

## Concentration of knowledge-based professions in the German city-system

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### 1 ABSTRACT

Presumptions of cities as centres of science, research and art have obtain great acceptance. Due to an increasing interest in human capital as a basis of knowledge-creation and economical development in cities and city-regions it is asked, where human capital is located in the German city-system. The German city-system is – unlike most other (esp. European) city-systems – characterised through a polycentric structure and division of labour. Therefore the article discusses the spatial occurrence and development of certain types of profession under two perspectives:

How do knowledge-based professions concentrate in metropolitan spaces? Do they concentrate equally or exist spatial distinctions within the concentration of different professions?

Does spatial concentration of knowledge-based professions lead to functional specialisation in the German labour divided city-system?

Based on these questions recommendations are discussed on how urban and regional planning can take advantage and shape places that support knowledge and innovation by strengthen human capital.

### 2 AGGLOMERATIONS AS KNOWLEDGE-GENERATING SPACES

In post-industrial societies knowledge is a crucial factor for economic processes. On the one hand knowledge is a production factor and on the other hand knowledge is an intermediate or final product of innovative processes. But not knowledge itself leads to a better position in the competition of cities and regions. Only the creation of new knowledge drives to advantages in competition and temporarily to monopolisation profits. In this context it is important to make a distinction between two types of knowledge: implicit and codified knowledge.

Implicit knowledge is societies' most important resource. All new knowledge arises as implicit knowledge. Though implicit knowledge is bounded to people and organisations and can only be shared by personal interaction. The necessity of personal interaction, often as face-to-face-interaction, leads not only to high costs but also to a gradually spatiotemporal process of diffusion (cf. SCHÄDLICH; STANGL 2005). Codifying reduces transaction costs of knowledge. Codified knowledge can not only be shared with a lot of interested parties but also be used multiple times. But as knowledge can be distributed and used easily after codification, monopolization profits of a region or a city get lost. Therefore it exists a constant motivation to create new knowledge (cf. KUJATH 2005).

Due to teat fact, human capital has become an issue of crucial interest. The demographic change and the increasing importance of knowledge-based economic processes lead to a growing demand of human capital with a simultaneously (middle- or longtime) shortage of this resource. Between cities and regions an increasing competition on human capital exists. But high qualified workers are not an equally distributed resource. Theories of agglomeration suggest that, due to positive agglomeration externalities, economic resources can be used more efficient in spaces of high density (cf. GLAESER 2003). It is assumed that (urban and regional) agglomerations have special structural conditions to initiate and foster the creation, distribution and use of knowledge. This is caused by a high interaction density in agglomerations which reduces risks and enforces exchange between knowledge workers (cf. DURANTON; PUGA 2001 and 2005).

The necessity of personal interaction and project-based working structures cause concentration processes of human capital in favour of dense areas with high interaction opportunities. Particularly, cities work as “random generators” on contacts, information and opportunities (cf. LÄPPLE 2004). As a consequence risks during working processes are reduced. The existence of human capital in agglomerations enhances the attractiveness of those agglomerations to an additional moving in of human capital and therefore results in the existence of “sticky places” (cf. MARKUSEN 1996).

The necessity of personal interaction during the process of creation, exchange and use of knowledge suggest that urban agglomerations are also of primarily interest for high qualified workers. A high interaction density in agglomerations yields to a crucial advantage in competition for knowledge employees who are working in

cities and city-regions. These positive agglomeration externalities lead to concentration processes of human capital in metropolitan regions and urban agglomerations. For this reason significant spatial disparities in the allocation of human capital can be expected (cf. CAMAGNI 1991 and MAILLAIT 1995).

But human capital is not a homogeneous occupational category. Knowledge workers can be differentiated into several knowledge-intensive professions. In conjunction with the necessity of personal interaction of knowledge workers to produce and to use knowledge, the possibility of interaction in agglomerations has to be differentiated, too. Localisation theories estimate that not only concentration of human capital, but also the concentration of the right knowledge workers, are crucial for interaction processes and therefore for the attractiveness of a city or a region to knowledge workers of a certain profession (cf. GERTLER 1995, SCHAMP 1996, STORPER 1997 and BATHELT 2000). Based on these assumptions, processes of spatial specialisation are expected. Therefore it should not only be asked, if knowledge worker in general concentrate in agglomerations, but also if the different knowledge-based professions concentrate equally in agglomerations.

Based on these theoretical approaches two hypotheses are discussed:

Human capital concentrates in agglomerations. But not all professions concentrate equally in every agglomeration. The necessity of personal interaction, working together and understanding each others work, leads to differentiated concentration processes.

Changes in concentration occur according to the labour divided city-system in Germany: agglomerations with strengths to a certain field of work are of above average attractiveness to a moving of corresponding professions and therefore concentration processes strengthen the structure of the German labour divided city-system.

### 3 STUDY AREA AND STATISTICAL DATA

As the paper contains comparisons between agglomerated and non-agglomerated spaces as well as comparisons between different agglomerations, the analysis is based on statistical data for all urban districts and district free cities.

Unlike to other studies this paper differentiates human capital not by economical branches. Analysing occupants by economical sectors enables conclusions about the regional economical structure, but knowledge workers can best be differentiated by their activities. Analysing the spatial distribution of knowledge-worker by their profession enables conclusions about the functional spatial structure. Due to that reason this paper differentiates knowledge worker by their profession. Based on occupational data by the Federal Employment Office (Bundesagentur für Arbeit) the following knowledge-based professions are differentiated:

- Engineers
- Chemists, Mathematicians, Physicists
- Technicians
- Technical Qualified Personnel
- Banker, Insurance Salesmen
- Entrepreneurs, Accountants
- Delegates, Civil Servants
- Calculation and Data Processing Employees
- Lawyer, Legal Advisors
- Publicists, Librarians, Interpreters
- Artists
- Health Professionals
- Social and Natural Scientists

The first part of the analysis covers all urban districts and district free cities to extract spatial patterns of concentration of human capital. The second part is based on spatial categories, developed by the Federal Office for Building and Regional Planning (BBR). These spatial categories (see Fig. 1) base on the population density and differentiate three main categories: agglomerations (yellow, orange, red), urbanised areas (shades of blue) and rural areas (shades of green).

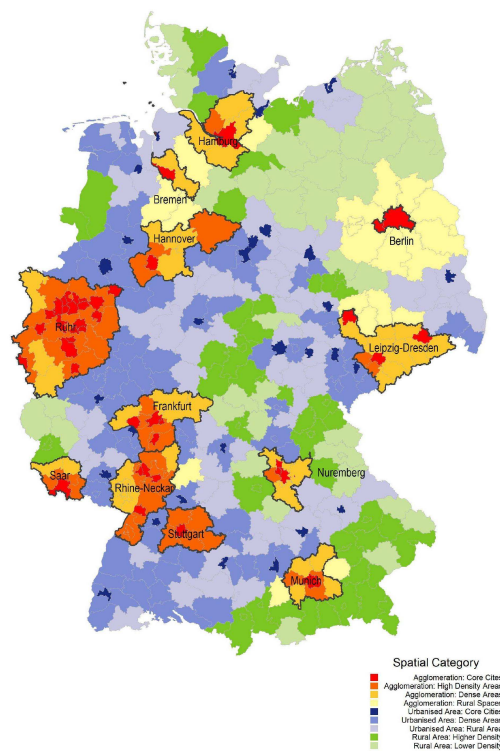


Fig. 1: Spatial Categories

#### 4 CONCENTRATION OF KNOWLEDGE-BASED PROFESSIONS

First it is asked, whether human capital is concentrated in agglomerations and second, if concentration patterns differ between knowledge-based professions. To answer those questions, spatial patterns of concentration of different knowledge-based professions are compared under two perspectives. The comparison of the absolute number of employees shows the real concentration of human capital. By this figure administrative unities with a higher number of occupants are structurally preferred. To eliminate this effect patterns of location quotients are compared. That data shows spatial patterns of structural deviations. Reference parameters are data for Germany.

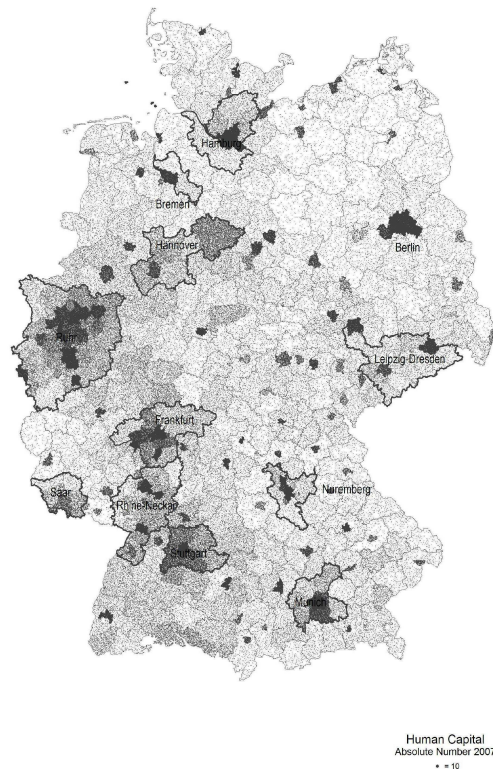


Fig. 2: Human Capital 2007

Fig. 2 shows the spatial patterns of concentration of the twelve knowledge-based professions in Germany (each dot stands for 10 employees). Agglomerations and district free cities are dark pigmented, so the absolute number of knowledge-based employees is high in these spaces. This spatial pattern keeps similar after differentiating human capital into knowledge-based professions. These professions (by absolute number) concentrate most in agglomerations and district free cities, too. That indicates a preference of agglomerations and dense urban spaces through knowledge workers.

To eliminate the size effect of agglomerations it is useful to compare spatial patterns of location quotients. Fig. 3 (location quotient of ‘Entrepreneurs, Accountants’) and Fig. 4 (location quotient of ‘Health Professionals’) show that not all knowledge-based professions are located above average in agglomerations. Dark colourings show an above average structure of the occupational category in comparison to the German average structure. Gray and white colourings show an under average structure of the occupational category. The above average structures of some occupational categories show deviations of spatial structures of agglomerations (see Fig. 4), whereas other job related categories show above average structures that fit to the spatial structures of agglomerations (see Fig. 3). The different spatial patterns of above and under average concentration of some vocational categories suggest that not all knowledge-based professions show a similar affinity to agglomerations.

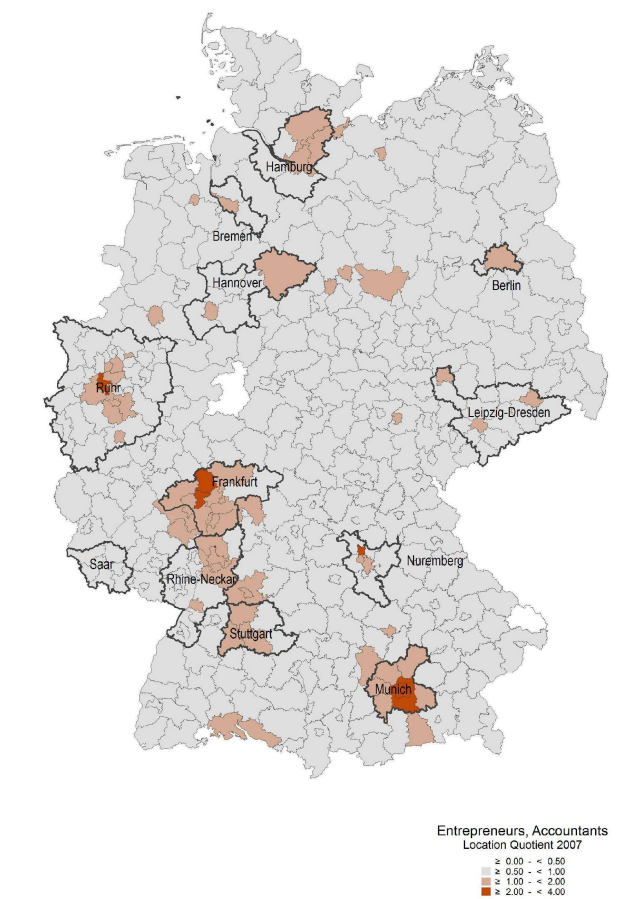


Fig. 3: Entrepreneurs, Accountants: Location Quotient

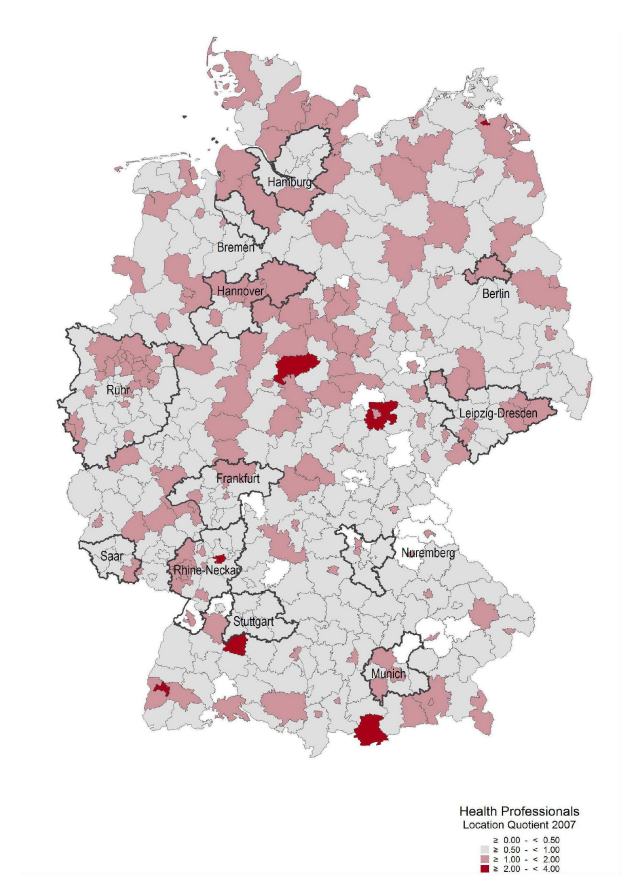


Fig. 4: Health Professionals: Location Quotient



To identify agglomeration-orientated and knowledge-based professions the analysis of patterns of concentration by comparing their density in different spatial categories can be used. The following chart shows values for the location quotient of each occupational category. The colours in the chart represent different spatial categories. Figures > 1 stand for an above average concentration of professionals in the spatial category, figures < 1 show an under average concentration of professionals.

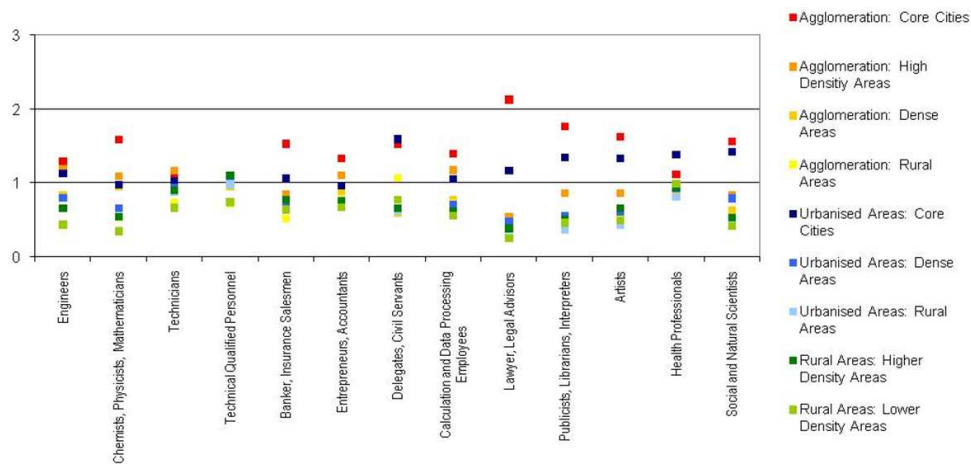


Fig. 5: Location Quotients of Occupational Categories (2007)

Most vocational categories are overrepresented in agglomerations (yellow, orange, red) and urbanised areas (shades of blue) but not in rural areas (shades of green). But also within agglomerations and urbanised areas the concentration of knowledge-based professions differs. The colours show that above average concentration is highest in core cities of agglomeration (red), core cities of urbanised areas (dark blue), and high density areas in agglomeration (dark orange). Knowledge-based professions are underrepresented in rural categories. And this underrepresentation occurs not only in greater rural areas (shades of green) but also in rural and less density areas of agglomerations and urbanised areas (yellow and light blue).

The occupational categories 'Technicians', 'Technical qualified personnel', 'Delegates' and 'Civil Servants' as well as 'Health Professionals' are an exception. These professions don't show an above average concentration in agglomerations and urbanised areas. The other occupational categories can be divided into three main groups: professions with an affinity towards regional agglomeration and professions with an affinity towards core cities.

The first group can be identified by a higher above average concentration in agglomeration categories (both core cities and high density areas) than in core cities of urbanised areas. That group contains 'Chemists, Mathematicians, Physicists', 'Entrepreneurs, Accountants', and 'Calculation and data processing employees' and defines them as occupational categories with an affinity to regional agglomerations. 'Engineers' can also be understood as a part of this group but they show more diffuse patterns as they are concentrated almost similarly in agglomeration core cities, agglomeration high density areas, and core cities of urbanised areas.

The second group is defined by a higher concentration in core cities (in both, agglomerations and urbanised areas) than in other agglomeration categories. The categories 'Publicists, Librarians, Interpreters', 'Artists', and 'Social and Natural Scientists' belong to this group and therefore can be described as professions with an affinity to core cities.

The third group can also be detected by a higher concentration in core cities than in other agglomeration categories (e.g. high density areas in agglomerations). But in this group the difference between the figures for the location quotient for agglomeration core cities and for core cities of urbanised areas is disproportionately high. The third group comprises the categories 'Banker, Insurance Salesmen' and 'Lawyer, Legal Advisors' and defines them as professions with an affinity to agglomeration core cities.

## 5 CONCENTRATION BY SPATIAL CATEGORIES

Analysing spatial patterns of human capital, the development of concentration processes is crucial. The following chart shows development and changes of location quotients of knowledge-based occupational

categories during the last decade. Location quotients of 1997 had been equated with 100. An increasing concentration leads to a figure higher than 100, a decreasing concentration leads to a figure lower than 100. The analysis of concentration patterns is structured by spatial categories, symbolised by the colours of the squares.

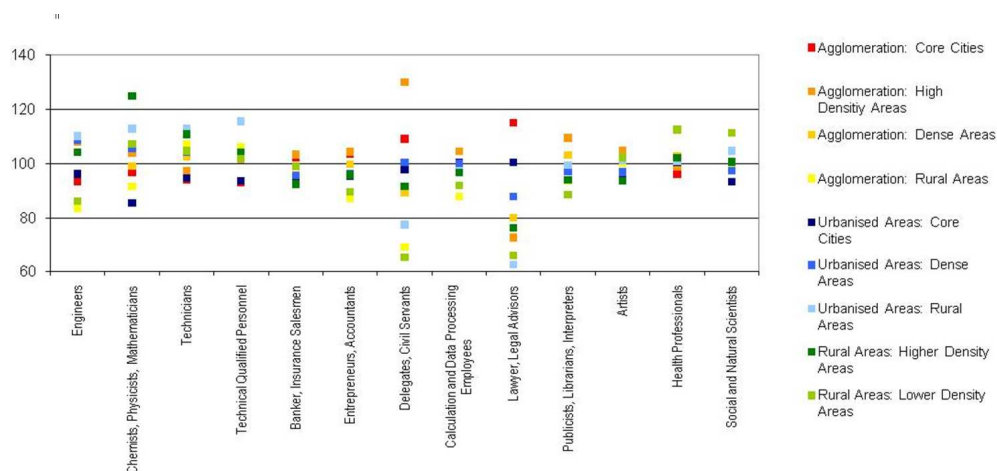


Fig. 6: Development of Location Quotients (1997-2007)

A comparison of the location quotients in the time course shows that only three of thirteen occupational categories increase most within core cities and high density areas of agglomerations ('Banker, Insurance Salesmen', 'Entrepreneurs, Accountants' as well as 'Delegates, Civil Servants'). The increasing of concentration for the occupational categories 'Calculation and Data Processing Employees' and 'Publicists, Librarians, Interpreters' is highest in high density areas of agglomerations whereas the level of concentration in core cities of agglomerations is constant. These professions seem to have a relation to core city activities but don't have to be located in the cores of regional agglomerations themselves. The occupational categories with the highest affinity to dense spatial structures seem to be 'Lawyer, Legal Advisor'. They don't only concentrate in core cities of agglomerations but also increase the concentration in that spatial structure types.

Summarising the data it can be shown that mainly three professional categories concentrate exceptionally in core cities of agglomerations, and their concentration has also increased in the time course of the last decade in this spatial category. These occupational categories are 'Banker, Insurance Salesmen', 'Entrepreneurs, Accountants' and 'Lawyer, Legal Advisors'. The category of 'Calculation and Data Processing Employees' is concentrated in dense areas and the concentration increases, but spatial reference are not core cities but areas of high density in agglomerations.

Regarding the development of concentration it can be surveyed that on the one hand spatial concentration of knowledge-based professions increases (e.g. 'Banker, Insurance Salesmen', 'Entrepreneurs, Accountants' and 'Lawyer, Legal Advisors' still concentrate in already dense areas) and therefore spatial disparities with these professions deepen. On the other hand spatial concentration decreases. E.g. 'Technicians', 'Technical Qualified Personnel' and 'Health Professionals' accumulate increasingly in areas of less density and therefore moderate spatial disparities.

## 6 CONCENTRATION BY AGGLOMERATIONS

The concentration of knowledge-based professions differs not only between different spatial categories but also within the different categories. Due to the interest in concentration processes in agglomerations, the change of knowledge-based professions in the first of the spatial categories is of crucial interest. Twelve agglomerations are aggregated and compared: Berlin, Bremen, Frankfurt, Hamburg, Hannover, Munich, Nuremberg, Rhine-Neckar, Ruhr, Saar, Leipzig-Dresden, and Stuttgart. These agglomerations are identified by agglomeration of the three spatial categories of core cities (red), high density areas (dark orange) and dense areas (orange) in agglomerations (as can be seen in Fig. 1).

The comparison of the concentration processes of different professions in the twelve agglomerations suggests that agglomerations specialize on different economical functions. An increase of concentration of knowledge-based professions in an agglomeration where these professions are already concentrated above

average suggests one the one hand, that agglomeration effects are important for this occupational category and on the other hand it suggests that these effects can be used best in that particular agglomeration.

Some agglomerations contain a larger area than others (e.g. Ruhr and Berlin) and due to that reason have structural advantages by comparing the absolute number of knowledge-based professionals. To eliminate the size effects, also for the comparison of the concentration processes of different occupational categories in the 12 agglomerations the location quotient has been calculated.

Figures > 1 stand for an above average concentration of that occupational group in the agglomeration, whereas figures < 1 show an under average concentration of that occupational group in the agglomeration. The arithmetic mean of the following charts is averaged over the data of all agglomeration areas and not over all spatial categories in Germany. To compare the above or under average concentration between agglomeration areas it is more useful to refer to the agglomeration mean. Referring to the German mean would suggest that all agglomerations show an above average concentration.

The above average concentration of different occupational categories in the various agglomerations reflects the labor-division in the German city system. The following charts show two examples ('Banker, Insurance Salesmen' and 'Artists') for the development and changes of location quotients of knowledge-based occupational categories during the last 10 years.

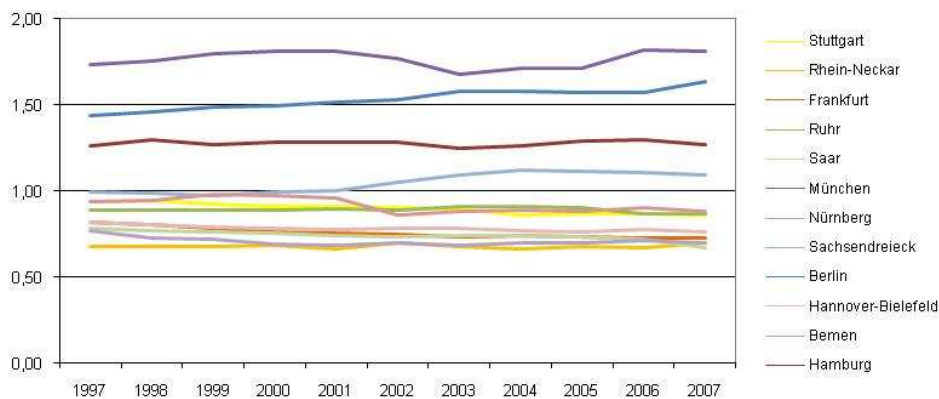


Fig. 7: Artists (Location Quotient)

Occupational categories of creative workers like 'Publicists, Librarians, Interpreters' and 'Artists' (see Fig. 7) concentrate above average in Munich and – increasingly – in Berlin and Hamburg. These agglomerations can be identified as centres of culture and creative economy.

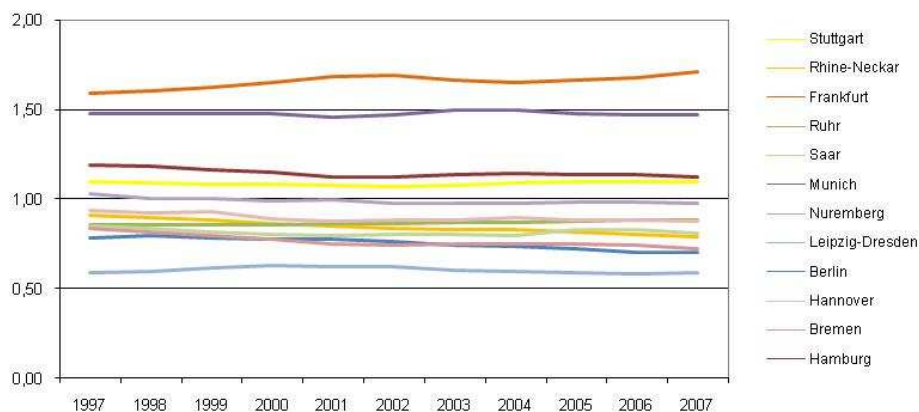


Fig. 8: Banker, Insurance Salesmen (Location Quotient)

The occupational categories 'Banker, Insurance Salesmen' and 'Entrepreneurs, Accountants' concentrate in agglomerations but the comparison between the various agglomerations show an above average concentration in the areas of Frankfurt, Munich and – with a distance – Hamburg. These agglomerations are centres for economical and financial services.



The occupational category 'Banker, Insurance Salesmen' is a good example for increasing concentration processes. The data shows that Frankfurt has not only the highest location quotient compared to other agglomerations and therefore the occupational category 'Banker, Insurance Salesmen' is mostly concentrated in Frankfurt, but also shows increasing values over the last decade which leads to a specialization of this agglomeration (see Fig. 8).

To draw first conclusions about specialized labour division in the German city-system the over or under average concentration of all occupational groups in all agglomerations can be compared (see Fig. 9). The following map shows a circular chart for each agglomeration with segments for every vocational category. The parameter value of each chart segment is dependent on the location quotient of each occupational category in the specific agglomeration. The black circle in each agglomeration stands for the mean of the occupational categories. Therefore a segment bigger than the circle represents a functional surplus of the agglomeration and a segment smaller than the circle represents a functional deficit (in that agglomeration would be less knowledge-based professionals than the mean value of that occupational category of all agglomerations is). The vocational categories in the diagramm are systematised by colour. Shades of blue show technical professions, shades of yellow and orange illustrate economical and financial services. Creative professions are indicated by shades of violet and the colour red shows health professions whereas shades of green scientifically working professions represent. Delegates and civil servants are shown by the colour grey.

Fig. 9 shows the functional strengths of agglomerations in Germany. Some regions show pronounced complementary strength. Frankfurt has a functional surplus in with services and engineering, in contrast Berlin has a functional surplus with sciences, creative professions and law services. The strengths of these two agglomerations are complementary and emphasise the hypothesis of increasing labour division in the German city system. Other agglomerations show a functional overvalues but almost equal for all occupational categories. One of these agglomerations is Hamburg, whose functional structure is balanced but close to the mean with only a small surplus in creative professions. Munich is another agglomeration that has an almost balanced functional structure, but a much bigger functional surplus with all knowledge-based professions. The Ruhr, as the last of the five big agglomerations, demonstrates that there is no correlation between region-size and functional surplus. The industrial heritage has influenced the functional structure till today. A functional surplus can be found with 'Technicians' and 'Technical Qualified Personnel'. Other knowledge-based professions are present and close to mean but not above average.

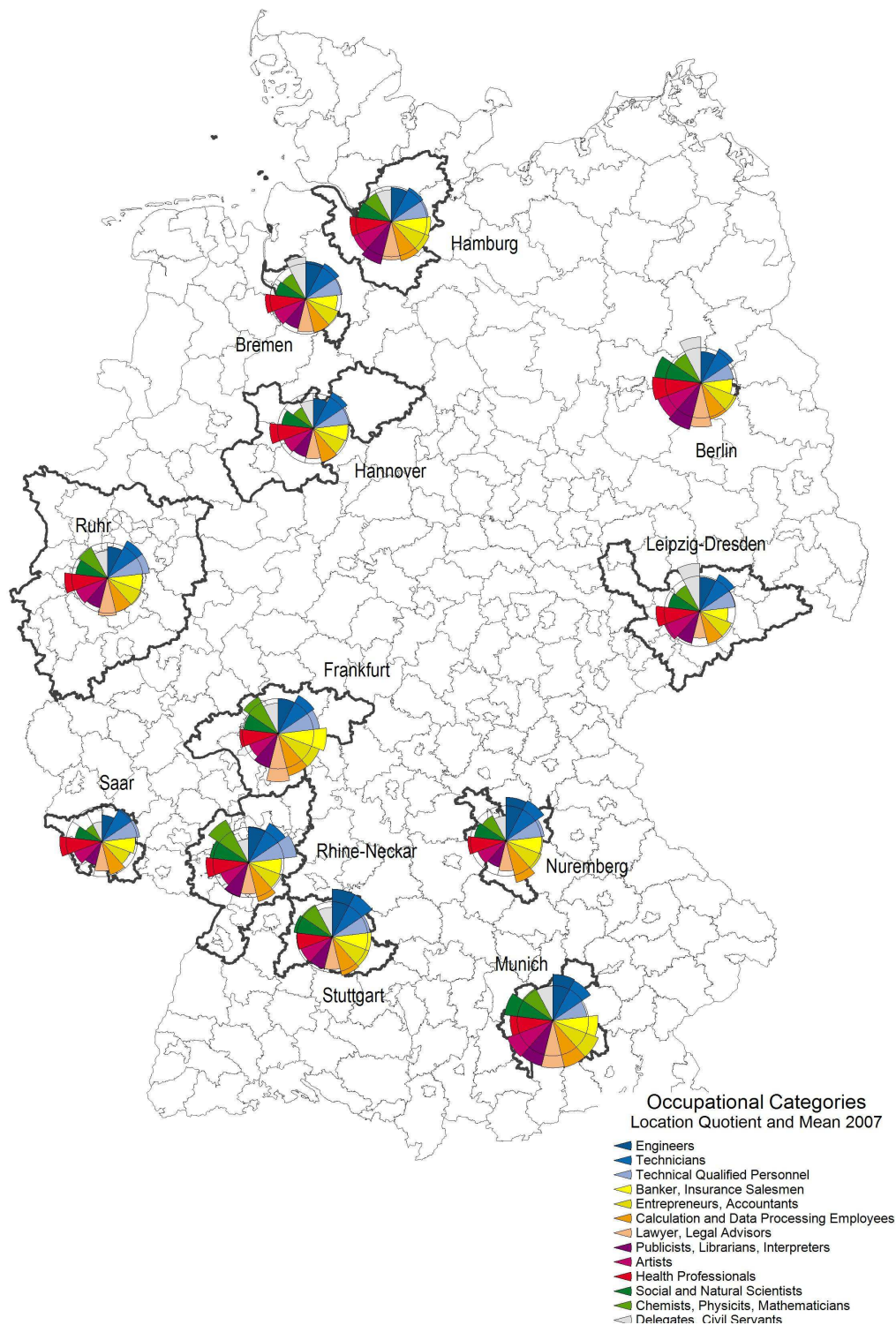


Fig. 9: Occupational Categories 2007

## 7 CONCLUSION

Summarizing the results of the analysis first conclusions for the two hypotheses can be drawn. Concerning the hypotheses about differentiated concentration processes it has been shown, that knowledge-based professions do not concentrate equally above average in agglomerations. The absolute number of knowledge-based professionals suggests a concentration of these vocations in agglomerations. By calculating the location quotient, size effects had been eliminated. Furthermore four groups were identified that vary in their affinity of spatial concentration patterns: professions with no affinity to agglomerations, professions with an affinity to regional agglomerations, professions with an affinity to core cities, and professions with an affinity to agglomeration core cities.

However, these groups do not develop independent from each other. Occupational categories of different affinity groups can depend on each other. In this case different spatial affinities can be a hint on spatial demands of the diverse professions concerning their work environments. For example the concentration of management and consulting services ('Banker, Insurance Salesmen', 'Entrepreneurs, Accountants', 'Lawyer, Legal Advisors') increase mainly in the centres of agglomerations. Close connected to these services are 'Calculation and Data Processing Employees', but that occupational category concentrates more in high density areas next to metropolitan cores than in the core cities themselves. A possible explanation could be that on the one hand both services depend on each other as a client or as a service provider and therefore prefer a certain spatial proximity but on the other hand spatial demands of management and consulting services look much more about representativeness and accessibility whereas calculation and data services look about reasonably priced and sometimes large scaled sites.

Concerning the hypothesis about strengthening the labour divided city-system it had been shown that concentration processes reflect the labour division in the German city system as not all professions show the same patterns of concentration. By comparing the development of the values for location quotients during the last decade with the above or under average strength of agglomerations it has been shown that the two examples 'Banker, Insurance Salesmen' and 'Artists' tend to concentrate in agglomerations where already strength in management and consultant services or in creative economies exist. The increase of certain professions in agglomerations where these professions are already concentrated above average suggest an increase of the characteristic labour division of the German city system.

## 8 DISCUSSING STRATEGIES ON GAINING HUMAN CAPITAL

First interpretations of the statistical data show that challenges concerning the gain of human capital differ very much throughout all regions. On the one hand agglomerations and core cities have good starting points to develop strategies that focus in knowledge work. But as there has also been shown that not all knowledge professions concentrate in huge agglomerations. There are also special types of cities which are not belonging to huge agglomeration areas but show approaches of concentration anyway (e.g. rural areas of lower density, which show an increase of concentration with health professionals and scientists or rural parts of urbanised areas, which show an increase of concentration of 'Technicians', 'Technical Qualified Personnel' and 'Engineers').

Each region has therefore to study their occupational structure and to identify possible future strength. But analysing occupational categories is only one perspective in working on human capital and often difficult to be influenced by regional planning and politics. Spatial planning and regional politics can find a lot of starting points for developing strategies on gaining human capital if they consider spatial demands of human capital.

Human capital builds a very heterogeneous group. It can not only be differentiated between professions but also by different spatial demands which are influenced by their work as well as their private life, e.g. by different housing preferences or by different recreational activities. Spatial demands of human capital are therefore based on a close link between work and private life, but differ within lifestyles and phases of life. The example of choosing places of residence show the consequences: on the one hand a lot of skilled people are well off people and therefore prefer the life style of well off people including living in suburbs and commuting into town (cf. GLAESER 2004). But on the other hand there are skilled people who have – due to the change of working situations like working in projects and decentralised responsibilities instead of hierarchical controlling – a most flexible everyday and workaday life. Consequence of the flexibility is a raised need of coordination and therefore resembles working situations of self-employed. With this group of knowledge worker a high affinity to city cores and urban life is assumed (cf. HELBRECHT; MEISTER 2007).

Social life is another important aspect influencing spatial demands, first and foremost partnership and family. Approaches to work on this aspect were developed – up to now – mainly by private enterprises that compete – like cities and city-regions – for highly skilled labour forces. For them the availability of human capital is crucial to stay in market and therefore private companies developed strategies to tie skilled workers on a long term down to themselves and avoid a movement of labour to competitors. Strategies for that aspect exceed financial incentives and focus on the family-friendliness of the companies. It is the ambition to diminish conflicts between family and career and to influence the decision in favour of the own company on a long

term. Companies' engagement for that aspect makes not only future labour migration unattractive but has also the positive side effect of better usability of the staffs' knowledge, e.g. with a quick returning of high skilled women in the workplace (cf. SIEDENBIEDEL 2006 and ROBBACH 2007).

Hence spatial demands of knowledge workers do not result only from working processes and the necessity to participate in face-to-face-communication. The attractiveness of a city or a city-region can also be raised by consideration of private-life-aspects, like particular needs in conjunction with living, leisure time, family life and different financial opportunities. Thus proposals for strategy development can derive from urban development as well as business management.

In the following part of the paper the four aspects (job situation, leisure time, family life and financial situation) are discussed and spatial demands are substantiated that result from those aspects.

Knowledge worker as ...	Approaches for strategy development
... people with a strong intention in making career	<p>Work on basic economical politics to attract knowledge-based services or research-intensive industries and to support the creation of knowledge-based and well paid jobs.</p> <p>Work on specialized economical politics to sustain the strengths of the city or regions and to create synergies between educational facilities and regional enterprises, e.g. by cluster-development.</p> <p>Develop strategies on internationalization to attract foreign companies, employees and students.</p> <p>Support network-building between economy and science to enable students already during their studies career opportunities in the city or region and therefore to tie them in the long run to the city or region.</p>
... people with a strong requirement of education	<p>Extend further education in the city or region and provide these institutions with personal and impersonal expenses.</p> <p>Gather information about further education.</p> <p>Identify sectors of priorities and support network-building between educational and economical institutions.</p> <p>Provide cultural facilities.</p>
... people with creative activities	<p>Provide spaces for creativity, e.g. backyards, garages, creative houses etc.</p> <p>Create urban spaces to generate stimulations and help to socialise.</p> <p>Provide meeting places and spaces of communication.</p>
... people as part of a well paid population group	<p>Provide high quality living and working opportunities in a well-kept and safe environment.</p> <p>Provide excellent environmental quality.</p> <p>Advance leisure time and recreational opportunities.</p>
... people as part of an unwealthy population group (students, academics without permanent employment)	<p>Provide low priced living opportunities.</p> <p>Provide low priced working spaces, where temporal projects can hark back on office equipment.</p> <p>Provide low priced leisure opportunities that can also be used to make contacts to increase potential earnings.</p>
... companies' founder and self-employed	<p>Provide spatial proximity between living and working to ease coordination during phases of intensive work.</p> <p>Provide research infrastructure that can be used for low prices.</p>

	Provide cheap working spaces to attenuate shortage of capital during initial stages.
... young employees that start a family	Provide high quality child care institutions that offer flexible opening hours  Provide high quality schools that meet demands of educational orientated parents.  Provide spatial proximity to relieve coordination between family life and career.
... people with high requirements on mobility and flexibility	Provide access to high quality transportation systems to be attractive for knowledge worker with private or job connections beyond the city or region, e.g. long-distance-relationships or working in national and international projects.  Develop new kinds of infrastructure, e.g. free access to power sockets, WLAN and internet access in public spaces.
... people working in international contexts	Preparing and supporting immigration of foreign students and employees by reducing language barriers (e.g. on websites and within administrations) and supporting settling in (e.g. help finding accommodations and settling in a foreign culture).  Supporting the moving in of family members of foreign employees by providing international and multilingual child care and schools.  Providing full time opening hours of infrastructure because working hours might be orientated at working hours of customers and partners e.g. in Japan or in the U.S.

It becomes obvious that human capital is not a homogenous group of skilled workers. On the one hand empirical evidence can be found that spatial patterns of human capital differ within occupational categories. Some professions tend to increase concentration processes in agglomerations and therefore deepen spatial disparities. Other professions increase in less dense areas and therefore diminish disparities. These empirical results can be used as a basis by regional planning and politics to analyse regional challenges and chances. Hence strategies to attract human capital and knowledge-based jobs can tie in with present human capital and their spatial demands.

In that context it seems necessary to match separated policies and above all intensify the connection between education and economic policy with city and regional development. Due to the fact that education and training are crucial to human capital, the connection between city and regional policy and education policy is important. Furthermore the connection between economic policy and regional development has not only to limit on questions about traffic and company locations but should also consider the importance of regions attractiveness to human capital and the opportunities to satisfy the knowledge workers spatial demands.

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