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Towards Cross-Border Innovation Spaces

A theoretical analysis and empirical comparison of the Öresund region and the Centrope area

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Abstract

Due to strong regionalization tendencies in many parts of the world, the political collapse in Central and Eastern Europe and the continuing enlargement of the European Union cross-border regions have grown considerably in number and importance in the last years. There is a widespread agreement in the academic literature that in the emerging globalized knowledge economy the competitive strength of these areas increasingly rests on their capacity to create an integrated innovation space. The focus of this paper is on a theoretical analysis of different stages in the development of cross-border regional innovation systems and on a comparative analysis of the innovation capabilities of two cross-border areas in Europe, the Öresund region, composed of Southern Sweden and Eastern Denmark, and the Centrope area, which is located at the intersection of Austria, Slovakia, Czech Republic and Hungary. Departing from the regional innovation system approach, in a first step we will identify conceptually crucial preconditions and key determinants for the rise of transfrontier innovation systems. From an evolutionary perspective cross-border regional innovation systems could be seen as the last and most advanced form of cross-border integration building on the success of previous incremental but less advanced modes of integration. We will discuss a conceptual framework describing the different stages of such a process and we will examine how the prospects for a successful development vary between different geographical settings. This is followed by a comparative analysis of the innovation capacity of the Öresund region and the Centrope area. A special emphasis will be given on comparing the interplay of critical economic, socio-institutional and political factors, and the main barriers for establishing a cross-border regional innovation system. Our results suggest that the Öresund region and the Centrope area differ enormously regarding their capacity to develop an integrated innovation space.

1 Introduction

Due to strong regionalization tendencies in many parts of the world, the political collapse in Central and Eastern Europe and the continuing enlargement of the European Union cross-border regions have grown considerably in number and importance in the last years. There is a widespread agreement in the academic literature that in the emerging globalized knowledge economy the long term competitive strength of these areas, like in "normal" regions, increasingly rests on their capacity to create an integrated innovation space. This view is often shared by local and European policy makers and other stakeholders promoting cross-border integration and it goes hand in hand with the intention of the Lisbon treaty to create the most dynamic and competitive knowledge based economy in the world.

However there are reasons to put some question marks regarding how reachable this is for the vast majority of cross-border regions in Europe. According to Lundquist and Winther (2006) it can be argued that recent theoretical developments in economic geography on localized innovation and learning processes might fall short in analyzing cross-border regions as many of them are not characterized by collective learning systems or by socio-cultural and institutional proximity that is assumed to be an important prerequisite for successful localized innovation systems. This is related to the embeddedness of cross-border areas in different national and regional innovations systems and position and roles in national, regional and urban systems.

The different parts of cross-border regions often show very dissimilar economic histories, technological trajectories, institutional set-ups as well as different social dynamics, political visions, governance structures, modes of regulation and cultural identities. Simultaneously as these differences create the foundation for cross-border growth, i.e. the potentials to reap the benefits of new and unexploited complementarities and synergies, they also forms barriers obstructing successful integration, especially when it comes to generate, transmit and share innovation relevant knowledge (Koschatzky 2000, Hoeckman et al. 2009). In line with this skepticism whether the concept of regional innovation systems can be applied to cross-border settings Trippl (2009) points out that for instance the innovation related infrastructure, considered as one of the key components of regional innovation systems, usually reflects the specific needs of the regional and national context and therefore is far from being well equipped for knowledge transfer across borders. From this point of view there are probably "easier" ways to go than following a "high road" innovation oriented growth path. At least in the short run and as a first step to benefit from cross-border integration other pathways might be more reasonable. This could include e.g. integration and enlargement of local consumer and factor markets, increase of labor mobility, extended division of labor and specialization. A rather large body of research has focused on different forms of cross border integration processes of this kind, as well as the diversity of barriers and differences that inhibit or foster the development of cross-border integration. Aspects concerning governance, different forms of institutions, political strategies and networking related to cross-border co-operations and cross-border regions could be found for example in Church and Reid (1999), Perkman (1999), Scott (1999), Jerneck (2000) and Novi et al (2008). The importance of economic, cultural and social borders and its impact on the character and magnitude of integration processes are discussed among others by Anderson and O'Dowd (1999), Krätke (1999), Ek (2003), Stöber 2003, Hospers (2006) and Löfgren (2008). Another stream of literature picks up more general features of economic growth focusing on the importance of barriers and asymmetries for industrial dynamics and specialization, the development of factor markets and transport and contact patterns in different cross-border settings (Andersson and Matthiessen 1993,, Krätke 1999, Krätke and Borst 2007, Matthiessen 2004, Lundquist and Winther 2003, 2006).

However, may be explained as it appears at a first glance, by the lack of an immediate and fruitful relation between the regional innovation system approach and the conditions characterizing many cross-border regions, the integration processes have not with a few exceptions, (see for example Maskell and Törnqvist 1999, Coenen et al 2004, Moodysson and Jonsson 2007 and Trippl 2009) been conceptualized or empirical analyzed from an explicit regional innovation system approach. In this paper we will argue from an evolutionary perspective that cross-border regional innovation systems should be seen as the last and most advanced form of cross-border integration, building on the success of previous incremental and less innovation-oriented modes of integration. Departing from the regional innovation system approach we will identify conceptually crucial preconditions and key determinants for the rise of transfrontier innovation systems. Focusing on different concepts of proximity we will discuss a conceptual framework describing the different stages of such a process and we will examine how the prospects for successful development vary between different geographical settings. The empirical focus is on a comparative analysis of the innovation capabilities of two cross-border areas in Europe, the Öresund region, composed of Southern Sweden and Eastern Denmark, and the Centrope area, which is located at the intersection of Austria, Slovakia, Czech Republic and Hungary. The totally different character of these two cross-border areas in terms of socio-institutional and political factors, culture, history, economic structure and geography makes them suitable for a critical analysis of the preconditions for cross-border regional integration in general and their capacity to develop an integrated innovation space in particular. Special emphasis will be given on comparing the interplay of critical economic, socio-institutional and political factors, and the main barriers for establishing a cross-border regional innovation system. To summarize, the aim of the paper is

i) to theoretically identify different ideal stages of the development of a cross-border regional innovation system, and to explore in a conceptual way critical preconditions and key determinants necessary for each stage, and

ii) to compare the innovative capabilities of two cross-border regions located in totally different geographical settings of Europe and their possibilities to develop an integrated innovation space.

The paper is structured as follows: In the second Section we discuss a "stepwise evolutionary model" of cross-border integration elaborating on some basic conceptual ideas of regional innovation processes and how it can be related or not to different forms of cross-border integration processes. The third Section presents some basic figures and characteristics of the two cross-border regions of Centrope and Öresund, putting a special emphasis on innovation-related activities, institutions and linkages. In the fourth Section, based on our conceptual model, we analyze the preconditions for creating a transfrontier innovation space in these two cross border settings. In the final Section we summarize our main findings and draw some conclusions.

2 Conceptual Part: Stages of Cross-Border RIS Development

2.1 Basic features of heterogeneity

As a starting point of the theoretical discussion of the preconditions and possibilities to create a regional innovation system (RIS) in different cross-border setting we will initially apply a very broad and simple definition of a cross-border region as an area consisting of adjacent territories belonging to different nation states. This broad definition covers all types of cross-border setting regardless of differences in terms of size, geographic conditions, history, culture and socio-economic conditions. The heterogeneity between different cross-border areas is, however, considerable. On the one extreme they can be very extensive in terms of space and population stretching over several nations and include a larger number of regions located in densely populated economic core areas, for example, the Centrope region with a total population of more than 7 million consisting of the two capital city regions of Vienna and Bratislava and adjacent regions in Austria, Hungary, Slovakia and the Czech republic. On the other hand this definition also covers cross-border areas including only two neighboring regions with a small population distributed on a large area in the geographic as well as the economic periphery far away from core national and international markets. One example for such a cross-border region is the area around the twin cities of Haparanda and Torneå located along the northern part of the Swedish and Finish border. Between these two "extremes" there is wide range of cross-border regions showing a considerable variation in basic geographical preconditions in terms of scale, size and location engendering primary restriction of what kind of integration is likely to occur and what types of benefits are possible to reap from different integration processes.

In addition to these basic conditions decisive for a variety of forms of cross-border regions, the magnitude and character of internal heterogeneity in the single cross-border setting will have a strong impact on possibilities for and constraints to the emergence of an integrated socio-economic space. As briefly discussed in the introduction, many cross-border regions tend to show very dissimilar economic histories, technological trajectories and innovation capacities, institutional set-ups and positions in the regional system of their respective nations, as well as different social dynamics, political visions, governance structures, modes of regulation and cultural identities. To a certain extent these differences create the foundation for cross-border growth, i.e. the potentials to reap benefits from new and unexploited complementarities and synergies. These potentials could include an integration and enlargement of local consumer, labor and factor markets, enhanced competition, extended division of labor and increased specialization leading to shared growth effects and new opportunities for upgrading the competitive edge of the economy on both sides of the border. Simultaneously as some of these differences create the main driving force for cross-border growth, they also form barriers hindering successful integration. Thus, in addition to the political-administrative borders also economic, cultural and social borders tends to further divide these areas.

2.2 Dealing with the complexity

To summarize the short discussion above, cross-border regionalization is a multi-faceted and complex phenomenon. It takes shape along nation state boundaries and requires foreign contacts and partnership between public as well as private actors on the regional level. The process is localized in what could be labeled as a "grey zone" between civil and public law in combination with the emergence of informal and formal networks between a wide spectrum

of actors, ranging from the single citizen and firm, universities, industrial organizations, trade unions, political parties, institutions to cultural organizations. The overall concern of the importance of increased cross-border integration and the different ways to achieve it can be assumed to vary among the actors, reflecting conflicting goals and asymmetry in power relations. Furthermore, all these stakeholders are more or less strongly embedded in or have relations to other spatial scales, from the local community to the global level. This historically rooted embeddedness shapes routines and path dependence that will govern the actors' decisions in general, for instance a firm's decision about what to produce, when and how, investment decisions and search behavior for networking partners (Nelson and Winter 1982, Nelson 1995). In many respects these routines and path dependence will also frame the actors' potential "cross-border behavior".

Furthermore, the driving forces for cross-border integration processes, e.g. the differences in economic structure, innovation capabilities and cost structure giving rise to new complementarities and synergies, often generate the barriers that exist between the different parts of a cross-border region. Consequently, this tension and interplay between differences working as driving force on the one hand and as barriers on the other hand add further complexity to the understanding of cross-border integration processes. A crucial point of departure to understand cross-border integration in general and in particular when it comes to possibilities for the emergence of an integrated innovation space is to uncover the role of different types of proximity and distance and to explore how they have an influence on what linkages are likely to be established.

Following the literature two main categories of distance and proximity could be identified as central for this understanding, *functional proximity* dealing with the degree of physical distance and accessibility and *relational proximity* referring to a variety of non-tangible dimensions based on degree of similarity and affinity (Torre and Gilly 2000; Moodysson and Jonsson 2007). Functional proximity is closely interrelated to the geographical dimension of agglomeration economies, transaction cost and transportation cost. When it comes to the exchange of knowledge (especially tacit one) which depends on face-to-face contacts the accessibility dimension of functional distance could be assumed to be very important. As underlined in the literature it has less to do with pure distance in kilometers between different actors, but with the efforts it takes for them to interact in terms of time and costs. This could depend on several factors, for instance the quality of the transport infrastructure and political-administrative set ups that facilitates or hinders mobility of goods and people. The construction of the fixed link between Sweden and Denmark is one example where investments in infrastructure have had a strong impact on reducing the functional distance between different parts of the cross-border area of the Öresund. In the case of Centrope, the fall of the iron curtain, followed by the EU-membership of the former Eastern countries and finally the Schengen Treaty have gradually but significantly decreased the functional distance between different parts of the area triggering the same kind of hope as in the Öresund area: new possibilities for the creation of a powerful international competitive cross-border region. However, in the literature we also find another conceptualization and meaning of functional distance. Maggioni and Uberti (2007) use the term to point to differences between regions in innovation performance and receiver competence. In order to avoid misunderstandings, in the following we will adopt the definition of functional distance as it has been suggested by Maggioni and Uberti (2007) and use the term spatial or geographical distance to refer to aspects of accessibility.

Maggioni and Uberti (2007) show that knowledge does not flow easily between areas, if they differ strongly in their innovation performances. Consequently, a strong asymmetry in performance and capability will limited the opportunity for mutual advantages of integration and thereby increase the functional distance in a cross-border setting. From these points of view a certain degree of functional proximity could be seen as a necessary condition in all cross-border setting, although as will be further discussed below, this is far from sufficient to set of cross-border integration, particularly when it comes to the creation of an integrated innovation space.

As suggested by Moodysson and Jonsson (2007) relational proximity could be used as an umbrella for a number of non-tangible dimensions discussed in the literature, for instance cognitive, organizational, social, institutional, cultural and technological proximity (Torre and Gilly 2000; Zeller 2004; Boschma 2005). Relational proximity is associated with the structures, relations and processes that originate from, for instance, the social dynamics, governance structures, regulation and cultural identities that together comprise the embeddedness of social action (Granovetter 1985). In a growing strand of literature (see for instance Gertler 2003, Boschma 2005, Sternberg 2007) on relational proximity the discussion is centered around the increased importance of shared norms, institutions and regulation, mutual understanding, trust and codes of conduct and shared organizational and technological cultures for collaboration patterns and knowledge exchange. A certain degree of relational proximity between key actors is a necessary condition for a fruitful knowledge exchange and collaboration in a cross-border area. In the stepwise model discussed below special attention will be given to the importance of the cognitive and institutional dimension of relational proximity. The cognitive dimension (Nooteboom 2000; Nooteboom et al. 2007) is about the fine balance between being so close in terms of knowledge bases, technical and organizational know-how that the partners are able to cooperate efficiently, but far away enough to learn something new through cross-fertilization and the exploitation of new complementarities. The institutional dimension of relational proximity reflects the importance of differences in both formal and informal institutions, laws, regulations and also differences in culture and language.

The relation between the concept of spatial proximity and different aspects of relational proximity is complex (for a further discussion see e.g. Coenen et al 2004, Boschma 2005, Moodysson and Jonsson 2007). Spatial proximity could in some cases be an important facilitator of relational proximity in other cases relational proximity can emerge totally detached from geographical proximity. The latter case is in line with Granovetter's (1985) geographically unbounded view of the concept, where embeddedness and proximity can emerge regardless of geographical proximity (Moodysson 2008). This aspect is important to remember in the discussion of cross-border areas, just because being geographically close does not mean that it is good (more fruitful alternative relations could be found elsewhere). But on the other hand it is also true – when it is close and good, cross-border regions offer unique opportunities to develop new knowledge and learning dynamics. It is this interplay between certain degrees of spatial proximity and appropriate levels of relational proximity and distance that under certain circumstances shape a unique competitive advantage of cross-border regions compared to other spatial units.

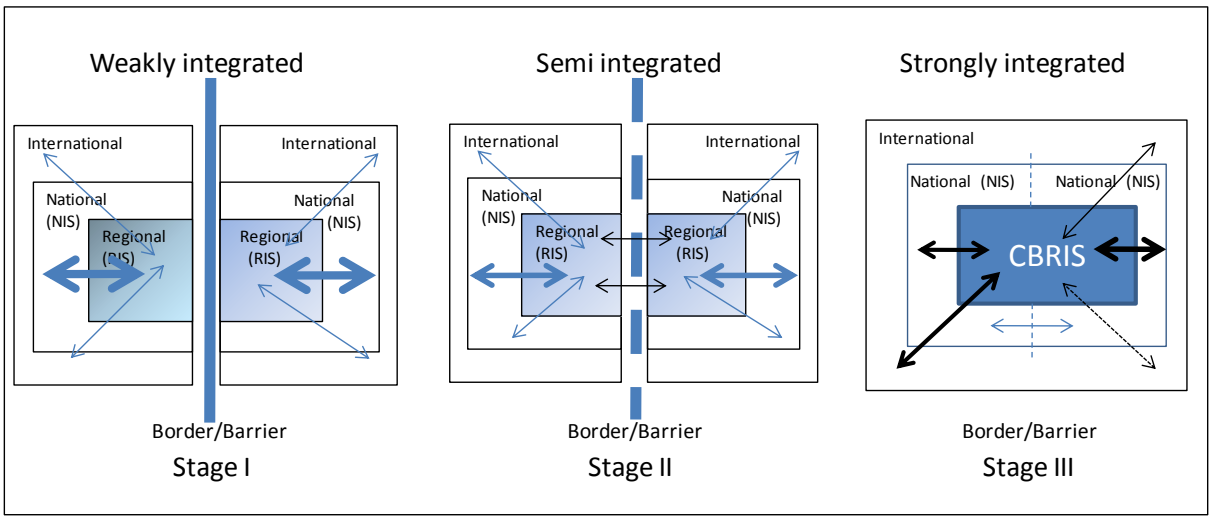
From this point it is vital to understand cross-border regions in terms of their relations to and dependence on other spatial scales rather than concentrate only on the internal conditions of the cross-border area. The embeddedness in existing and historically evolved regional and national innovation systems as well as the importance of more far away relations on the global arena must be taken into consideration. These already established linkages on both

sides of the border have been established under similar constraints of spatial and relational proximity as will influence the character of new potential cross-border linkages. From this point of view it is important to take into consideration to what extent the exploitation of potential cross-border linkages will be affected by the quality and strength of existing linkages embedded in other geographical scales. In what way will cross-border integration reinforce, complement, change, challenge or even substitute existing relations and linkages?

2.3 Reducing the complexity –a stepwise model

In order to reduce some of the complexity which characterizes cross-border integration processes we will restrict the discussion to the preconditions, driving forces and barriers for the emergence of a common innovation space. Other categories of cross-border integration processes, mentioned above and in the introduction, will only be discussed as facilitating or hindering the potential for the emergence of an integrated innovation space. Does one kind of integration exclude another one, or are they dependent on each other? Departing from the regional innovation system approach we will identify conceptually crucial preconditions and key determinants for the rise of transfrontier innovation systems. Focusing on the role of different types of proximity we will discuss a conceptual framework describing the different stages of such a process and we will examine how the prospects for a successful development vary between different geographical settings.

Figure 1: Ideal types of different levels of cross-border integration



Source: Own compilation

To guide this discussion three ideal types of cross-border settings are constructed representing different degrees of integration: stage I "weakly integrated", stage II "semi-integrated" and stage III "strongly integrated" (see Figure 1). In the following we will pinpoint basic conditions characterizing each stage in terms of economic structure, science base/knowledge infrastructure, relationship/character of integration and governance. As indicated by the figure, the linkages to other geographical scales as well as the effects of different barriers are crucial for the understanding of the character and magnitude of cross-border integration in each of the ideal types. Furthermore, two points should be underlined. Firstly, the distinction between the ideal types is not clear-cut – in the real world cross-border areas which for instance display semi-integration in one dimension, can be more or less strongly integrated in

other dimensions. Secondly, although we will discuss conditions for further development this does not imply that cross-border areas move necessarily or automatically from one stage to another.

STAGE I: Weakly integrated

Cross-border areas sticking in stage I are characterized by a low level of cross-border economic relations in general and a lack of knowledge interactions and innovation linkages in particular. The integration that exists or develops shows a dominance of asymmetric cost-driven linkages mainly exploiting internal price and cost differences. We can draw a distinction between two main reasons, *lack of synergies* and *unexploited synergies* which could lead to such a situation characterizing stage I.

First, non-integration can be the outcome of the absence of synergies for cross-border linkages. On the one hand, too strong differences in the scientific specialization, knowledge bases, and economic structures (i.e. cognitive distance) make interaction useless, because neither region 1 nor region 2 can reap benefits from integration. On the other hand, if the regions are too similar in terms of their knowledge bases, i.e. characterized by too much cognitive proximity, also little can be learnt from interaction. Consequently, the rationality for the actors to establish relations and invest in new cross-border linkages is very low compared to further develop and capitalize on already existing links with actors in respectively RIS, NIS and further away on the global arena. If the absence of synergies is the main reason for lack of linkages the prospect, at least in the short and medium long run, for the development of more advanced and interactive knowledge co-operation is are very poor regardless if it is possible to the remove other kind of barriers. Second, there might be synergies, but several kinds of borders and distances prevent to capitalize on them. Spatial distance might prohibit the establishment of contacts. If the accessibility is restricted and resulting in high time costs to cross the border it will jeopardize the possibilities to reap many potential synergies connected to enlarged and enhanced agglomeration advantages. This type of distance could be one of many reasons for a low level of linkages and flows in general. Furthermore, concerning knowledge linkages and learning processes depending on frequent face-to-face contacts (often containing a large proportion of tacit knowledge) a high degree of geographical distance will strongly prevent the emergence of cross-border learning processes. Furthermore, a low level of cross-border interaction and integration might also be the outcome of functional distance. Although there might be some similarities in the scientific or economic specialization pattern there is no interaction because the regions differ too strongly in their respective capabilities, performances and receiver competences. For the strong region little can be learnt from the weak region, whilst the weak regions might potentially learn a lot but might miss the absorption capacity. Consequently, functional distance results an unequal distribution of benefits from interaction and is closely related to the problem of absorptive capacity. Compared with the situation of lack of synergies the unexploited potential could at least in some case be easier to deal with. Some barriers can be removed or become more permeable, new investment in infrastructure or minimizing the cost to use it for crossing the border will for instance affect the accessibility and smoothing up physical interaction for goods and people. Barrier related to functional distance, i.e. strong differences in capabilities, performances and receiver competences can take decades to erode if ever. One key factor in this respect is if the asymmetric cost-driven integration characterizing these kinds of cross-border areas also are able to generate a certain amount of learning and knowledge spillovers to the weak side of the border, erasing from FDI, mobility of managers and key labor in general and not only exploiting differences in costs and prices.

Other reasons for the lack of exploitation of synergies might have to do with the impact of other kinds of distances. Various manifestations of institutional distance, for example, can act as an impervious border. This could include differences in both hard institutions such as laws and regulations and soft institutions such as the lack of a common culture and language. Subsequently, one feature in this type of weakly integrated cross-border settings is the "institutional thinness" depending on very few cross-border institutions and the absence of trustful cross-border "leadership" reflecting a lack of legitimacy and conflicting goals between different actors. One important aspect of this is for instance a general low or asymmetric support and interest from the involved nation states. Also a too strong embeddedness of actors in their RIS and NIS or in other contexts and relations might be a powerful impediment. Examples of the effect of a such a strong institutional path dependence and institutional "lock-in" are an exclusive orientation of transfer agencies on their own regional or national contexts lowering the search costs and reducing uncertainty due to strong social proximity (i.e. long standing, trust based linkages to regional and national partners or agents in other parts of the world and specific search routines for new partners).

The combination of institutional thinness, strong path dependence and institutional lock-in on the one hand and a very low social acceptance among firms and citizen on the other hand will not only be a barrier for many forms of integration, it will also shape a very weak cross-border identity internally and externally. This means that it is more or less impossible to "brand" the area trustworthy as an attractive cross-border location alternative for foreign direct investment. Foreign firms, not suffering from the same institutional-lock in and framed by path dependences rooted outside the area might be more open and less restricted to act on both sides of the border than indigenous firms.

STAGE II: Semi-integrated

In cross-border areas which are characterized by this stage of development we can observe what can be referred to as an emerging knowledge driven system. The asymmetrical cross-border links and flows are still important and the most dominant feature in the pattern of interaction. However, the asymmetry is decreasing and opening up for new and more mutual beneficial linkages on both sides of the border. In addition to links drawing on pure internal price-cost differences resulting in increased economies of scales and new market opportunities and relations, there are also windows of opportunities leading to economies of scope and increased cross-border learning processes in a few selective parts of the economy. These more interactive linkages occur in narrow segments of the science base and economic structure where good levels of cognitive and functional proximity could be found. As indicated in Figure 1, this interaction still takes place between distinct RIS embedded in their respective NIS. The cross-border knowledge links are of subordinate importance compared to links with other contexts for the overall innovative performance on both sides of the border. This emerging knowledge integration could also be partial in the sense that it only includes single steps in an innovation process as indicated by Moodysson and Jonsson (2007) in their empirical analysis of the bio-tech sector in the Öresund area. Furthermore in this semi-integrated space of stage II the linkages are also likely to be geographically concentrated to selective parts of the cross-border area and leaving other out.

These innovation activities of the cross-border area could be described as rather isolated "islands of innovation" in an otherwise fragmented cross-border innovation space. However, these small segments of the economy could be important role models and drivers of change. Through their daily experience in working in a cross-border area they are able to identify the

barriers in terms of accessibility, institutions, laws, regulation and also trustfully suggest how these could be transformed or removed in order facilitate further cross-border integration.

Compared to stage I the physical accessibility is not a major obstacle for the interaction. We might observe an increase of exchange of students, researchers, highly qualified people, scientific collaborations, university-industry partnerships, and institutional networking. In contrast to stage I the emergence of bridging-organizations (often related to areas where good functional and cognitive proximity exist), a growing social acceptance for the cross-border project and a growing consensus among different actors about potential benefits of increased integration lead to less strong path dependence and some institutional un-locking, promoting interaction at the cross-border level.

STAGE III: Strongly integrated

This stage of cross-border RIS development represents the most advanced and final form of innovation-driven integration. We look at an ideal type of integration, where distinct RIS in the constituent regions of the cross-border area cease to exist and become more and more melted into a single one. Strongly integrated transfrontier RIS are characterized by a considerable flow of knowledge, expertise and skills across the border, brought about by a high intensity of mobility of students and labor, innovation related networking among firms, academic collaborations, university-industry partnerships and so on. These knowledge interactions have reached a level at which they form a central underpinning of the innovation performance of the cross-border region. This does not mean that innovation linkages at other spatial scales have lost in significance. The argument is more that cross-border innovation linkages have grown in strategic importance and are no longer subordinate when compared to other innovation linkages. These linkages reflect the existence of substantial synergies for cross-border interaction and learning. Such synergies result from the co-existence of high levels of functional proximity (i.e. similar high levels of innovation abilities and knowledge generating capacity) and optimal levels of cognitive distance (related variety) in both the business systems and the knowledge bases. In contrast to stage II such synergies could not only be found in a few fields, but in many economic and scientific sectors. Consequently, we might observe the rise of several working cross-border clusters with strong collective learning mechanisms and modes of knowledge transmission.

Strongly integrated cross-border RIS do not only provide good synergy potentials as they have been described above, but they offer also favorable conditions which enable and support actors to make effectively use of them. They exhibit an excellent transportation and communication infrastructure, thus, allowing for easy accessibility and interaction (spatial proximity). Furthermore, many other kinds of borders and barriers have been dismantled rather successfully, allowing for the establishment of cross-border interactions. Arguably, most critical and difficult to reach in this context is the existence or at least emergence of a good level of institutional proximity in the cross-border area. We might observe a high societal acceptance of building a strongly integrated cross-border RIS, probably even a gradual emergence of a common culture and identity and a high density of bridging institutions which help to overcome socio-institutional and cultural barriers (such as differences in language) which might never vanish. A key feature of stage 3 is, indeed, that a process of new institutional path creation has been started, where solving common problems at the cross-border level is becoming part of normal life, where knowledge sharing and establishing innovation linkages are turning into a routinized activity and where cross-border RIS development is widely accepted in business, academic and other societal spheres.

Institutional path creation is tightly connected to advanced forms of cross-border political governance. In strongly integrated RIS we might find fully working cross-border governance structures and high levels of institutional thickness. There are not only many organizations and policy actions geared towards innovation-driven integration, but they form a coherent whole and reflect a successful implementation of institutionalized and stable mechanisms for long-term policy coordination. Specialized organizations responsible for steering cross-border issues and a common innovation strategy and policy might be essential elements in this regard. In the best case we find democratic platforms which allow for inclusive forms of governance and which are vital for the emergence of societal acceptance and a common identity at the cross-border level.

Table 1: Characteristics of different stages in cross-border RIS integration

	Asymmetric cost-driven system *Weakly integrated*	**Emerging knowledge-driven system, decreasing asymmetry** *Semi-integrated*	**Symmetric innovation driven system** *Strongly integrated*
Economic structure	Lack of synergies and complementarities	Emerging synergies and complementarities in a few business areas	Synergies and complementarities in a wide range of business areas
Science base/ knowledge infrastructure	Strong differences in specialization/capacity	Fruitful synergies in a few knowledge/business areas	Optimal related variety and relatedness in a wide range areas
Relationships/ Character of integration	Cost-driven asymmetrical. Lack of CBR innovation linkages. Innovation totally embedded in established RIS and NIS and other links	Asymmetry decreasing, Interactive links between parts of the regions in selected business areas. Links to existing RIS, NIS and global level more important	Symmetric interactive flows of knowledge and skills integrating links to RIS, NIS and global level on both side of the border. Reshaping the importance of established links
Soft institutional factors	Very strong path dependence. Institutional lock-in and low acceptance of the "CBR-project"	Strong to medium path dependence. Institutional "un-looking" through emergence of bridging institutions	Institutional path creation High acceptance of "CBR-project" in a wide range of actors
Governance	Institutional thinness	Developing	Institutional thickness
Physical proximity	Low/Medium	Medium/High	High/excellent

Source: Own compilation

Table 1 summarizes the main features of the three ideal stages of cross-border innovation spaces. These dimensions will be further scrutinized in the following empirical discussion.

3 Empirical Part: The Öresund Region and the Centrope area compared

In this Section we examine the level of innovation-driven integration in two cross-border regions, namely the Öresund area and the Centrope region. After a brief overview on socio-economic characteristics and innovation potentials, we will have a closer look on the key structures of the transfrontier innovation systems in these two areas. This will be followed by a comparative analysis of cross-border RIS development in the Öresund region and Centrope.

3.1 Overview on the Öresund region and the Centrope area

The Centrope region is regarded as "one of the most important transnational economic areas at the former Eastern borders of the European Union" (WIFO and WIIW 2007, p. 31). It comprises the two capital cities Vienna and Bratislava, other major cities such as Brno and Gyor and some of the most dynamic regions in Central and Eastern Europe. More specifically, the Centrope region consists of the Czech region of South Moravia, the Hungarian counties of Gyor-Moson-Sopron and Vas, the Austrian federal states of Vienna, Lower Austria and Burgenland, and the Slovakian regions of Bratislava and Trnava (NUTS 3 regions). As Table 2 reveals, Centrope covers a territory of approximately 44,000 square kilometers and it has a population of around 6.5 million inhabitants. In the following we will not only look at the Centrope area in terms of NUTS 3 regions as it has been defined above but also in terms of NUTS 2 regions, because relevant data is sometimes available only at this spatial level. According to the NUTS 2 level definition Centrope includes the South East of the Czech Republic, Western Transdanubia in Hungary, the Austrian provinces of Vienna, Lower Austria and Burgenland and the Slovakian regions of Bratislava and Western Slovakia. At this level Centrope covers a territory of 66,000 square kilometers and it has a population of 8.6 million inhabitants. The Öresund region, in comparison, is by far smaller than the Centrope area. It spans a territory of about 21,000 square kilometers and hosts 3.6 million people (NUTS 3 level). This cross-border area is constituted by the Danish regions Hovedstaden and Sjaelland and the Swedish region of Scania. The metropolitan area Copenhagen and the cities Malmö and Lund form the key centers of this cross-border region. If South Sweden as a whole is included (NUTS 2), it covers a territory of 24,000 square kilometers and it counts around 3.8 million inhabitants. The Öresund region is acknowledged to be a well performing, knowledge intensive cross-border area with an excellent innovation capacity and strong growth potentials.

As many other cross-border areas located at the intersection of old and new EU member states the Centrope region is characterized by substantial internal development disparities. Looking at the GDP per capita shows that the Austrian parts are by far richer than the Eastern parts of Centrope. The only exception in this context is Bratislava, which has the second highest GDP per capita amongst all Centrope regions. A comparison of GDP growth rates (Table 2), however, reveals that the Eastern regions of Centrope are more dynamic than their Austrian counterparts, reflecting the general trend of rapid catching-up processes of the Central and Eastern European countries and regions.

Table 2: Socio-economic characteristics of Centrope and Öresund region

	Area, km2 (%)		Population, 1000 (%), 2007		GDP[1]	GDP growth[2]	Unemploy-ment rate 2007
CENTROPE							
NUTS3							
South Moravia (CZ)	7196	(16.2 %)	1136,5	(17.3 %)	71.0	5.0	5.4
Gyor-Moson-Sopron (HU)	4208	(9.5 %)	443,5	(6.8 %)	73.2	9.0	3.6
Vas (HU)	3336	(7.5 %)	262,6	(4.0 %)	62.7	5.6	6.8
Vienna (AUT)	415	(0.9 %)	1671,0	(25.5 %)	165.9	2.9	8.3
Lower Austria (AUT)	19178	(43.1 %)	1593,4	(24.3 %)	101.4	3.9	3.6
Burgenland (AUT)	3965	(8.9 %)	280,7	(4.3 %)	82.1	4.4	5.0 (2)
Bratislava (SK)	2052	(4.6 %)	608,8	(9.3 %)	148.7	9.6	4.3
Trnava (SK)	4147	(9.3 %)	556,1	(8.5 %)	77.2	10.2	6.5
	44497	**(100.0 %)**	**6552,6**	**(100.0 %)**			
NUTS2							
South East (CZ)	13992	(21.2 %)	1649,2	(19.0 %)	69.3	5.3	5.2
Western Hungary (HU)	11328	(17.2 %)	998,7	(11.5 %)	63.8	7.2	5.0
Vienna (AUT)	415	(0.6 %)	1671,0	(19.3 %)	165.9	2.9	8.3
Lower Austria (AUT)	19178	(29.1 %)	1593,4	(18.4 %)	101.4	3.9	3.6
Burgenland (AUT)	3965	(6.0 %)	280,7	(3.2 %)	82.1	4.4	5.0 (2)
Bratislava (SK)	2052	(3.1 %)	608,8	(7.0 %)	148.7	9.6	4.3
Western Slovakia (SK)	14992	(22.7 %)	1863,0	(21.5 %)	62.8	9.0	7.8
	65922	**(100 %)**	**8664,8**	**(100.0 %)**			
ÖRESUND REGION							
NUTS3							
Scania (SE)	11369	53.6 %	1191,9	32,6 %	109,0	3,9	7.0
Hovedstaden (DK)	2561	12.1 %	1641,3	45,0 %	155,0	2,9*	n.d.
Sjælland (DK)	7273	34.3 %	817,8	22,4 %	93,3	2,3*	n.d.
	21203	**100 %**	**3651**	**100 %**			
NUTS2							
Southern Sweden (SE)	14424	59.5 %	1343,6	35.3 %	108.8	3.7	7.1
Hovedstaden (DK)	2561	10.6 %	1641,3	43.2 %	155.0	2.9*	n.d.
Sjælland (DK)	7273	30.0 %	817,8	21.5 %	93.3	2.3*	n.d
	24258	**100.0 %**	**3802**	**100.0 %**			

Source: Eurostat

[1] GDP per inhabitant at PPS (2006) in % of the EU average

[2] GDP growth 1997/2006, average annual change in %, data for DK: GDP growth 2004/2006

Furthermore, there is an uneven distribution of unemployment within the Centrope region. Remarkably, Vienna (8.3 %) is the only region within the Centrope area which has an unemployment rate above the EU 25 average (7.2 %), whilst for the other regions more favorable labor market conditions could be observed.

Although we can observe also development disparities within the Öresund region, these differences are more modest than those within Centrope. Looking at the GDP per capita we found that Copenhagen is the richest part in the Öresund region, whilst South Sweden is slightly above and Sjælland slightly below the EU average. In terms of dynamic evolution (measured by the growth rate of the GDP per capita), all three sub-areas of the Öresund region show a similar pattern of growth rates around 3 %.

The areas forming the Centrope region differ strongly regarding their innovation capacities (Table 3). Vienna clearly has the lead regarding public and business R&D and it shows also a good performance with respect to patents and high-tech services. Also Bratislava seems to

have good innovation potentials, brought about by a good endowment with highly qualified workers and a comparatively strong presence of high tech services. This indicates that not only in Vienna but also in the Eastern part of Centrope high innovation potentials can be found.

Table 3: RIS 2006 data – relative to EU (NUTS 2)

	HRSTC	Life-Long-Learning	Med/Hi-Tech Manuf.	Hi-Tech Services	Public R&D	Business R&D	Patents
CENTROPE							
Western Hungary (HU)	69	42	183	62	23	11	3
South Czech (CZ)	80	86	146	99	81	39	11
Vienna (AUT)	95	139	97	159	201	154	102
Lower Austria (AUT)	58	110	84	98	7	53	119
Burgenland (AUT)	55	64	62	65	7	12	42
Bratislava (SK)	157	144	59	249	80	31	10
Western Slovakia (SK)	42	60	164	48	12	40	3
ÖRESUND REGION							
Southern Sweden (SE)	162	318	107	149	no data	234	259
Denmark (DK)	158	258	92	164	109	115	156

Source: Eurostat
HRSTC: Human resources in science and technology – core (% of population)
Life-Long learning: Participation in life-long learning per 100 population aged 25-64
Med/Hi-Tech Manuf.: Employment in medium-high and high-tech manufacturing (% of total workforce)
Hi-Tech Services: Employment in high-tech services (% of workforce)
Public R&D: Public R&D expenditures (% of GDP)
Business R&D: Business R&D expenditures (% of GDP)
Patents: EPO patents per million population

There is also a strong presence of high tech and medium high tech manufacturing activities in South Czech, Western Hungary and Western Slovakia. However, these regions and also the Austrian province of Burgenland are clearly behind in terms of availability of knowledge workers, R&D expenditures and patenting activities. Consequently, the differences between the constituent parts of Centrope in innovation capacity are significant, pointing to a high degree of functional distance.

In the Öresund region, the distribution of innovation capabilities seems to be more balanced. Although the information given in Table 3 for this area has to be interpreted cautiously, because data is only available for Denmark as a whole, we can see that both parts share high innovation potentials. Except for medium high tech and high tech manufacturing, Denmark and Southern Sweden are above the EU average concerning all innovation indicators (Table 3). Key differences include patenting activities and business R&D where Southern Sweden shows a better performance than Denmark. This finding also reflects a well known key difference between the Swedish and Danish national innovation systems. In Sweden R&D expenditures are higher than in Denmark, the Swedish system is more based on organized R&D in large firms while the Danish system is more prone to incremental innovation and successful implementation of new technology through imitation (Lundvall 1999). Looking at the overall pattern, however, shows that the differences in the innovation capacity of the two areas constituting the Öresund region are less pronounced than in Centrope.

In the following, we will examine in more detail the key structures and dimensions of the cross-border RIS development in the Öresund region and the Centrope area.

3.2 The Öresund Region

The fixed link between Denmark and Sweden has been in place since the year 2000 and hence the Öresund cross-border region has now existed for close to ten years as an integrated part of the regional economic and political reality. It is regarded as a role model of transfrontier co-operation, as one of the most powerful cross-border areas in Europe, displaying a strong capacity to compete in the globalizing knowledge based economy. However, as it has been claimed by the OECD (2003), the region still underperforms as measured by its potential.

Economic and industrial structure

Compared to the Centrope area (see Section 3.3) the Öresund region seems to be characterized by more homogeneous economic structures. The differences between the sectoral specialization patterns of the areas which form the Öresund region are – at least at the first glance – more modest (Table 4). We find a high importance of services in general and knowledge intensive services in particular. The rough classification of economic activity contained in Table 4, however, tend to mask the heterogeneity and diversity of the Öresund region. In the metropolitan city Copenhagen (Hovedstaden) we find a strong concentration of advanced business services, high-tech industries and creative industries (entertainment, experience industries), whilst Sjaelland seems to be dominated by more traditional low-tech industries. Malmö and Lund at the Swedish side host many R&D intensive firms and industries, but their share of advanced business and producer services is not as pronounced as it is in Copenhagen. These differences might also reflect the different roles which are played

Table 4: Shares of employment (2007) – NUTS 2 level

	Öresund Region		
Sector (NACE codes)	Hovedstaden (DK)	Sjælland (DK)	Southern Sweden (SE)
Agriculture, hunting, forestry, fishing mining and quarrying (A-C (01-14)	**0.9**	**3.1**	**2.3**
Manufacturing (D)	**10.4**	**13.2**	**14.0**
High and medium high tech manufacturing	5.1	5.3	6.1
. Low and medium low tech manufacturing	5.3	7.9	7.9
Electricity, gas, water supply and construction (E, F)	**5.7**	**10.5**	**7.0**
Services (G to Q = 50 to 99)	**82.9**	**73.2**	**76.2**
Knowledge intensive services	51.7	42.7	47.4
Less knowledge intensive services	31.2	30.6	28.8

Source: Eurostat

by Copenhagen und Malmö and Lund in their respective national and urban systems (Lundquist and Winther 2006). Furthermore, the economic and industrial structure in the rest of Sealand and Scania is based on older more stagnating sectors and suffers from firm closure and out-migration (Hansen and Winther (2007), Lundquist and Olander (2007). Looking at cross-border cluster structures in the Öresund region, we find amongst others a rather strong biotechnology and pharmaceutical industry. It is one of Europe's most important life science clusters. The term "Medicon Valley" has been coined to refer to the high concentration of biotechnology and other life science firms in the Öresund region. This cluster hosts about 70

pharmaceutical companies, 100 dedicated biotech firms and 130 firms active in the field of medical technology. Cluster firms benefit from the presence of specialized knowledge infrastructure elements (for a general description of the knowledge infrastructure of the Öresund region see below) such as universities and hospitals and other institutions that back-up the biotech industry in the cross-border region. Most important in this context is the organisation "Medicon Valley Alliance" (MVA) which acts as a cluster management unit, serving as a project leader for cross-border initiatives and promoting interaction between universities, hospitals, companies and service providers firms.

Knowledge infrastructure

The Öresund region exhibits an excellent knowledge infrastructure. According to Garlick et al. (2006) this cross-border area is the largest knowledge centre within Scandinavia, accommodating not fewer than 10,000 university researchers, 150,000 students and 14 higher education centres and several science parks. Looking at the NUTS 2 level we even find almost 190,000 students in the Öresund region (Table 5), two thirds of them in the Danish part[1]. Hovedstaden and Sjaelland host not fewer than 54 % of all students in Denmark, while in Southern Sweden only 15 % of all Swedish students could be found.

Table 5: Number of students (2006) in the Öresund region (NUTS 2 level) tertiary education levels 5-6 (ISCED 1997)

	Number of students	*Share in %*
Hovedstaden (DK)	103,695	*55.4*
Sjaelland (DK)	18,960	*10.1*
Southern Sweden (SE)	64,937	*34.5*
	187,592	*100.0*

Source: Eurostat

Key knowledge generating institutions in the Danish part of the Öresund region include Copenhagen Business School, IT University of Copenhagen, Roskilde University, Technical University of Denmark, University of Copenhagen, as well as The Royal Academy of Fine Arts School of Architecture, and the Royal School of Library and Information Science. Whilst Copenhagen is the undisputed centre of knowledge production in Denmark, Scania and Southern Sweden respectively do not hold a similar position within Sweden. The region is lagging behind the scientific powerhouse Stockholm in this regard. Nevertheless, it is well endowed with universities. Key institutions are Lund University, Malmö University, the Swedish University of Agricultural Sciences and University of Kristianstad. The region's scientific capacity will be further strengthened in the future, when the huge material research centre "ESS – European Spallation Scource" will open its doors at Lund University.

Most importantly, there is a strong and institutionalized form of cross-border co-operation between the knowledge organizations located in the Öresund region, the "Öresund University" (ÖU). More specifically, ÖU is a consortium of 11 universities and aims at contributing to the creation of a strong cross-border science-based region by increased interaction evolving around research and education. A part of the collaboration is "Öresund science region" (ÖSR) region, which consists of four network organizations (or platforms) in the fields of IT, logistics, food and environment. To summarize, the Öresund region is not

[1] Due to the lack of data, we cannot analyze the stock of R&D personnel in this region at the NUTS 2 level as it will be done for Centrope (see Section 3.3).

only well endowed with knowledge infrastructure elements, but it also exhibits a rather thick web of co-ordinating institutions, promoting scientific collaboration and knowledge exchange.

Nature of Linkages

Examining the relational dimension and pattern of interaction within the Öresund region, we can observe multiple forms of cross-border linkages between its constituent parts. There is some evidence for labor mobility and migration, more traditional supplier links and market relationships, and FDI, reflecting a good level of integration. Labor mobility from Sweden to Denmark, for example, has increased from the years 2000 to 2006, partly reflecting a lack of qualified workers in the Copenhagen area.

Furthermore – and most relevant for the purpose of this paper – several studies and reports have pointed to the existence of cross-border knowledge links in the Öresund region. There is, for example, evidence for the exchange of students across borders (Garlick et al. 2006) and in specific fields such as in biotechnology (see for instance Coenen et al. 2004, Moodysson et al. 2008) or in the food processing industry, we find cross-border knowledge linkages and innovation partnerships between researchers, firms and institutions, providing potentials for further knowledge generation and radically new ventures. Arguably, these relationships should also be seen in the context of the initiatives taken by "Öresund University" (ÖU), "Öresund science region" (ÖSR) and "Medicon Valley Alliance" (MVA) described above, which do not only focus on increased collaboration among scientific organizations, but also aim at promoting interactions with business and industry in the cross-border region examined here. However, due to the lack of data we can hardly assess the overall pattern of knowledge sharing in the Öresund region.

As it has been pointed out by Garlick et al. (2006) there are still many integration barriers in the Öresund region, hampering an easy flow of knowledge across borders. Apart from communication barriers between universities and the business sector, it seems to be mainly institutional distance which hampers cross-border networking and knowledge sharing. In this context, Garlick et al. (2006) emphasize the negative role of differences in educational systems, taxation systems and legislation which exist between the Danish and Swedish parts of the Öresund region (for similar observations see Edquist and Lundvall (1993) and Lundquist and Winther (2006)). Moreover, Garlick et al. (2006) argue that there are also strongly limiting rules for public funding of cross-border projects. Given these impediments, it cannot be argued that the Öresund region already exhibits a strongly integrated cross-border RIS. Arguably, it is better characterized as a knowledge-driven semi-integrated RIS

Governance and Institutional Setting

Both Denmark and Sweden are characterized by decentralized political-administrative structures, delegating many responsibilities to the local and regional levels. Consequently, national governments are mostly indirectly involved in cross-border projects in the Öresund region (Garlick et al. 2006). As already mentioned above, there are several forms of institutional distance (i.e. differences in educational systems, tax regimes, labor market rules and regulations, intellectual property rights, etc.) to be found between the Swedish and Danish parts of the Öresund region, impinging on cross-border integration.

Analyzing the cross-border governance setting reveals that the institutionalization of the Öresund region has a long history (Stöber, 2003). Although already in the year 1964 co-operative initiatives by local politicians could be observed, it was not until the 1990s that more comprehensive efforts were made to create a new region connecting Copenhagen and southern Sweden. Throughout the 1990s, the composition of the region has changed considerably, from including Copenhagen and the western part of Scania in the early 1990s to include the whole of Zealand (and the island of Bornholm) and Scania in the late 1990s. In 1993 the Öresund Committee was established by local and regional authorities and in 1996 the organization was given the administration of the INTERREG programs of the region. According to Stöber (2003) the foundation of the Öresund Committee represents a decisive step in the institutionalization process of this cross-border region. In the first ten years, the Öresund Committee initiated several cross-border network projects including amongst other the Medicon Valley Academy mentioned above. Today the Committee promotes regional cross-border cooperation at all levels and sees itself as an "embassy" of the Öresund region. It has 12 members, i.e. the regions and main municipalities of the areas, with a representation of 36 politicians, 18 from Denmark and 18 from Sweden. The organization has three long term strategic goals. First, it intends to sustain and promote long term economic growth and competitiveness. Second, it aims at sustain everyday integration by promoting mobility, institutions and identity. Third, it is oriented on securing a more connected region by strengthen infrastructure, communication and co-operation. In terms of innovation and regional knowledge production the focus of the Committee is more blurred. However, there are other and more specialized organizations working in this field (Öresund science region, Öresund university, Medicon Valley) and together they form a rather institutionally thick and stable governance structure, promoting an innovation oriented integration.

Physical proximity

Huge investments in public transport infrastructure, i.e. in rails, roads bridges have been made the last decade in order increase the accessibility between the Swedish and Danish parts of the Öresund. The most spectacular and important investment, the Öresund bridge, with its opening in July 2000 resulted in a dramatic decrease of the time distance between the two core areas, Copenhagen on the Danish side and Malmö/Lund on the Swedish side of the Öresund. The bridge resulted in an explosive increase of traffic, from 2-3 million vehicles per year in the 1990s to 9.2 million vehicles and 35.5 million travelers during 2007 (www.tendensoresund.org/en). An important "side effect" of the bridge for the Swedish part of the area is a substantial increase in the regions international accessibility through the easy access to Copenhagen international airport. Even if the time distance has been reduced and accessibility heavily increased the toll-level (one way ticket for a car is between 7 and 30 Euros) for crossing the bridge appears still to be an important barrier for interacting over the Öresund. Model calculation by Bruzelius and Holmberg (2002) indicates that lowering the tolls with 25-50 percent would result in a quadrupling of the traffic. Furthermore, the physical proximity in the Öresund region should probably also benefit from a construction of a second fixed link located in the northern part of the region between the cities of Helsingborg and Helsingör. From these points of view there are still important steps to go in further improve the physical proximity in the area.

3.3 The Centrope Region

The fall of the iron curtain, the transformation of former communist countries in Central and Eastern Europe into market economies and their entry into the European Union have essentially propelled the rise and development of new cross-border areas in Europe. The Centrope region represents an interesting example in this context.

Economic Structure

As noted above, the Centrope region is characterized by significant disparities regarding prosperity, economic development and dynamics within the Centrope area. Looking at sectoral specialization patterns we find also considerable differences between the regions. As revealed in Table 6 Vienna and Bratislava have a stronger service sector than the other regions. Czech South East, Western Transdanubia and Western Slovakia exhibit a strong manufacturing base. In contrast to other cross-border areas consisting of Eastern and Western regions, Centrope has no lagging regions with a strong agricultural sector. Compared to the average of the new EU member states, in the Eastern part of Centrope we find more modern diversified regions which do not suffer from mono-industrialization (Huber and Mayerhofer 2006). Remarkably, not only low tech activities can be observed there but – partly due to considerable foreign direct investment – these regions also host high and medium high tech manufacturing industries such as the automotive and electronics sector. In Vienna and Bratislava, in contrast, a significant share of knowledge intensive services can be found. Consequently, the Centrope area is characterized by sectoral heterogeneity and diversity. Whilst the metropolitan region of Vienna and the agglomeration Bratislava are key locations for knowledge intensive services, economic development in the Czech South East, Western Slovakia and Western Transdanubia (Western Hungary) is tightly connected to their industrial base. Lower Austria and Burgenland lie in between, showing a tendency towards increasing tertiarization.

Table 6: Shares of employment (2007) – NUTS 2 level

Sector (NACE codes)	South East (CZ)	West Hungary (HU)	Vienna (A)	Lower Austria (A)	Burgen-land (A)	Bratisl. (SK)	Western Slovakia (SK)
Agriculture, hunting, forestry, fishing mining and quarrying (A to C = 01-14)	**5.7**	**4.6**	**0.8**	**8.3**	**6.8**	**1.6**	**5.9**
Manufacturing (D)	**31.3**	**30.1**	**11.2**	**18.2**	**15.7**	**14.9**	**31.0**
High and medium high tech manufacturing	11.3	13.5	5.2	5.9	4.8	6.5	13.4
. Low and medium low tech manufacturing	20.0	16.7	6.0	12.3	10.9	8.4	17.6
Electricity, gas, water supply and construction (E, F)	**11.4**	**9.3**	**7.9**	**8.9**	**11.9**	**8.3**	**11.3**
Services (G to Q = 50 to 99)	**51.6**	**56.1**	**80.1**	**64.6**	**65.6**	**75.2**	**51.9**
Knowledge intensive services	24.4	21.7	41.7	29.0	25.5	40.5	21.6
Less knowledge intensive services	27.2	34.3	38.4	35.6	40.2	34.6	30.3

Source: Eurostat

In sharp contrast to the Öresund region, there is hardly any evidence of strong cross-border clustering processes in the Centrope region. Although there seem to be some potentials for

building cross-border clusters (for example in the fields of ICT, biotechnology and automotive) little have been done so far to promote a stronger interaction between firms active in these industries.

Knowledge Infrastructure

Centrope is well endowed with knowledge generating organizations. It hosts not fewer than 25 public universities and art academics. Furthermore, there is a large number of non-university research organizations, technical colleges and innovation centers. In sum, we find more than 40,000 R&D workers (Table 7) and more than 365,000 students (Table 8) there.

However, there is a strong uneven distribution of research capacity and students within the cross-border region. Vienna is not only the undisputed scientific centre of Austria (hosting 54 % of all students and 40 % of all R&D workers in Austria), but it represents also the core of knowledge production within the Centrope region. More than 19.000 R&D specialists (46 % of all R&D workers located in Centrope) and more than 136.000 students (37 % of all students in Centrope) can be found there. The most important knowledge production organizations are the University of Vienna, the Technical University of Vienna, the Medical University of Vienna and the Vienna University of Natural Resources and Applied Life Sciences. Furthermore, there are 50 research institutions of the Austrian Academy of Sciences, more than 100 institutes and research sites of the Ludwig Boltzmann Society (focus

Table 7: R&D personnel in the Centrope region (NUTS 2 level) in 2006

	All sectors	*(Share in %)*	Business sector	Higher education sector	Government sector	Private non-profit sector
Vienna (AUT)	19207	*(46,1 %)*	10784	6671	1620	132
Lower Austria (AUT)	3999	*(9,6 %)*	3673	124	190	12
Burgenland (AUT)	336	*(0,8 %)*	299	n.d.	n.d.	
South Czech (CZ)	6806	*(16,3 %)*	3231	2247	1324	3
West Transdanubia (HU)	1268	*(3,0 %)*	507	503	258	
Bratislava	7178*	*(12,2 %)*	1037*	3548*	2591*	2*
Western Slovakia (SK)	2835*	*(6,8 %)*	1347*	1028*	458*	2*
	41629	*(100,0%)*	20878	14121	6441	151

Source: Eurostat
* data for 2005

Table 8: Number of students (2006) in the Centrope region (NUTS 2 level) tertiary education levels 5-6 (ISCED 1997)

	Number of students	*Share in %*
Vienna (AUT)	136076	*37.3*
Lower Austria (AUT)	7495	*2.1*
Burgenland (AUT)	1596	*0.4*
South Czech (CZ)	70570	*19.3*
West Transdanubia (HU)	34358	*9.4*
Bratislava	64924	*17.7*
Western Slovakia (SK)	50192	*13.7*
	365211	*100.0*

Source: Eurostat

on human medicine), about 250 further non-university research institutions in different fields and several technical colleges. Whilst Vienna is clearly dominating, the two other Austrian Centrope regions, i.e. Lower Austria and Burgenland, play a comparatively weak role in scientific knowledge generation and education.

The region South Moravia with its capital city Brno is the second largest centre of research and science in the Czech Republic. It hosts about 6800 R&D workers (representing 14 % of all R&D workers in the Czech Republic and 16% of all R&D workers in Centrope) and not fewer than 70500 students (21% of Czech Republic and 19 % of Centrope). In Brno we find six public and three private universities as well as 13 technical colleges. Key institutions include Masaryk University Brno, Brno University of Technology and the Mendel University of Agriculture and Forestry. Another key element of the scientific base is the Czech Academy of Sciences which maintains 15 research institutions in Brno (focus on natural sciences). A number of non-public institutes oriented towards applied research strengthen the scientific base in such traditional industrial sectors as chemistry, engineering, textile, etc. is also present.

Western Hungary is clearly lagging behind in terms of knowledge generation. It hosts about 1300 R&D workers (4.9 % of all Hungarian experts and only 3 % of Centrope) and 34400 students (7,8 % of Hungary and 9,4 % of Centrope). Important knowledge production centers include the Szechenyi University in Györ and the University of West Hungary in Sopron. The Györ University has a traditionally strong technical orientation and now also a focus on economics.

The Slovakian regions Bratislava and Trnva together host 10013 R&D workers (70 % of Slovakia and 24% of Centrope) and 115129 students (58 % of Slovakia and 32% of Centrope). Bratislava hosts eight public and four private universities (with a strong focus on business education) and a large number of non-university research institutions. The most important universities include the Comenius University, the Slovak University of Technology, the Bratislava University of Economics and the Slovak Medical University. Moreover 45 institutes of the Slovak Academy of Sciences are located in Bratislava. In Trnava we find the University of St. Cyril and Methodius as well as the University of Trnava.

To summarize, Centrope is well endowed knowledge generating institutions. The research capacity, however, is unequally distributed amongst the different sub-areas. We can observe an extraordinarily strong role of Vienna and good potentials in the Slovakian and Czech part, whilst Lower Austria, Burgenland and Western Hungary are clearly lagging behind.

We also have to note that two key knowledge centers in the Eastern Centrope countries, i.e. the capital cities Prague and Budapest, are not included in the cross-border region. Both cities play a rather strong role in their respective national innovation systems. In Prague we found not fewer than 19,889 R&D specialists (42 % of all R&D workers in the Czech Republic) and 125,000 students (37 % of all students in the Czech Republic). In Budapest and its surrounding are there are: 187,025 students (43 % of all students in Hungary) and 16,273 R&D workers (63 % of all R&D specialists in Hungary). Given these innovation potentials, we might critically ask how adequate Centrope's current borders are.

Nature of Linkages

Several studies have shown that in the last 15 years or so cross-border linkages have grown significantly within the Centrope region and between the Centrope countries. This holds in particularly true for market links, supplier relations and foreign direct investment (Palme and Feldkircher 2005; KMU Forschung Austria 2005; Huber and Mayerhofer 2006; WIFO and WIIW 2007). These findings are confirmed by more recent empirical work done by Trippl (2008) who examined as to what extent Viennese companies have built up innovation linkages and economic relations with actors in Hungary, the Czech Republic and Slovakia. It is shown that such cross-border contacts have already developed to a considerable extent, reflecting a relatively high level of interaction and integration. This study, however, also highlights that not all kinds of links have a high relevance. Innovation interactions where found to be less significant, when compared to other kinds of relationships. The most important ties included market links, supplier relations and the employment of migrants and commuters (labor mobility). The analyses revealed that 17 % of the surveyed companies have established knowledge linkages with partners located in the Eastern Centrope countries. The large majority of these firms, however, interact only with one type of partner; they do not make use of a larger variety of different knowledge sources. Trippl (2008) showed also that cross-border knowledge links with other entities of the same company, i.e. within multinational companies, play the most important role. Other relevant knowledge sources and innovation partners included knowledge generating organizations and competitors. Innovation networks along the value chain – i.e. with customers and suppliers – turned out to be less important. Given the relatively low importance of knowledge links, we can conclude that the Centrope region does not exhibit a fully integrated innovation system yet. An analysis of supplier linkages, FDI and labor mobility (Trippl 2008) further substantiates this finding, revealing that integration processes in the Centrope area are not innovation-driven in nature but oriented on searching new markets and exploiting cost and price differences in this cross-border region. It was shown that supplier linkages have mainly been established to benefit from the lower production costs in the Eastern part of Centrope, whereas flexibility and quality advantages of suppliers in this area play a negligible role. Thus, asymmetrical cross-border relations seem to dominate, indicating that the development and dynamics of the Centrope area does not rest on transnational production networks based on high quality and innovation. Integration seems to be more driven by the exploitation of cost differences which still exist in the Centrope area. As argued recently by Palme and Feldkircher (2005) wages and unit labor costs in Eastern Centrope are still by far lower than in Austria and "the competitive advantage of low labor costs is evident particularly in labor and technology intensive industries" (Palme and Feldkircher 2006, p. 3). Furthermore, a closer look to FDI revealed that the main reason for this type of cross-border activity is to open up new markets, whilst getting access to the innovation capacity of the Eastern part of Centrope has not been a motive for FDI at all. Finally, little evidence was found for the mobility of highly skilled labor and talent. The overwhelming majority of migrants and commuters who move to Vienna are working at the shopfloor level; only few hold positions in middle or top management. Consequently, these findings suggest that Centrope does not constitute an integrated cross-border innovation system yet.

Several obstacles restrain the functioning of existing transfrontier relations and impede the establishment of new ones (Trippl 2008). For existing relations it is mainly differences in language (i.e. a specific form of institutional distance) which seem to have a hampering effect. Exploring the reasons why Viennese firms have not created cross-border linkages to the Eastern Centrope countries one key factor turned out to play a decisive role. Many Viennese firms are strongly embedded into the regional or national innovation and business systems,

whilst at the same time they interact with global partners, which are mainly located in the Western part of the world. Consequently, notwithstanding spatial proximity to Hungary, the Czech Republic and Slovakia and potential transaction cost advantages Viennese firms have not substituted connections with the Eastern Centrope countries for their existing international linkages.

Governance and Institutional Setting

The Centrope area is characterized by a substantial degree of institutional distance, brought about by differences in political-administrative systems, regional policy capabilities (formal competences and financial resources), legal frameworks and standards, decision making procedures, tax regimes and so on. Looking at the political-administrative context it has to be stated that there exist clear differences between the four Centrope countries. In the federal state of Austria the provinces have to a relatively large extent competencies in policy making. The Eastern Centrope countries are still characterized by quite new and unstable administrative structures. The Slovakian regions were established in 1996. Since 2001 they have been undergoing a process of re-organization. They have specific competences but lack financial resources. The Czech regions were created in 2000 and in Hungary the administrative structure has been revised only recently. The lack of financial resources in the Eastern Centrope regions forces regional authorities to focus on short-term thinking to solve acute problems. There is no time, capacity or money to think about more long-term and structural policies and solutions (Otgaar et al. 2008).

Since the mid 1990s a flurry of cross-border projects and initiatives have been introduced within the scope of various programs and initiatives. The business-led "Vienna-Bratislava Twin City" project is worth mentioning in this context. Another example is the DIANE (Direct Investment Agency Net) network which was established in 2002 and includes as members the regional development agencies of Vienna, Lower Austria, Burgenland, South Bohemia, South Moravia, West Slovakia and West Hungary. DIANE (Direct Investment Agency Net) is an EU-supported network aiming at the repositioning of Centrope in the international market for business locations. The OECD Territorial Review for the Vienna-Bratislava agglomeration concluded in 2003 that there are numerous initiatives, but that a clear strategy for the development of a cross-border region was lacking. Cross-border agreements were piecemeal and ad hoc (Otgaar et al. 2008).

In 2003 a more comprehensive approach – the Centrope partnership – was started. In this year regional and local leaders signed a declaration "to build a common Central European Region", using the name Centrope as a trademark. The Austrian federal government is only indirectly involved in Centrope, as most issues are decided on the regional level. The national governments of the Eastern Centrope countries are relatively stronger involved although not formally represented. The work of Centrope partnership draws on political declarations adopted at the "Summit Meetings". These political conferences enable the political leaders of the regions and cities to agree on the shape and content of their future cooperation. On the top of the organization of the Centrope partnership is the Steering Committee which is responsible for the performance of the project. Then there is an Advisory Board which is a forum for discussions among official representatives of the partners, and the Centrope Consortium which organizes all activities, guides the process and prepares implementations. Most importantly, so far Centrope has been financed only by the Austrian regions. The Austrian side is the initiator, leader, organizer and (co-)financier of cross-border projects. The Eastern regions have no position in the Steering Committee and in the Centrope Consortium;

they have no resources available for full participation, neither financially or in terms of human capacity. Currently, attempts are made to strengthen the integration of the Eastern part (Otgaar et al. 2008).

Cross-border institution building and policy coordination is still in its infancy in the Centrope region. Although a process of institutionalization of cross-border cooperation has set in (regular summit meetings, establishment of a Steering Committee, etc.) the governance structures are still institutionally thin and unstable. First, partly due to the unequal position of partners in the policy network, public commitment in some parts of Centrope is still low. Second, private partners are not involved in the Centrope partnership and they show little inclination to do so, pointing to a lack of private commitment. Third, there is little policy co-operation amongst the Eastern Centrope regions.

Physical proximity

Cross-border integration in Centrope still suffers from a rather low degree of spatial proximity. As noted by Otgaar et al. (2008) there are still gaps with respect to transportation and communication infrastructures. For decades cross-border traffic has been interrupted and there are still capacity bottlenecks and to little investments to enhance spatial proximity. As argued by Palme and Feldkircher (2006) the number of border crossings is limited and does not correspond to that of a densely populated region striving for integration (Palme and Feldkircher 2006).

3.4 Comparative analysis of cross-border RIS integration in the Öresund region and the Centrope area

In this Section we present the results of our comparative analysis of cross-border RIS integration in the two case studies discussed above. The Öresund region and the Centrope area represent two cross-border areas which are very different in nature in many respects. Centrope is not only much larger than the Öresund region (in terms of land area and inhabitants), but even more importantly, it is also characterized by a huge prosperity gap between its constituent parts. Development disparities exist also within the Öresund region, but they are by far less pronounced than those found in the Centrope area. Furthermore, and highly relevant for our discussion of cross-border RIS integration, the two cases investigated here, display very distinctive levels of internal functional distance. Within the Centrope area, the different sub-regions differ enormously in their innovation capacities, pointing to a rather high degree of functional distance in this cross-border area. In the Öresund region, in contrast, there seem to be higher levels of functional proximity, as the internal distribution of overall innovation capabilities (measured by the revealed regional innovation index, see above) appears to be more balanced. In the following, we draw on the key dimensions of cross-border RIS integration, as they have been identified in the theoretical part of the paper and analyze the cases of Centrope and the Öresund region in relation to our conceptual model.

Economic structure: Looking at the economic structure of both case studies, it has become clear that Centrope and the Öresund are characterized by a substantial degree of internal heterogeneity. A careful and reliable assessment of the degree of cognitive distance and related variety that might result from this economic diversity in both cross-border areas cannot be done here. Nevertheless, we can argue that in the Öresund region more actions have been taken so far to capitalize on potential advantages from related variety than in the

Centrope area. This becomes manifest in cross-border clustering processes (i.e. in the field of life sciences), which could be observed in the Öresund region, whilst in Centrope such processes are still in their infancy.

Knowledge infrastructure: Both the Centrope region and the Öresund area are well endowed with knowledge generating organizations such as universities and research institutes and in both cross-border regions we find a critical number of R&D personnel and students. However, in the Öresund region transfrontier scientific collaboration and knowledge sharing are more "organized" and institutionalized (Öresund University) than it is the case in the Centrope area. However, we have to admit that we know relatively little about the degree of functional and cognitive proximity that might exist between the scientific bases of the sub-areas of our two case studies. It was beyond the scope of this paper to examine in detail scientific specialization patterns and potential complementarities in science and research in each cross-border area investigated here.

Nature of linkages: Neither the Centrope area nor the Öresund region could be considered as a fully integrated transfrontier RIS as both regions lack a sufficiently high degree of knowledge interactions to qualify for such a categorization. This should not mean that our two case studies are similar in terms of their relational dimension. The Öresund region is clearly many steps ahead when compared to the Centrope area. In the Öresund region we can observe a good level of knowledge sharing at least in a few fields (such as biotechnology) and furthermore there is little evidence for asymmetrical relationships reproducing economic and innovation inequalities. Examining the nature of linkages in Centrope, a different picture was found. We could observe that cross-border knowledge interactions are generally weakly developed yet and the evidence also suggests, that in this cross-border region the integration process is still relatively strongly oriented on exploiting cost and price differences, leading to rather asymmetrical economic linkages. There are strong reasons to assume, that these findings for Centrope and the Öresund region reflect differences between our two case studies in functional and cognitive distance.

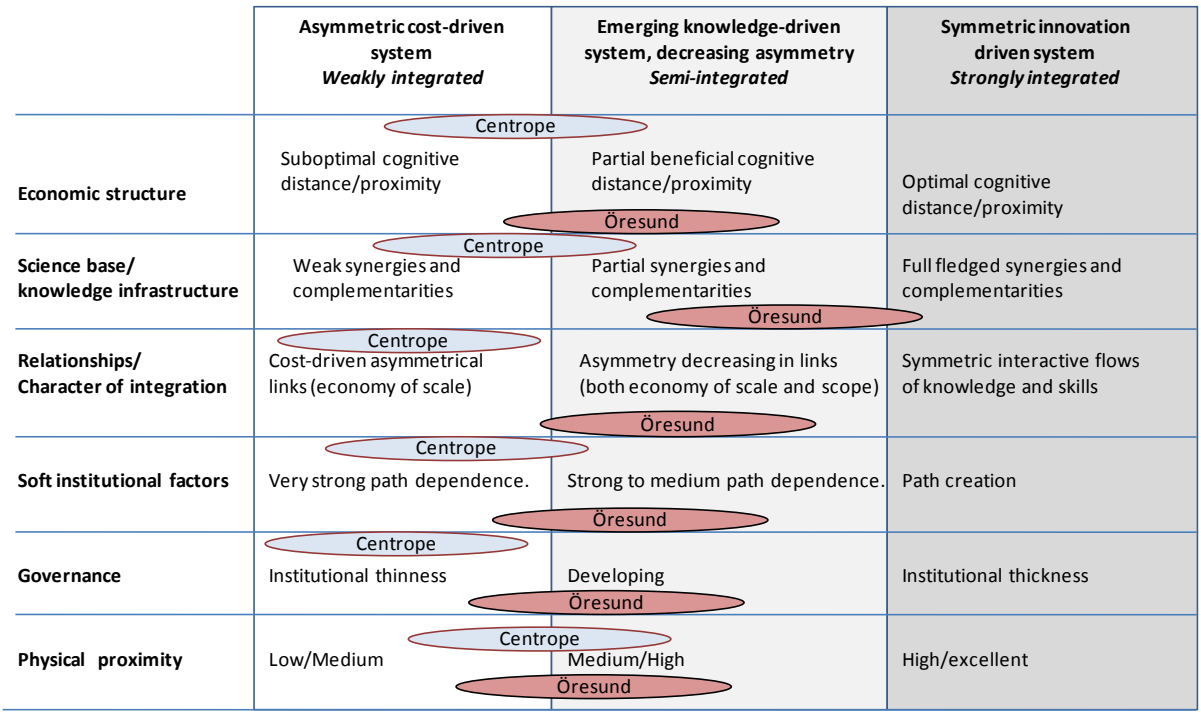
Governance and institutional settings: Compared to the Centrope area, the Öresund region has clearly many "institutional advantages", brought about more institutional thickness and an active promotion of enhancing institutional proximity. Both in Sweden and Denmark we find a more stable overall political-administrative context than it could be observed in Centrope. Particularly in the Eastern Centrope countries are still characterized by rather new and unstable administrative structures. Moreover, the Öresund region has a longer history of cross-border policy co-operation. Processes geared towards an institutionalization of governance structures at the cross-border level date back to the 1960s, whilst in Centrope only recently such attempts have been made. Then, and partly associated with the last point, regional actors in the Öresund region are more experienced and have more policy capabilities when it comes to foster integration processes and engage in cross-border policy actions, than it could be observed in Centrope. This becomes manifest in a set of working cross-border governance institutions in the Öresund region. Finally, public and private commitment and societal acceptance of building a cross-border region seem to be higher in the Öresund region than in the Centrope area.

Physical proximity: Finally, our two case studies differ also in terms of spatial proximity. Centrope is not only by far larger than the Öresund region. Due to considerable gaps which still exist with respect to transportation infrastructures it suffers from a rather high degree geographical distance. In the Öresund region, in contrast, the opening of the fixed link and other huge investments in public transport infrastructure, have led to an enormous reduction

of time distance between the Swedish and the Danish part. However, there are relatively high costs for crossing the border, which might act as a barrier to more intensive interaction in this area.

Figure 2 provides an overview on the results of our comparative analysis. Taking all the findings which have been discussed above together we might conclude that the Öresund region exhibits already a semi-integrated cross-border RIS and shows a good potential to move – at least in some dimensions – towards a strongly integrated one. Centrope, in contrast, seems to be better characterized as a system that is cost-driven and based on asymmetrical relations and only weakly integrated in terms of innovation and knowledge sharing so far.

Figure 2: Positioning the stages of cross-border RIS integration in Centrope and the Öresund region: Key components and main features



Source: Own compilation

However, we should bear in mind that this pattern might change in the near future. Current attempts to strengthen institutional thickness and cross-border governance in this area combined with the ongoing catching-up processes of the involved Eastern regions might move the system into a semi-integrated one in the next years.

4 Conclusions

As reported in a rather large body of literature and further underlined in this paper cross-border regionalization is a multi-faceted and complex phenomenon. Firstly, there is wide range of types of cross-border regions showing a considerable variation in basic geographical precondition in terms of scale, size and location causing primary restriction of what kind of integration is likely to occur and what types of benefits that are possible to reap from different integration processes. Secondly, cross-border regionalization is a complex evolutionary

process taken place in a "grey zone" between civil and public law in combination with the emergence of informal and formal networks between a wide spectrum of actors. The overall concern and interest of increased cross-border integration can be assumed to vary among the actors reflecting conflicting goals and asymmetry in power relations. Thirdly, these stakeholders are more or less strongly embedded in or have relations to other spatial scales, from the local community to the global level. This historically rooted embeddedness shapes routines and path dependence that will govern the actors' decisions in general but also their "cross border behavior". Fourthly, the driving forces for cross-border integration processes, e.g. the differences in economic structure, innovation capabilities and cost structure give rise to new complementarities and synergies, but often also generate the barriers that exist between the different parts of a cross-border region. Consequently, this tension and interplay between differences working as driving force on the one hand and as barriers on the other hand add further complexity to the understanding of cross-border integration processes. As argued in this paper, a crucial point of departure to understand cross-border integration in general and in particular when it comes to possibilities for the emergence of an integrated innovation space is to uncover the role of different types of proximity and distance and how they influence driving forces and barriers and determine what linkages are likely to be established.

There seems to be a widespread agreement in both academic and policy circles that in the rising globalized knowledge economy the long term competitive advantages of cross-border areas, like in most other regions, increasingly rests on their capacity to create an integrated innovation space. As a general statement this is a rather undisputed one. However, a crucial question rosen in this paper is how achievable this is for many cross-border settings as many of them are not characterized by the collective learning systems or the socio-cultural proximity that are assumed to be important prerequisites for successful localized innovation systems. In order to unleash this paradox, or as it appears at a first glance the clash between the regional innovation system approach and the understanding of cross-border integration processes, we suggest an evolutionary approach identifying crucial preconditions and key determinants for a stepwise rise of transfrontier innovation systems. In this paper we have conceptually underpinned the arguments of employing such an evolutionary approach consisting of three ideal stages of cross-border integration: "stage I weakly integrated", "stage II semi-integrated" and "stage III strongly integrated ".

Stage I is characterized by a low level of cross-border economic relations in general and a lack of knowledge interactions and innovation linkages in particular. The integration that exists shows a dominance of asymmetric cost-driven linkages mainly exploiting internal price and cost differences. The main reasons for this situation are lack of synergies (suboptimal cognitive distance/proximity) and/or unexploited synergies coming from too large differences in innovation ability, performance and receiver competence (too much functional distance) and other kind of soft and hard barriers (too much physical distance and institutional distance) that act as an impervious border.

In stage II we can observe what can be categorized as an emerging knowledge driven system. The asymmetrical cross-border links and flows are still important and the most dominant feature in the pattern of interaction. However, in addition to these links drawing on pure internal price-cost differences there are also windows of opportunities leading to economies of scope and increased cross-border learning processes in a few selective parts of the economy. These more interactive linkages occur in narrow segments of the science base and economic structure where good levels of cognitive and functional proximity could be found. Compared to stage I the physical accessibility is not a major obstacle for the interaction and

there are also processes leading to some institutional un-locking and a growing social acceptance, promoting interaction at the cross-border level.

Stage III is characterized by a considerable flow of knowledge, expertise and skills across the border. These knowledge interactions form a central underpinning of the innovation performance of the cross-border region reflecting the existence of substantial synergies for cross-border interaction and learning in both the business systems and the knowledge bases (high levels of functional proximity and optimal levels of cognitive distance). In contrast to stage II such synergies could be found in many economic and scientific sectors. In addition stage III exhibits an excellent transportation and communication infrastructure (high physical proximity) and many other kinds of borders and barriers have been dismantled rather successfully, allowing for the establishment of cross-border interactions (new institutional path creation and increased cultural proximity).

To summarize, the three steps are characterized by very different levels of physical, functional, cognitive and institutional proximity which in turn lead to very different possibilities for cross-border knowledge interactions to emerge. Cross-border regional innovation systems constitute the last and most advanced form of cross-border building based on the success of previous incremental but less advanced modes of integration. From a theoretical point of view this final stage could be referred to as the "utopia" of cross-border region building and probably it is very hard for most cross-border areas to ever meet in the real world.

The conceptual stepwise model has been applied empirically in a comparative analysis of two cross-border settings in Europe, the Öresund region, composed of Southern Sweden and Eastern Denmark often promoted as a role model for other cross-border projects in Europe, and the Centrope area, which is located at the intersection of Austria, Slovakia, Czech Republic and Hungary representing an important new type of cross-border areas consisting of old and new EU-member countries. As showed in the empirical part of the paper the Öresund region and the Centrope area represent two cross-border settings which are very different in nature in many respects. Centrope is not only much larger than the Öresund region (in terms of land area and inhabitants), but even more importantly, it is also characterized by a huge prosperity gap between its constituent parts. Disparities exist also within the Öresund region, but they are by far less pronounced than those found in the Centrope area. Furthermore, and highly relevant for our discussion of cross-border RIS integration, the two cases display very distinctive levels of internal functional distance. Within the Centrope area, the different sub-regions differ enormously in their innovation capacities, pointing to a rather high degree of functional distance in this cross-border area. In the Öresund region, in contrast, there seem to be higher levels of functional proximity, as the internal distribution of overall innovation capabilities appears to be more balanced.

Following from the analysis it can be clearly stated that neither the Centrope area nor the Öresund region could be considered as a fully integrated transfrontier RIS as both regions lack a sufficiently high degree of knowledge interactions to qualify for such a categorization. However, the Öresund region is clearly many steps ahead when compared to the Centrope area. In the Öresund region we can observe a good level of knowledge sharing at least in a few fields (such as biotechnology, life science, parts of the food industry) and furthermore there is little evidence for asymmetrical relationships reproducing economic and innovation inequalities. Examining the nature of linkages in Centrope, a different picture was found. We could observe that cross-border knowledge interactions are generally weakly developed yet and the evidence also suggests, that in this cross-border region the integration process is still

relatively strongly oriented on exploiting cost and price differences, leading to rather asymmetrical economic linkages. There are strong reasons to assume, that these findings for Centrope and the Öresund region reflect differences between our two case studies in functional and cognitive distance as well as differences in terms of institutional thickness.

Taking all the findings together, although in some dimension based on too crude and aggregated data to dismantle the level of cognitive and functional proximity in detail, we might conclude that the Öresund region exhibits already a semi-integrated cross-border RIS and shows some potential to move – at least in a few dimensions – towards a strongly integrated one. Centrope, in contrast, seems to be better characterized as a system that is cost-driven and based on asymmetrical relations and only weakly integrated in terms of innovation and knowledge sharing so far. However, specific parts of the region, i.e. the Vienna – Bratislava area show a relatively high degree of functional proximity and might therefore dwell better preconditions to develop interactive knowledge links than other parts of the Centrope area.

The suggested conceptual framework and the comparative empirical analysis of two very different cross-border settings may have contributed with some new insights on how the prospects for the emergence of cross-border RIS vary in time and space. However, many questions are still open and need further research. As this papers delivers some more broad and tentative indications on the relevance of the stage model, the theoretical implications must be subject to further empirical analysis. As acknowledged in the paper more detailed empirical research is needed to understand the importance of functional and cognitive proximity, not least to reveal in which areas of the economy good levels of relatedness could be found in different cross-border setting. One way to analyze this is to investigate the degree of skill-relatedness (Nefke and Svensson Henning 2009) among different industries by analyzing labor flows between key industries in a cross border area. Furthermore the policy implications of the stage model have not been explicitly discussed in this paper. Several questions could be raised in this context, for instance in what ways differ the roles of policy actor in different stages of RIS integration and how crucial is policy making for the transition from one stage to the next one.

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