

Working Papers Firms and Region
No. R1/2013



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Occurrence of cluster structures in
knowledge-intensive services

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Karlsruhe 2013

ISSN 1438-9843

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1 Introduction

Knowledge-intensive industries¹ in both manufacturing and the service sector have developed much better with regard to value added and employment over the last 20 years than non-knowledge-intensive industries. While employment figures in the knowledge-intensive industries of the manufacturing sector have tended to stagnate, the number of employees in knowledge-intensive services has grown (Gehrke et al. 2009). In 2008, almost one third of the employees were working in these economic areas. Some of this growth can be explained by outsourcing its service activities (Hüther/Eekhoff 2007). Nevertheless, knowledge-intensive services are regarded as an increasingly important driver of economic growth in Germany and Europe (European Commission 2007).

Another trend can also be observed: there has been an increase in the significance of clusters over the last years in regional economic studies and regional economic policy. Based on the assumption that the spatial concentration of actors working together in value added processes (companies, research institutions, associations etc.) has a positive effect on the innovative activities and economic development of individual companies and thus on the region as a whole, the attempt is being made to promote the formation of clusters and network structures.

Combining these two trends – tertiarisation on the one hand and the significance of cluster structures on the other – gives rise to the question to what extent knowledge-based service clusters have developed. In particular, it has to be clarified whether the agglomeration of knowledge-oriented service companies is based more strongly on the existence of urbanisation or localisation effects. While the former can be traced back to the concentration of companies from different industries, localisation advantages are sector-specific. Hüther and Eekhoff (2007: 40) note: "At the centre of a cluster, there are typically manufacturing companies which function as a kind of hub and at which industrial suppliers, industry-affiliated service providers and academic institutions direct their services"². This would mean that concentrations of knowledge-intensive service companies cannot be explained by localisation advantages, i. e. this would not involve regional clusters in the narrower sense.

The following research questions should be answered to examine this issue in more detail:

1 Definition based on NIW/ISI lists 2006

2 own translation

- In which knowledge-intensive service industries has spatial concentration been shown to have taken place?
- In which regions are these concentrations found?
- To what extent have clusters of knowledge-based services developed there?
- On which type of agglomeration advantage is the spatial clustering of knowledge-intensive services based?

Based on the insights into clusters as well as knowledge-intensive services (Chapter 2), this article tackles the first two research questions in Chapter 2. This is done using an analysis of employment data so that search areas for cluster structures can be identified. Showing the existence of clusters, however, can only be done via the case-based analysis of networking structures and competitive environments. This is why the question of whether localisation or urbanisation advantages exist is tackled in Chapter 3 by analysing case studies. Because clusters are of interest to regional economic policies, the question of policy implications then has to be answered.

2 Theoretical background: Clusters and knowledge-intensive services

The following sections look at the reasons why the spatial concentration of companies is advantageous. Spatial proximity continues to be relevant in spite of the increasing networking of economic activities worldwide. One explanation is the specifics of knowledge generation and exchange. Attempts to explain this dealing with the advantages of spatial clustering in the innovation process are summarised in the knowledge-based cluster theory. Addressing the origins of clusters is another aspect in this context. This is followed by a theoretical description of knowledge-intensive services.

The advantages of clusters and agglomerations

The concentration of companies generates external effects (agglomeration effects). External agglomeration advantages are subdivided by their origin (localisation vs. urbanisation savings, cf. Richardson 1995; Schätzl 2003: 34f.) and their impact (static vs. dynamic). Specialisation advantages, i.e. localisation advantages are the focal point of cluster theory (Feser 1998: 30).

Urbanisation advantages are caused by the agglomeration of companies which are active in different economic industries: the greater the spatial concentration of firms from different industries, the easier it is to find suppliers for different kinds of products and services which are in demand by many companies (Jacobs 1969). **Localisation**

advantages in contrast are activity-specific (Parr 2002: 719). The localisation advantages described by Marshall (1890) are the following (Bathelt/Glückler 2002: 77; Malmberg/Maskell 2002: 432f.; Sternberg 2001: 163):

- **Specific supplier and distribution networks:** these make it possible to get hold of even specialised products externally or to outsource activities.
- **Labour pool:** specialised workers make an essential contribution to the competitiveness of companies. This means there is an incentive for companies to settle where a specialised labour market can be found. Empirical studies show that highly qualified employees are more concentrated in spatial terms than those with lower qualifications (Fritsch/Stützer 2006; Roos 2002: 42).
- **Knowledge spillover (and flow of knowledge and information):** Marshall (1898: 178) describes knowledge spillover as knowledge about products and production processes which is available in clusters "as it were in the air". Today, however, this frequently requires the direct participation of actors in research and development processes to enable the exchange of knowledge. Actors therefore already have to have access to very specialised knowledge beforehand so that an effective exchange is possible.

Static agglomeration advantages are effects caused by more favourable market conditions, for example shorter delivery times even for specific products. **Dynamic agglomeration advantages** like knowledge spillovers have a long-term effect. These involve learning processes which stimulate innovative activities. They are at the forefront of knowledge-based cluster theory (Revilla Diez 2004: 69).

Knowledge-based cluster theory

Today's competitive environment means that it is more important than ever before to be able to introduce a constant stream of innovations onto the market. Not only product innovations are important, but also innovations in design, marketing and sales as well as in production processes and in the organisation itself. The resources relevant for the innovation process are mainly of an intangible and informal nature. This means knowledge and continuous learning processes have become more important. The cluster concept is therefore a reflection of the general paradigm shift taking place from an industrial to a knowledge economy (see Martin/Sunley 2003).

Knowledge is distinguished into explicit or codified and implicit knowledge (*tacit knowledge*) (Polanyi 1967). Howells (2002: 872f.) points out that these forms are often misinterpreted as a dichotomy. Instead, their relationship is more like a continuum because *tacit knowledge* is a prerequisite for interpreting explicit knowledge (Howells 2002: 872f.) or, in other words, they are complementary (Kiese 2004: 6). Because explicit knowledge of markets is more or less globally accessible, being able to tap into and

use implicit knowledge gives companies the chance to generate innovations and thus achieve competitive advantages (monopoly rents). The resulting dynamic external effects also explain why the geographical proximity of companies is still so important in spite of the diverse innovations in communication and information technologies (Rallet/Torre 1999: 374; Storper/Venables 2004: 2).

Networks make it easier to exchange implicit knowledge and help to kick-start learning processes (Koschatzky 2001a; Schamp 2000). Networks are one component of functioning clusters (Rosenfeld 1997). However, companies in clusters are also driven by competition (Porter 1998). Based on his work, Glaeser et al. (1992) talk about **Porter externalities** and define these as being different to **Marshall-Arrow-Romer externalities** as well as **Jacobs externalities**. Marshall-Arrow-Romer externalities are caused by the internalisation of local monopolies like workforce mobility. These dynamic localisation advantages are contrasted with Jacobs externalities. Referring to Jacobs (1969), the diversity of knowledge from different industries (i.e. urbanisation advantages) is seen here as the source of knowledge spillovers. "The variety of industries within an urban region can be a powerful engine of growth for that region, and the exchange of complementary knowledge across diverse firm and economic agents leads to increasing returns to new economic knowledge" (Karlsson/Manduchi 2001: 108).

So far, the relevance of externalities has been evaluated differently in empirical studies: in their study of US-American cities, Glaeser et al. (1992) conclude that above all Jacobs externalities were responsible for economic growth. Feldman and Audretsch (1999) derive similar results. As a consequence of this, regional specialisation and thus cluster formation should not be supported. Paci and Usai (1999) do not assume a contradictory relation between urban and localisation advantages, because it is possible to have different combinations of sectoral specialisation on the one hand with regional diversification on the other. In a study of Italy, they found the importance of both externalities to be substantiated. *Jacobs externalities* were identified predominantly in high-tech industries in metropolitan regions.

The previous statements about dynamic effects within the framework of the cluster concept highlighted the role of implicit types of knowledge. Summarising these statements, it appears that these types of knowledge are exchanged by four mechanisms in clusters and that learning processes are initiated as a result (*localised learning*):

- Informal contacts: knowledge is exchanged in the wide variety of informal contacts between clusters (Dahl/Pedersen 2004). This exchange is made possible due to the cluster actors being embedded in the environment (Camagni 1991) and contributes to knowledge spillovers.

- Workforce mobility: changing employer promotes the exchange of knowledge and is another source of knowledge spillover (Dahl 2002).
- Competition: according to Porter, knowledge spillovers are generated by the competition between spatially concentrated companies. Companies are constantly comparing their competitive position mainly with rivals located nearby. As a result they are well informed about their innovative activities. This acts as a spur for their own innovative activities and is the reason why companies in a cluster are more innovative than more widely dispersed companies (Porter 1998). The positive effects of competition have been shown empirically in Silicon Valley (Castells/Hall 1994: 22).
- Knowledge is generated by cluster actors cooperating with each other (Maskell 2001). Different forms of cooperation, e.g. innovative networks, favour the transfer of knowledge and therefore play a key role in the innovation process (Koschatzky 2001b). Besides companies and research institutions working together, customer and supplier relations are also important (*buyer-supplier* or *user-producer linkages*) (Lundvall 1988) to enable learning processes which bring innovations in their wake.

It is important not to overestimate the importance of the spatial proximity of cluster actors. "Neither the argument of localized processes of interactive learning nor the existence of localized capabilities does in any way presuppose that most interaction should be local, that it is better with more local than global interaction, or that the most important capabilities are geared toward local interaction" (Boschma 2005; Malmberg/Maskell 2006: 9).

Formation of clusters

The factors referred to for the formation of clusters should be differentiated from growth and development factors (Moßig 2002). To start with, a critical mass of actors has to be reached or exceeded before self-reinforcing effects kick in.

As the basis for the emergence of clusters, Brenner (2004: 63) emphasises the role of universities and research institutions and natural conditions such as geography or natural resources. Depending on the sector involved, these factors differ in their relevance. However, clusters cannot be formed in regions without these kinds of organisations or features (ibid. 194). Brenner names diverse factors which determine the attractiveness of a region and thus influence the emergence of clusters. These include: cultural factors, which influence the willingness for innovative and entrepreneurial activities, political conditions and the public policy framework, the geographical location, how urban a region is, the existence and excellence of universities and research institutions as well as already ongoing activities in related industries (ibid. 194). Sometimes, however, all these factors can be present without clusters being formed or clusters can be formed in regions which seem unattractive based on the factors cited. Brenner goes on to say

that cluster formation cannot be predicted, but that the following initiating factors can be identified retrospectively:

- Promoters (individual actors) and focal organisations (mainly companies)
- Start-up activities
- Policy measures
- Occurrence of groundbreaking innovations
- Specific historical events.

As the analytical results in Chapter 4 show, the cluster structures investigated differ noticeably with regard to the significance of individual factors.

Knowledge-intensive services

The contribution that services make to innovation was largely ignored for a long time. A shift has only taken place over the past 20 years (Hipp 2000; Muller/Doloreux 2007). The perception of services has altered during this period: starting from the assumption that service companies only adapt innovations from the manufacturing sector, they have since been recognised as important players in cooperative innovation processes. Only very recently has attention been drawn to their autonomy in innovative activities (Howells 2001).

However, the innovativeness of service companies diverges significantly between the individual service industries. While 61 % of all knowledge-intensive service providers conducted innovation activities in the period 2006 to 2008, this was only 40 % in other service areas. Clear differences are also apparent in the successfully completed projects. While almost half of the knowledge-intensive service companies can be described as successful innovators, this is only the case for one third of the other service companies (Rammer et al. 2010). In this study, knowledge-intensive services cover the following economic industries: publishers, film industry, radio, telecommunications, data processing, information services, financial services, R&D services, engineering offices, technical laboratories, business and management consulting, legal advice and advertising (industrial classes 58-66, 69-73)³. The share of employees with a university or college degree is the main indicator for classification. Due to data availability, the NIW/ISI lists 2006 are used in the following (Legler/Frietsch 2007), which are based on NACE Rev. 1. At the 2-digit level, the following industries are classified as knowledge-intensive:

³ This definition is based on the NIW/ISI/ZEW lists (Gehrke et al. 2010), which also include the economic industries 74-75, 86 and 90-91.

Table 1: Knowledge-intensive services (NACE Rev. 1)

22	Publishing, printing and reproduction of recorded media
64	Post and telecommunications
65	Financial intermediation, except insurance and pension funding
66	Insurance and pension funding, except compulsory social security
67	Activities auxiliary to financial intermediation
72	Computer and related activities
73	Research and development
74	Other business activities
85	Health and social work
92	Recreational, cultural and sporting activities

Source: Legler and Frietsch (2007: 19)

There are other statistics-based definitions apart from this one, which are used for surveys. Based on an EU regulation (EU Regulation 753/2004), Eurostat is oriented to the lists in the Frascati Manual (OECD 2002).

Knowledge-intensive service companies are characterised by the fact that knowledge is their main production factor and also their main product (Strambach 2008). Especially corporate service providers (so-called knowledge-intensive business services) learn from the intensive interaction with their clients. It is possible to solve problems jointly by adapting the companies' expertise (*ibid.*, p. 156).

Innovation processes in service companies show certain peculiarities which have impacts on their role as innovation service providers. These include (see Burr 2007; Tether/Hipp 2000):

- The outstanding role of human capital as a production factor or the factor of knowledge which is described as "embodied in people and embedded in networks" (Strambach 2008: 161).
- Close interaction of production and consumption.
- High significance of information content and the intangible nature of the service output.
- Close ties to customers.

These points make it clear that it is often almost impossible to differentiate between product and process innovation in services. This is illustrated by the example of workshops, which are initiated by service companies for clients and which result in the generation of new ideas. It is not possible to separate process and output in advance. The

ideas can be evaluated *ex post* based on the success of the further implementation. How innovative the services really are can often only be assessed from the customer's perspective.

Due to the wide diversity of knowledge-intensive services there is no one pattern of innovation which applies equally to all companies (Miles 2001). Innovation processes are usually of an incremental nature (see Kanerva et al. 2006). Radical innovations in services are often linked to new technologies (Burr 2007: 74). In their study of knowledge-intensive service companies in Germany, Tether and Hipp (2000) find that these predominantly market products adapted to their customers. Customers are the main source for innovations, while R&D expenditures are mainly used for internal process innovations.

Knowledge-intensive services are concentrated in urban centres. This is particularly valid for business services (Strambach 2001). A continuation of this spatial concentration is thought to be probable and could lead to a more marked centre-periphery gap (Jennequin 2008). However, individual service industries do not behave uniformly (Wood 2005). Sheamur and Doloreux (2009) analysed the innovation patterns of knowledge-intensive service companies in the region around Quebec. In several of the industries they find that the innovativeness emanating from the core region first decreases and then, with increasing distance, rises again. Muller and Zenker (2001) show that knowledge-intensive business services are essential for the innovative activities of SMEs. And yet the knowledge-intensive service companies in core urban regions seem to have a different function than in peripheral regions. Analysing Norwegian companies, Aslesen and Isaksen (2010) show that knowledge-intensive business service providers in core regions function as a bridge to international contacts while, in more remote regions, they represent important national channels for companies in the region.

To sum up, the following points are important with regard to the above mentioned questions from a theoretical perspective. Clusters are formed under different conditions. Once they have reached and exceeded a certain size, agglomeration advantages or localisation advantages are generated. Whether these kinds of external effects are also caused where knowledge-intensive service industries are concentrated will be investigated in the following. Because especially knowledge-intensive services tend to be concentrated in urban centres, it seems reasonable to presume that urbanisation advantages play an important role.

3 Empirical study

Before we can tackle the questions of where clusters of knowledge-based services exist and which of the described effects predominate in these clusters, the question arises whether and in which knowledge-intensive service industries spatial concentration can be found.

Alecke and Untiedt (2008) use the Ellison-Glaeser index, to identify those industries which are spatially concentrated in Germany. The applied Ellison-Glaeser index (Ellison/Glaeser 1997) takes into account that spatial concentration provokes both company-internal and -external economies of scale. The index uses the Herfindahl index to include to what extent an economic industry is characterised by intra-sectoral concentration. This means that regional industry concentrations which are based on the presence of one or only a few very large companies carry less weight. The index also integrates employment data. Of the 56 economic industries regarded by Alecke and Untiedt at 2-digit level, the knowledge-intensive services show varying tendencies to co-agglomeration. Table 2 illustrates the resulting ranking. The insurance industry shows the biggest spatial concentration; communications is at the other end of the scale.

Table 2: Results of the Ellison-Glaeser index for Germany: Ranking sequence of knowledge-intensive services (2-digit level)

Rank	WZ-Code	Description
8	66	Insurance and pension funding, except compulsory social security
13	92	Recreational, cultural and sporting activities
14	67	Activities auxiliary to financial intermediation
18	73	Research and development
25	72	Computer and related activities
34	65	Financial intermediation, except insurance and pension funding
37	74	Other business activities
40	22	Publishing, printing and reproduction of recorded media
50	85	Health and social work
53	64	Post and telecommunications

Source: Alecke and Untiedt (2008: 78-80)

The results suggest focusing the search for clusters on the upper section. However, it should be noted that cluster formation is not ruled out for those economic industries which are on average less strongly agglomerated. The financial industry provides a clear example of this: while the nationwide coverage of bank branches in Germany

contributes to a low measure of spatial concentration, there are a few financial centres like Frankfurt which have international significance.

The next step is to identify the first indications of possible clusters. Localisation quotients are calculated as a relative measure of concentration. This concentration measure provides additional information about whether an industry is localised to a greater (values >1) or lesser (values <1) extent. Localisation quotients > 1 can therefore be a first indication of cluster structures. However, a more detailed analysis of the search areas thus identified is still necessary to confirm the existence of clusters (Krätke/Scheuplein 2001). If the calculation is based on employee data, an individual company with a large workforce in a small or monostructured region can lead to a high localisation quotient for this industry. Because, in this case, only a single company is involved, it does not meet the important criterion of clusters of exceeding a critical mass of actors (Menzel/Fornahl 2005: 135). Furthermore, it should be pointed out that clusters are not oriented on administrative borders. As a result, clusters can be overlooked which spread across several regions and which are not immediately apparent when looking at each region individually. Plotting them on a map can help here.

Calculating localisation quotients is the starting-point for further analysis. This means that an unbiased look at potential clusters can then be taken as a first step. Employment data from the German Federal Employment Agency for the year 2008 are used for NUTS 3 regions at the 2-digit level of the NACE classification. The maps in Annex 1 show the results. Diverse NUTS 3 regions show no values for data protection reasons; this mainly affects insurance and research and development services. Overall, the maps confirm that knowledge-intensive services are frequently concentrated in the urban centres. In addition, a West-East divide can be made out in the case of banking and, to a lesser extent, in printing, publishing and copying.

In the case of insurance and financial intermediation, it should be examined whether these should be regarded together with the 'activities auxiliary to financial intermediation'. However correlations based on localisation quotients or the share of employees do not indicate this (correlation coefficient <0.3). There are even higher values for correlating the 'activities auxiliary to financial intermediation' with 'other business activities'. For this reason, the three economic industries continue to be regarded independently⁴.

⁴ However, it is not possible to rule out a spatial division of labour or higher correlations at an individual 3-digit level of industrial classification. This cannot be verified using the available data. Nonetheless, the maps suggest a spatial division of labour mainly in the case of Frankfurt.

Table 3 shows the NUTS 3 regions with the highest localisation quotients (relative concentration) for selected knowledge-intensive services and the respective share of employees as well as the NUTS 3 regions with the most employees (absolute concentration) in each industry. As Stam (2009: 322) criticises, the question is still unanswered whether one can talk about clusters if individual activities are relatively strongly concentrated in peripheral regions, or if there is a large number of actors in one field of activity in urban centres, but these are not significant when compared to other activities in the region. For this reason, the first five regions are listed for each of the two ways of looking at them. Comparing the two groups shows that they only overlap (grey shading) in a few cases. This raises the question of whether clusters have actually developed in these regions and which external effects are being generated as a result.

Coburg has a very high localisation quotient in the **insurance industry**. This can be traced back to the existence of one large company so that it is not possible to talk about cluster structures in this case. Koblenz represents a similar case. One characteristic of the insurance industry is its very high degree of vertical integration (Michaels/Langheid 2004). As a consequence of this, specific supplier networks are unable to play a significant role here. Localisation effects are therefore caused – if at all – by a specialised labour pool or by knowledge spillovers. In this regard, it should be noted that specialised research and education services have been set up at locations like Wiesbaden and Hannover: In Wiesbaden, Bachelor and Master programmes were introduced in the faculty of Insurance and Finance at the technical university in cooperation with local insurance companies. The Competence Centre Insurance Studies was established in 2002 at the universities in Hannover and Göttingen and at the Hannover Medical School. In a nationwide analysis of the industrial concentration of the insurance industry at the level of planning regions (Raumordnungsregion), Meyer-Stiens (2004) examined the significance of spatial concentration using productivity indicators. However, it was not possible to confirm a positive correlation between spatial concentration and regional productivity advantages. "[...] A spatially concentrated, highly specialized supply of labor and the associated high human capital ratios as well as technological spillover effects [generate] hardly any centripetal effects on the insurance industry"⁵ (p. 156). The question is whether the positive effects of a specialised labour pool, for example, can be measured in this way and how long it takes for the impact of setting up specialised education and training offers to be felt. In addition, it should be noted that current outsourcing tendencies in the insurance industry lead to changes in the existing structures in the long term.

⁵ own translation

Table 3: Relative and absolute importance of selected knowledge-intensive services at NUTS 3 level (2008)

Insurance industry								
Relative concentration	N°. employees	LQ	Share (in %)	Ø annual growth rate 2003-2008 (in %)	Absolute concentration	N°. employees	Share (in %)	Ø annual growth rate 2003-2008 (in %)
Coburg	4,641	22.11	15.5	k. A.	Köln	22,576	4.9	-3.0
Wiesbaden	6,641	7.83	5.5	-4.8	München	20,962	3.1	-3.8
Köln	22,576	7.07	4.9	-3.0	Hamburg	18,630	2.3	-2.7
Münster	5,919	6.22	4.4	-1.5	Stuttgart	9,818	2.8	-7.9
Koblenz	2,630	5.83	4.1	0.3	Düsseldorf	9,390	2.6	-1.9
<i>Germany</i>	<i>191,925</i>	<i>1.00</i>	<i>0.7</i>	<i>-4.2</i>	<i>Germany</i>	<i>191,925</i>	<i>0.7</i>	<i>-4.2</i>
Recreational, cultural and sporting activities								
Baden-Baden	4,648	13.42	16.0	3.8	Berlin	30,156	2.8	0.1
Mainz	8,145	6.88	8.2	0.1	Hamburg	19,988	2.5	0.6
Potsdam	5,560	6.32	7.6	4.0	Köln	18,170	4.0	-0.3
München (Kreis)	8,740	4.15	5.0	1.3	München	17,905	2.6	0.1
Weimar	1,055	5.83	4.1	-1.3	Frankfurt Main	9,234	1.9	1.6
<i>Germany</i>	<i>328,521</i>	<i>1.00</i>	<i>1.2</i>	<i>-0.02</i>	<i>Germany</i>	<i>328,521</i>	<i>1.2</i>	<i>-0.02</i>
Research and development								
Düren	4,873	11.6	6.8	0.5	Berlin	13,842	1.3	2.5
Greifswald	1,379	10.2	6.0	6.1	Frankfurt am Main	10,273	2.1	-0.1
Jena	2,561	9.5	5.6	5.6	München	8,959	1.3	5.8
Heidelberg	3,823	8.4	4.9	0.8	München (Kreis)	6,587	3.7	-0.4
Starnberg	4,431	6.8	4.0	7.5	Dresden	5,052	2.3	5.6
<i>Germany</i>	<i>161,706</i>	<i>1.00</i>	<i>0.6</i>	<i>1.9</i>	<i>Germany</i>	<i>161,706</i>	<i>0.6</i>	<i>1.9</i>
Computer and related activities								
Rhein-Neckar-Kreis	16,324	7.19	11.3	5.3	München	23,527	2.2	-0.6
München (Kreis)	14,387	5.22	8.2	6.9	Berlin	23,019	1.4	4.7
Darmstadt	5,194	3.79	5.9	1.1	Hamburg	22,079	1.8	3.2
Karlsruhe, Stadt	7,998	3.30	5.2	5.5	Rhein-Neckar-Kreis	16,324	7.2	5.3
Groß-Gerau	4,051	4.01	4.8	-2.2	München (Kreis)	14,387	5.2	6.9
<i>Germany</i>	<i>430,385</i>	<i>1.00</i>	<i>1.6</i>	<i>3.3</i>	<i>Germany</i>	<i>430,385</i>	<i>1.6</i>	<i>3.3</i>
Financial intermediation								
Frankfurt am Main	56,871	11.66	4.9	-0.9	Frankfurt am Main	56,871	3.4	-0.9
Main-Taunus-Kreis	5,632	7.01	2.9	1.9	München	28,645	2.1	-2.0
Hamel-Pyrmont	3,016	6.38	2.7	-6.3	Hamburg	23,383	2.8	-1.8
Offenbach am Main	2,846	6.35	2.7	-2.9	Berlin	19,672	11.3	-3.2
Schwäbisch Hall	3,996	2.69	1.2	-0.5	Düsseldorf	19,546	8.2	1.6
<i>Germany</i>	<i>656,463</i>	<i>1.00</i>	<i>2.4</i>	<i>-1.8</i>	<i>Germany</i>	<i>656,463</i>	<i>2.4</i>	<i>-1.8</i>

Source: Federal Employment Agency, own calculations

The economic industry that spans **recreational, cultural and sporting activity services** is made up of different services. It therefore makes sense to examine its individual sections separately. The section comprising film, television and radio stands out in this regard. In this section the value chain is divided into several steps. (Krätke/Scheuplein 2001: 85). Not all activities are included in WZ-Code 92. The core areas are film however and video production and the production of radio and television programmes.

In recent years different studies in the film and television industry have been conducted (for a list see Lütke 2004: 23). In addition to Germany-wide studies, Hamburg, Munich, Berlin and Cologne were examined more closely. Moßig names Cologne, Munich and Berlin as equal locations (p. 98) The data in table 3 point to a relatively high concentration in Baden-Baden and Mainz. This can be attributed primarily to the location of the ZDF and SWR.⁶ In the case of Mainz Moßig points out that a cluster structure does not exist here. The SWR in Baden-Baden has 1,600 permanent employees and thus makes a major contribution to employment in the region.

The remaining employees in this industry probably work in entertainment facilities and museums which make the town culturally attractive and therefore interesting for tourists.

Localised customer-supplier relations are described as highly significant for different locations (Babelsberg/Berlin: Krätke/Scheuplein 2001; Munich: Kaiser/Liecke 2007; Moßig 2006).

Specialised educational institutions also contribute to a specialised labour pool as for example the University of Television and Film in Munich, which provides the basis for a dense network of actors (Kaiser/Liecke 2007). Competition is not explicitly addressed in any of the available studies, but it can be assumed that a certain degree of competition exists. Particularly for the private commercial stations which do not receive public money for their film productions, the choice of a project partner may depend on the price services cost. The most important criteria are however successful cooperation on previous projects, recommendations, reputation and credibility (ibid.). Spatial proximity and face-to-face contacts are very important. It is important to participate in different events within the industry to exchange experiences and trends. An exchange of symbolic knowledge takes place, i.e. knowledge spillover is generated. (Asheim et al. 2005).

⁶ Two of the German public television and radio stations

An examination of the genesis of clusters reveals the important role played by political decisions. The location of radio companies in Berlin, Frankfurt, Hamburg, Leipzig, Münster, Cologne, Stuttgart und Munich were determined in the 1920s. Decisions made by the occupation powers left a clear mark on the film industry which had been strong before the Second World War. As the medium had been exploited for propaganda purposes, film production in Bavaria for instance did not start again until 1947. Political decisions have also had a considerable influence on subsequent developments. This holds particularly true for the financing of films. When comparing the above-listed locations of pre-war radio broadcasting companies with those of today's media centres, we can see that structures established 80 years ago are still by and large existent today.

As in the film and television industry, the example of the formation of clusters in the music industry in Mannheim shows that personal contacts contribute to the success of individuals; this in turn can lead to the formation of clusters in this industry. An important institution here is the Popakademie (University of Popular Music and Music Business) (Gosselin et al. 2010).

In the case of **research and development** existing concentrations are mostly based in large public research facilities. For example, in the case of the municipality of Düren the FZ Jülich, which is a partly public financed research institution, plays the lead role. We can therefore not speak of R&D cluster structures. While this, however, does not mean that R&D services cannot be part of a cluster, we cannot necessarily assume the existence of independent R&D clusters.

The illustrations on **computer and related activities** in the appendix show a number of cluster structures in this field. For instance in the Munich area, in the Rheine-Main area and in the Rhineland several municipalities with a high localisation quotient are adjacent to each other. Software and IT services serve as key and crossover technologies so that proximity to the customer can become very important. It is therefore necessary to study precisely the kind of external effects to which spatial concentration will lead. Leimbach (2010b) points to the significance of important customers in the regions with a high concentration of software and IT service companies (i.e. Jacobs externalities are being generated).

Cooperations, particularly in the form of development partnerships, exist within this field of activity. Buxmann et al. (2008: 75) point out that large producers of standard software frequently collaborate with specialised software suppliers; sales cooperations are another form of cooperation chosen by providers of complementary software. The probability of spatial concentration is greater for development partnerships than for

sales cooperations. Spatial concentration can be particularly important for the generation of ideas and in the early phases of a project. The transport of software does not call for spatial proximity so that permanent spatial proximity is not a necessary requirement. On the other hand, a supply of qualified labour and higher education institutions are essential for software clusters (Leimbach 2010: 13).

Matuschewski (2006) uses a qualitative study design to examine cluster structures of the information economy in Hamburg, Dresden and the Karlsruhe technology region. Data processing and data bases are sub-area of the areas that were examined in addition to hardware, media and so on. Among the regions covered in this study, it is in the Karlsruhe technology region that the area of software is most highly developed. Matuschewski finds local customer relations there and her discussions with customers suggested that spatial proximity to the customer plays an important role. Frequent direct contact facilitates customized programming and adjustment of software as well as consultation. For this reason larger companies tend to open regional branches. The study also proves the importance of a local labour pool. In contrast to the other two regions studied, where different patterns of specialisation in the information economy are highly developed, knowledge exchange within the region is not as important. Because of the high specialisation of companies in the Karlsruhe technology region, only some cooperation partners are located in the area. The companies are not as integrated into local networks either. On the one hand, these two points could be explained by the lack of corresponding cooperation partners in the region; on the other hand, the above listed results point to the fact that this aspect does not play such an important role in the area of data processing and data bases. The study does not examine the aspect of local competition so that it is not possible to make an assertion about Porter-externalities, while the perceived provincialism of the Karlsruhe technology region, its lack of urban flair and the absence of a business environment are emphasised. The companies surveyed assessed the natural setting and scenery positively.

Knowledge spillover was of decisive significance for the development of **financial intermediation** in Frankfurt. Particularly during the time of the Bretton-Wood system, banks sought the proximity to the Federal Bank. The system necessitated frequent currency intervention by the Federal Bank. It was in the interest of the banks to be close to the Central Bank in order to receive timely information about monetary decisions. Thus dynamic processes were set in motion and an important financial hub was established which is however now subject to structural change. The proximity to the Central Bank (as well as to the European Central Bank) is no longer of great importance. Today the exchange of information for less transparent financial transactions such as the financing of M&A transactions is important. Various specialised service industries have settled in the region, some of which are spin-outs (Schamp 2009).

Nevertheless the internal real net output ratio is still relatively high. Highly specialised financial products require qualified staff. It is striking that the expansion of courses in financial management has only taken place in recent years at universities in Frankfurt. Schamp (2009) concludes that "in a best case scenario the foundations of a knowledge base of a finance cluster have been laid" (p. 100).

Table 4 summarizes the external effects that were demonstrated in case studies. It is apparent that some knowledge-intensive industries of the service industry exhibit cluster structures. In the case of the insurance industry they play a very minor role or no role at all. A specialised labour pool is of the utmost importance for all examined clusters. Furthermore, the examined knowledge-intensive service clusters differ from one another in the significance of individual externalities.

Table 4: Proven externalities in clusters of knowledge-intensive services

	Insurance industry	Film, television and radio	Computer and related activities	Financial intermediation
Marshall-Arrow-Romer externalities				
• Labour pool	(x)	x	x	x
• Specific supplier and distribution networks	-	x	x	x
• Knowledge spillover	-	x	(x)	x
Porter externalities (competition)	-	(x)	-	-
Jacobs externalities (diversification)	-	-	x	-

Source: own compilation

4 Summary and recommendations

The aim of this article was to investigate how far clusters in knowledge-intensive service industries have developed and what kind of agglomeration advantages they generate. Therefore the first step was to analyse which knowledge-intensive service industries exhibit spatial concentration. Based on this analysis, the absolute as well as the relative concentrations in these industries was examined at the NUTS 3 level.

The results show that cluster structures have developed in some but not all knowledge-intensive industries of the service sector. A high measure of spatial concentration does not necessarily mean that a cluster exists, since especially in less urban region high

localisation quotients are frequently ascribed to either one company or only a small number of companies.

The knowledge-intensive services with cluster structures differ with regard to external effects, each of which becomes important: a highly qualified labour pool is by definition important for all knowledge-intensive industries of the service sector and fundamental for the existence of cluster structures in each of the examined services. Nevertheless there are however crucial differences regarding the significance of further external effects. Porter-externalities do not appear to stimulate competitiveness in any of the examined industries of the service industry. However, none of the available studies explicitly examined the aspect of competition. Thus the interplay of agglomeration advantages needs to be researched further. The type of knowledge and the market environment should also be regarded as important factors (Orsenigo 2006: 201). Contact to local suppliers and customers in industries that are characterized by project work, such as the film and television industry or the media, are particularly important.

Supporting clusters and networks is currently fashionable and is practised by different actors. The results show that cluster and network policies have to be focussed on the field of activity. It seems in any case sensible to expand the knowledge and education infrastructure in knowledge-intensive services which do not have cluster structures. The spatial proximity of actors in the innovation process or of suppliers and customers is not always advantageous. Too strong a focus on spatially concentrated exchange processes, leading to an isolation from global trends, can prove to have negative effects in the long term.

In this respect the great importance of a qualified labour pool provides a starting point for policy measures that could also be useful for other fields of activity. This includes the development and financing of (partially specialised) educational institutions or measures. The appeal of the surroundings is also important to tie highly qualified staff to a region, as the discussion on a creative class (Florida 2002; 2005) also shows. While factors such as urbanity can hardly be influenced politically, there are certain initiatives regions can adopt to compensate for the lack of attractiveness. In regions where companies find it difficult to attract qualified staff from other regions higher education institutions are important sources of qualified staff. Therefore increasing the attractiveness of higher education institutions and of relevant study programmes are a first starting point. Likewise, the example of ITsax shows how companies can cooperate successfully in the area of recruitment. Furthermore, the provision of childcare facilities or international schools is important for the creation of attractive conditions particularly for women and / or international employees.

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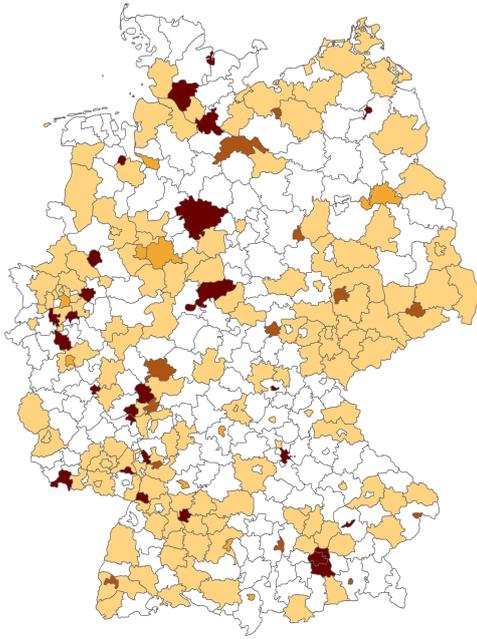
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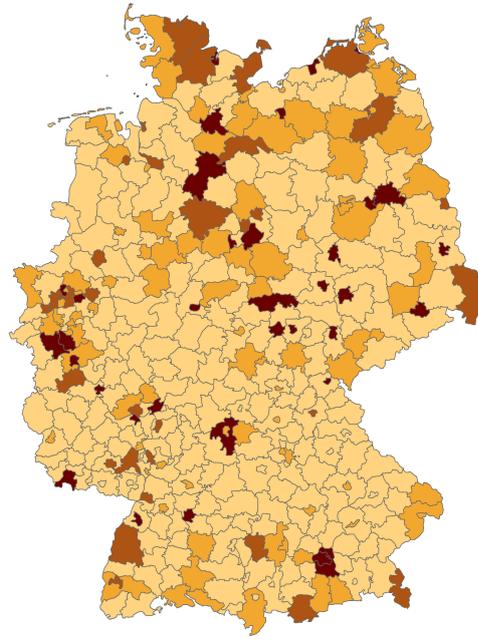
6 Annex

Figure: Localisation quotients (2008)

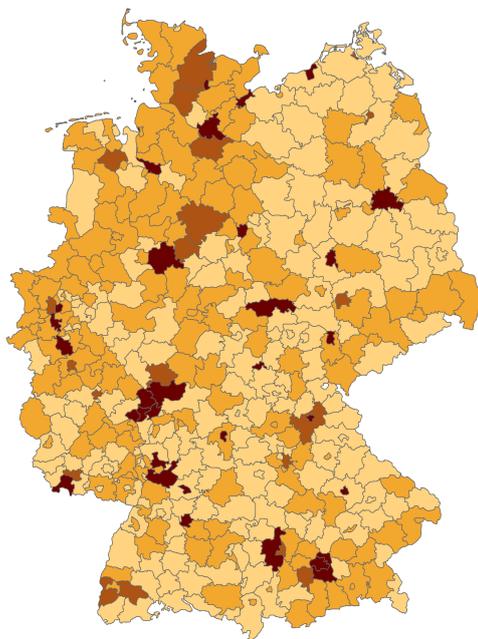
Insurance and pension funding (66)



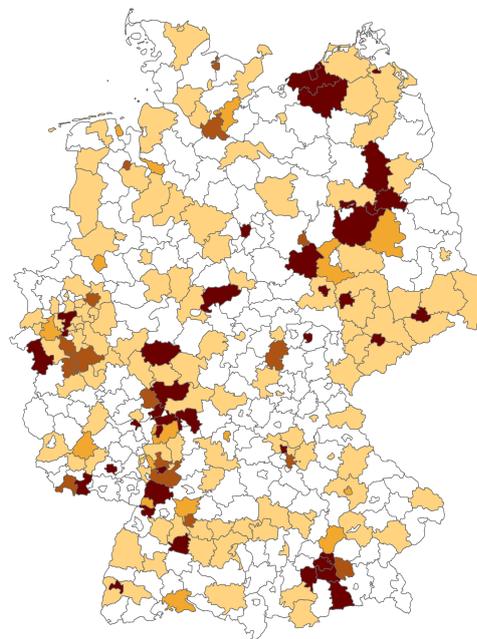
Recreational, cultural and sporting activities (92)



Activities auxiliary to financial intermediation (67)

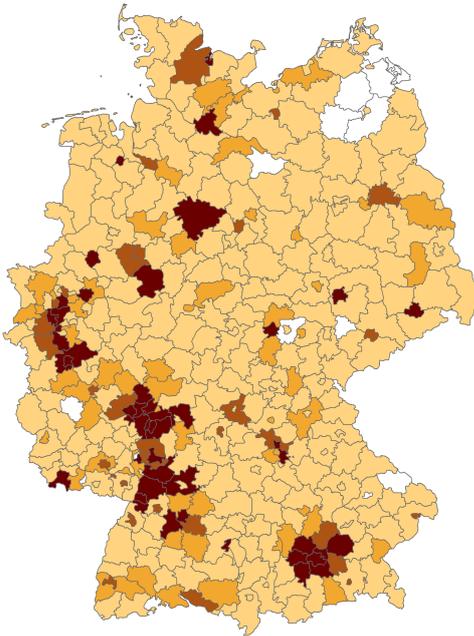


Research and development (73)

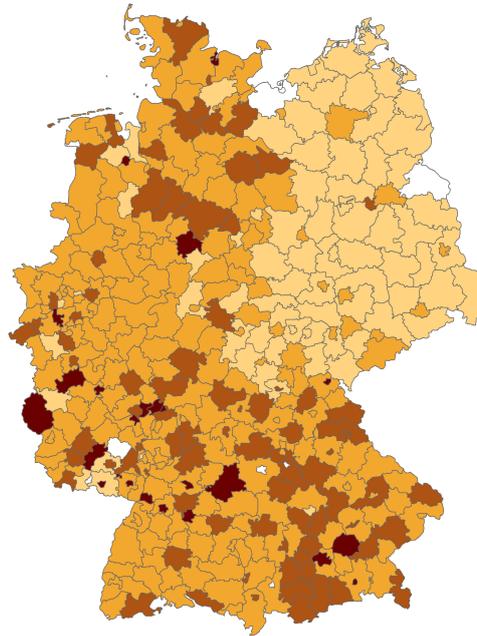


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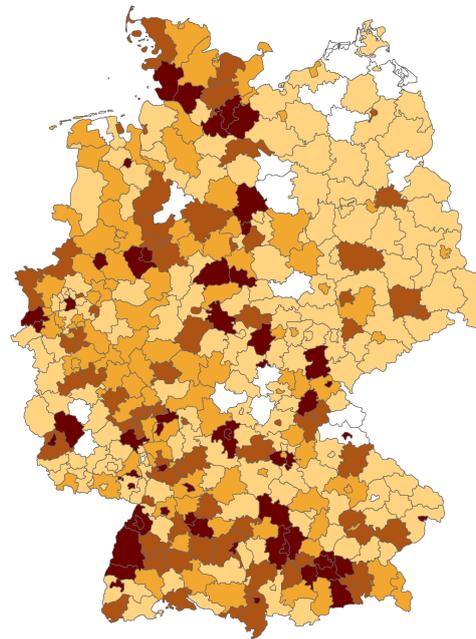
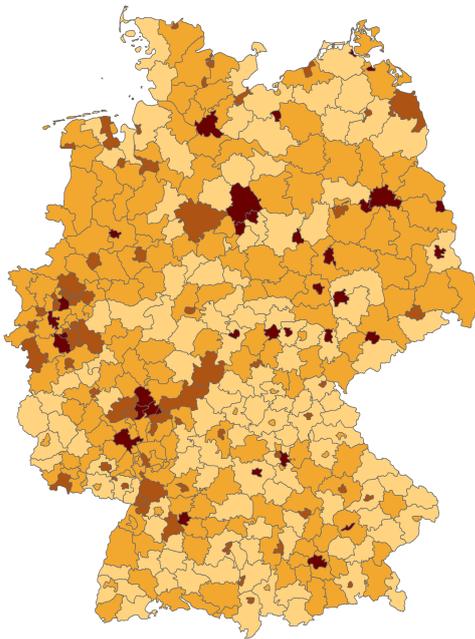
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Other business activities (74)



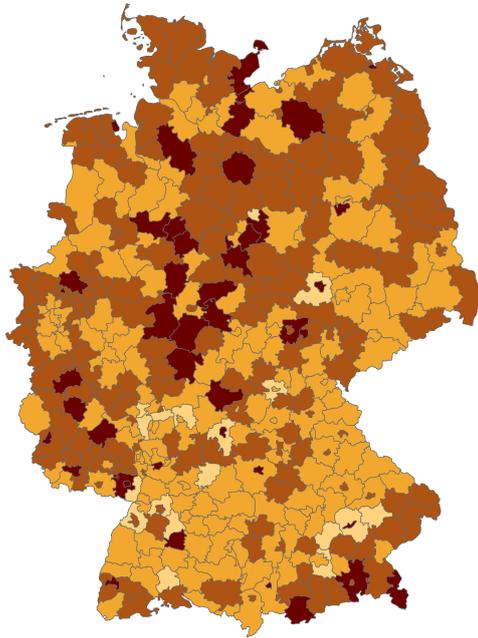
Publishing, printing and reproduction of recorded media (22)



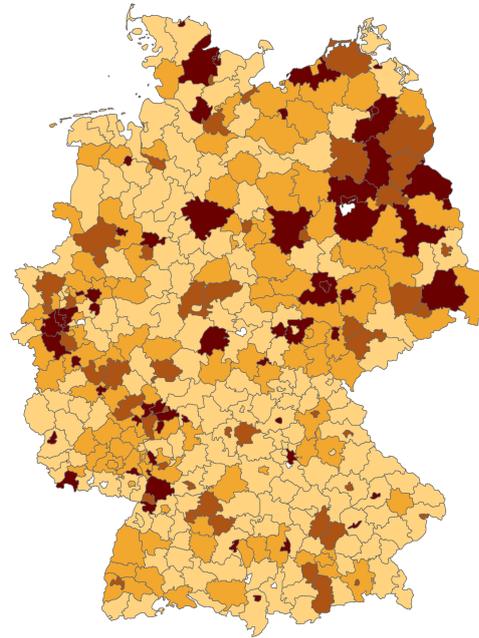
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□ <0.6 □ <1 □ <1.4 □ >1.4 □ No information

Health and social work (85)



Post and telecommunications (64)



Key



Source: German Federal Employment Agency, own calculations

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