, however, as Maskell and Törnqvist (1999, p. 11) remind us, a long term process: “It will take years of hard work to amalgamate two countries’ distinctive innovation systems into one, even when most formal barriers have been eroded. It will take even longer for a common cross-border regional identity to form.”
- *Stimulation of cross-border knowledge interactions:* There are strong reasons to assume that transboundary innovation linkages do not always emerge spontaneously in cross-border RIS. As stated above, several barriers might hamper the exchange of ideas, expertise, and knowledge among companies as well as between firms and research organisations, resulting in a limited capitalisation on the economic strengths and innovation potentials of cross-border areas. This calls for policy actions geared towards the promotion of knowledge flows that cross national and regional borders. Existing public strategies of that sort, however, are still mainly national or regional today. Consequently, comprehensive forms of institutional adaptation and change are required for successfully realising this core policy task.
- *Fostering the development of cross-border clusters:* Cross-border cluster represent a core building block of cross-border RIS and should therefore be actively promoted by policy-makers.
- *Creation of bridging organisations:* In cross-border regions there is a pronounced need for organisations which are specialised in brokering innovation contacts between actors that are embedded in different regional and national institutional contexts. Policy agents face the challenge to facilitate such processes of institution building geared towards reducing institutional and cultural distances and disparities.
- *Promoting multi-actor governance in policy networks and negotiation systems:* A further key task of policy actors is to animate and facilitate dialogue and consensus building in cross-border policy networks and negotiation systems. As Gualini (2003, p. 45) put it: “Building cross-border governance as a regional community of interests is a social-constructive process that requires the development of concrete capacities of networking, co-operation and coalition building across differences.”

To foster the emergence of a cross-border RIS is, thus, no “routine job” for policy agents. It requires a substantial amount of policy learning, readiness to combine traditional tasks with new policy functions, and positive attitudes towards experimentation with new forms of state interventions.

4.2 Agenda for further research

Cross-border RIS constitute a field of research, which has been rarely studied so far. Consequently, there are many open questions regarding their emergence and functioning, which deserve more attention in the future. We will concentrate on some of the most intriguing ones: To begin with, in our view far more research is necessary to identify the specific features of cross-border RIS and to analyse its mode of functioning. Furthermore, it is still relatively unclear, which types of proximity matter in cross-border regions. Also the nature of knowledge flows in cross-border RIS and their potential obstacles remain little understood. More research activities are called for to explore which types of knowledge interactions are of relevance for cross-border RIS. Moreover, the impact of borders on knowledge links deserves further attention. How do political, economic, institutional and cultural borders affect the exchange and transfer of expertise and skills? It might be assumed that for some types of knowledge flows borders are more permeable than for others. They may be relatively porous for market linkages, but highly impervious for knowledge transfer via networks and spillovers. Furthermore, it can be hypothesised that borders play a significantly more important role as hindrance for the exchange of tacit knowledge than for the transfer of codified technological and scientific knowledge (see also Koschatzky 2000). In addition, we still have a poor knowledge about the outcomes of the formation of an integrated innovation space in terms of socio-institutional change. What are the effects of “coupling” different regional and national institutions in a cross-border RIS? Will they continue to persist? Will the institutional regime of a particular region or nation dominate over those of the other areas and finally become enforced in the whole cross-border area? Or should we suppose that a completely new institutional order makes its appearance at the level of the cross-border region⁴? In this paper, cultural, social and institutional forms of distance have been conceptualised as major restraints to cross-border learning processes. We should, however, critically ask, whether certain manifestations of distance can also be a driving force for mainly radical innovations, as they could imply high levels of complementarities⁵. Relevant question in this context include: Under what circumstances have social, cultural and institutional distance positive effects on innovation?

⁴ I am grateful to Heidi Fichter-Wolf for this comment.

⁵ Many thanks to Angelika Pauli for discussions on this point.

When is it mainly negative? Is there an optimal level of distance? Finally, an important conclusion of this paper has been that only a few cross-border regions offer optimal conditions for the emergence of an integrated innovation space. Perhaps a more fruitful approach would be to study exchange processes and innovation relations between distinct RIS instead of examining the prospects for their amalgamation.

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