LOCATION CONDITIONS OF ENERGY-INTENSIVE ENTERPRISES

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Abstract

There is an interdependent relationship between enterprises and the region in which they are located: On the one hand the conditions of this location influence turnover, costs, profits and thus the economic situation of the individual firm. On the other hand the economic situation of the regional firms is an important determinant of regional economic success and the welfare of the people living in that region. This happens directly because the firms stabilize regional income and employment; but there are also indirect effects running via income and input-output-linkages. Regional economic success and welfare in turn determine the regional tax receipts and the regions' possibilities for positively influencing the location conditions. These interdependencies give an explanation for the high interest firms, politicians and researchers normally have in regional location conditions and their quality. The better a region's information about these issues, the better its possibilities to promote its location advantages and the more efficiently it can use its scarce financial means to reduce the locational disadvantages. Regional marketing and improvements of the region's location conditions aim at the acquisition of new firms, at additional private investment in the region, at the creation and stabilization of employment and the population's welfare.

In recent years the Niederrhein Institute for Regional- and Structural Research (NIERS) has surveyed firms to thoroughly analyze the location conditions of Middle Lower Rhine Area – a German region located in the western part of Northrhine-Westphalia. This research especially aimed at judging the location conditions' quality in Middle Lower Rhine Area. But as the firms had to evaluate not only the local quality but also the general importance of the location factors and as firms' participation in these surveys has been sufficiently high the results also give the opportunity to rank the location factors by its relevance and to differentiate this kind of analysis by industry. So, the aim of the proposed paper is twofold: It firstly describes which locational factors are – on the basis of the above mentioned surveys – most important from the firms' point of view. To find out whether energy-intensive industries have special location requirements it secondly compares these general results with those from energy-intensive industries.

Keywords: Location, location conditions, energy-intensive industries
JEL classification: R12

0. Introduction

There is an interdependent relationship between enterprises and the region in which they are located: On the one hand the conditions of this location influence turnover, costs, profits and thus the economic situation of the individual firm. On the other hand the economic situation of the regional firms is an important determinant of regional economic success and the welfare of the people living in that region. This happens directly because the firms stabilize regional income and employment; but there are also indirect effects running via income and input-output-linkages. Regional economic success and welfare in turn determine the regional tax receipts and the regions' possibilities for positively influencing the location conditions.

The above briefly described interdependent causal structures give an explanation for the high interest firms, politicians and researchers normally have in regional location conditions and their quality. The better a municipality's information about these issues, the better its possi-

bilities to promote its location advantages and the more efficiently it can use its scarce financial means to reduce the locational disadvantages. Regional marketing and improvements of the region's location conditions aim at the acquisition of new firms, at additional private investment in the region, at the creation and stabilization of employment and the population's welfare.

In recent years the Niederrhein Institute for Regional- and Structural Research (NIERS) at the Niederrhein University of Applied Sciences has surveyed firms[1] to thoroughly analyze the location conditions of Middle Lower Rhine Area – a German region located in the western part of Northrhine-Westphalia between the river Rhine and the Dutch-German Border[2]. This research especially aimed at judging the location conditions' quality in Middle Lower Rhine Area and at deriving proposals on how to improve them. But as the firms had to evaluate not only the local quality but also the general importance of the location factors and as firms' participation in these surveys has been sufficiently high the results also give the opportunity to rank the location factors by its relevance and to differentiate this kind of analysis by industry. So, after some introductory theoretical remarks (chapter 1) the aim of the following paper is twofold: It firstly describes which locational factors are – on the basis of the above mentioned survey – most important from the firms' point of view (chapter 2) and it secondly compares these general results with those from energy-intensive industries (chapter 3). The paper ends with a summary.

1. Theoretical Considerations – an Overview

Beside firm-internal aspects economic, social, political and natural framework conditions determine entrepreneurial success. A great deal of these conditions depends on the location; location conditions are all factors which meet the two following requirements (MAIER/TÖDTLING, 2006, p. 20).:

- The factor is relevant for the firm's costs or sales revenue, whereas nonmonetary costs (e.g. expenditure of time) and long run effects (e.g. on innovativeness) have to be regarded as well.
- The factor must show spatial differences concerning availability, quality and/or price.

Starting from this definition the factors determining the firm's location decision can be systemized following Berlemann und Tilgner (BERLEMANN/TILGNER, 2006, p. 17); in general they differentiate between …

- … determinants of production conditions (input),
- … determinants of market conditions (output) and
- … political and legal framework conditions.

In addition to that it might be helpful to discuss agglomerative factors as a further group of location conditions.

Determinants of production conditions

Talking about determinants of production conditions means talking about regional factor endowments – i.e. workforce, private and public capital and real estate. In each case quantitative and qualitative aspects must be distinguished and in addition to that of course prices do matter. Using workforce as an example this means: At first it is important whether there is a sufficient amount of labor available in a region. Nowadays the quantitative availability of workforce usually is not a bottleneck of economic development in German regions. Although unemployment rates are quite high in many German regions there often are deficits in qualified workforce because the increase in qualification requirements of firms has caused a shift from

[1] These surveys have been part of two projects finished in 2003 and 2009 by NIERS and financed by the Chamber of Industry and Commerce Mittlerer Niederrhein. (GOEBEL/HAMM/WENKE, 2009; HAMM/WENKE, 2003).

[2] It consists of the two cities of Mönchengladbach and Krefeld, and the counties Rhein-Kreis Neuss and Viersen.

quantitative to qualitative aspects. Prices mean in this example wages and salaries. Similar considerations apply to real estate; again availability, quality and prices (rents) are relevant.

Concerning capital private and public capital must be distinguished. Availability and prices of real capital highly depends on the availability of financial capital; but as financial capital is mobile, it can be expected that there are hardly any regional differences in availability and prices; so financial capital does not fulfill the requirements for a regional location condition.

Public capital means infrastructure, which can be divided into production and household oriented components. While production infrastructure is directly used by private firms, the household oriented infrastructure influences firms‘ location decisions only indirectly: It improves a location's living standards and quality of life thus making the location more attractive to high qualified workforce, which in turn makes the location more interesting for firms. Important examples of production oriented infrastructure are traffic connections (by road, railroad, water roads and airplanes), information and communication infrastructure, energy infrastructure and facilities for education on all levels as well as research institutions. On the contrary hospitals, homes for elder people or Kindergartens (social infrastructure) are part of household infrastructure; in addition cultural, recreational and leisure facilities could be mentioned in this context.

Determinants of market conditions

One of the main motives of entrepreneurial location decisions is the opening up of markets. In this context the magnitude, the distance and the accessibility of markets internal and external to the region are relevant factors. So transport costs to providers and clients as well as transport connections and the location in economic-geographical space gain special attention. The extent to which a region succeeds in attracting demand external to the region depends on the region's structures by industry, because the industries' export opportunities differ. Whether the regional export-base actually can sell its products to other regions or not is determined by the entrepreneurial competitiveness which again is influenced by costs of inputs, productivity and technology.

Political, legal and social framework conditions

On the macro-level (i.e. nationwide) aspects like political stability, legal stability, system of property ownership and tax burden surely play an important role for firms' location decisions. Framework conditions differing from region to region for instance are the business climate, the duration of permit procedures and the special local fees and taxes.

Agglomerative factors

The fourth group of location conditions considered here is the regional agglomerative potential that cannot be clearly distinguished from the already discussed groups (MAIER/TÖDTLING, 2006, p. 101ff; STAUDACHER, 2005, p. 115). The spatial distribution of already existing eco-nomic activity directly and indirectly influences the location decisions of new and additional activities. These interdependencies between existing and new activities are called agglomera-tive effects. Agglomerative effects can be positive or negative; they can be internal or external to the firm. Economies of scale are positive effects internal to the firm. External Effects influ-ence the economic success of one actor but are controlled by other actors. External agglom-eration effects can be divided into two groups:

- Effects of localization [3] (or rather effects of specialization) appear between firms of one industry and are the higher, the higher the regional concentration of this industry is. Regional concentration can result in certain advantages because (for instance) all firms need the same resources, have similar requirements in infrastructure, have related forward and backward linkages, look for research facilities and possibilities for technology transfer or access a common pool of workforce with similar qualifications.

[3] Sometimes called MAR-Externalities following MARSHALL (1890), ARROW (1962) and ROMER (1986).

• Effects of urbanization [4] in contrast arise between enterprises of different industries. They are in most cases the result of a certain magnitude combined with urban attractiveness, of a variety of offerings stemming from different fields that can be used by firms of all industries. Examples are urban lifestyle, the broad supply of high-quality firm-oriented services, and the variety of worker's qualification or facilities that increase a region's attractiveness executives.

Beside this more traditional systemization of location conditions another classification gained importance in the last decades, namely between hard and soft location factors. Soft location factors are all aspects that might determine a location decision but that can hardly or not at all be expressed in figures or monetary terms – e.g. image, living conditions, leisure or cultural facilities and their quality. Soft and hard location factors are complementary and form in total the relevant determinants of location decisions (GRABOW, 2005, p. 38). Soft location factors can have direct effects – in most cases difficult to measure – or they can be relevant for employees and/or employers. DILLER (1991, p. 29f. and for a similar systematization GRABOW, 1994, p. 148ff) distinguishes firm- and employment-oriented factors as well as personal pref-erences, while GRABOW (2005, p. 38f.) denotes the first group as firm-oriented the two other groups as personal-oriented factors. Furthermore some authors argue that a location's image depends on the one hand on the occurrence of some other already mentioned aspects but on the other hand can be seen as a factor of its own, too.

The outline of location conditions shows that entrepreneurial location decisions are determined by a broad variety of aspects. Nevertheless it should be stressed that …

• … the relevance of these factors can be very different – some of them are of higher others of less importance. The first aim of the present paper is to work out these differences us-ing empirical methods.

• … the relevance of these factors differs by industry. The second aim is to analyze the spe-cial requirements of energy-intensive industries.

2. The Role of Location Conditions

2.1. General Requirements

The following empirical results are based on a firm survey. In spring 2008 the member firms of the Chamber of Industry and Commerce in Middle Lower Rhine Area have been asked (GOEBEL/HAMM/WENKE, 2009) to judge the importance and the specific quality in Nieder-rhein Area for 59 different location factors. More than 1500 (from 6000 asked) enterprises participated in the survey. The research project tried to account for a large number of location relevant factors which all are related to the theoretical considerations of the last chapter. The firms had to judge each single location factor on a scale reaching from 1 to 4 [5].

Table 1 summarizes the firms' answers concerning the relevance of location factors ranked by average marks. The results show, that cost aspects are ranked most important by the firms: Energy costs, costs of waste removal as well as water and waste water fees are the three most important location factors. In addition the municipal fiscal burden seems to be of special importance for the firms; public fees and local taxes on entrepreneurial capital and on land also belong to the ten most important location conditions. Furthermore there are some „traditional" location factors like highways, availability and qualification of workforce amongst the ten factors ranked most important. Finally a business-friendly climate of the local authorities is the last of the ten most relevant location determinants.

Tab. 1: The Role of Location Conditions

[4] Sometimes called Jacobs-Externalities following JACOBS (1969).

[5] With 1 = very important, 2 = important, 3 = less important, 4 = unimportant. The average possible mark therefore was 2,5.

Tabelle 1: The Role of Location Conditions

Location factor	Ranking	all branches
Energy costs	1	1,58
Costs of waste disposal	2	1,72
Water and wastewater taxes	3	1,72
Road and highway access	4	1,73
Local business tax	5	1,75
Qualification of workforce	6	1,82
Public charges	7	1,84
Pro-business local administration	8	1,86
Availability of workforce	9	1,91
Local property tax	10	1,95
Smooth cooperation of local authorities	11	1,97
Adminstrative response time	12	1,99
Information and communication infrastructure	13	2,05
Safety in inner city	14	2,05
Cityscape (cleanliness)	15	2,06
Level of adminstrative regulations	16	2,13
Rents	17	2,17
Portfolio management for local enterprises	18	2,17
Proximity to important customers	19	2,19
Satisfaction with municipal business development	20	2,20
Parking	21	2,21
Duration of permit procedure	22	2,21
Offerings for further ecucation	23	2,21
Vocational training schools	24	2,23
Image and awareness of location	25	2,24
Shopping facilities	26	2,25
Comprehensive schools	27	2,25
Accessabilit/Opening hours of local administration	28	2,26
Cooperation enterprises - schools	29	2,32
Consulting on governmental funding	30	2,32
innercity traffic conditions	31	2,34
Cityscape (architecture)	32	2,35
Supply with firm-oriented services	33	2,35
Availability of R&D facilities	34	2,38
Financing advice	35	2,43
Regional location marketing	36	2,48
Parking fees	37	2,51
University of Applied Sciences (Education)	38	2,51
Supply of household-oriented services	39	2,53
Environmental consulting	40	2,55
Recreation and leisure facilities	41	2,57
Citymarketing	42	2,57
Proximity to important providers	43	2,59
Land price	44	2,61
Cultural offerings	45	2,62
Local public transport	46	2,68
Housing	47	2,71
Consulting in corporate descent	48	2,73
Start-up consulting	49	2,73
Technology consulting	50	2,73
Privatization of municipal responses	51	2,74
University of Applied Sciences (Research)	52	2,76
Sopport in searching real estates	53	2,77
Airport	54	2,97
Event premises	55	3,00
Availablity of industrial real estate	56	3,04
Supply of commercial property	57	3,13
Railway connection	58	3,26
Average		***2,34***
Own calculations		

Conversely railway connections have been the location factor with the lowest relevance. This is plausible bearing in mind that railroad connections only are important for a small number of industrial firms but not for a great number of retail trade and service firms. At first glance does not seem to be plausible, that the availability of real estate and the supply of commercial properties are of minor importance. But these results might stem from a weakness of the underlying research method: The judgment of the relevance of location conditions are based on the answers of already established enterprises; for these firms bottlenecks stemming from the availability of real estate or commercial property seldom exist. Therefore surveying firms that actually want to relocate or just have relocated might be a better approach. The result can be distorted by another disadvantage of our method: If the quality of a location factor is quite good in a certain region firms will hardly see a bottleneck; in this case the factor might lose relevance in the judgment of importance, because the firms do not longer clearly distinguish between importance and quality – a methodological disadvantage which cannot be completely avoided. It cannot be accurately answered whether this argument applies to real estate and commercial properties, but it apparently plays a role in the judgment of airport connections: Theoretical considerations suggest that in the process of globalization airports gained increasing importance as a location factor. This cannot really be seen in the firms' answers to the questionnaire. But with Düsseldorf International Airport and some other not so far away airports (Weeze, Köln, Maastricht, Eindhoven) the airway connections of Middle Lower Rhine are quite good; so that a distortion between „quality" and „importance" might explain this result here.

It is surprising, too, that the availability of technological consulting and the regional university as partner for research and development is less important than most other location conditions. The explanation might be similar to the case of railway connections: A high orientation to new technologies and innovation might not be relevant for many of the interviewed firms.

2.2. Requirements of Energy-Intensive Enterprises

For working out whether the requirements of energy-intensive firms significantly differ from the average, these firms had to be identified in the survey. As the classification numbers (WZ 2003) of all firms participating in the survey were known it was necessary to have a clear definition of "energy-intensiveness" based on this classification. The problem of definition is discussed in some more detail in a study by Eickmeier et.al. (EICKMEIER/GABRIEL/ PFAFFEN-BERGER, 2005, p. 2-1ff). They argue that there is no generally accepted definition and that the chosen relationship to measure energy-intensity or electricity-intensity often depends on po-litical motivation. Despite this critical comment their discussion was helpful for finding a pragmatic solution for the present analysis: First of all, the definition to be used should allow for a clear decision which industry is energy-intensive and which is not. As the paper does not only focus on electricity but also on energy in total, the amount of or the costs of energy in-puts are correct variables to be used in the denominator of an indicator. Costs of energy inputs are preferred here not only because of data availability but also because the possible nomina-tors of the indicator are also monetary variables. With regard to the indicator's nominator data availability is the most important aspect because data at the four digit level of the German Classification of Economic Activities [6] is required. The German Federal Statistical Office pub-lishes gross value added as well as gross value of production [7] at this level of disaggregation. Hence one had to choose between these two variables. As gross production value encloses the costs of all intermediate inputs gross value

[6] See Statistisches Bundesamt (Ed.), Klassifikation der Wirtschaftszweige, Ausgabe 2003 (WZ 2003), Wiesbaden. The Classification WZ 2003 had to be used here because the firms that participated in the survey are classified by this version of the WZ so that this was the only possibility to identify energy-intensive firms in the survey via its WZ-code.

[7] See Statistisches Bundesamt (Ed.), Fachserie 4, Reihe 4.3. The latest data for the WZ 2003 are available for 2007; so these data are used in the present paper.

added is the preferred indicator to avoid distortions that depend on the industries' share of intermediate inputs.

Table 2: Energy-Intensive Branches 2007

WZ	No. of firms in sample		Gross Value of Production (GVP)	Gross Value Added (GVA)	Energy Consumption	Energy Consumption Share in GVA in %	Enery Consumption Share in GVP in %
DA1597		Manufacture of malt	322.635	36.158	30.960	85,63	9,60
DI2653		Manufacture of plaster	176.205	54.445	34.311	63,02	19,47
DI2652		Manufacture of lime	649.674	245.762	153.126	62,31	23,57
CA10		Mining of coal and lignite; extraction of peat	4.279.279	419.160	253.984	60,59	5,94
DI2651	1	Manufacture of cement	2.520.286	868.877	431.267	49,63	17,11
DE2112	3	Manufacture of paper and paperboard	16.252.688	3.718.550	1.761.694	47,38	10,84
DG2413		Manufacture of other inorganic basis chemicals	5.124.057	1.141.518	533.379	46,73	10,41
DI2640	1	Manufacture of bricks, tiles and construction produrcts in baked clay	1.474.913	548.071	243.286	44,39	16,49
DJ2742	1	Aluminium production	14.237.921	2.063.684	736.403	35,68	5,17
DJ2710		Manufacture of basic iron and steel and of ferro-alloys	41.523.840	10.577.925	3.663.448	34,63	8,82
CB141		Quarrying of stone	1.061.682	380.181	128.473	33,79	12,10
DG2470		Manufacture of man-made fibres	4.242.699	917.318	307.666	33,54	7,25
DA1562	1	Manufacture of starches and starch products	1.669.497	342.942	111.943	32,64	6,71
DI2630		Manufacture of ceramic tiles and flags	789.492	261.675	84.509	32,30	10,70
DI2611		Manufacture of flat glass	1.363.565	463.844	143.376	30,91	10,51
DI2613		Manufacture of hollow glas	2.570.075	1.013.622	307.145	30,30	11,95
DI2662		Manufacture of plaster products for construction purposes	1.398.966	370.693	109.218	29,46	7,81
CB1422	1	Mining of clays and koalin	349.530	146.467	40.791	27,85	11,67
DD2020		Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards	6.381.552	1.289.752	336.975	26,13	5,28
DG2414	1	Manufacture of other organic basic chemicals	24.365.531	5.334.872	1.333.165	24,99	5,47
DA1541		Manufacture of crude oil and fats	2.380.218	212.808	52.526	24,68	2,21
CB1421	5	Operation of gravel and sand pits	2.265.621	854.770	209.950	24,56	9,27
DG2415		Manufacture of fertilizers and nitrogen compounds	3.385.200	947.562	224.256	23,67	6,62
DB1723		Worsted-type weaving	176.174	45.958	10.719	23,32	6,08
DB1711		Preparation and spinning of cotton-type fibres	485.467	132.283	30.470	23,03	6,28
DI2614		Manufacture of glass fibres	1.029.432	363.896	83.280	22,89	8,09
DJ2745	1	Other non-ferrous metal production	2.174.413	154.085	33.582	21,79	1,54
DA1531		Porcessing and preserving of potatoes	1.487.343	356.006	74.991	21,06	5,04
DB1730	4	Finishing of textiles	976.591	372.896	78.271	20,99	8,01
DJ2751	3	Casting of iron	6.162.893	2.049.878	426.762	20,82	6,92
DG2412		Manufacture of dyes and pigments	3.100.923	958.044	198.026	20,67	6,39
DA1512		Production and preserving of poultrymeat	3.492.724	425.153	86.489	20,34	2,48
DA1583		Manufacture of sugar	2.871.076	829.579	165.181	19,91	5,75
DJ2743	1	Lead, zinc and tin production	2.716.015	507.316	100.906	19,89	3,72
DI2615	1	Manufacture and processing of other glass, including technical glassware	2.133.575	849.389	162.411	19,12	7,61
DN3720	4	Recycling of non-metal waste and scrap	1.715.704	472.377	90.165	19,09	5,26
DA1551		Operation of dairies and cheese making	26.101.322	2.417.618	454.504	18,80	1,74
CB1450		Other mining and quarrying n.e.c.	126.765	30.565	5.529	18,09	4,36
DJ2734	6	Wire drawing	1.822.391	336.298	60.153	17,89	3,30
DG2416	1	Manufacture of plastic in primary forms	44.742.060	10.670.274	1.885.798	17,67	4,21
DA1585		Manufacture of macaroni, noodles, couscous and similiär farinaceous products	581.715	118.636	20.943	17,65	3,60
DA1532		Manufacture of fruit and vegetable juice	2.965.693	345.499	59.495	17,22	2,01
DI2682		Manufacture of other non-metallic mineral products n.e.c.	4.315.568	1.133.190	192.103	16,95	4,45
DE2122		Manufacture of household and sanitary goods and of toilet requisites	4.716.415	1.281.247	216.625	16,91	4,59
DA1571	1	Manufacture of prepared feeds for farm animals	4.576.934	548.930	90.602	16,51	1,98
DJ2721		Manufacture of cast iron tubes	458.381	126.606	20.416	16,13	4,45
DE2111		Manufacture of pulp	746.659	225.453	35.174	15,60	4,71
DI2626	1	Manufacture of refractory ceramic products	1.669.310	522.650	78.554	15,03	4,71
Calculated on basis of German Ferderal Statistical Office							

The second question to be answered was the definition of a threshold value. For pragmatic purposes an industry is defined to be energy-intensive if the share of total energy costs in gross value added exceeded 15 % in 2007. Table 2 shows the industries whose energy-

intensiveness lies above this threshold. Most of these industries can be assigned to the following 2-digit-industries: Manufacture of food products (15), of pulp, paper and paper products (21), of chemicals (24), of non metallic mineral products (26) and of basic metals and metal products (27). The table also gives information about the number of energy-intensive firms that participated in the survey (37 in total) and their allocation by industry – energy-intensive firms are distributed among a relatively wide range of different fields of production. So number of the firms and their distribution in the sample suggest that the database is sufficient to analyze the special location requirements of energy-intensive firms.

Table 3: Location Requirements of Energy-intensive Branches

Table 3: The Role of Location Conditions

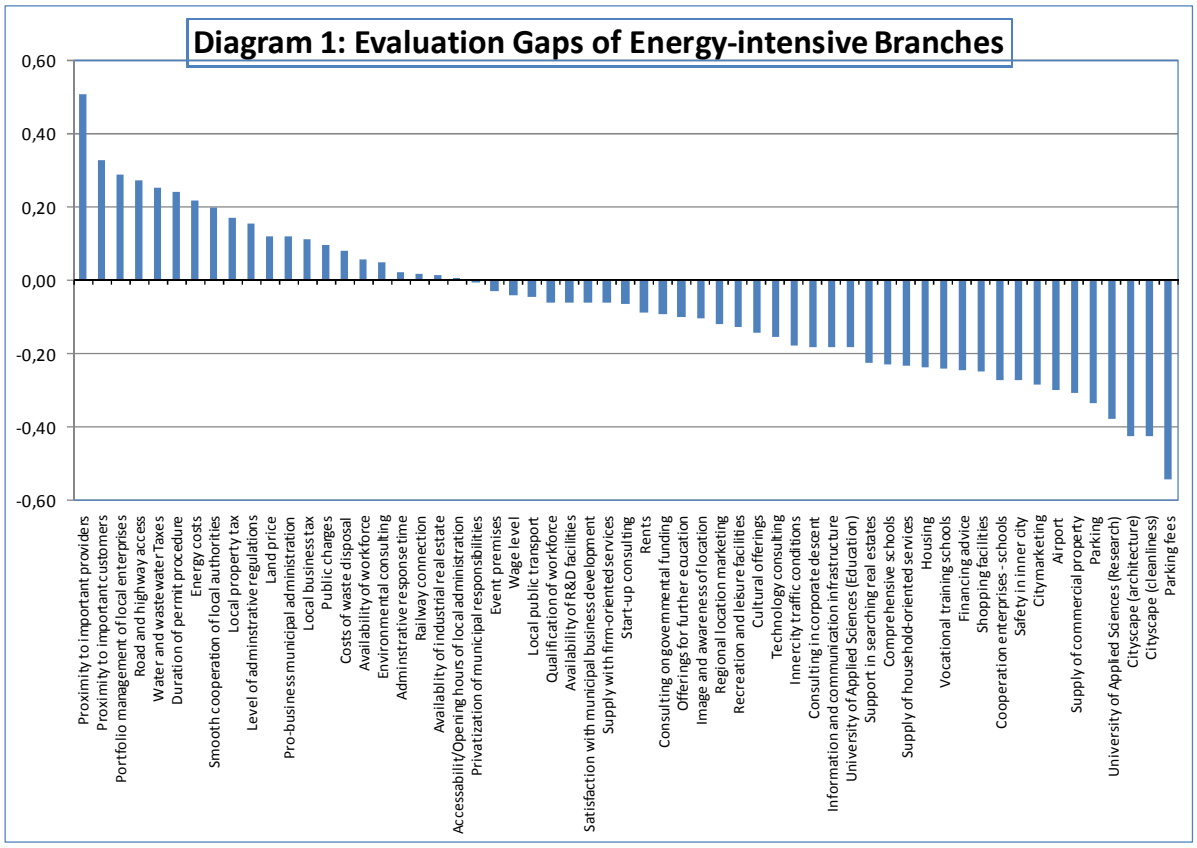
Ranking	Location factor	evaluation		Ranking Gap	Evaluation Gap
		energy-intensive branches	all branches		
1	Energy costs	1,36	1,58	0	0,22
2	Road and highway access	1,46	1,73	2	0,27
3	Water and wastewater taxes	1,47	1,72	0	0,25
4	Costs of waste disposal	1,64	1,72	-2	0,08
5	Local business tax	1,64	1,75	0	0,11
6	Public charges	1,74	1,84	1	0,10
7	Pro-business local administration	1,74	1,86	1	0,12
8	Smooth cooperation of local authorities	1,77	1,97	4	0,20
9	Local property tax	1,78	1,95	2	0,17
10	Availability of workforce	1,85	1,91	0	0,06
11	Proximity to important customers	1,86	2,19	9	0,33
12	Qualification of workforce	1,88	1,82	-6	-0,06
13	Portfolio management for local enterprises	1,89	2,17	6	0,29
14	Wage level	1,94	1,90	-5	-0,04
15	Adminstrative response time	1,97	1,99	-2	0,02
16	Level of adminstrative regulations	1,97	2,13	1	0,16
17	Duration of permit procedure	1,97	2,21	6	0,24
18	Proximity to important providers	2,08	2,59	26	0,51
19	Information and communication infrastructure	2,23	2,05	-5	-0,18
20	Rents	2,26	2,17	-2	-0,09
21	Accessability/Opening hours of local administration	2,26	2,26	8	0,01
22	Satisfaction with municipal business development	2,26	2,20	-1	-0,06
23	Offerings for further ecucation	2,31	2,21	1	-0,10
24	Safety in inner city	2,32	2,05	-9	-0,27
25	Image and awareness of location	2,34	2,24	1	-0,10
26	Consulting on governmantal funding	2,41	2,32	5	-0,09
27	Supply with firm-oriented services	2,42	2,35	7	-0,06
28	Availability of R&D facilities	2,44	2,38	7	-0,06
29	Vocational training schools	2,47	2,23	-4	-0,24
30	Comprehensive schools	2,48	2,25	-2	-0,23
31	Cityscape (cleanliness)	2,49	2,06	-15	-0,43
32	Land price	2,49	2,61	13	0,12
33	Shopping facilities	2,50	2,25	-6	-0,25
34	Environmental consulting	2,50	2,55	7	0,05
35	innercity traffic conditions	2,51	2,34	-3	-0,18
36	Parking	2,54	2,21	-14	-0,33
37	Cooperation enterprises - schools	2,59	2,32	-7	-0,27
38	Regional location marketing	2,60	2,48	-1	-0,12
39	Financing advice	2,68	2,43	-3	-0,25
40	University of Applied Sciences (Education)	2,70	2,51	-1	-0,18
41	Recreation and leisure facilities	2,70	2,57	1	-0,13
42	Local public transport	2,72	2,68	5	-0,05
43	Privitazation of municipal responsibilities	2,74	2,74	9	-0,01
44	Cultural offerings	2,76	2,62	2	-0,14
45	Supply of household-oriented services	2,76	2,53	-5	-0,23
46	Cityscape (architecture)	2,77	2,35	-13	-0,42
47	Start-up consulting	2,79	2,73	3	-0,06
48	Citymarketing	2,85	2,57	-5	-0,28
49	Technology consulting	2,89	2,73	2	-0,16
50	Consulting in corporate descent	2,91	2,73	-1	-0,18
51	Housing	2,94	2,71	-3	-0,24
52	Sopport in searching real estates	3,00	2,77	2	-0,23
53	Acvailablity of industrial real estate	3,03	3,04	4	0,02
54	Event premises	3,03	3,00	2	-0,03
55	Parking fees	3,06	2,51	-17	-0,55
56	University of Applied Sciences (Research)	3,14	2,76	-3	-0,38
57	Railway connection	3,24	3,26	2	0,02
58	Airport	3,27	2,97	-3	-0,30
59	Supply of commercial property	3,44	3,13	-1	-0,31

Own calculations

Table 3 summarizes the returns of these 37 firms using again average marks. In order to compare the ranking of location factors based on the answers of all firms with that of energy-intensive firms in detail, table 3 also shows the differences between the positions of all single location factors in both rankings and the analogous deviations concerning the average marks; for further illustration diagram 1 depicts the latter deviations, too.

Starting with the ranking position, it can be seen that some location factors noticeably changed their positions. Especially proximity to important providers seems to be much more important to energy-intensive firms. The same applies for proximity to important customers, land prices and privatization of municipal responsibilities. While these factors are ranked higher by the energy-intensive firms, there are other factors that seem to be of less importance to these firms: Parking fees, sufficient parking, cityscape seen from its cleanliness as well as from its architecture and safety in the inner cities must be mentioned in that context. The first generalization of these results is hardly surprising at all: Apparently soft factors of location are of minor relevance for energy-intensive industries which belong to the industrial nucleus of an economy while spatial contiguity is still a crucial factor for them.

Diagram 1: Evaluation Gaps of Energy-intensive Branches



The differences in the ranking give a first idea of the special location requirements of energy-intensive industries; the evaluation gaps allow some further concretization. Diagram 1 shows that there are especially three groups of location factors that are more relevant to energy-intensive industries than to others (evaluation gaps in brackets):

- **Proximity:** Proximity to important providers (0,51) and to important customers (0,33) show the highest positive evaluation gaps of all location factors. That underlines the high relevance of spatial proximity for energy-intensive firms.
- **Cost aspects:** In addition location factors closely connected with costs are more important to energy-intensive industries than to the rest. This of course holds for energy costs: With the average mark 1,58 energy costs are by far the most important factor of location in the total survey. But the energy-intensive firms judge the energy costs even more important (0,22); for two third of them this is a "very important" location factor. Besides water and

wastewater taxes (0,25), local property and business taxes (0,17 respectively 0,11), land prices (0,12), public charges (0,10) and costs of waste disposal (0,08) are cost inducing location factors which are more relevant for energy-intensive firms. An explanation why cost components are of special relevance for these firms might be the relatively high de-gree of global (price-) competition in these energy-intensive industries. So for them fac-tors that increase cost pressure are of special importance.

- **Governmental behavior:** The third group encompasses factors which are combined with governmental behavior: Portfolio management of local enterprises (0,29), duration of permit procedures (0,24), the quality of cooperation with local authorities and administra-tion (0,20), the level of administrative regulations (0,16) and a pro-business municipal administration (0,12) are all aspects underlining that the level of governmental regulation and intervention might be more important than average for these firms.
- The only other location factor not belonging to the three groups above which is evaluated higher by energy-intensive firms is road and highway access (0,27).

While on the one hand spatial proximity, cost aspects and governmental behavior apparently are more important location factors for the energy-intensive branches, there are on the other hand location conditions that seem to be of less relevance to them; these aspects can be grouped as follows (negative evaluation gaps in brackets):

- **Inner city conditions:** It is hardly surprising that all location conditions related to inner city conditions are unimportant for firms being part of a highly industrialized branch. So parking fees (0,55), cityscape as to cleanliness (0,43) and architecture (0,42), parking fa-cilities (0,33), city marketing (0,28), safety in inner city (0,27), shopping facilities (0,25) and inner city traffic conditions (0,18) are remarkably less relevant for energy-intensive firms than they are for all firms. The way by which these factors affect industrial location decisions is an indirect one: If firms have a high demand for skilled workforce they will be to certain extend interested in attractive living conditions for these workers. But a qualified workforce does not seem to be more important for energy-intensive industries than for all others; so consequently the inner city conditions are of minor importance. These factors should, of course, be of much higher relevance for retailers and household-oriented services.
- **Other soft location factors**: All location factors just mentioned can be seen as part of the soft location factors and their special attribute is related to the inner city. Other soft loca-tion factors are image of the location (0,10), recreation and leisure facilities (0,13), cul-tural offerings (0,14), supply of household-oriented services (0,23) and housing (0,24). These factors are also of minor importance for the energy intensive industries.
- **Consulting services:** A third group of location factors that tend to be less relevant for energy-intensive firms are consulting services like start-up consulting (0,06), consulting on governmental funding (0,09), technology consulting (0,16), consulting in corporate de-scent (0,18) or financial advice (0,25). A possible explanation might be that consulting services are of special importance for young enterprises and it can be supposed that there are more established enterprises amongst the energy-intensive firms.
- **Education:** At first sight it is a little bit surprising that aspects concerning schooling and education – i.e. offerings for further education (0,10), University education (0,18), com-prehensive schools (0,23), vocational training schools (0,24) and cooperation between en-terprises and schools (0,27) – are less important to the energy-intensive industries. If de-mand of qualification would be high these factors should be of special interest to the firms; as the latter does not seem to hold true one might conclude on a less than average demand of qualification by energy-intensive firms.
- There are not many location factors of minor importance to energy-intensive firms that have not been mentioned yet; airport connections (0,30) and factors related to commercial properties (0,31) and their rents (0,09) should be mentioned in this context.

3. Summary

The aim of the present paper was to discuss the role of different location factors for energy-intensive enterprises. Using the results of a broadly based firm survey run in Middle Lower Rhine Area in 2008 it was possible to rank nearly 60 different location factors by importance.

After the identification of energy-intensive industries a ranking based on the answers of all participating firms could be compared with a special ranking calculated only for the energy-intensive firms.

The analysis shows that cost aspects and local fiscal burdens are the most important location factors to all firms followed by some „traditional“ factors like highways and availability and qualification of workforce. Above all, a business-friendly climate of the local authorities seems to be another relevant location determinant.

As could be expected the results for energy-intensive industries remarkably differ from that, though these differences are hardly surprising. They can be summarized in the following way: On the one hand spatial proximity to customers and suppliers, cost aspects – especially energy costs – and the degree of governmental regulation and institutional constraints are factors of special relevance for energy-intensive firms. On the other hand soft factors of location – especially those related to inner city conditions – consulting services and some aspects of schooling and education are of lesser importance to energy-intensive firms than to the rest of the economy.

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