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Abstract
This chapter provides a review and discussion of recent conceptual and empirical contributions on the nature and geography of firms' knowledge acquisition activities. We offer a systematic conceptual view on the pattern on knowledge sourcing, bringing into focus and combining the notions of industrial knowledge bases (sectoral contexts), which are supposed to vary considerably with respect to the transferability of their key knowledge types and regional innovation systems (regional contexts), which are supposed to differ substantially in terms of the availability of knowledge sources. The empirical part of the chapter draws on cases from Austria, Finland, Germany and Sweden and provides an analysis and comparison of knowledge sourcing activities in analytical, synthetic and symbolic industrial sectors in metropolitan, specialised industrial and peripheral regional contexts.

JEL codes: D83, O30, R10

Keywords: knowledge sourcing activities, industrial knowledge bases, regional innovation systems

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How do firms acquire knowledge in different sectoral and regional contexts?

1) Introduction

There is a widespread agreement in the literature that innovation processes are open and interactive in nature (Lundvall and Johnson 1994, Chesbrough 2003, Laursen and Salter 2006, Tödtling et al. 2013). Due to the highly specialised and dynamic character of the knowledge economy firms increasingly rely on various kinds and combinations of external knowledge (i.e., knowledge that is not available within their boundaries) to bring forward innovations (Giuliani 2011). Previous studies have shown that innovation processes and the type of knowledge needed differ strongly between industrial knowledge bases (Asheim and Gertler 2005), although such patterns have turned out to be more complex than initially proposed. Recent research suggests that in particular for more radical innovation a broad search for knowledge, combinations of knowledge bases and integration of knowledge from various spatial scales are beneficial (Asheim et al. 2011, Grillitsch et al. 2012, Laursen 2012, Maniche 2012, Strambach and Klement 2012, Grillitsch and Trippl 2014).

The ability of firms to acquire external knowledge depends on various conditions such as the transferability of the respective knowledge as well as its availability at the firm's location (Chaminade 2014). The transferability of knowledge differs between knowledge types such as tacit/codified, or synthetic/analytic/symbolic knowledge (Asheim et al. 2011). Knowledge that has a more tacit character or is dependent on social and cultural contexts such as symbolic knowledge is strongly tied to particular locations, whereas knowledge that is easy to codify and is less dependent on particular contexts is more mobile across geographical space. Different mechanisms can be used for transferring such knowledge types (Tödtling et al. 2006): market-based relations and formalised co-operations are more appropriate for transferring well defined and codified knowledge, whereas knowledge spill-overs and informal networks are adequate channels for transferring tacit knowledge.

Geographical proximity to potential knowledge sources and innovation partners enhances the local availability of knowledge in specific fields. Companies find it easier in some locations than in others to access in particular tacit and context-dependent knowledge and to interact with relevant actors. Regions with a high density and diversity of firms, knowledge organisations and support agencies offer more opportunities for sourcing and combining different kinds of knowledge than highly specialised industrial areas or peripheral "organisationally thin" regions (Tödtling and Trippl 2005, Isaksen and Trippl 2014a). There are also other proximities that matter for knowledge interaction such as cognitive, social and institutional proximities (Boschma 2005, Breschi 2011). To some extent these other proximity types overlap with geographical proximity, but they can also be independent

from it as the growing importance of global innovation networks and professional or virtual communities demonstrates. Proximities may also change over time as an outcome of knowledge linkages (Balland et al. 2014).

In advanced knowledge economies companies do only partly rely on local knowledge sources. Often they acquire knowledge through various mechanisms also from national, international and global scales (Powell and Grodal 2005, Maskell et al. 2006, Bathelt 2011, Giuliani 2011, Chaminade 2014). This implies that knowledge sourcing is a multi-scalar process that enables companies to cope with locational disadvantages. Reaching out to new knowledge sources is often needed in particular for more radical innovations that benefit from the combination of various knowledge bases and integration of knowledge from different spatial contexts (Tödtling et al. 2009, Strambach and Klement 2012, Grillitsch and Trippl 2014, Tödtling and Grillitsch 2014).

The aim of this chapter is to review and synthesize recent conceptual and empirical contributions on the nature and geography of knowledge sourcing activities. It is argued that two essential factors, i.e., the transferability and availability of knowledge (see also Chaminade 2014) have a strong explanatory power in this regard. We provide a systematic view on pattern of knowledge sourcing by focusing on industrial knowledge bases (sectoral contexts), which differ enormously with respect to the transferability of their key knowledge types and regional innovation systems (regional contexts), which vary substantially in terms of knowledge availability. The remainder of this chapter is organized as follows. Section 2 presents a conceptual frame that seeks to explain the geography of knowledge sourcing activities in different sectoral and regional contexts. Section 3 reviews some empirical evidence on these patterns for a variety of industries and regions. This is followed by a discussion and comparison of the empirical cases in Section 4. Finally, Section 5 concludes.

2) Conceptual framework

The industrial knowledge base approach highlights that innovation processes as well as knowledge sources vary strongly between sectors (Asheim and Gertler 2005, Asheim et al. 2011, Martin 2013). This approach distinguishes between analytic, synthetic and symbolic knowledge bases. It is argued that these three types of knowledge bases contain different mixes of tacit and codified knowledge, which has implications for the transferability of the critical knowledge input on which innovation activities are based (Asheim et al. 2011). Codified knowledge is much easier to transfer, whereas tacit knowledge is often tied to geographical, cultural and social contexts. Sectors are regarded as being dominated by a particular knowledge base, although we often find mixes of them (such as in ICT, automotive and new media; Halkier et al. 2010). Recent research suggests that combinations of knowledge bases are most conducive to innovation. In particular more radical innovations (Tödtling et al. 2009, Strambach and Klement 2012) and the creation of new industry paths (Asheim et al. 2011, Isaksen and Trippl 2014a) often rely on the integration of knowledge from different spheres such as business, science and arts, and on knowledge from different geographical contexts (Bathelt 2011, Tödtling and Trippl 2012).

As regards the role of regional contexts for knowledge sourcing and innovation processes, several competing approaches can be found. Some scholars argue that the idea of a continuous geographical space (instead of fixed territories or spatial scales) should be applied in analyses of knowledge links and networks (Bunnel and Coe 2001, Bathelt 2011). However, based on the

argument that institutional settings and policy competencies can have a strong impact on innovation, we consider regional (and national) innovation systems as useful concepts for our analysis (Doloreux 2002, Cooke et al. 2000, 2004). This can be justified on the ground that innovations in firms and clusters can benefit from a strong availability of knowledge in the region, brought about by a critical mass and diversity of firms, universities, research centres and various types of supporting organizations. In addition to the degree of organisational thickness of places, institutional preconditions (or institutional thickness, Zukauskaite et al. 2014) like favourable regulatory settings, values, habits and routines also matter for innovation. Departing from these insights and based on earlier work, we distinguish between three types of regions to examine the role of regional contexts for knowledge sourcing: diversified metropolitan areas, specialised industrial regions and peripheral, organisationally "thin" areas (Tödtling and Trippl 2005, Isaksen and Trippl 2014a).

Combining the two dimensions, i.e., the transferability of knowledge (sectoral contexts) captured by the knowledge base approach and the availability of knowledge (regional contexts) captured by the innovation system approach, enables us to identify more and less favourable settings for sourcing specific types of knowledge (Figure 1). Metropolitan regions offer the best preconditions for accessing symbolic as well as analytical knowledge. Symbolic knowledge is most dependent on local contexts due to its highly tacit nature and its reliance on social and cultural patterns (Power and Scott 2011, Martin 2013). Metropolitan areas are often among the creative and cultural hotspots and they attract creative people in various fields (Florida 2005). They also offer good conditions for accessing analytical knowledge since they are usually well endowed with excellent universities and research organisations. Although analytical knowledge is to a large extent highly codified in nature, it still depends on tacit capabilities to access and use it. Face to face-interaction can be important in certain phases of R&D projects. In addition, metropolitan regions have usually a well-developed transportation and ICT-infrastructure, allowing for an easy access of knowledge and interaction with innovation partners at higher spatial scales.

Specialised industrial regions offer good preconditions for accessing synthetic knowledge that is often tied to specific local industries such steel, engineering, automotive, machinery, and materials. Synthetic knowledge has partly a tacit character in the form of experiences of workers and firms, and partly a codified one when it is embodied in machinery, software and licenses. Synthetic knowledge is frequently exchanged with customers and suppliers that are to some extent located in the region but also at higher spatial scales (Tödtling et al. 2006). Such knowledge from the value chain is important but it may lead to incremental innovation only (Tödtling et al. 2009) and support existing technology and industrial paths (Trippl and Tödtling 2008, Isaksen and Trippl 2014a). Industrial regions may host organisations providing specialised analytical knowledge (like universities, colleges or research organisations with a strong orientation on the region's industrial structure). For symbolic knowledge the preconditions are rather unfavourable. This type of knowledge is tied to creative people who are often not attracted to specialised industrial areas. Also, the traditional industries are usually not much engaged in symbolic knowledge base activities, leading to a limited potential for interactions for new creative firms that settle down in such areas. However, there is also evidence that this type of region can undergo major restructuring and diversification process (as it has been observed in some former "old" industrial regions; Trippl and Tödtling 2008, Trippl and Otto 2009), leading to better conditions for the emergence and growth of symbolic industries.

Peripheral and organisationally "thin" regions have some possibilities to source synthetic knowledge through their value-chain relationships to customers and suppliers outside the region. However, they

require also internal capabilities for absorbing such external knowledge as Grillitsch and Nilsson (2014) have shown in a study for European regions. In terms of analytical knowledge they face worse conditions since there are usually rather few universities and research organisations within the region. Only few examples of peripheral regions that host analytical sectors with intense regional knowledge flows do exist (Isaksen and Trippl 2014b). Companies, therefore, are forced to source analytical knowledge at higher spatial scales. This may happen inside the organisational context of multi-locational firms or through R&D and innovation co-operations with external research organisations and firms. As regards symbolic knowledge, peripheral regions face even more difficulties since this type of knowledge is usually concentrated in larger cities (Lazzeretti et al. 2008, Lorenzen and Frederiksen 2008, Power and Scott 2011) and characterised by a limited transferability due to its tacit and context-dependent nature. Ways to do it would be through recruitment of qualified personnel, cooperation, or taking part in project-based networks or communities.

Figure 1: Sectoral and regional contexts for knowledge sourcing

	Types of knowledge and their spatial character		
	Analytical knowledge: local-global	Synthetic knowledge: multi-scale	Symbolic knowledge: local
Metropolitan regions	**++**	**+**	**++**
Specialised industralised regions	**0**	**+**	**-**
Institutional "thin" regions	**--**	**0**	**--**

Contexts for knowledge sourcing: ++ excellent + good 0 neutral - unfavourable -- very unfavourable

3) Empirical findings

In this section we draw on cases from Austria, Finland, Germany and Sweden to examine the pattern knowledge sourcing in different sectoral and regional contexts. These countries are comparable in terms of their institutional and policy models (Hall and Soskice 2001). The cases presented below were originally analysed within the European "Constructing Regional Advantage Project" (CRA) (Asheim et al. 2011, Tödtling et al. 2013). We use them as empirical basis since they have applied a similar frame for investigating knowledge sourcing activities. These cases are complemented by other relevant literature. The questions to be addressed in this section are: Which knowledge sources at what spatial scales matter for innovation? Which kinds of mechanisms (or channels) are used to acquire knowledge? To what extent and in which ways are firms engaged in integrating different types of knowledge bases?

Knowledge sourcing in analytical sectors: biotechnology in Vienna and Aachen

Studies focussing on the analytical knowledge base often refer to biotechnology, nanotechnology, new materials, or parts or ICT. Although there are many regional case studies on life sciences and

biotechnology, only a few of them have examined knowledge sourcing activities in a systematic way (Gertler and Levitte 2005, Trippl and Tödtling 2007, Moodysson et al. 2008). Studies that have used a comparable frame have been carried out for the metropolitan region of Vienna (Tödtling and Trippl 2010), Prague (Blazek et al. 2011), and the formerly industrialised region of Aachen in Germany (Hassink and Plum 2011).

The metropolitan region of Vienna has both strengths as well as weaknesses for developing a biotechnology cluster. The city forms the core scientific centre in Austria and is well endowed with universities and research organizations in various medical fields. However the Austrian as well as the Viennese innovation systems lack funding and venture capital when compared to leading biotech regions and countries. Vienna is therefore a latecomer in this industry and the cluster is not yet strongly developed (Trippl and Tödtling 2007). The arrival of international firms such as Böhringer-Ingelheim and Baxter a few decades ago has strengthened the local knowledge base. Spin-offs and start-ups grew since the 1990s, partly supported by specific policies. Since Vienna is the dominant location for biotech in Austria with about 70% of sector employment, the observed knowledge relationships have a clear local-global pattern. At the regional level companies interact with research organisations from academia in both formal and informal ways (Tödtling and Trippl 2010). Knowledge links to local firms specialized in the provision of testing services and instruments (synthetic knowledge) also matter. At the same time formal R&D cooperations with international research centres and firms are eminently important for them. Biotech firms in Vienna, thus, combine analytical and synthetic knowledge sourced from both the local and global level.

Most biotechnology clusters can be found in metropolitan areas with a strong analytical knowledge base. Only a few of these clusters are located in less favourable regional contexts. The emerging biotechnology sector in Aachen, a former “old” industrialised region in North-Rhine Westphalia (NRW) in Germany is a good example in this regard. The rise of this sector can be traced back to the mid 1990s, when the “Aachen Technology Region” was among the winners of Germany’s Bioregio contest. National funding in the context of this initiative proved to be essential for strengthening the knowledge infrastructure and other preconditions for biotechnology. Hassink and Plum (2011) have shown that non-local knowledge sources play a major role for Aachen’s biotech firms. This reflects the rather unfavourable regional context and limited availability of knowledge within the region. Companies frequently engage in R&D cooperations with German or international universities and research organisations, underlining the analytical knowledge involved. In addition they rely on various forms of international knowledge spillovers. The structure of relationships reveals that ”interactive learning among biotechnology firms within the region is, so far, very rare … Firms that might keep the potential function as gatekeepers typically do not diffuse relevant … knowledge through the investigated cluster” (Hassink and Plum, 2011, p.1153f).

A comparison of the geography of knowledge sourcing activities in the Viennese biotech cluster and its counterpart in Aachen uncovers the importance of regional contexts and differences in the local availability of knowledge. Both clusters are globally connected to international research organisations and firms. In the metropolitan Vienna region, however, we also find an intensive knowledge exchange at the local level, whilst in Aachen such processes are almost absent due to the limited availability of knowledge sources within the region.

Knowledge sourcing in synthetic sectors: ICT and machinery in Austrian and Finnish regions

From the many sectors based on synthetic knowledge, we have selected the ICT sector that cuts across several knowledge bases and combines analytical, synthetic and symbolic knowledge (Halkier et al. 2010). However, most often innovations are based on synthetic knowledge in this sector. The Austrian regions included in our review represent three different types of RIS: a metropolitan RIS (Vienna), a specialised industrial RIS (Upper Austria) and an organisationally "thin" RIS (Salzburg). In the ICT and software sector in the metropolitan region of Vienna we find both hardware and software firms that differ in their knowledge bases, patterns of innovation and knowledge sourcing. Hardware firms are larger, have more R&D and they introduce more frequently "products new for the market" (Tödtling et al. 2011). As a consequence they also rely more often on knowledge drawn from universities and research organisations within the region and beyond. Software firms are mostly small, innovate without R&D and adapt existing technologies to the local market (Trippl et al. 2009). Customers, suppliers and competitors are thus most relevant as knowledge sources for software firms. Relations to these sources are informal and formal and they can be found both at the regional and global levels. For the whole ICT sector strong knowledge links to local and Austrian universities also prove to be important. Local universities, for instance, play a key role as providers of highly skilled graduates and as cooperation partner in R&D projects. Overall, Viennese ICT firms benefit in their knowledge sourcing activities from a strong availability of analytical knowledge, which is typical for metropolitan regions.

The ICT sector in Upper Austria, an industrial region, cannot rely on such a strong R&D base and firm density as its counterpart in Vienna (Tödtling et al. 2012). Upper Austria is specialised in steel, materials, engineering, vehicles and environmental technologies. It has, however, a relatively well-networked regional innovation system that includes a few universities and technical colleges, a large software park, several technology centres and some R&D intensive firms. The region´s ICT companies are more often in the software sector, and they generate mainly incremental innovations. Due to the networked character of the RIS, we find high levels of regional collaboration with universities and technical colleges. In addition, suppliers of hardware and software components located outside the region are important knowledge sources. ICT firms in Upper Austria, thus, benefit from a well-networked RIS and from knowledge sourcing activities at higher spatial scales.

The ICT sector in the organisationally thin RIS of Salzburg faces more disadvantages. The regional context is rather unfavourable. Universities located in the region are few and small, firm density is low and the labour market is small. Firms are on average smaller, less R&D intensive, and also less innovative than the firms in Vienna or Upper Austria. Key knowledge sources are customers, suppliers and competitors at national or international levels, regional and Austrian universities, and regional technology centres. Formal relationships such as R&D contracts and buying of technologies tend to prevail. Consequently, innovative firms compensate locational disadvantages and the weak availability of knowledge in the region by sourcing knowledge along the value chain and from partners outside the region.

For the synthetic knowledge base we can furthermore draw on the Finnish cases of intelligent machinery in the industrial region of Tampere and the agro-technology sector in the peripheral and organisationally "thin" region of South Ostrobothnia (Sotarauta et al. 2011). The heavy machinery cluster is located in Tampere**,** a medium sized town with a long industrial tradition. The machinery industry there has faced difficulties in the past but was able to restructure partly through enhanced

innovation capabilities and through intensive cooperation with knowledge-producing organizations such as the Tampere University of Technology and the VTT Technical Research Centre of Finland. There are now some world leading intelligent machinery companies in the region and Tampere is also a major location for machinery research. “The competitiveness of the cluster is based on adding “intelligence” to traditional machines ….” (p.1312). As regards knowledge relationships the study shows that the national level is the most important space for sourcing both market and technology related knowledge, followed by the international and the regional levels. For both kinds of knowledge, customers are the most relevant knowledge sources. Furthermore, local and national universities are important providers of technological knowledge.

The agro-technical sector of South Ostrobothnia, in contrast, is situated in a rural and organisational “thin” region”, characterised by a strong agricultural tradition, a relatively low per capita income and outmigration due to a lack of educational facilities. Only a polytechnical school and branches from external universities are present. Consequently, the level of R&D in the region is low. The region is specialised in the food industry, but there is also the agro-technical sector that combines competencies in machinery and ICT for uses in agriculture, forestry and the food industry. Most of the firms are small but there are also some larger branches of Finnish firms. Due to the “thin” RIS, fairs are an important channel for acquiring market and technological knowledge. Furthermore, companies draw innovation-relevant knowledge from national customers, suppliers and universities and from international competitors. Due to the weakness of the region and the strengths of the Finnish innovation system in both machinery and IT, sourcing of knowledge from partners located in other parts of Finland clearly dominate. The two Finnish case studies thus point to strong regional differences in the pattern of knowledge acquisition, reflecting the qualities of the respective RIS and diverging degrees of knowledge availability within the region.

Knowledge sourcing in symbolic sectors: new media in Vienna, Helsinki and Malmö

The new media sector in Vienna emerged in the mid 1990s at the interface of existing creative industries (Trippl et al. 2013) and the software/IT sector (Trippl et al. 2009). It relies not just on symbolic but also on synthetic (IT) knowledge. The cluster is populated by many small and micro-firms as well as freelancers that frequently cooperate in project-based temporary networks (Sinozic et al. 2014). The mobility of creative and qualified labour is one of the most important knowledge carriers in the Viennese new media cluster. Companies recruit both from the region and from the rest of Austria, and more recently also internationally. Being an attractive city for living, Vienna is able to attract talent from abroad. Relations to other cluster firms as well as more diverse networks within Vienna and Austria also matter for innovation. More recently these knowledge links have been extended to the international scale, due to relations with foreign clients and suppliers, and the use of internet based platforms and communities.

The Helsinki metropolitan area plays a dominating role in the Finnish innovation system since it is the hub of knowledge organisations, R&D centres, universities and schools. Its digital content industry cuts across three different branches, i.e., ICT, creative industries and business services, and it covers ”all production and design of products and services, that are in digital form” (Sotarauta et al. 2011, p.1311). There are numerous very small companies operating in this sector. They innovate mostly in the form of incremental service innovations, relying on a complex pattern of knowledge sourcing

activities. Recruitment of highly skilled experts at the local level (universities) and the national level (firms in the same sector) plays a key role. Furthermore, market knowledge sourced from local customers and competitors is essential. Technological knowledge is acquired from customers, other firms operating in the same sector, and suppliers at local and international levels. Customers are used for testing new services and products in different user communities. Relevant "digital knowledge" is drawn from the internet via virtual communities, websites and social media.

The core of the Southern Swedish moving media industry can be found in Malmö, a former industrialised city specialised in traditional sectors such as shipbuilding in the past. Malmö has undergone a major restructuring process towards new industries. New media is one of the prime examples in this regard. The rise of the sector was supported by the establishment of a new university college with a focus on fields related to media and design. It has provided the necessary skills and qualifications for the emergence of new media. Policy initiatives promoting start-ups and regional networking also contributed in essential ways to the sector's development (Martin and Moodysson 2011, Martin et al. 2014). Overall, the regional context for symbolic industries such as new media has been improved substantially. The mostly young and small companies source knowledge mainly through monitoring of markets, technologies and competitors, recruitment of highly skilled labour, and cooperation. Non-local knowledge is accessed by participating in fairs and internet searches. Highly skilled labour is mostly drawn from the same industry, with the region being most important besides national and international sources. Cooperations with suppliers and customers are also essential mechanisms for acquiring knowledge. More than half of all cooperations were within the wider Scania region, reflecting the context-dependent character of the new media sector. The case demonstrates that new symbolic industries can develop in a region with originally adverse preconditions and weak knowledge bases, if a policy-supported transformation of the regional context takes place.

4) Discussion and comparison of cases

The two biotechnology cases of Vienna (Austria) and Aachen (Germany) showed that companies due to the predominantly analytical knowledge base rely strongly on universities and research organisations as knowledge sources. However, they also use sources of synthetic knowledge such as hospitals, specialised services, suppliers and customers for testing, (re-)designing, or commercialising new discoveries and inventions. Knowledge combination, thus, is relevant in both cases. The spatial pattern of knowledge sources, however, differs between Vienna and Aachen. In Vienna the regional level plays a more important role, reflecting the much larger size of the Viennese biotech sector and a better knowledge availability within the city region. As a consequence we find for Vienna a local-global pattern of knowledge sourcing and in Aachen a strong reliance on knowledge drawn from the larger province of North-Rhine Westphalia and the rest of Germany.

For the ICT sector in Vienna, Upper Austria and Salzburg combinations of knowledge bases also matter. In all three regions there is a strong synthetic component in particular in the software subsector. In Vienna analytic knowledge seems to play a larger role and as a consequence universities and research organisations within the region (reflecting high levels of knowledge availability) and beyond are among the key knowledge sources. Salzburg`s ICT companies are located

in a rather weak RIS, leading to a strong external orientation of firms in the innovation process. They draw knowledge mainly from suppliers and customers at international and national scales and they rely to a larger extent on contract-based relations. The two Finnish machinery clusters located in the old but transformed region of Tampere and the "thin" and rural region of Southern Ostrobothnia complement our findings on the synthetic knowledge base. Due to the fact that Tampere´s RIS has competencies in both machinery and ICT, the heavy machinery industry had good preconditions to add "intelligence" (e.g. information technology based control systems) to the mechanical systems. Consequently we find many links to local universities and research organisations besides national ones. The agro-technology companies in the "thin" RIS of South Ostrobothnia have gone the same route of combining mechanical- and IT knowledge for new products mainly for the Finnish market. However, they face more challenges in this regard. As a consequence, and similar to the ICT firms in Salzburg, they use other sources and channels for acquiring market and technological knowledge, such as fairs, Finnish and international customers and suppliers, and competitors.

New media as a prime example for a symbolic sector is more dependent on knowledge from specific cultural and social contexts and shows a strong embeddedness in the region. Since new media is at the interface between creative industries and IT, knowledge combinations are eminently important. In all three investigated cases, companies rely on recruitment of qualified personnel, cooperations and knowledge spillovers as mechanisms for knowledge acquisition. Companies in the metropolitan regions of Vienna and Helsinki rely both on the regional and national labour markets for recruiting highly skilled people. Malmö as a former industrial region was expected to have a disadvantage in this regard. However, firms benefit from the establishment of a new university and are also able to draw talent from the wider Scania region. The region is also an important space for other types of knowledge sourcing in the Malmö case. For Vienna we find a shift from regional and national to multi-scalar networks, and in Helsinki a local-global pattern that is strongly supported and driven by the use of internet and virtual communities and platforms.

5) Conclusions

Sectoral and regional contexts matter strongly for knowledge sourcing and innovation. Companies require different kinds of knowledge depending on their predominant knowledge base and they face different challenges to source and acquire such knowledge depending on their location. Also, the potential to get access to and combine different knowledge bases varies between metropolitan, specialised industrial and organisationally "thin" contexts. One might thus expect a lack of radical innovation and diversification in specialised industrial and in peripheral regions (see also Isaksen and Trippl 2014a). The empirical cases discussed in this chapter, however, showed that there are possibilities to change the fate of less favourable regions. Policy actors, for instance, seem to have certain possibilities to support the emergence of new development paths as the cases of Upper Austria, Tampere and Malmö have shown. Also firms have possibilities to overcome adverse settings, by engaging in knowledge exchange with external firms and organisations (see the cases of ICT in Salzburg and agro-technology in South-Ostrobothnia). This requires, however, certain in-house capabilities of R&D and innovation in order to identify and acquire external knowledge.

The cases discussed in this chapter also suggest that good policy and governance may help to change unfavourable conditions for innovation and may support the rise of new sectors. In the case of

biotechnology in Aachen we could observe that the national policy initiative 'Bioregio' had such an effect. The emergence of new industrial activities could also be observed for Malmö (moving media) and Tampere (IT and intelligent machinery). Specific policy actions have changed the conditions for knowledge sourcing and innovation in these regions. The knowledge bases were broadened and diversified and new industries were able to develop. But this development has changed also the potential for existing industries to source new knowledge and to combine knowledge bases. The evidence shows that sectors based on synthetic knowledge can benefit from both an expansion of analytical knowledge (new research organisations and firms) as well as from symbolic knowledge (e.g. in fields of design, marketing, advertising etc.). Similarly, symbolic sectors such as creative industries and New Media benefit from a strength in the ICT sector. Finally, in line with recent work (Isaksen and Trippl 2014a,b) our findings suggest that specialised and organisationally thin regions are more reliant on policy support for combining knowledge bases than diversified metropolitan areas.

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