The Pattern of Spatially Concentrated Industries in East Germany: A Contribution to the Discussion on Economic "Clusters"

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Abstract

Throughout the literature in regional economics, there have been only a few attempts, so far, to look at a greater region or even at an economy as a whole, in order to find out – with empirical data which allow to compare between the sub-regions – for all sub-regions what their specific „competences" in the field of spatially concentrated industrial activities are and whether there is a typical spatial pattern of concentrated industrial activities. The proposed paper is presenting the empirical results of a study on spatially concentrated industries in the Eastern part of Germany, where the current regional policy scheme, which de facto follows the "watering can principle", is under debate. In the first part of the paper, the possible dimensions and the "ingredients" of economic "clusters" and industrial agglomerations will be discussed. One important dimension is the existence of intra-regional value-added chains for certain products. But, at the moment, it is not possible to identify such value-added chains by using existing empirical data at the more aggregated levels of an economy. Therefore, our study and the paper are concentrating on just three main dimensions of economic "clusters" and industrial agglomerations: (1.) Particular high spatial concentrations of certain industries are identified (based on employment data) for all East German counties. (2.) The existence of business networks in the East German regions is discovered. (3.) Spatially concentrated innovation activities are recorded for each region by using patent data by IPC classes. Finally, the findings from the three elements are synthesized for showing how sectoral concentration, business networking and innovation competencies in the individual regions are overlapping.

Keywords: Agglomeration, Cluster, Spatial Concentration, Regional Policy

JEL-Classification: R 12, O 31, R 58.

1. Introduction

In recent years, policymakers and regional marketing officials all over the world have turned to the practice to praise the attractiveness of their own regions with the potentials of the economic "clusters" within the respective regions. There is, at the moment, almost a kind of political euphoria on "clusters". Popular case studies of currently successful "clusters" in certain regions have supported this tendency; policymakers are trying to replicate the "success stories" in other regions. But, so far, no common practice has been developed in regional economics for coming to an objective picture of regional "clusters".

Throughout the literature in regional economics, most authors agree that spatially concentrated industrial activities are important for regional economic growth. Agglomeration economies, which may occur in the context of spatial concentration and "clusters", may lead to lower costs of production and may reduce transaction costs of all kind, e. g. information costs, including the costs for R&D activities. There is much less agreement on (and: knowledge about) the empirical identification of existing spatially concentrated economic activities in the real world. For the last decade, the discussion on spatial concentration has been dominated by praising the benefits of economic "clusters". Many case studies on regions with economic "clusters" are describing how the mechanisms of these specific "clusters" work. But there have been only a few attempts, so far, to look at a greater region or even at an economy as a whole, in order to find out – with empirical data which allow to compare between the sub-regions – for all sub-regions what their specific „competences" in the field of spatially concentrated industrial activities are and whether there is a typical spatial pattern of concentrated industrial activities.

The paper is presenting an approach to operationalize, to measure empirically, and to compare the existence and the quality of spatially concentrated industries (SCI) in different regions. In the following *second section* of the paper, the possible dimensions and the "ingredients" of economic "clusters" and industrial agglomerations will be discussed. The paper's *section three* is proposing an approach to operationalize SCI and their quality. *Section four* presents the empirical results of a study by the authors on the spatial pattern of different types of SCI. The empirical investigation was done for the Eastern part of Germany, [1] where the prevailing regional policy scheme, which de facto follows the "watering can principle" and has, so far,

[1] The empirical results are based on a study which was conducted for the German Federal Office for Building and Regional Planning (BBR). See Rosenfeld et al. 2004.

not brought the expected positive impacts on regional economic growth, is currently under debate. “Cluster policy” is one of the main slogans for a new regional policy scheme in East Germany. Finally, in *section five*, some conclusions for future research on “clusters” and SCI, as well as some possible political implications of our empirical results, are discussed.

2. Basic elements of economic clusters

Research on agglomeration effects has a long tradition in regional economics. Since the analytic description of “industrial districts” by Marshall, several categories of urbanisation effects and localisation effects have been differentiated (cf. Rosenthal/Strange 2003). In the light of this tradition, Porter’s cluster approach appears as an attempt to elaborate the localisation effects, to actualise the Marshallian "industrial district" for the case of high tech firms and to describe some intra-cluster micro processes more precisely. With regards to agglomeration externalities the local knowledge spillovers gain importance in this approach especially for the smaller firms in the cluster without own R&D capacities (cf. McCann 2004, 39).

In general, the cluster approach established by Porter (1990) represents the attempt to elaborate those conditions on which industrial firms unfold optimal growth chances. As a cluster Porter regards “ a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" (1998, 199). From this view, necessary basic elements of a cluster are

a) spatial proximity between a number of firms belonging to the same industry or to a field of industries,

b) relations between firms on a vertical level (suppliers, buyers), on a horizontal level (joint R&D, joint membership in a business network, but also as competitors in the same product and labour markets).

Beside firms, also universities, research units, technology parks, regional trade associations, etc. may belong to a cluster. Often these institutions are focussed on innovative activities within the cluster. Frequently this orientation to innovation (which leads to spatially concentrated innovative competences) is listed as an additional basic feature of a cluster (cf. Martin/Sunley 2003; Ketels 2003; Barjak 2004).

The characteristics specified in a) and b) are suffering from a conceptual vagueness: It is not clear which degree of spatial proximity is necessary for the cluster members, a fact that leads to uncertainties and to a wide variety in the measurement and delimitation of clusters. Another source of arbitrariness of the cluster demarcation comes from the circumstance that Por-

ter leaves open, which frequency and which degree of intensity of mutual relations between the firms in spatial proximity is required to set up a cluster. Moreover, it is still unsettled whether the experiences won by the example of high technology clusters can be transferred also to other technologies and industries. Another critical point is the confusion between causes and effects of clusters, for instance with regards to the above average innovation performance of the firms in a cluster or to the above average entrepreneurial dynamics within clusters. Because the cluster concept is relatively imprecisely, and there is a high pressure to use the cluster concept as a framework for regional policy actions, regional economists have the task to deliver an analytical framework to identify existing clusters empirically as precisely as possible.

3. Operationalisation for the purpose of an empirical investigation

For the purpose of cluster identification, at present different methods are in use. On the one hand, calculations of statistical indices relating the concentration of employment, firms, etc. in a subregion to that in a larger region allow country- or regionwide statements. On the other hand, more expensive empirical investigations of value-added chains and of business networks located in a region result in case specific in-depth information, but this knowledge stays restricted to special cases (case studies). The following operationalisation steps start from the assumption that clusters are a multi-dimensional phenomenon which cannot be captured satisfactorily by a single indicator.

From the viewpoint of the authors, three elements (cf. sub-sections 3.1-3.3), which have to appear simultaneously, are of particular adequacy when it comes to the identification of clusters:

a) Criterion of spatial proximity: the existence of a spatially concentrated industry (SCI),

b) Criterion of interconnectedness: an interconnection between firms and/or between firms and regional research units in shape of at least one business network,

c) Criterion of the existence of spatially concentrated innovative competences.

3.1 Spatial concentration

For the measurement of the spatial concentration of industries, the toolbox of regionally oriented statistical analysis provides a wide range of indicators (cf. e. g. Aiginger et al. [1999]: pp. 36-37):

- *Absolute concentration* is calculated as a ratio of economic activity in a certain industry in an individual sub-region and the economic activity of the same industry in the region as a whole (i. e., in the sum of the sub-regions). For the purpose of our investigation, we regard the seven regions which have the highest absolute concentration rate as the most important locations in a certain industry. Hereafter these regions will be considered as regions with spatially concentrated industries (SCI). The existence of counties or of towns within a Spatial Planning Region, which belong to the seven most important locations in East Germany in terms of a certain industry, is considered as a starting point, when it comes to the identification of economic clusters. Despite the easiness of its calculation and interpretation, the measurement of absolute concentration has a number of disadvantages too: It does only reveal the weight of the top-ranking regions. Furthermore, the number (n) of top-ranked regions which were regarded as the most important locations – in our case: n = 7) remains de facto arbitrarily. Against this background, the indicator of absolute concentration should be completed by an indicator which allows to measure the relative concentration of an industry.
- *Relative concentration:* As a measure of relative spatial concentration of economic activities, the Gini-coefficient will be used. Contrary to the measurement of absolute concentration, it reveals the spatial distribution of the respective economic activities among all sub-regions. The value lies between 0 and 1. The value "0" shows a completely equal distribution of economic activities among the sub-regions, whereas a value near "1" reflects a high degree of spatial concentration of a certain industry.

Beyond regional concentration, *sectoral specialisation* might be regarded as an alternative approach to measure industrial agglomeration. Both approaches are based on the same set of data, i. e. data on economic activity (employment, turnover etc.) by industries and by sub-regions. However, the authors focused on the measurement of *regional concentration*. The focus was laid on the latter because the question was not to which extent a certain industry contributes to the total employment of a region. Instead, the question was, at which locations the economic activities of a certain industry show the strongest presence.

As far as the "economic activity" is concerned, as proxies generally data on employment, turnover or on the number of firms can be used. For the purpose of our investigation, we used employment data by industries. Unlike turnover data, they are available both in sectorally and in territorially disaggregated form. Furthermore, unlike the number of firms, the use of employment data allows to take into account the economic potential of the given kind of eco-

nomic activity.[2] The basic level of sectoral disaggregation is the NACE 2-digit level[3]. Using sectoral data at the 2-digit level can be regarded as adequate because a medium aggregation level allows to display industrial aggregates which already represent interrelated sub-sectors. These data stem from the database of the Federal Labour Agency on employees which are subject to social insurance contributions. The basic territorial unit (named above as "sub-region") for the measurement of spatial concentration is the level of the counties (Kreise) and of the Free Towns (kreisfreie Staedte). The investigation covers the whole territory of East Germany (mentioned above as "region as a whole"), including all 112 counties and Free Towns. However, in order to reduce the complexity of information, arising from the relatively large number of sub-regions, the information on spatial concentration patterns are presented for more aggregated territorial units, i. e. for the 23 spatial planning regions in East Germany.

3.2 Business networks

Exploring business networks empirically is by no means an easy task, at least for two reasons: First, the phenomenon "business network" is a quite "shimmering" term. Second, data on business networks were not handed on the plate. As far as the first aspect is concerned, in its ideal form, business networks consist of specific inter-firm cooperation, which go beyond pure market-oriented transactions. Its target is to improve the competitiveness of the network partners (for a definition of business networks, cf. e. g. Sydow [1992], p. 79). As "specific" in terms of inter-firm cooperation are regarded its interdependency, reciprocity and the more intensive know-how transfer in comparison with transactions outside business networks.[4] Even this brief enumeration of characteristics makes clear, that for empirical investigations at the meso-level (if interviews at the firm level are not intended) only business networks can be explored which show a certain degree of formalization. Formalization means that the respective inter-firm cooperation reveals itself as a "network" in the public, e. g. by publishing an own website or by installing a network manager or by publishing a contact address. Putting the focus on somehow formalized business networks, means, in turn, that not all networks existing in the real world could be considered. Those business networks which shape a more informal type of cooperation can not be identified. So far as the above mentioned second kind

[2] Using the number of employees as a measure of "economic activity, however, has disadvantages too. In an extreme case, an SCI might be represented only by one firm in the respective region.

[3] In our investigation, we used the German version of the NACE classification, i. e. the German Classification of Economic Activities, Edition 1993 (WZ 1993), cf. Statistisches Bundesamt 2003.

[4] For the characteristics of business networks cf. Grabher (1993).

of difficulties is concerned, databases on business networks which cover Germany or East Germany in total do not exist.[5]

Against this background, an empirical approach was practised which comprised two steps of work. Within a first step of work, a broad variety of publicly available information sources, particularly of internet sources, was explored. The information sources explored concerned especially internet platforms of networks which receive public financial support, e. g. by Federal R&D assistance programmes. Furthermore, network databases for two Federal States were explored (see footnote 5). As a second step of work, an inquiry was conducted among governmental administrations at the "Laender" level in East Germany as well as among regional development agencies and chambers of industry and commerce. As a result of the second work step, a number of additional networks could be identified which did not get any public financial support or which where supported by specific programmes of the individual Federal States.[6] Within our investigation, networks were gathered which represent formalized cooperation; at least one of the network members has to be a private business. Public research units had to be regarded as network partners too. The investigation of networks included forms of cooperation, with the exception of training activities. For each network, a set of data was compiled. The set comprises particularly information about the industry affiliation (at NACE 2-digit level), about the location of the network (by using the contact address).

3.3 Spatially concentrated innovative competences

The spatial concentration of industries and business networks is an essential precondition of clusters. Additionally, the existence of spatially concentrated innovative competences can help to define whether clusters exist in a region. The firms constituting a regional cluster of innovative competences may not belong to the same industry, but they and service companies as well as research units shall be oriented to a common technology.

For the measurement of spatially concentrated innovative competences, in principle, output-oriented indicators (e.g. number of newly developed products and procedures, patents, sold licenses) appear better suited than input-oriented (e.g. R&D expenditures, regionally available human capital). In order to be able to locate spatially concentrated innovative competences,

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[5] As far as East Germany is concerned, comprehensive databases on networks are only available with respect to the Laender Brandenburg and Saxony. For the database regarding Saxony, R. Schöne, Chemnitz University of Technology, laid the foundations, cf. Schöne (without year of publication).

[6] These programmes offered at the Laender level often have a relatively small funding, and, contrary to a number of networks which received Federal support, more detailed information on these networks usually are not published.

the appropriate indicators had to be available on a disaggregated level with respect to industry and spatial scale. These requirements are met by the statistics of patent applications. This indicator documents first of all invention activities, which prospered so far that their economic utilization can be expected. However, the indicator does not supply information whether this utilization expected in the future actually takes place. Beyond that, the patent indicator does not cover industries with – typically – low patenting activities.[7] Problems may also arise from the circumstance that the East German firm structure is characterised by a large proportion of branch plants. Frequently multi-location enterprises practise patenting the inventions developed at the branch plants from the (West German or European) headquarters. These disadvantages should be kept in mind with regard to the following interpretation of the results.

The more patent applications in the same technological field, the larger the regional stock of knowledge available for transformation in competitive products. The higher the number of patent applications, the larger the probability that the patents will be applied not only by a single source, but by a larger number of companies and research units, i.e. the indicator also informs about the size relations of the diverse spatially concentrated innovative competences.

For the measurement of spatially concentrated innovative competences, the number of patent applications recorded at the German and the European patent office by technical area and by planning regions for the period 1995-2000 were used. To display spatially concentrated innovative competences, the absolute number of the patent applications seems more appropriate than the patent density (patent applications per 100,000 inhabitants and/or person employed). The inclusion of a six-year-period results from the idea that spatially concentrated innovative competencies should be characterised by a certain steadiness of the innovation activities. A case of a spatially concentrated innovative competency is regarded as given, if there is a minimum of 50 patent applications related to a certain technical field.

4. Empirical findings

4.1 The pattern of spatially concentrated industries (SCI)

As has been explained in section 3.1, for the empirical identification of SCI, we propose to refer to employment data and to the absolute concentration rate: If a county or a Free Town belongs to one of the seven most important East German locations in a certain industry, this

[7] For further critical aspects of patent applications as an indicator for innovation see Schmoch (1999).

county or Free Town has a SCI in the respective industry. In addition, the Gini-coefficient may be used for qualifying the SCI. If a certain industry shows a low degree of spatial concentration (a low Gini-coefficient), the differences in the levels of economic activities between the seven most important locations (= locations with SCI) and all the other locations in the respective industry will only be small. In this case, one might expect that the potentials of the SCI for becoming the cores of regional "economic clusters" are smaller than if the degree of spatial concentration is higher.

SCI in General

If one is looking for the general spatial pattern of SCI, it could be expected that the degree of agglomeration of a region may have some impact on the localization of SCI. With regard to the degree of agglomeration of a region, the German Federal Office for Building and Regional Planning (BBR) has developed a categorization at the level of the counties and Free Towns. Each county or Free Town is allocated to one of the following categories: Agglomerated spaces, Urbanized spaces, Rural spaces. Some German Planning Regions include counties or Free Towns from more than one of these categories. By looking only at those Planning Regions which include only counties from one of the three categories, Table 1 shows in column 2 that the densely populated areas have the higest share of all SCI. Of course, this result is not surprising, as the density of population will usually go along with a regional concentration of businesses. But Table 1 also shows that the number of SCI is above average in the more densely populated areas, compared with the shares of business units (column 3) and population (column 4) per type of region, while the share of SCI in the Rural Spaces is lower than theses regions' shares of business units and population. This result might be interpreted in the sense that urbanization economies play a relevant role for the location of SCI. Another explanation could be that in more agglomerated areas, businesses which are producing goods and services that are important for the functions of central places are highly concentrated *(SCI with central-place-related functions)*. Industries of this type are e. g. the following ones: Electricity, gas, steam and hot water supply; Collection, purification and distribution of water; Retail trade; Hotels and restaurants.

Other findings on the spatial pattern of SCI concern the question whether their location is inside or outside of Free Towns ("kreisfreie Städte"). All larger German towns (where the population density is, in general, relatively high) have the legal status of Free Towns, while the smaller towns and localities have to be members of counties (the German term for these

towns and localities is "kreisangehörige Städte und Gemeinden"). Although the population density inside the counties is, in general, lower than inside the Free Towns, for interpreting the following results one has to take into account that there are some German counties where the population density is not much lower than that of the Free Towns.

Table 1: SCI, business units and inhabitants in the East German planning regions[a] by types of regions (as of June 30, 2001)

Type of Region	Number (Percentage) of SCI per Type of Region	Percentage of Business Units perType of Region (as of Dezember 31, 2001)	Percentage of Inhabitants per Type of Region (as of December 31, 2001)
Agglomerated Spaces (Type 1)	190 (54.8 %)	51.5 %	48.6 %
Urbanized Spaces (Type 2)	118 (34.0 %)	30.2 %	32.0 %
Rural Spaces (Type 3)	39 (11.2 %)	18.4 %	19.4 %
Total	347 SCI (100.0 %)	100.0 %	100.0 %

[a] The table does only include spatial planning regions which are unequivocally affilated to one of the three types of Regions.

Sources: Compilation of the authors based on the IWH database on SCI; Rosenfeld et al 2004, Anhang A-2; annex-table A.1; German Federal Statistical Office, Statistical Offices of the German Laender; spatial typology by the German Federal Office for Building and Spatial Planning; calculations by the authors.

Our empirical findings show that from a total of 410 SCI[8], 246 (60 %) are located in Free Towns, while 164 (40 %) have their location inside Counties.[9] This underlines the general tendency of SCI to chose their location in densely populated areas. SCI are concentrated, above all, in Berlin, the regions around Dresden (Upper Elbe Valley/Eastern Ore Mountains), Leipzig (Western Saxony), and Chemnitz (Chemnitz-Ore Mountains).[10] All other Planning Regions have much less SCI. By looking at all Planning Regions with more than 20 SCI, apart from the regions already mentioned, only Central Thuringia (the region around Erfurt, with 25 SCI), Magdeburg (with 24 SCI), and Halle (with 22 SCI) have higher numbers of SCI. Central Thuringia, Magdeburg and Halle belong to the Urbanized Spaces (regions with a medium degree of agglomeration). The existence of larger cities (Erfurt, Magdeburg, Halle) might give some explanation for the comparatively high numbers of SCI in the regions in question. But: The region Central Mecklenburg/Rostock (with the larger city of Rostock) has

[8] This number includes all SCI, not only the SCI of those Spatial Planning Regions which are unequivocally affilated to one of the three Types of Regions, and all SCI if there is more than one SCI in the respective industry inside a certain Planning Region.

[9] Source: Calculations by the authors.

[10] Cf. the annex-table A-1.

no more than 11 SCI. This spatial pattern fits into the common picture of South-North-Disparities among Germany's regions.

SCI in sectors with different degrees of spatial concentration (according to the Gini-coefficient)

The picture of the spatial pattern of SCI (as the seven most important locations in East Germany in terms of a certain industry), as described so far, could be modified by looking at the relative spatial concentration (measured with the Gini-coefficient). If a certain industry shows a low degree of spatial concentration (a low Gini-coefficient), one might expect that the potential of the SCI in this industry for becoming the core of a regional "economic cluster" is smaller than if the degree of spatial concentration was higher. According to this general idea, all SCI were divided into three groups:

- The "High Type of SCI" includes all SCI in those industries, where the Gini-coefficient is between 0.78 and 1.00.
- If the Gini-coefficient in an industry is between 0.56 and 0.78, the SCI in this industry belong to the "Medium Type of SCI".
- The SCI in those industries, where the Gini-coeficient is between 0.34 and 0.56, are classified as the "Low Type of SCI".[11]

The most important differences between the spatial pattern of SCI in general (see Table 1, column 2) and the spatial pattern of the three types of SCI (see Table 2, columns 2, 3, and 4) are the following ones: Most interesting is that the share of the rural spaces (agglomerated spaces) on the High Type of SCI (see Table 2, column 2) is higher (lower) than the share of the rural spaces (agglomerated spaces) on the SCI in general (see Table 1, column 2). On the other hand, the share of the rural spaces (agglomerated spaces) on the Low Type of SCI (see Table 2, column 4) is lower (higher) than the share of the rural spaces (agglomerated spaces) on the SCI in general. The spatial pattern of the High Type of SCI (see Table 2, column 2) is more or less identical with the distribution of the percentage of business units per type pf Region (see Table 1, column 3).

[11] The highest Gini-coefficient for an East German industry reaches the value of 0.99, while the lowest Gini-coefficient for an East German industry is about 0.34. Cf. Rosenfeld et al. 2004, Anhang A-1.

Table 2: Different types of SCI in the East German planning regions[a] by types of regions (as of June 30, 2001)

Type of Region	Number (Percentage) of the High Type of SCI per Type of Region	Number (Percentage) of the Medium Type of SCI per Type of Region	Number (Percentage) of the Low Type of SCI per Type of Region
Agglomerated Spaces (Type 1)	42 (50.6 %)	76 (55.1 %)	72 (57.1 %)
Urbanized Spaces (Type 2)	26 (31.3 %)	50 (36.2 %)	42 (33.3 %)
Rural Spaces (Type 3)	15 (18.1 %)	12 (8.7 %)	12 (9.5 %)
Total	83 (100.0 %)	138 (100.0 %)	126 (100.0 %)

[a] The table does only include spatial planning regions which are unequivocally affilated to one of the three types of regions.

Sources: Compilation of the authors based on the IWH database on SCI; Rosenfeld et al 2004, Anhang A-2; annex-table A-1; spatial typology by the German Federal Office for Building and Spatial Planning; calculations by the authors.

By asking for those regions, where the High Type of SCI has the largest share at the total of all SCI in the respective region, the – surprising – result is, that Vorpommern (a region which belongs to the category of the rural spaces) is leading with 66.7 %, followed by (the urbanized space) Upper Lusatia-Lower Silesia (40 %) and the agglomerated spaces of Havelland-Fläming (28.6 %), Berlin (24.5 %), Chemnitz-Ore Mountains (21.6 %), and Upper Elbe Valley/Eastern Ore Mountains (22.5 %).[12] These findings might be explained with the hypothesis, mentioned above, that in the agglomerated spaces, a lot of SCI are existing which may be categorized as *SCI with central-place-related functions* and are producing typical goods and services which are connected to the so-called "Functions of Central Places". The respective industries have to be present in every Central Place, as they are producing necessary basic goods for other industries and / or the private households, and are not concentrated at only a limited number of places, as it is the case in many other industries.

There are some additional important differences between the types of industry which are clustering for SCI in the rural spaces and those types of industry which are clustering for SCI in the agglomerated spaces. By looking only at the branches which belong to the High Type of SCI, there are four industries which are completely missing in Rural spaces. These four industries may be categorized as *SCI with knowledge-intensive products*. The industries in question

[12] Calculations of the authors, based on Rosenfeld et al. 2004.

are the fields of Manufacture of office machinery and computers (30), Air Transport (62), Computer and related activities (72), and Research and development (73).[13]

4.2 SCI which go along with business networks

The operationalisation conducted in section 2 requires that in addition to SCI the networks existing in the respective industry have to be identified. The idea to complete the findings on SCI by information on networks results from the theoretical background (see section 2), that the existence of a spatially concentrated industry alone does not provide sufficient indication for the existence of economic clusters. Therefore, as a next step, the congruences between spatially concentrated industries and the existence of business networks which show an affiliation to the respective industry, are investigated. A congruency with a business network is taken for granted, if at least one of the industries in which the network is active, overlaps with the respective SCI in the region under consideration.

Before we present the findings whether and to which extent SCI go along with networks, a brief overview rearding the networks identified in total should be presented: As a result of our investigation, totally, 256 networks were identified for East Germany.[14] For 254 of them, information on the sectoral affiliation were available. The findings show, that 183 (72%) of these networks show congruences with SCI, 71 (28%) networks do not show such congruences.

Changing the perspective, from the viewpoint of SCI, 118 of totally 369[15] SCI show congruences with at least one business network. This means that the majority of SCI is not supported by formal network activities. As far as the places are concerned where such congruencies show a high frequency it could be expected that this is mostly the case in densely populated areas, where businesses and research units are highly concentrated. Indeed, the highest absolute numbers of congruencies reveal a number of regions with high or medium population

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[13] Compilation of the authors, based on Rosenfeld et al. 2004.

[14] The spatial criterion for their identification is the location of the contact person/management/coordination unit of the respective network.

[15] The total number of spatially concentrated industries stems from a simple calculation. As spatially concentrated industries were counted the seven largest locations. The calculation covers 59 industries x 7 = 413. One specific industries is only existent in 4 counties, therefore the total number of spatially concentrated industries is 410. To reduce the complexity of information, the spatially concentrated industries were assigned to the 23 Spatial Planning Regions, which usually cover 2-7 counties. In 41 cases there was more than one county within a Spatial Planning Region which ranked among the top-7 largest locations of a certain industry. These multiple counts were excluded from the calculation, which results in number of 369 cases of spatially concentrated industries.

density, i. e. the regions of Berlin, Chemnitz-Ore Mountains. Western Saxony, Upper Elbe Valley/Eastern Ore Mountains and Central Thuringia (see Table A-1). In the real world, moreover, there are many cases where a spatially concentrated industry is connected with more than one network which is active in the respective industry.[16] As examples for the existence of more than one network within SCI, the *manufacture of machinery and equipment* and the *manufacture of textiles* in the Chemnitz-Erzgebirge (Saxony) can be regarded. Within the former SCI, 18 networks are active, within the latter 10. As another example the *manufacture of medical, precision and optical instruments, watches and clocks* in Berlin can be used: 9 networks were identified which are active in this SCI.[17] The empirical findings show, that congruencies between spatially concentrated industries and networking in East Germany are not limited to high-tech und medium high-tech manufacturing sectors and to science-based service industries.[18] This finding can be regarded as an indication that facilitating innovation is only one among a broader variety of motivations for establishing business networks.

Whereas in densely populated areas congruencies between spatially concentrated industries and networks are often existent, it is less often the case in areas with low population density. Among the 7 regions where the share of SCI, which are connected with networks, lies only between 0-20%, 5 regions are sparsely populated rural spaces (see annex, table A-1).

As far as the 71 networks are concerned, which are not backed by a respective SCI, it might be assumed that they do not show a sufficient stability and durability, because they suffer from the lacking sectoral "backbone". However, a positive perspective of networks which are not backed by an SCI, can not generally be excluded. E. g., we found out the existence of a number of networks in the field of information and communication technologies (ICT), where suppliers and clients established common platforms, e. g. in rural regions, to foster the use of ICT. For this purpose, SCI in the ICT sector, probably, might not be necessary.

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[16] An indication for the co-existence of business networks in a SCI is the fact, that there are 118 SCI which show a congruence with a network and, in turn, that there are 178 networks which are backed by a SCI. This fact reveals that a number of SCI covers more than one network.

[17] However, the typical case is that the business networks gathered in our study have a cross sectoral character. In many cases this has to do with the strategic orientation to come up with innovation in advanced technologies, e. g. in bio- or nano-technology which are per se cross sectoral technologies.

[18] In line with a rough classification delivered by Eurostat (see Strack 2003) the group of high-tech manufacturing sectors includes the following industries (No. of the NACE 2-digit classification): 30, 32, 33. The group of the medium high-tech manufacturing industries covers the following industries (No. of the NACE 2-digit classification): 24, 29, 31, 34, 35. The group of science based services includes the following industries (No. of the NACE 2-digit classification): 61, 62, 64, 65, 66, 67, 70, 71, 72, 73, 74, 80, 85, 92. For an explanation of the NACE code – see the annex, table A-1.

To sum up, the circumstance, that one third of the SCI show congruences with business networks shows, that such congruences do not represent ubiquitary characteristics. Regions which possess such SCI which are linked with business networks, might bear good economic development prospects. However, to deepen the insights whether SCI bear the characteristics of clusters, in the following subsection the congruence of SCI with spatially concentrated innovation competences will be investigated.

4.3 SCI which go along with cases of spatially concentrated innovative competences

General overview on the location of spatially concentrated innovative competences

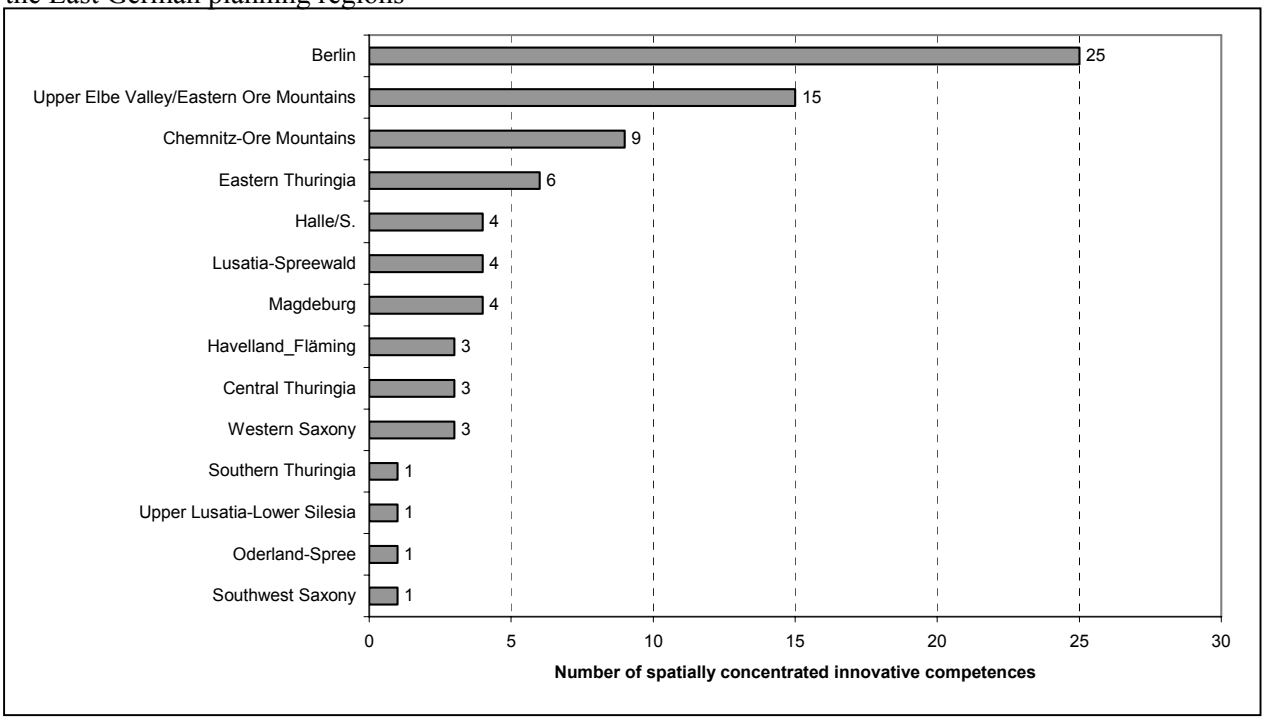
On base of the operationalisation as it was explained in sub-section 3.3, 80 cases of spatially concentrated innovative competences were identified. They are located in 14 of the 23 East German planning regions (see chart 1). As expected, innovative competences are not evenly distributed all over the planning regions. The majority of them is situated in or close to agglomerations: 25 are located in Berlin and 7 in the adjacent southern Brandenburg planning regions (Havelland-Fläming, Lusatia-Spreewald). Another main area of spatially concentrated innovative competences are the Saxonian planning regions around Dresden (Upper Elbe Valley/Eastern Ore Mountains) and Chemnitz (Chemnitz-Ore Mountains).

For the dominance of the capital Berlin, several factors may be influential. Merely because of its sheer size Berlin is the most important East German firm location for many industries (cf. Rosenfeld et al. 2004, Anhang A-2). Beyond that, Berlin is distinguished by a high density of universities and research units.[19] Moreover, the firms in the Western part of Berlin, which were integrated in the West European economy, could continue their innovative activities after 1990.

In the period 1995-2000 the East German patent applications contributed to 9.4% of all German patent applications. Compared with the East German population share of 20% this performance is below average. Table 3 shows the specific technological fields where East Germany reveals strengths in innovation. The percentages in column 3 of Table 3 can be regarded as indicators for the innovation performance in the specific technological field: the proportion of 11.8% in the field of electrical engineering lies above, the proportion of 4.9% in the field of 'land vehicles, ships, aircraft' below the average for Germany as a whole.

[19] This high density of universities and research units leads to the fact that in 2000 11.3% of the patent applications came from the science sector whereas in Germany as a whole this proportion came to 4.0% (Greif/Schmiedl 2002, 137).

Chart 1:
Cases of spatially concentrated innovative competences in East Germany and their distribution across the East German planning regions



Source: Authors' calculations based on Greif/Schmiedl (2002).

Berlin appears in each of the technological fields and in seven of eight cases with the largest number of patents. This dominance stems not alone from the city's spatial concentration of universities, research units and firms practising R&D, but partially also goes back to the habit of several larger firms to apply the patents at the firm's headquarter and not necessarily at the location where the invention originated from.

This dominance stems not alone from the city's spatial concentration of universities, research units and firms practising R&D, but partially also goes back to the habit of several larger firms to apply the patents at the firm's headquarter and not necessarily at the location where the invention originated from.

Table 3

Technological fields where the greatest number[a] of spatially concentrated innovative competences does exist (IPC; sum of patent applications 1995-2000)

Technological field (IPC)	Patent applications		Planning region in East Germany (number of patent applications in the specific technological field)
	In East Germany (abs.)	Share of all German pat. appl. (%)	
Electrical engineering	2 172	11.8	Berlin (1 150); Upper Elbe Valley/Eastern Ore Mountains (277); Eastern Thuringia (104); Chemnitz-Ore Mountains (93); Central Thuringia (68); Havelland-Fläming (63); Southern Thuringia (59); Western Saxony (59); Oderland-Spree (51)
Measuring, testing, optics, photography	2 042	13.3	Berlin (717); Eastern Thuringia (323); Upper Elbe Valley (218); Central Thuringia (111); Chemnitz-Ore Mountains (93); Halle (67); Havelland-Fläming (60); Lusatia-Spreewald (55); Magdeburg (51)
Fixed constructions	1 004	8.1	Berlin (232); Upper Elbe Valley/Eastern Ore Mountains (93); Chemnitz-Ore Mountains (72); Western Saxony (65); Magdeburg (58); Havelland-Fläming (54)
Separating, mixing	887	10.7	Berlin (208); Upper Elbe Valley/Eastern Ore Mountains (90); Eastern Thuringia (78); Halle (71); Lusatia-Spreewald (59); Chemnitz-Ore Mountains (53)
Health, amusement	1 021	11.0	Berlin (435); Eastern Thuringia (109); Western Saxony (60); Upper Elbe Valley/Eastern Ore Mountains (60)
Land vehicles, ships, aircraft	978	4.9	Berlin (350); Upper Lusatia-Lower Silesia (61); Magdeburg (55); Chemnitz-Ore Mountains (54)
Anorganic chemistry	652	16.4	Berlin (122); Upper Elbe Valley/Eastern Ore Mountains (87); Eastern Thuringia (52); Halle (50)
Organic Macromolecular Componds	474	8.5	Halle (153); Lusatia-Spreewald (70); Berlin (66); Upper Elbe Valley/Eastern Ore Mountains (61)

[a] There are only technical fields displayed which show 4 and more spatially concentrated technological fields.

Source: Authors' calculations based on Greif/Schmiedl (2002).

Congruences with SCI

According to the cluster operationalisation explained above (cf. 2.), it is necessary to check, how many of the identified spatially concentrated innovative competences are congruent with a SCI in the East German planning regions. The relation between both elements is complex:

a) two or more spatially concentrated innovative competences (e.g. 'organic chemistry', 'anorganic chemistry') can be aligned to a single SCI (e.g. chemical industry);

b) one spatially concentrated innovative competence (e.g. 'land vehicles, ships, aircraft') can be aligned to two or more SCI (e.g. automobile industry, shipbuilding industry);

c) one spatially concentrated innovative competence (e.g. biotechnology) has no SCI counterpart, because this field of technology has a cross-sectoral character;

d) a certain spatially concentrated innovative competence does not have a SCI counterpart, because the number of employees in the related industry is too small.

In some cases additional region-specific information is needed to connect a spatially concentrated innovative competence with a SCI, because the designation of certain technological fields (e.g. 'separating, mixing') is very general. Taken this into consideration, the results of the check show that the majority of the 80 cases of spatially concentrated innovative competences is congruent with a SCI. Obviously, there are only few cases where spatially concentrated innovative competences arise without any backing by a SCI, whereas networks more often exist while a SCI is not given. Only 11 of the spatially concentrated innovative competences cannot be connected to a SCI. In the following chapter (4.4) the results concerning the SCI (4.1), the business networks (4.2), and the spatially concentrated innovative competences (4.3) will be integrated with the goal to identify the clusters in East Germany.

4.4 SCI which go along with both networks and innovative competences

What spatial pattern can be displayed by combining all the three elements of "economic clusters", which have been analyzed, so far? Table 4 shows a very strong spatial concentration of SCI which go along with both other elements of "economic clusters" (according to the operationalization explained in this paper's section 2) to the Agglomerated spaces (see column 3).

Table 4: SCI, business networks and spatially concentrated innovative activities in the East German planning regions[a] by types of regions (as of June 30, 2001)

Type of Region	Number (Percentage) of SCI per Type of Region	Number (Percentage) of SCI which go along with both other elements of "economic clusters", per Type of Region	Number (Percentage) of SCI which go along with just one of the other elements of "economic clusters", per Type of Region
Agglomerated Spaces (Type 1)	190 (54.8 %)	44 (80.0 %)	30 (49.2)
Urbanized Spaces (Type 2)	118 (34.0 %)	11 (20.0 %)	24 (39.3)
Rural Spaces (Type 3)	39 (11.2 %)	0 (0 %)	7 (11.5)
Total	347 SCI (100 %)	55 (100 %)	61 (100 %)

[a] The table does only include Spatial Planning Regions which are unequivocally affilated to one of the three Types of Regions.

Sources: Compilation of the authors based on the IWH database on SCI; Rosenfeld et al 2004, Anhang A-2; annex-table A.1; spatial typology by the German Federal Office for Building and Spatial Planning; calculations by the authors.

This concentration is much stronger than that of the SCI in total (see column 2). In the Rural spaces, 11,2 % of all SCI are located, but none of these SCI goes along with business networks and spatially concentrated innovative activities. A look at column 4 shows that the spatial concentration is less strong in the case of SCI which go along with either networks or with spatially concentrated innovative activities.

5. Conclusions

5.1 Conclusions for future empirical studies on "economic clusters"

The paper had the intention (a) to bring more light into the discussion on "economic clusters" by proposing an approach to operationalize SCI and the quality of SCI, and (b) to conduct a first empirical test of this operationalization for the regions in East Germany, the results of which were presented in section 4. Future studies will have the task to check whether the operationalization may also be adopted to other regions. One problem that might occur for other regions is that the empirical identification of business networks could be more difficult than in East Germany. In East Germany, most businesses evolved in the time after the German Reunification (since 1990). Networks among those businesses are in many cases supported by grants from the Laender or the German federal government. Therefore, a great proportion of East Germany's business networks are formal networks; formalization is a precondition for public support. In other regions, where the majority of business networks has an informal character, probably much more research efforts will be necessary to identify empirically the existing networks than in the case of East Germany.

Other tasks for future empirical studies should be to look at the impact of the different types of SCI on the economic performance of the respective industries, as well as on their impact on regional economic growth. What is, e. g., the influence of *SCI with central-place-related functions* on other industries? In addition, the location-pattern of SCI has to be explained. Why are, e. g., *SCI with knowledge-intensive products* exclusively located in the Agglomerated spaces? Finally, it would also be interesting to study the development of business networks and / or spatially concentrated innovative activities which are not connected to SCI. It could be asked, e. g., whether networks which are not backed by SCI will have less chances to survive, in the long run, than those networks which are closely connected to certain SCI.

5.2 Implications for Regional Policy

The questions mentioned above show that our knowledge on the mechanisms of „economic clusters" and their impacts on regional economic development is still rather limited. Policy-

makers have, of course, not the time to wait until regional economists have solved all the existing „mysteries“ of SCI and „economic clusters“. At least at the moment, policymakers in (East) Germany and all over Europe, at all levels of government, are trying to support regional growth processes, especially in order to stimulate the development in those regions which are lagging behind. What could policymakers learn from our findings on “economic clusters” in East Germany?

- In those regions, where the majority of or a lot of SCI go along with business networks plus spatially concentrated innovative activities (this is in general the case, as has been shown, for the Agglomerated spaces), one could suppose that growth conditions for the SCI are good, and that there is no need for regional policy. Although this strategy of “doing nothing” might be right in general, for the regions in East Germany it will probably be the wrong choice, because the economic performance of the East German Agglomerated spaces is still significantly below the level of economic activities in the Agglomerated spaces in the western parts of Germany.[20] Therefore, regional policy in favour of the East German agglomerations is still necessary. Strategies could be to support existing network activities or innovative competences.
- In those regions, where SCI go along with only one of the other elements of economic clusters, policymakers may try to supplement the respective missing element, in order to support the conditions for economic growth. If networks are missing, regional policy could try to stimulate network activities, e. g. by paying subsidies for a network management. If spatially concentrated innovative activities are missing, regional policy could e. g. try to attract public research units into the respective region. The idea behind this strategy is that the researchers from this units could cooperate with the private firms of the SCI in question and contribute to more private research activities.
- If a region has no SCI at all, at the moment, a strategy to implant (with high amounts of public subsidies) an “artificial” SCI in this region is rather risky. Today, nobody has enough information on the future development of different categories of industries; an “implanted” SCI in a region, without linkages to other economic actors in the respective region, could collapse in the near future. Only for those regions without SCI, where the current network activities and / or innovative activities (of private firms or public research

[20] For details see Rosenfeld/Heimpold 2004.

units) in a certain field are extremely promising and apparently attractive for additional private investments, policymakers could turn to the strategy to improve the information about these regional conditions for potential investors.

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Annex

Table A-1: Congruencies between spatially concentrated industries and business networks in East German Planning Regions

Planning Region (Type of region[a])	Number of spatially concentrated industries[b] (as of June 30, 2001)	Of which: Number (share) of spatially concentrated industries which show congruencies with a business network[b]	Of which: Number (share) of spatially concentrated industries which do not show congruencies with a business network[b]	Industries[c] (which show a congruency[d] with (at least) one network (in parentheses: German Classification of Economic Activities, Edition 1993 [WZ 93])
Berlin (1)	53	24 (45.3)	29 (54.7)	Agriculture, hunting and related service activities (01); Manufacture of food products and beverages (15); Publishing, printing and reproduction of recorded media (22); Manufacture of chemicals and chemical products (24); Manufacture of fabricated metal products, except machinery and equipment (28); Manufacture of machinery and equipment n.e.c. (29); Manufacture of office machinery and computers (30); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Manufacture of motor vehicles, trailers and semi- trailers (34); Manufacture of other transport equipment (35); Collection, purification and distribution of water (41); Construction (45) ; Hotels and restaurants (55); Supporting and auxiliary transport activities; activities of travel agencies (63); Post and telecommunications (64); Real estate activities (70); Computer and related activities (72); Research and development (73); Other business activities (74); Public administration and defence; compulsory social security (75); Health and social work (85); Recreational, cultural and sporting activities (92); Other service activities (93)
Chemnitz-Ore Mountains (1)	37	17 (45.9)	20 (54.1)	Manufacture of textiles (17); Manufacture of wearing apparel; dressing and dyeing of fur (18); Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20); Manufacture of fabricated metal products, except machinery and equipment (28); Manufacture of machinery and equipment n.e.c. (29); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of motor vehicles, trailers and semi- trailers (34); Manufacture of furniture; manufacturing n.e.c. (36); Recycling (37); Electricity, gas, steam and hot water supply (40); Construction (45); Hotels and restaurants (55); Computer and related activities (72); Other business activities (74); Education (80); Health and social work (85); Sewage and refuse disposal, sanitation and similar activities (90)
Western Saxony (1)	38	11 (28.9)	27 (71.7)	Publishing, printing and reproduction of recorded media (22); Manufacture of basic metals (27); Manufacture of fabricated metal products, except machinery and equipment (28); Manufacture of machinery and equipment n.e.c. (29); Manufacture of medical, precision and optical instruments, watches and clocks (33); Construction (45); Computer and related activities (72); Research and development (73); Other business activities (74); Education (80); Health and social work (85);
Upper Elbe Valley/ Eastern Ore Mountains (1)	40	11 (27.5)	29 (72.5)	Manufacture of food products and beverages (15); Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20); Manufacture of chemicals and chemical products (24); Manufacture of other non- metallic mineral products (26); Manufacture of machinery and equipment n.e.c. (29); Manufacture of electrical machinery and apparatus n.e.c. (31); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Computer and related activities (72); Other business activities (74); Health and social work (85)
Havelland-Fläming (1)	14	4 (28.6)	10 (71.4)	Manufacture of medical, precision and optical instruments, watches and clocks (33); Manufacture of motor vehicles, trailers and semi- trailers (34); Air transport (62); Recreational, cultural and sporting activities (92)
Oderland-Spree (1)	8	1 (12.5)	7 (87.5)	Recycling (37)

Continuation of the table A-1: Congruencies between spatially concentrated industries and business networks in East German Planning Regions

Planning Region (Type of region[a])	Number of spatially concentrated industries[b] (as of June 30, 2001)	Of which: Number (share) of spatially concentrated industries which show congruencies with a business network[b]	Of which: Number (share) of spatially concentrated industries which do not show congruencies with a business network[b]	Industries[c] which show a congruency[d] with (at least) one network
Lusatia-Spreewald (1, 2)	14	6 (42.9)	8 (57.1)	Other Mining and quarrying (14); Manufacture of chemicals and chemical products (24); Recycling (37); Electricity, gas, steam and hot water supply (40); Education (80); Sewage and refuse disposal, sanitation and similar activities (90)
Prignitz-Oberhavel (1, 3)	4	2 (50)	2 (50)	Forestry, logging and related service activities (02); Manufacture of other transport equipment (35);
Uckermark-Barnim (1, 3)	4	1 (25)	3 (75)	Agriculture, hunting and related service activities (01)
Central Thuringia (2)	25	7 (28)	18 (72)	Manufacture of rubber and plastic products (25); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Construction (45) ; Computer and related activities (72); Other business activities (74); Recreational, cultural and sporting activities (92)
Halle (Saale) (2)	22	6 (27.3)	16 (72.7)	Manufacture of chemicals and chemical products (24); Manufacture of fabricated metal products, except machinery and equipment (28); Research and development (73); Other business activities (74); Public administration and defence; compulsory social security (75); Education (80);
Upper Lusatia-Lower Silesian (2)	10	6 (60)	4 (40)	Manufacture of food products and beverages (15); Manufacture of textiles (17); Manufacture of wearing apparel; dressing and dyeing of fur (18); Manufacture of rubber and plastic products (25); Manufacture of other transport equipment (35); Sewage and refuse disposal, sanitation and similar activities (90)
Central Mecklenburg/ Rostock (2)	11	5 (45.5)	6 (54.5)	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing (05); Manufacture of other transport equipment (35); Water transport (61); Supporting and auxiliary transport activities; activities of travel agencies (63); Recreational, cultural and sporting activities (92)
Magdeburg (2)	24	4 (16.7)	20 (83.3)	Construction (45) ; Other business activities (74); Health and social work (85); Other service activities (93)
Eastern Thuringia (2)	14	4 (28.6)	10 (71.4)	Manufacture of rubber and plastic products (25); Manufacture of other non- metallic mineral products (26); Manufacture of medical, precision and optical instruments, watches and clocks (33); Research and development (73)
Soutwest Saxony (2)	12	3 (25.0)	9 (75.0)	Manufacture of machinery and equipment n.e.c. (29); Manufacture of motor vehicles, trailers and semi- trailers (34); Manufacture of furniture; manufacturing n.e.c. (36);
Southern Thuringia (3)	12	3 (25.0)	9 (75.0)	Manufacture of fabricated metal products, except machinery and equipment (28); Manufacture of machinery and equipment n.e.c. (29); Manufacture of motor vehicles, trailers and semi- trailers (34)
Vorpommern (3)	6	1 (16.7)	5 (83.3)	Manufacture of other transport equipment (35)
Northern Thuringia (3)	2	1 (50)	1 (50)	Manufacture of furniture; manufacturing n.e.c. (36)
Western Mecklenburg (3)	8	0 (0.0)	8 (100.0)	
Mecklenburg Lake Plateau (3)	4	0 (0.0)	4 (100.0)	
Altmark (3)	2	0 (0.0)	2 (100.0)	
Dessau (3)	5	0 (0,0)	5 (100.0)	Manufacture of chemicals and chemical products (24)

[a] For the explanation of the Typology see Table A-2, footnote a. [b] Excluding multiple counts. c The sectoral classification used here is the German Classification of Economic Activities, Edition 1993 (WZ 93) – see Statistisches Bundesamt 2003. [d] For an explanation what congruency between a spatially concentrated industry and a network means is given in the text, paragraph 4.2, footnote c

Source: Compilation of the authors based on the IWH database on innovation competences, business networks and spatially concentrated industries; Rosenfeld et al 2004, Anhang A-2., spatial typology by the German Federal Office for Building and Spatial Planning; calculations by the authors.

Table A-2: Congruence between SCI and spatially concentrated innovative competences in the East German Planning Regions

Planning Region (Type of region-[a])	Number of SCI[b] (as of June 30, 2001)	Number of spatially concentrated competences with congruence to a SCI	Industries[c] congruent with (at least one) spatially concentrated innovative competences
Berlin (1)	53	23	Manufacture of food products and beverages (15); Manufacture of textiles (17); Publishing, printing and reproduction of recorded media (22); Manufacture of chemicals and chemical products (24); Manufacture of fabricated metal products, except machinery and equipment (28); Manufacture of machinery and equipment n.e.c. (29); Manufacture of office machinery and computers (30); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Manufacture of motor vehicles, trailers and semi- trailers (34); Manufacture of other transport equipment (35); Electricity, gas, steam and hot water supply (40); Collection, purification and distribution of water (41); Construction (45) ; Computer and related activities (72); Research and development (73); Other business activities (74); Education (80); Health and social work (85); Recreational, cultural and sporting activities (92); Other service activities (93)
Chemnitz-Ore Mountains (1)	37	9	Manufacture of textiles (17); Manufacture of wearing apparel; dressing and dyeing of fur (18); Manufacture of fabricated metal products, except machinery and equipment (28); Manufacture of machinery and equipment n.e.c. (29); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Manufacture of motor vehicles, trailers and semi- trailers (34); Recycling (37); Construction (45); Sewage and refuse disposal, sanitation and similar activities (90)
Western Saxony (1)	38	3	Publishing, printing and reproduction of recorded media (22); Manufacture of medical, precision and optical instruments, watches and clocks (33); Construction (45); Computer and related activities (72); Research and development (73); Other business activities (74); Health and social work (85)
Upper Elbe Valleyl (1)	40	15	Publishing, printing and reproduction of recorded media (22); Manufacture of chemicals and chemical products (24); Manufacture of other non- metallic mineral products (26); Manufacture of machinery and equipment n.e.c. (29); Manufacture of electrical machinery and apparatus n.e.c. (31); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Electricity, gas, steam and hot water supply (40); Construction (45); Computer and related activities (72); Other business activities (74); Health and social work (85)
Havelland-Fläming (1)	14	3	Manufacture of electrical machinery and apparatus n.e.c. (31); Manufacture of medical, precision and optical instruments, watches and clocks (33); Construction (45);
Oderland-Spree (1)	8	1	Manufacture of electrical machinery and apparatus n.e.c. (31)
Lusatia-Spreewald (1, 2)	14	3	Manufacture of chemicals and chemical products (24); Recycling (37); Electricity, gas, steam and hot water supply (40); Education (80); Sewage and refuse disposal, sanitation and similar activities (90)
Central Thuringia (2)	25	3	Manufacture of rubber and plastic products (25); Manufacture of radio, television and communication equipment and apparatus (32); Manufacture of medical, precision and optical instruments, watches and clocks (33); Computer and related activities (72);
Eastern Thuringia (2)	14	5	Manufacture of chemicals and chemical products (24); Manufacture of rubber and plastic products (25); Manufacture of other non-metallic mineral products (26); Manufacture of medical, precision and optical instruments, watches and clocks (33); Research and development (73); Health and social work (85)
Halle (Saale) (2)	22	2	Manufacture of chemicals and chemical products (24)
Magdeburg (2)	24	4	Manufacture of medical, precision and optical instruments, watches and clocks (33); Manufacture of other transport equipment (35); Construction (45)
Upper Lusatia-Lower Silesia (2)	10	1	Manufacture of other transport equipment (35)

Continuation of the table A-2: Congruence between SCI and spatially concentrated innovative competences in the East German Planning Regions

Planning Region (Type of region[a])	Number of SCI[b] (as of June 30, 2001)	Number of spatially concentrated competences with congruence to a SCI	Industries[c] congruent with (at least one) spatially concentrated innovative competences
Central Mecklenburg/ Rostock (2)	11	0	
South West Saxony (2)	12	1	Publishing, printing and reproduction of recorded media (22
Southern Thuringia (3)	12	1	Manufacture of electrical machinery and apparatus n.e.c. (31)
Vorpommern (3)	6	0	
Northern Thuringia (3)	2	0	
Western Mecklenburg (3)	8	0	
Mecklenburg Lake Plateau District (3)	4	0	
Altmark (3)	2	0	
Dessau (3)	5	0	

[a] The figure set in brackets reveals to which type of regions (Typology of the Federal Office for Building and Regional Planning [BBR]) the respective Spatial Planning Region belongs. Explanation regarding the Typology: 1 = Agglomerated spaces: Urban Centre > 300 000 inhabitants (inh.) or population density about/>300 inh./km^2; 2 =Urbanized spaces: population density > 150 inh./km^2 or Urban Centre > 100 000 inh., with a population density not less than 100 inh./km^2; 3 =Rural spaces: population density < 150 inh./km^2 and without Urban Centre > 100 000 inh.; with an Urban Centre > 100 000 inh. and a population density of < 100 inh/km^2. [b] Excluding multiple counts. [c] The sectoral classification used here is the German Classification of Economic Activities, Edition 1993 (WZ 93) – see Statistisches Bundesamt 2003.

Source: Own compilation based on the IWH database on innovation competences, business networks and spatially concentrated industries; spatial typology by the German Federal Office for Building and Spatial Planning.