

## **SERIE** RESEARCH MEMORANDA

Spatial planning of industrial sites in Europe:  
A benchmark approach to competitiveness analysis

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# 1 On Global Tracks

In modern growth theory much attention is devoted to the conditions for long-term economic development. The rising popularity of innovation as a driver of economic growth illustrates that productivity increase is not an autonomous factor (the 'manna from heaven' hypothesis), but an outcome of deliberate choices and policies focused on achieving the highest possible returns on both public and private investments (see also Adams and Pigliaru, 1999).

Such investments should not only concern physical equipment and facilities, but also immaterial assets such as R&D capital, advanced logistics, information accessibility, training and educational infrastructure. This idea is at the heart of modern endogenous growth theory, which argues that there is no such thing as a natural growth rate, but that productivity growth is the result of endogenous expenditures in both the private and public sector (see also Aschauer, 1989).

Clearly, there are many determinants of international or inter-regional disparities in growth patterns. Of course, there is the availability of traditional input factors, such as land, capital and labour. Secondly, there is the access to resources or minerals, which are of decisive importance for product specialisation (following Ricardo's comparative cost principles). Next, as mentioned above, R&D, education and skills play a crucial role. And finally, it is evident that geographic accessibility to networks (e.g. mainports, hub and spoke systems, use of sophisticated ICT networks) is a factor of major importance. The combination of creativity, connectivity and centrality (the triple-C concept) is a determining factor for the productivity position - and hence the competitiveness profile - of a region or country.

In recent economic studies, we have witnessed a shift from the concept of comparative advantage (as a cost-efficiency concept) to that of competitive advantage (as an external market strength concept). The notion of Porter's diamond is illustrative for the latter line of thinking (see Porter, 1990). Clearly, competitive advantage is not an ambiguous notion, as it is related to choices on pioneering behaviour, national champion policy, niche strategies and the like. These notions indicate already that there is a spatial differentiation in economic opportunities. But such opportunities are not constant, as the industrial organisation in a modern economy exhibits a high degree of volatility caused by flexible specialisation and short product life cycles. This phenomenon prompts a reflection on successful conditions and concepts of promising geographic-economic concepts such as Marshallian districts or hub-and-spoke districts (see for a review Bryson et al., 1999).

It is noteworthy that in a modern economy a new concept is emerging, viz. a network configuration (see Castells, 1995). It seems to be a wise regional or national policy to acquire a strong nodal position in an international network of trade, commerce, information and telecommunication (e.g. as a mainport, infoport or brainport). In a small open economy like The Netherlands, which is vulnerable to shifts in international activity patterns, it is of a critical importance to map out, monitor and analyse the structural economic conditions and changes therein. These determine the national competitive condition, not only at the macro-level, but also at a sector-specific or regional level. The Dutch government has recognised the need for a critical permanent assessment of trends in the strong and weak aspects of the Dutch economic position (see Ministry of Economic Affairs, *Toets op het concurrentievermogen*, 1996, 1997, 1999).

In the light of the previous remarks, the present paper aims to shed some light on the competitive profile of nations by applying a benchmark approach in order to analyse the spatial planning of industrial sites and office locations in core regions in North-western Europe. Our study concentrates in particular on the supply and quality of industrial sites and

office locations that facilitate international mobile or footloose investment projects. For this purpose, five distinct classes of economic activity patterns are taken into consideration: assembly and production, distribution and value added logistics (VAL), chemicals, high-tech, and European headquarters of corporate companies.

A selection of various European countries is made, viz. Belgium, Denmark, France, Germany, Ireland, The Netherlands and The United Kingdom. The main focus of the benchmark analysis will be on institutional factors, such as the number of governments or government institutions involved with spatial planning procedures in the countries concerned, the development over time of the demand for and supply of industrial sites, the geographic segmentation of such sites, and the potential of private-public partnerships.

The paper offers a concise description of each of the regions selected in the study, based inter alia on a field visit to these regions. These regions are subsequently judged on their future potential and suitability as an industrial location for the above mentioned classes of activities by using five evaluation criteria: economic strength, infrastructure, land prices, available stock of sites, and spatial planning procedures. Next, the specific industrial sites are – for each class of economic activity – evaluated by four criteria, viz. accessibility, representativeness, size and capacity, and price level. A new way to represent and visualise the findings of the benchmark analysis undertaken here is the use of so-called spider models. In a final part of the study a more analytical approach is employed to derive general findings, viz. rough set analysis. This non-parametric statistical method, stemming from artificial intelligence, is able to identify the main structures behind the differences in the supply of the industrial sites for the above mentioned five categories of economic activities in the countries considered. The study is concluded with research and policy perspectives.

## **2 Some Background Observations on Innovation, Learning and Competition**

In recent years we have seen an increased interest in the new role of regions in a dynamic and often globalising business environment. They are dynamic and self-organising artefacts and the result of creative design, architectural implementation, land use policy and management of human resources within a cohesive framework imposed by their cultural and political history. Regions have become multi-faceted economic, social, cultural and environmental systems making up an organic assembly of multiple interacting subsystems and they exhibit complex evolutionary patterns in which growth and decline are in turn present.

There is also a tendency to emphasise the new role of the region as the creator of a portfolio of locational opportunities. The main question is, of course, whether sufficient and effective governance strategies – in both the public and the private sector – can be developed that guarantee a sustainable regional development. European regions increasingly are losing the protection provided by national borders. Vanishing borders mean the opening of regional economies to new networks and new social and economic influences, introducing particularly an increased competition between regions. In a dynamic competitive environment, the generation and absorption of new technology and organisational innovation in the regional economy is of paramount importance for the future role of that region. At the same time a strict environmental policy is needed to prevent the basis for sustainability from being eroded: non-sustainable regional growth implies by necessity that the whole regional economy will witness a process of socio-economic (and environmental) decay in the long run.

It is, therefore, important to know in what way the local environment can contribute to learning processes in regional business locations that lead to new competitive strategies.

A typical feature of present-day business is high *uncertainty* and *risk*, mainly due to the pervasive nature of new (generic) technologies, such as information and communication technology, bio-technology and new materials, and new modes of organisation and production. In addition, the increasing global competition and the shortening of technology life cycles have progressively increased the need for new knowledge. Accordingly, different kinds of knowledge are relevant for company managers: technical, commercial, managerial, and public policy (including mandatory requirements and potential sources for assistance). It is now recognised increasingly that knowledge - with learning as the most important process - constitutes one of the few important sources of competitiveness of regions. In this context, the knowledge capability can be conceived as a set of conditions that allows actors to learn and adopt new innovative strategies.

There is also an important valorisation issue of knowledge producing activities. The so-called *synergetic* effect of the often multi-faceted knowledge types (science, art, fundamental and applied science) is seldom used. This 'missing link' follows, among others, from mental barriers, disciplinary diversity, as well as a lack of occasions to work together on joint projects. The knowledge capability approach now takes a broad perspective by not only including knowledge availability, receptivity and absorption, but also the *institutional* environment that sets particular conditions for learning. In this respect, a key condition is the *self-organising power* of regions to co-ordinate, preserve and renew the knowledge capability. Networking is a crucial activity in learning and innovation. Learning relationships are formed, maintained and broken in an intentional way in view of the perceived value in a particular strategic context. The common consideration of network participation is to increase knowledge in a more efficient way than without networks. Network externalities may be derived from a higher speed, a greater coverage of knowledge, or synergy with other sources of knowledge. However, the increase of positive externalities may be different for the channels used. For example, when using telecommunication - such as in a discussion on a Website - positive externalities increase with the number of subscribers, but in learning networks using face-to-face contact, the situation seems different (see also Shapiro and Varian, 1999).

There are different opinions on the question as to whether learning and innovation are so critically dependent on local factors that they agglomerate in particular places (like in Marshallian districts). One counter-argument is that large multinational corporations decide where they conduct research and development, and thereby determine to a large extent what economic activities agglomerate in particular places. In a further refinement of the argumentation, it is now recognised that the two trends - localisation and globalisation - do not exclude each other; instead, they are dependent upon each other. This situation calls for empirical research of learning innovation in various regions by using a common analytical (conceptual) framework. The design and results of such an analysis will be discussed in the next sections on competitiveness conditions of various regions in Europe.

This paper is organised as follows. In Section 3, we will offer a concise description of the seven European regions considered in this study. In Section 4, the emphasis is on the spatial planning procedures in these selected regions. In Section 5, we will discuss the locational suitability for five economic activities of a number of industrial sites in five of the selected regions. In Section 6, we will apply rough set analysis as a technical tool to find the strengths and weaknesses of the selected regions for attracting companies belonging to the five selected economic activities. In Section 7, we will offer some conclusions.

### 3 European Benchmark Regions: an Introduction

#### 3.1 The selection of regions

In our analysis we aim to investigate the competitiveness conditions of various areas. In our comparison seven major core regions in North-western Europe are studied; viz.:

Region:	Country:
Brussels-Antwerp-Gent	Belgium
East Ireland	Ireland
Greater Copenhagen	Denmark
Ile-de-France	France
Northrhine Westfalia	Germany
Southeast England	United Kingdom
The Randstad	The Netherlands

In our study the emphasis is on the comparison of spatial planning procedures in the various core regions and their implications for the quantity and quality of industrial sites and office locations in those regions. The reason behind this study is that those regions are in fierce competition in attracting foreign – American and Asian – investors. The supply of infrastructure – including industrial sites and office locations – is one of the remaining opportunities in the common European market through which countries can compete. Differences in spatial planning procedures in the various countries may strongly affect the supply – both quantitatively as qualitatively - of industrial sites and office locations. As a consequence, national governments may learn from the experiences – both successes and failures - of other European countries.

#### 3.2 The spider model

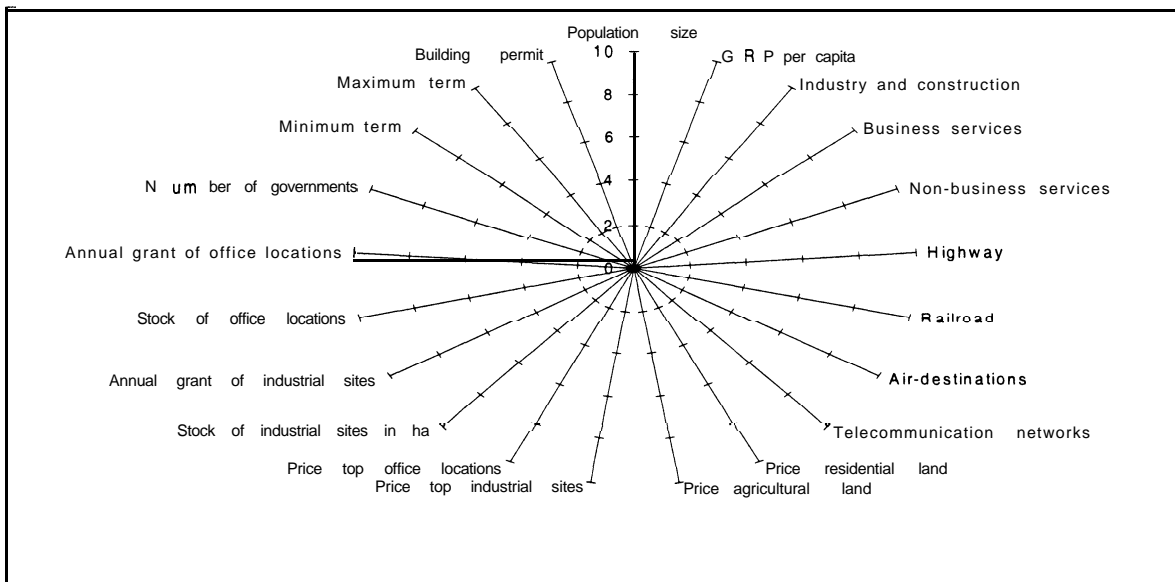


Figure 1 The axes of the Spider model

As an analytical tool for our benchmark analysis we will employ the so-called spider models (see Rienstra, 1998, for references to the spider technique). Spider models are used to

visualise the relative strengths and weaknesses of the selected regions for various locational factors. In the context of our comparison these factors are clustered in five main categories: economy, infrastructure, land prices, site information and spatial planning procedures (see for a classification Table 1).

In the spider representation, each factor in each category is represented by an axis starting from the interior towards the outer boundary of the spider (see Figure 1). The axes are scaled from one (centre) to ten (outer edges). All locational factors are mapped on this ordinal scale under the assumption that higher scores represent a better score. The score of each factor is based on statistical information or other quantitative information. Nevertheless, there is no weighing between the factors. In other words: a score of 6 on one factor is as important as a score of 6 on any other factor. The envelope composed of all scores per factor forms a connecting line resulting in a surface representing the integral representation of these factors per region. In general, one might state that the larger the surface, the better the region performs. The advantage of this visualisation by means of the spider model is that it is easy to show the relative strengths and weaknesses of the regions.

*Table 1 Categories of factors*

Category	Factors
Economy	Population size Gross regional product per capita Share employment industry and construction Share employment business services Share employment non-business services
Infrastructure	Length highway per 100 km <sup>2</sup> Length railroad per 100 km <sup>2</sup> Number of foreign destinations airport Digitalisation telecommunication network
Land prices	Price agricultural land Price residential land Price top industrial sites Price top office locations
Site information	Stock of industrial sites in ha Annual allocation of sites as share of the stock Stock of offices locations in m <sup>2</sup> Annual grant of locations as share of the stock
Planning procedures	Number of government institutions involved Minimal time required to change the designated use of land Maximal time required to change the designated use of land Average time required to obtain a building permit

### 3.3 Comparison of the selected core regions

For the comparison of the regions under consideration, we refer to Table 2 for the statistical information and to Figure 2a-b for the visualisation by means of a spider model. Although the seven selected regions all belong to the major urban areas in Northwest Europe, the size of the regions both in terms of surface and in numbers of population are quite diverse. Northrhine Westfalia, Southeast England and Ile-de-France are the largest regions and Greater Copenhagen and East Ireland , the smallest. The city structure of the region is not dependent

on the size of the region: there are both monocentric and polycentric regions among the largest regions.

The *gross regional product per capita* is relatively low in East Ireland and Southeast England. With the exception of Ile-de-France, where the gross regional product per capita is the highest, the gross regional product per capita is about the same in all remaining regions. The high gross regional product per capita in Ile-de-France can be partly explained by the high costs of living in Paris. Of course, this also holds good for the costs of living in London.

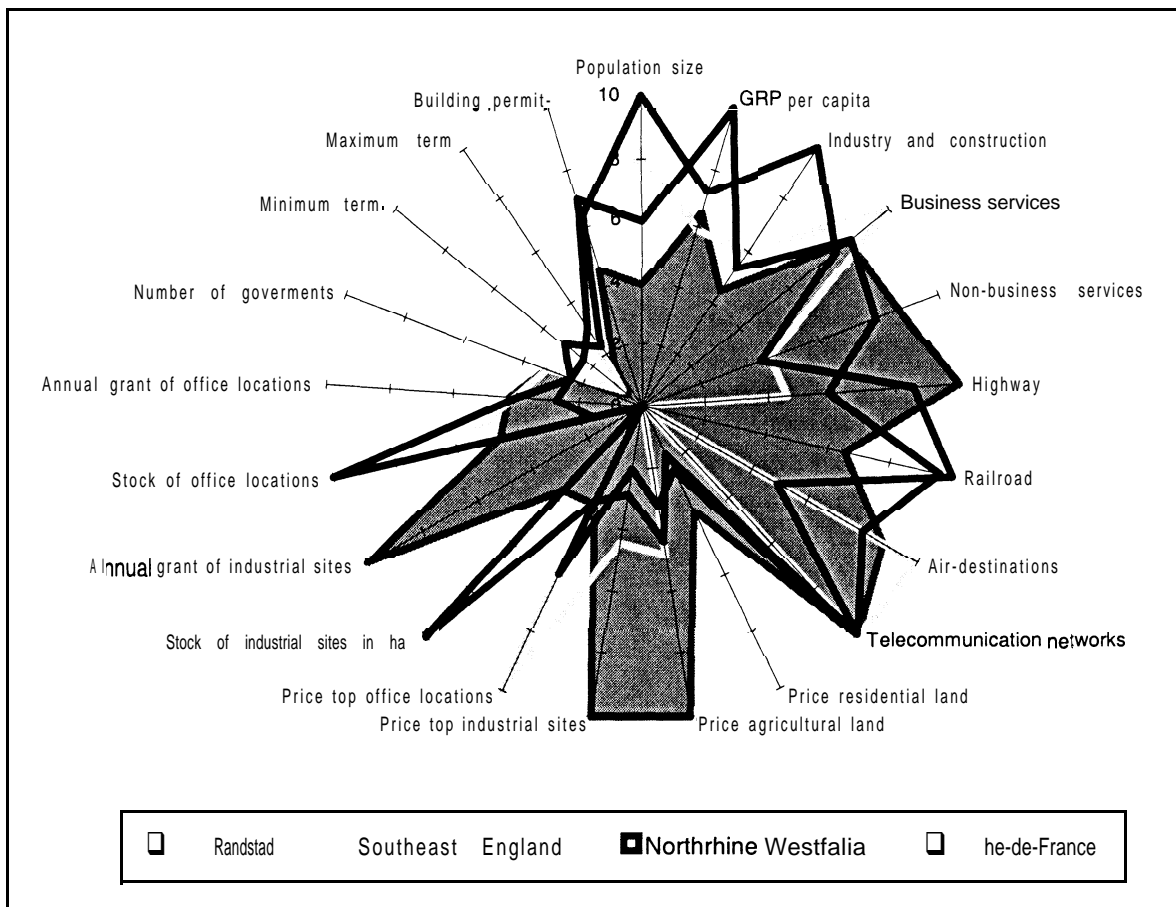


Figure 2 General characteristics of: The Randstad, Southeast England, Northrhine Westfalia, and Ile-de-France.

However, the Ile-de-France region is much more narrowly defined around Paris than the region Southeast of London. On average, the impact of London on the region Southeast England is much smaller than the influence of Paris on Ile-de-France.

There are some large differences in the *sectoral structure* of the regional economies measured by the sectors' share in regional employment. The economy of Northrhine Westfalia is still strongly influenced by industrial activities, although the business service sector is the main employer. In all regions the share of the business service employment is the largest. In the smaller regions – Brussels-Antwerp-Gent, Greater Copenhagen, and The Randstad – a relatively large share of employment is found in the non-business services, such as public servants. The only exception is East Ireland where the most even distribution of employment is found.



Important factors in the attractiveness of a region are the *prices paid for the various types of land use*. By increasing land pressure – due to claims for residential, industrial, or nature preservation purposes – the agricultural sector is always the party that loses out on land. The high prices for agricultural land in The Randstad express the high pressure on land in this region.

The prices of residential land show a large variety among the regions with relatively high prices in Greater Copenhagen and relatively low prices in Northrhine Westfalia and Ile-de-France. With regard to industrial sites and office locations, the land prices given in Table 2 (shown in Figure 2a-b) are the highest prices in the respective regions. Here the prices express the “willingness to pay”: the more attractive the location on offer is, the more companies are willing to pay for such a location.

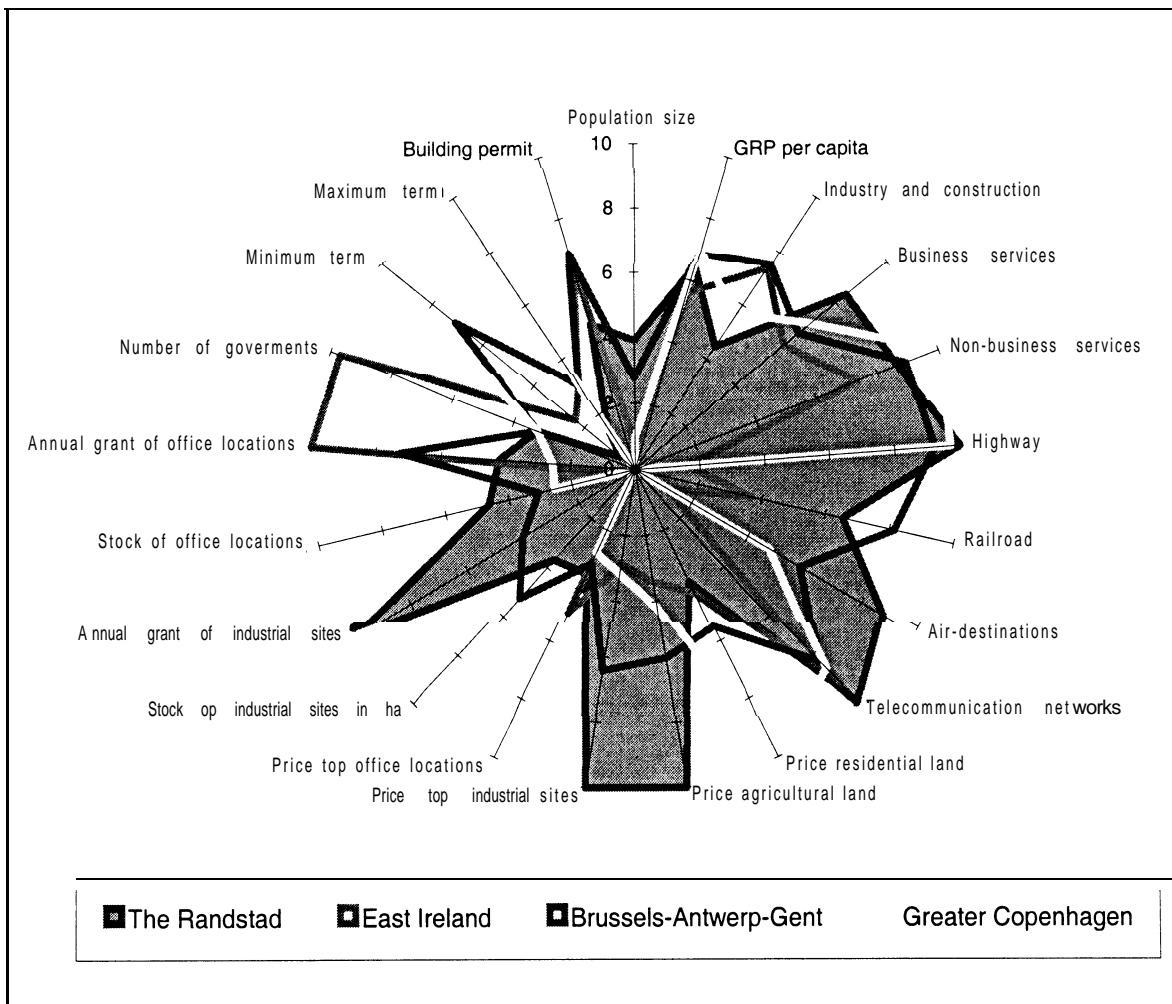


Figure 2b General characteristics of The Randstad, East Ireland, Brussels-Antwerp-Gent, and Greater Copenhagen.

Industrial sites are relatively expensive in The Randstad, while for office locations the highest prices are paid in Southeast England, followed at a respectable distance, by Ile-de-France. In Table 2 *infrastructure* is given quantitatively - by the number of foreign destinations (airports), the density of networks (highways and railways) and the availability of digital telecommunication networks that counts. Qualitatively, it is by their relative position in the trans-European infrastructure networks. In Figure 2a-b the scores for the quantitative infrastructure measures are presented. Southeast England, The Randstad and Ile-de-France are

best provided with airport infrastructure. East Ireland has the least dense highway network. The highway networks of Ile-de-France and Southeast England are less dense than expected: the network of the remaining regions is much denser. Remarkable is that in all regions the railroad network is denser than the highway network. The telecommunication network in all regions is of a high standard: the poorest quality is found in Brussels-Antwerp-Gent and even here over 80% of the network is digitised.

Table 2 Statistics for the selected regions

	Brussels-Antwerp-Gent	Greater Copenhagen	Northrhine Westfalia	Ile-de-France	East Ireland	Southeast England	The Randstad	
<b>Geography</b>								
-Surface (km <sup>2</sup> )	8,161	2,862	34,079	12,000	6,947	27,200	8,910	
-Population (mln)	4.91	1.79	17.9	10.6	1.41	14.8	7.0	
-Density	601	624	527	883	203	544	786	
-City structure	polycentric	monocentric	polycentric	monocentric	monocentric	monocentric	polycentric	
<b>Economy</b>								
-GRP (billion dfl)	235.5	86.9	899.9	738.1	55.0	321.0	315.2	
-GRP/cap	47,900	48,550	49,995	69,635	39,000	2.8	45,034	
-Share industry	27.7	20.9	36.7	19.6	27.1	--	16.4	
-Share business	40.4	43.4	48.7	52.6	36.7	155	52.1	
-Share non-business	31.0	34.7	13.9	27.4	25.7	751	30.1	
<b>Land prices</b>								
-Agriculture				1.9	2.0	252	+++	5.7
-Residential	342.5	225.2	340.4	140	255	3.4	++	231
-Industry sites				71	100	--	++	350
-Office locations				449	358	100	+++	260
<b>Infrastructure*</b>								
-Airport				20	+++	29	+	22
-Highways				4.3	+++	1.2	0	7.4
-Railroads				14	+++	5.5	0	9.9
-Telecom.				10	+++	92	+++	100
<b>Industrial sites</b>								
-Stock (ha)	28,030	--	53,425	--	--	--	--	19,666
-Annual grant	3.0	--	--	--	--	--	--	8.0
<b>Office locations</b>								
-Stock (mln m <sup>2</sup> )	9.0	7.5	4.6**	29.4	1.4	17.9		13.6
-Annual grant	8.8	3.1	3.3**	4.8	12.1	4.9		5.1
<b>Spatial planning</b>								
-Government levels	3	3	4	4	1	3		3
-Permit	6	--	6.5	6	6.5	7.5		9

\* The first column shows the data as described in Table 1, the second column gives a qualitative judgement about the quality and accessibility from a European perspective.

\*\* Data for Dusseldorf only.

Unfortunately, there is hardly any data available about the stock of *industrial sites* in the selected regions. Although in most regions data is available about the quantity of new sites granted annually, this information is of little use, since it cannot be expressed as a share of the stock.

More data is available about the *office stock*, although for Northrhine Westfalia only data for Dusseldorf – the main office city in this region - were available. The largest stock of office space is found in Ile-de-France at a reasonable distance followed by Southeast England.

However, the most dynamic office markets – measured by the annual share of offices granted – are found in East Ireland and in Brussels-Antwerp-Gent.

Considering the *spatial planning procedures*, the fastest adjustments to the market demand can be realised in Greater Copenhagen, whereas it takes by far the most time to change prevailing land use plans in The Randstad.

In the next section we will discuss in more detail the spatial planning procedure in the regions considered.

## **4 Spatial Planning Procedures in the Regions under Consideration**

In this section a thorough analysis of the spatial planning procedures of seven European countries is presented. The main focus of this analysis is on the institutional factors, such as the number of governments or government institutions involved in spatial planning procedures in the countries concerned. In addition the development in time of the demand for and the supply of industrial sites, the geographic segmentation of such sites, and the potential of private-public partnerships are discussed in this section.

### **4.1 Spatial planning procedures: governments involved**

#### *Belgium*

In recent years spatial planning procedures changed drastically in Belgium. With the change of procedures more emphasis is placed on the role of provincial governments in the design of spatial plans. Until 1997 the role of the provinces was limited. From that time on, three governmental levels (national, provincial and municipal) were involved in the design and execution of spatial plans. Municipal governments, however, are responsible for the detailed planning and execution of spatial plans.

The government of the Flanders region has no role in the execution or design of spatial plans, but plays a crucial role in the reviewing process of these plans.

#### *Germany*

In Germany spatial plans are designed at three to four governmental levels, depending on the 'Bundesland'. In Northrhine-Westfalia four governmental levels are involved.

At the national level guidelines are set according to the so-called 'Raumordnungspolitischer Orientierungs- und Handlungsrahmen', in which national and international developments are the main driving factors for policy directions.

Spatial plans designed on a lower governmental level must comply with these guidelines. At the level of the various 'Bundeslander' the 'Landesentwicklungsplan' is developed. These regional plans, although more detailed than the national plans, give a global view of the most important spatial developments on a regional level and are guidelines of how the available space must be utilised in the upcoming years.

Municipalities are involved in the design of more detailed spatial plans. These plans are almost identical to plans made by Dutch municipalities. In these plans the exact location of the activities and type of activities are specified. The main objective of these plans is a more intensive use of industrial sites.

#### *Denmark*

In Denmark three governmental levels are involved in the development of spatial plans and land use plans. As in Belgium and Germany, municipalities are responsible for local plans, whereby the counties do the regional planning. At the national level the Ministry of Environment and Energy is responsible for developing spatial policies.

Plans at the regional level in Denmark resemble the Dutch regional plans - the so-called 'streekplannen'. These regional plans are revised every four years and a division is made between rural zones and urban zones. The counties are responsible for spatial planning in the rural zones and the municipalities develop plans for the urban zones.

In Denmark much emphasis is placed on the role of the municipalities in the design and development of spatial plans. Plans made on a municipal level are legally binding and

therefore have the same importance as Dutch plans made on a municipal level ('Bestemmingsplannen').

#### *France*

In France four administrative levels are present e.g. State, Region, Departments and Municipalities. Because of the lack of space in Ile-de-France the French central government (State and Region) has a relatively large influence on the development of policies concerning industrial sites and site selection of companies. In general, however the central government (State) sets, by means of a national spatial plan, the guidelines for spatial planning at lower governmental levels. These guidelines form the boundaries for more detailed spatial plans made at the regional and the municipal level.

#### *Ireland*

In Ireland no national spatial plan exists at the moment. However in 1999 the national Irish Government decided to develop a National Spatial Planning programme. The main objective of this plan is the optimisation of the planning process. At the moment there is a lack of co-ordination between the different governmental institutions involved in the design and construction of spatial plans.

The National Development Plan that is designed by the Department of Finance pays attention to economical as well as spatial planning aspects. At lower governmental levels, local and regional governments are responsible for the design of a Development Plan, which has a planning horizon of 5 years. At this level all governments have the same competencies. They are also responsible for granting building permits and environmental issues.

#### *United Kingdom*

Various governments in the United Kingdom are involved in spatial planning. In general, London excluded, three governmental levels are responsible for spatial planning. The National Government is responsible for the National Planning Policy Guidelines, which sketches the boundaries of spatial planning on lower governmental levels. Spatial plans for regions are made by the Country Councils in the form of a so-called Structure Plan. District Councils are responsible for Local plans at the level of a municipality. These plans are very detailed concerning parts of municipalities.

#### *The Netherlands*

In *The Netherlands* three governmental levels are involved in spatial planning; these are the National government, provinces and municipalities. Spatial plans developed on the municipal level are the most important ones, since these plans are legally binding. Plans made on higher levels can be seen as strict guidelines for spatial planning.

## **4.2 Spatial planning procedures: length of spatial planning processes**

### *Belgium*

The minimum period required to change the designated use of land in Belgium is 5 months. As a result of public consultation rounds, the period can be extended to 3 years.

### *Germany*

Spatial planning terms in Germany take a minimum period of nine months. Normally, terms encompass 2 to 3 years, which includes all necessary public consultation rounds.

In Northrhine-Westfalia many industrial sites are developed on areas previously used for mining and heavy industries; these areas are called brownfields. The reconstruction of brownfields takes an average period of 5 to 6 years, mainly because of the time involved in the demolition and preparation of these sites. Financial problems are often also a cause of delay.

### *Denmark*

In Denmark public consultation rounds play a very important part in the design and development of local spatial plans. During public consultation rounds, not only citizens have

the right to amend plans but also higher governmental levels can raise objections and change local plans if those plans do not comply with national policy or national interests.

Although one might expect that spatial planning terms are longer in these circumstances, with the active role of citizens in the development and design of spatial plans, planning processes are as short as 6 to 9 months in Denmark. These short planning periods are possibly due to the fact that they are revised every four years. Local plans form the bridge between national and regional plans on the one hand and the interests of individuals on the other hand.

*France*

Planning of new industrial sites in France takes longer than in Denmark. This is mainly because of the time it requires to make the necessary adjustments to existing spatial plans: which could be between one and three years.

*Ireland*

The length of planning terms in Ireland is mainly related to adjustments in existing spatial plans. In order to adjust a Development Plan one needs to take into account a period of 1 to 1 1/2 years.

*United Kingdom*

The time involved in Southeast England with the design of new Development Plans, like a Structure Plan or a Local Plan, is around five years. Changes in these plans take about three years.

*The Netherlands*

Spatial planning procedures are relatively drawn out in The Netherlands. They can have a time-span of 4 to 6 years, including the preparations and the design of the various plans. Although the terms are long, governments have the opportunity to shorten the process by means of a so-called article 19-procedure. The designated use of land can be changed in 9 months when the proposed change complies with guidelines set at the provincial and national level.

*Table 3 Summary of spatial planning procedures*

Country	Spatial planning levels	Spatial level	Length planning process
Belgium	3 governments	Region Province Municipalities	2-4 years
Denmark	3 governments	National government Counties Municipalities	½ • 1 year
Germany	4 governments	Federal government Province Regierungsbezirke Municipalities	2-4 years
France	4 governments	National government Region Inter-municipal agencies Municipalities	1-3 years
Ireland	1 level	'Local authorities'	1-1½ Years
United Kingdom	3 governments	National government Country councils District councils	3 years
The Netherlands	3 governments	National government Province Municipalities	4-6 Years

### **4.3 Demand and supply of industrial sites**

#### *Belgium*

Until recently no analysis of demand for and supply of industrial sites in Flanders was available. Planning and construction of industrial sites in Flanders was not based on supply-demand forecast. With recent change of spatial planning procedures, the need for space is based on a more thorough analysis. This includes an analysis of the working population, employment growth and analysis of main economic sectors.

The Belgium government expects a demand of 10.000 hectares of new industrial sites in the period 1992-2007.

Around 5.500 hectares are already designated as industrial sites in recent spatial plans. The remaining 4.500 hectares are not included in current spatial plans. When demand exceeds supply, new sites will be designated for industrial activities.

In the past, segmentation of industrial sites on the regional level was absent, due to a lack of a broad overview concerning the development of industrial sites. As of 1997, more attention has been paid to the segmentation of industrial sites. Distinctions are made according to types of activity.

#### *Germany*

In Northrhine-Westfalia plans are made for the development of industrial sites in the period 2000-2010. Therefore, a forecast of the future need of industrial sites has been made. This forecast forms the basis for the design and development of industrial sites on certain locations. Although the spatial plan for Northrhine-Westfalia states that supply of land for industrial sites is adequate, the actual availability of agricultural land does not comply with the planned availability of agricultural land for industrial purposes.

In Germany a division is made on the basis of the environmental impact of an industrial site. Two types of industrial sites can be distinguished, e.g. 'Gewerbegebiete' for light-industrial activities and the so-called 'Industriegebiete' which facilitates heavy industrial activities. Municipalities are responsible for designating activities to a certain type of site.

#### *Denmark*

In Denmark no forecast for industrial sites is made at a national level. Municipalities are free to decide, within a set of guidelines, how much space will be designated and developed for industrial activities and in which period of time. In Denmark a short period of time is needed to revise a local plan to develop an industrial site, with the result that no problems arise in matching supply and demand for industrial sites.

The general expectation is that there will be enough space for industrial activities in Denmark in the near future. Only in the region Greater Copenhagen, the possibility of a shortage in the long term exists. This also depends on the impact of the direct connection with Sweden on the economic development of Greater Copenhagen.

In Denmark, at the moment, a discussion is taking place about the need for a bigger role of the national government in spatial planning concerning the development of industrial sites. This discussion stems from the fact that a better fit between supply and demand is of crucial importance for the long term economic development of Denmark.

Although in general, industrial sites are developed for certain types of activities, segmentation is not part of Denmark's spatial policy. In Denmark mainly modern mixed industrial sites are developed next to sites designated for Value Added Logistics. Research and science parks are developed for companies involved in biotechnological research. These parks are small and often related to universities or other research institutes. Although heavy industries are not significantly present in Denmark, they are mainly located in harbour areas.

### *France*

Since Ile-de-France is a very urbanised area, the need for information in relation to industrial sites is substantial. Analysis and registration of demand and supply are carried out by two governmental institutions:

- Observatoire Regional du Foncier en Ile-de-France: makes a periodical inventory of demand and supply;
- Chambre du Commerce et l'Industrie de Paris.

At the moment no complete overview of stock, demand and supply concerning industrial sites is available for the region Ile-de-France.

Segmentation of industrial sites in France takes place on a national, regional and municipal level. At the regional level, segmentation of industrial sites is assessed globally and is mainly based on possible national developments, while municipalities pay more attention to a detailed form of segmentation of industrial sites. In general segmentation is based on the following types of business activities:

- Zone d'Activité: light industrial activities;
- Zone d'Activité Légère: light industrial activities with minor impact on the direct environment;
- Zone Industrielle: all types of production activities;
- Zone Industrielle Portuaire: heavy industries with severe impact on the direct environment.

### *Ireland*

Ireland has no central agency which keeps record of the available supply of industrial sites. The national development organisation (IDA Ireland) is responsible for 120 industrial parks with a total space of 9.000 hectares. This organisation often analyses supply of and demand for industrial sites.

Zoning of land use is done by means of the Development Plan. Land use activities form the basis for segmentation of land.

A division is made in classes like:

- agricultural land use
- housing
- industry and services
- VAL and distribution

However, at the municipality level, more refined classifications are used.

### *United Kingdom*

A thorough analysis of supply and demand does not take place in Southeast England. Recent data concerning the availability and demand for industrial sites is not available.

Segmentation of industrial sites is done by means of Use Classes. These Use Classes make a distinction between various economic activities. For the classes of distribution and industrial production, the following distinctions are made:

B1 Business: light industry and development;

B2 General industrial

B3 Storage and distribution.

### *The Netherlands*

In The Netherlands various steps are undertaken in order to analyse the demand for space.

First, three forecasting scenarios concerning the development of the Dutch economy are made.

Each scenario has its own demand for industrial sites. Finally, the demand for industrial sites is compared to future supply of industrial sites.

Five types of industry characteristics are used for the segmentation of industrial sites:

- . Mixed sites

- Modern mixed sites
- Transport- and distribution sites
- Business parks
- Sea harbour sites

The Netherlands is the only country considered where segmentation of activities on individual sites is planned.

#### 4.4 Parties involved in the development of industrial sites

##### *Belgium*

In Belgium public, private and joint public and private organisations - the so-called Public-Private-Partnerships (PPP) - are involved in the development of industrial sites. Private developers often possess the land and the government involvement is limited to the provisioning of permits and promotional activities of governmental regional development institutions. Other common constructions to develop industrial sites are co-operations between municipalities which carry full responsibility (also financial) for the development. Finally, private parties are active, in particular in and around Brussels where private parties develop about 90% of the industrial sites.

##### *Denmark*

In Denmark industrial sites are developed by municipalities, however private parties are allowed to develop – parts of - sites.

##### *Germany*

The government stimulates private involvement, partly due to own financial shortages. Nevertheless most industrial sites are developed by co-operations between municipalities and regional development institutions. PPP-constructions are common, in particular when sites have to be restructured. In these PPP-constructions, regional and local government, banks, insurance companies and some major industries, participate.

##### *France*

In particular in the ‘villes nouvelles’ of Ile-de-France are due to a shortage of land private parties extensively involved in the development of industrial sites. In areas with less pressure on the land market the government is the main developer of industrial sites, due to the lower land prices.

*Table 4 Forecasts, segmentation and parties involve in the development of sites*

Region	Demand & supply	Segmentation	Developer
Flanders	1997 first forecast 2007 5.500 ha shortage	Since 1997, between sites, 7 classes	Mainly private, some public or PPP
Northrhine Westfalia	Unclear forecast No shortages expected	Between sites, 2 classes	Mainly public and PPP
Copenhagen	No forecast Possible shortage	No planned segmentation	Mainly public, exceptionally private
Ile-de-France	No forecast No stock information	Between sites, 4 classes	Public and private
Ireland	Only IDA forecast Plan what is needed	Between sites, many extensive classifications	Public and recently private
South East	Estimates by District Councils No shortages expected	Between sites, 3 classes	Private
The Randstad	Forecast 20 10 1.000 ha shortage	Between sites, 5 classes, on sites	Mainly public, some PPP initiatives



### *Ireland*

The sites are possessed by the counties and developed by the Ireland Development Agency. Given the increase in land prices, private parties have shown initiatives to become involved.

### *United Kingdom*

In recent years the British government has tried to withdraw its interventions in the land market and let the market forces organise the supply of industrial sites.

### *The Netherlands*

The development of industrial sites is primarily in the hands of individual municipalities. There are some initiatives to develop PPP-constructions, in particular in the small restructuring areas.

## **5 Inventory of industrial sites and office locations**

### **5.1 The selected economic activities**

The main aim of the study was a systematic, comparative inventory of industrial sites and office locations in various regions in terms of their suitability of location for one or more of the following activities:

- Chemical industry;
- Distribution and Value Added Logistics (VAL);
- Assembly and production requiring a multi-modal terminal;
- High-tech;
- European headquarters.

Due to time and budget restrictions, only five regions have been investigated in greater detail. East Ireland and Southeast England were not further considered due to time constraints. In total 46 industrial sites and office locations have been inspected (see Table 5).

*Table 5 Inspected sites and their suitability for the selected economic activities*

Region	Number of inspections	Suitable for the following economic activities:				
		Chemical industry	Distribution and VAL	Assembly and production	High-tech	European headquarters
Brussels	14	6	10	4	6	2
Copenhagen	5	3	3	2	1	1
Westfalia	7	2	5	1	1	0
Ile-de-France	11	6	6	3	8	4
The Randstad	9	2	4	3	2	2

All sites were judged on their suitability for each of the above listed economic activities. On the basis of extensive field work, amongst others, the following information for each site was collected:

- Size of the site, percentage direct available for grants, and planned site extensions;
- Price (minimum/maximum) and rent;
- Accessibility by road, rail, waterways and public traffic and the presence of an intermodal terminal;
- Representativeness of the site and the buildings;
- Governmental subsidies;
- Greenfield or brownfield.

A number of remarks is in order here before presenting the results of the field work: First, since we are interested in the suitability of individual sites for specific economic activities, it is important to note that the impact of the price of land is interpreted in contrast to Section 3, where it expressed a “willingness to pay”. In the present context, it is interpreted as a supply factor: in case of individual sites, the lower the land price, the easier it is to attract (foreign) companies. Moreover, the selection of inspected sites is too limited to guarantee representativeness for all sites in each region and for the selected economic activities.

## 5.2 Chemical industry

Considering the accessibility of sites judged suitable for the location of the chemical industry, most of these sites are well accessible by car, though less so by rail and waterways.

Exceptions are the sites in The Randstad: most of them are well accessible by waterways (see Figure 3).

The representativeness of sites and the buildings on these sites is rather equal among the regions. The inspected sites are large in The Randstad compared to the surface of the sites in the other regions. In particular in Greater Copenhagen the percentage of space available for direct occupation by chemical industries is high (about 70%), although the size of the sites in this region is rather small (32.5 ha). In particular in The Randstad (708 ha) and Ile-de-France (151 ha) the size of the inspected sites was large. Given the inspected sites and the fact that in The Randstad nearly 40% is directly available for occupation, the opportunities for chemical industries to locate in The Randstad are better than in Greater Copenhagen. In Brussels-Antwerp-Gent and Ile-de-France some minor extensions of the sites are planned.

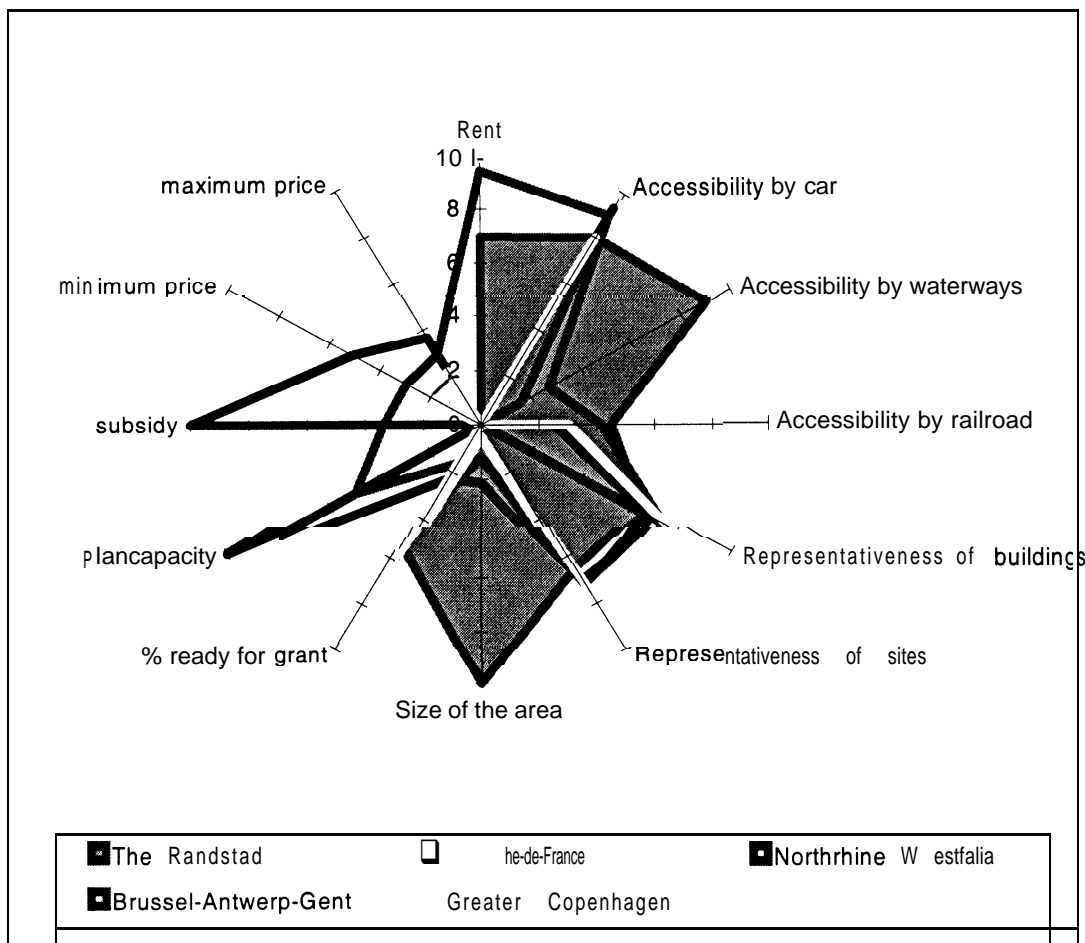


Figure 3 Chemical industry

Investment subsidies are only available in Brussels-Antwerp-Gent (8%) and Northrhine Westfalia (23%).

In those regions the average prices of the industrial sites are the lowest, viz. about 75% and 50% respectively of the prices on sites in Greater Copenhagen and Ile-de-France.

Unfortunately, the prices on the sites visited in The Randstad were not available. However, the rents on sites in The Randstad are about 25% higher than those on sites in Brussels-Antwerp-Gent. Those regions were the only ones where sites can be rented.

### 5.3 Distribution and Value Added Logistics (VAL)

In all regions the accessibility by car of sites suitable for distribution and VAL activities is of a high standard (see Figure 4). In particular in The Randstad, the accessibility of sites by water and rail is relatively good. In Ile-de-France and Greater Copenhagen none of the sites are accessible by water. It speaks in the favour of Brussels-Antwerp-Gent that all sites have access to a multi-modal terminal at a distance of less then 10 kilometres (in The Randstad only 50% of the sites have such a connection).

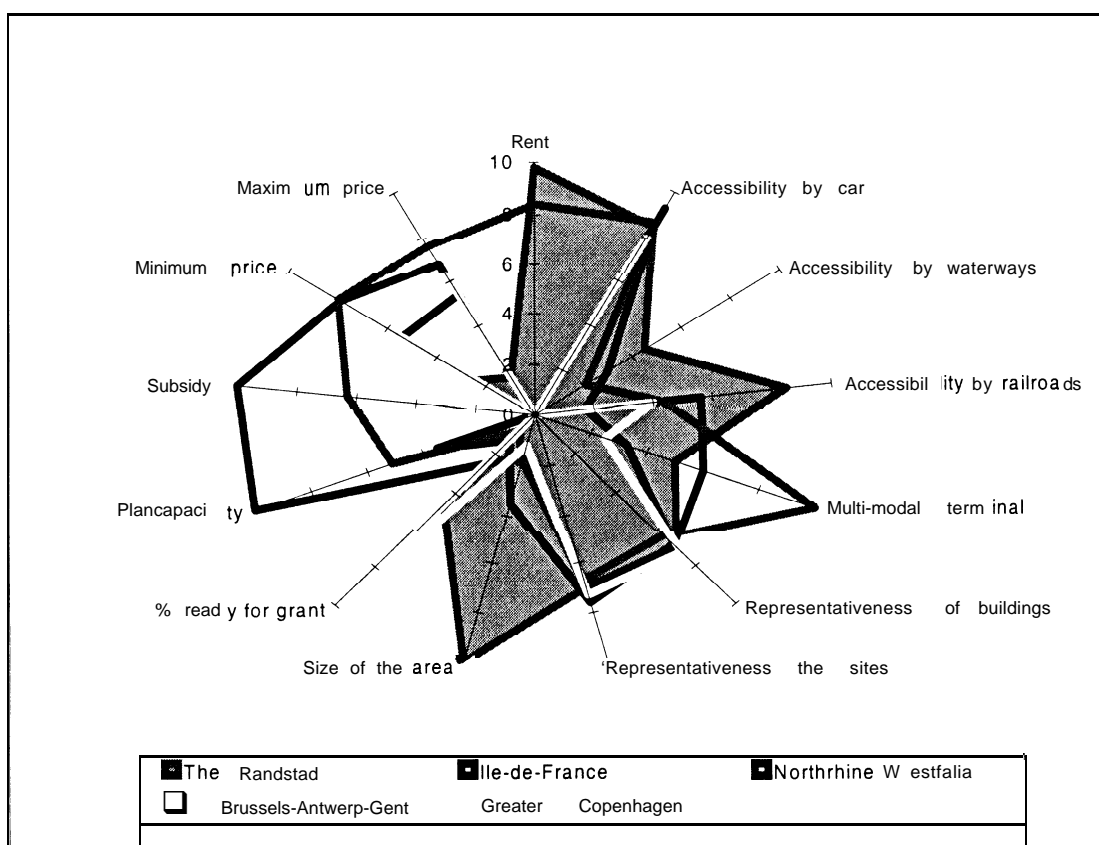


Figure 4 Distribution and Value Added Logistics (VAL)

Again the representativeness of sites and buildings does not differentiate much over the regions, and again a large percentage of the sites in Greater Copenhagen is directly available for occupation, although the size of the inspected sites is small. The size of the sites visited in The Randstad is large (616 ha), just over 40% is directly available for occupation, however, no extensions of these sites are planned. The size of the visited sites Northrhine Westfalia, Brussels-Antwerp-Gent, and Ile-de-France is smaller (102 ha, 113 ha and 216 ha,

respectively) and their direct available reserve is smaller (22%, 7% and 12%, respectively), but they have planned large extensions of their sites (140 ha, 71 ha and 49 ha, respectively). Investment subsidies are only available in Brussels-Antwerp-Gent (9%) and Northrhine Westfalia (14%). In those regions, the average prices of the industrial sites are lowest (84 and 90 dfl per m<sup>2</sup> on average, respectively).

By far the highest prices are paid in The Randstad (minimum price 270 dfl, maximum price 400 dfl). The price levels in Greater Copenhagen (103 dfl) and Ile-de-France (123 dfl) are closer to the Belgian and German price levels than to Dutch levels. Again only in Brussels-Antwerp-Gent and The Randstad sites can be rented: the annual rents are fairly equally high. Investment subsidies are only available in Brussels-Antwerp-Gent (on average 9%) and Northrhine Westfalia (on average 14%).

#### 5.4 Assembly and production requiring a multi-modal terminal

The inspected sites suitable for assembly and production activities are well accessible by car, in particular in Ile-de-France (see Figure 5). The accessibility by rail is good in Ile-de-France and The Randstad, and to a lesser extent, Brussels-Antwerp-Gent. The accessibility by waterways is good in The Randstad and Northrhine Westfalia and, finally, the visited sites in Northrhine Westfalia and Brussels-Antwerp-Gent are all close to a multi-modal terminal. Considering the representativeness of the sites and buildings, the scores are marginally discriminating: on average the inspected sites in Ile-de-France score above the overall average and the sites in Brussels-Antwerp-Gent, and in particular Northrhine Westfalia, score below this average.

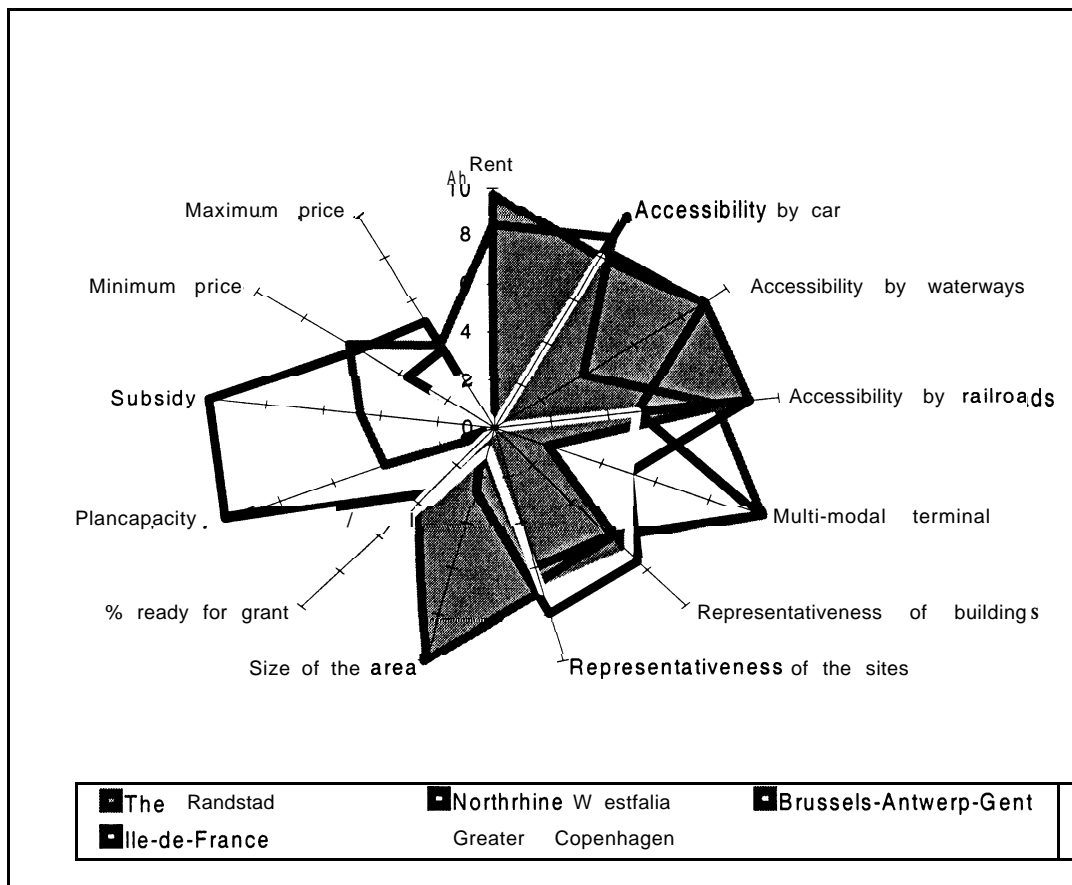


Figure 5 Assembly and production industries requiring a multi-modal terminal

The size of the sites visited in The Randstad is large (1173 ha) and nearly 40% is directly available for grants, however no extensions are planned. The size of the inspected sites in all other regions is much smaller. With exception of Greater Copenhagen – and to a less extent Northrhine Westfalia – a much lower percentage of the sites is directly available for grants. However, again with exception of Greater Copenhagen, all other regions have sites where extensions are planned.

The prices of land are highest in Greater Copenhagen (on average 175 dfl) and lowest in Brussels-Antwerp Gent (72 dfl.). Unfortunately, prices are not available for the sites in The Randstad. Only in Brussels-Antwerp-Gent and The Randstad sites can be rented: the rents are about equally high. Investment subsidies are, again, only available in Brussels-Antwerp-Gent (on average 11%) and Northrhine Westfalia (on average 23%).

### 5.5 High-tech

The accessibility by car on the inspected sites suitable for high-tech activities is quite good (see Figure 6). The accessibility by rail and waterways is poor. The representativeness of the sites is in general high however not much different in the regions visited.

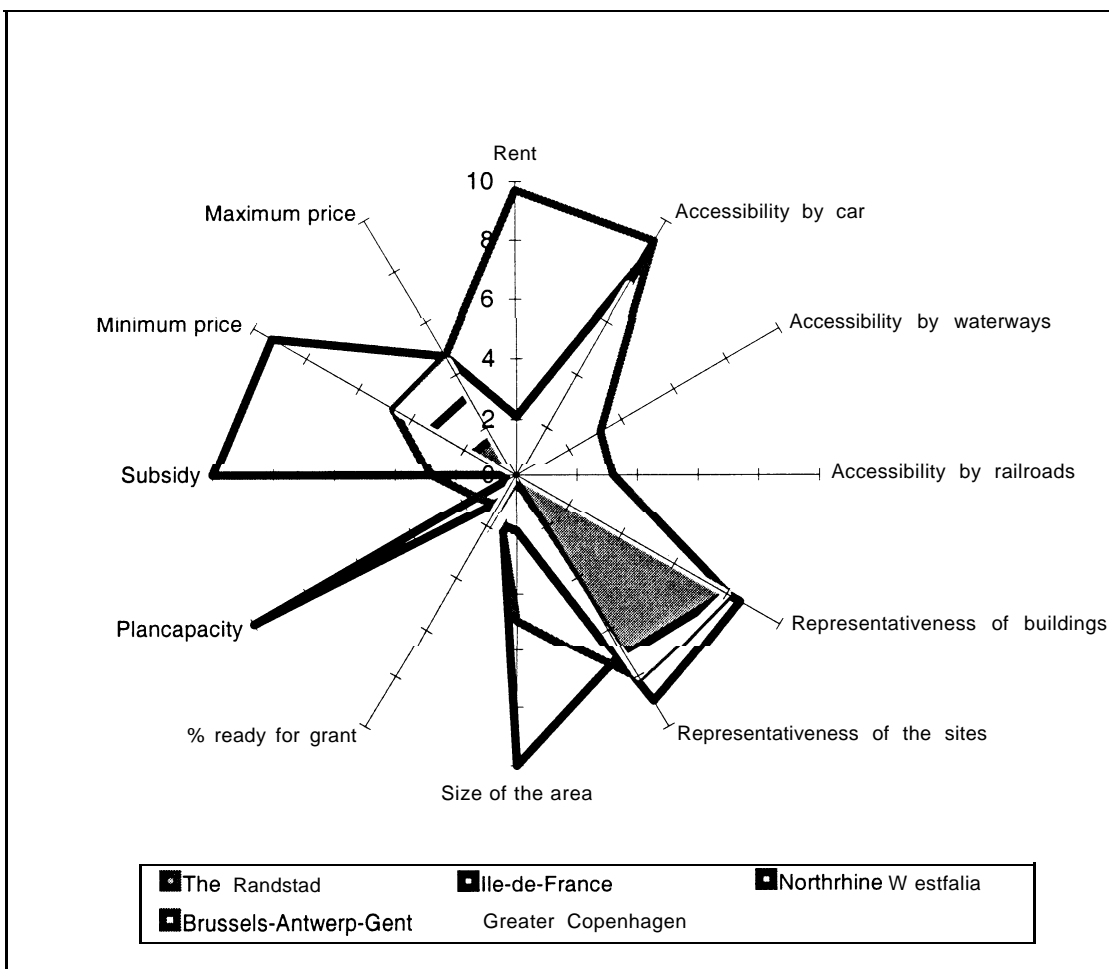


Figure 6 High-tech

The size of the visited sites is relatively small. Only in Ile-de-France (170 ha) and Brussels-Antwerp-Gent (83 ha) are large sites available, although there is not much space left that is directly available for grants. These two regions are the only regions where large extensions are

planned (130 ha and 20 ha, respectively). In particular in The Randstad (4 ha) and Greater Copenhagen (12.5 ha) the inspected sites were small.

Land prices are by far the highest in The Randstad (on average 290 dfl), followed by Ile-de-France (150 dfl). Land prices are about equally high in the other regions (between 100 and 110 dfl), although in Northrhine Westfalia one site offers low land prices (53 dfl). Again, investment subsidies are only available in Brussels-Antwerp-Gent (on average 7%) and Northrhine Westfalia (on average 23 %).

### 56 European headquarters

Important for European headquarters is good accessibility by car and by public transport. As can be seen in Figure 7 all regions match these criteria. The scores of Northrhine Westfalia and Greater Copenhagen are slightly below average, but the visited sites in those regions remain highly accessible by car and public traffic.

In all regions, but in particular in Brussels-Antwerp-Gent, the sites and buildings are - as expected - highly representative.

The largest sites were visited in Ile-de-France, followed at a fair distance by Northrhine Westfalia. In all regions the percentage of land directly available for office locations is low (the highest figure is scored by The Randstad: 15%). However in all regions - with exception of Greater Copenhagen - relatively large extensions are planned.

The inspected sites were all located outside the inner city, because European headquarters are hardly located on inner city locations. This might be an explanation that again the highest prices are found in The Randstad (450 dfl). In this region a number of "top-locations" are located in the outskirts of large cities and not in the inner cities.

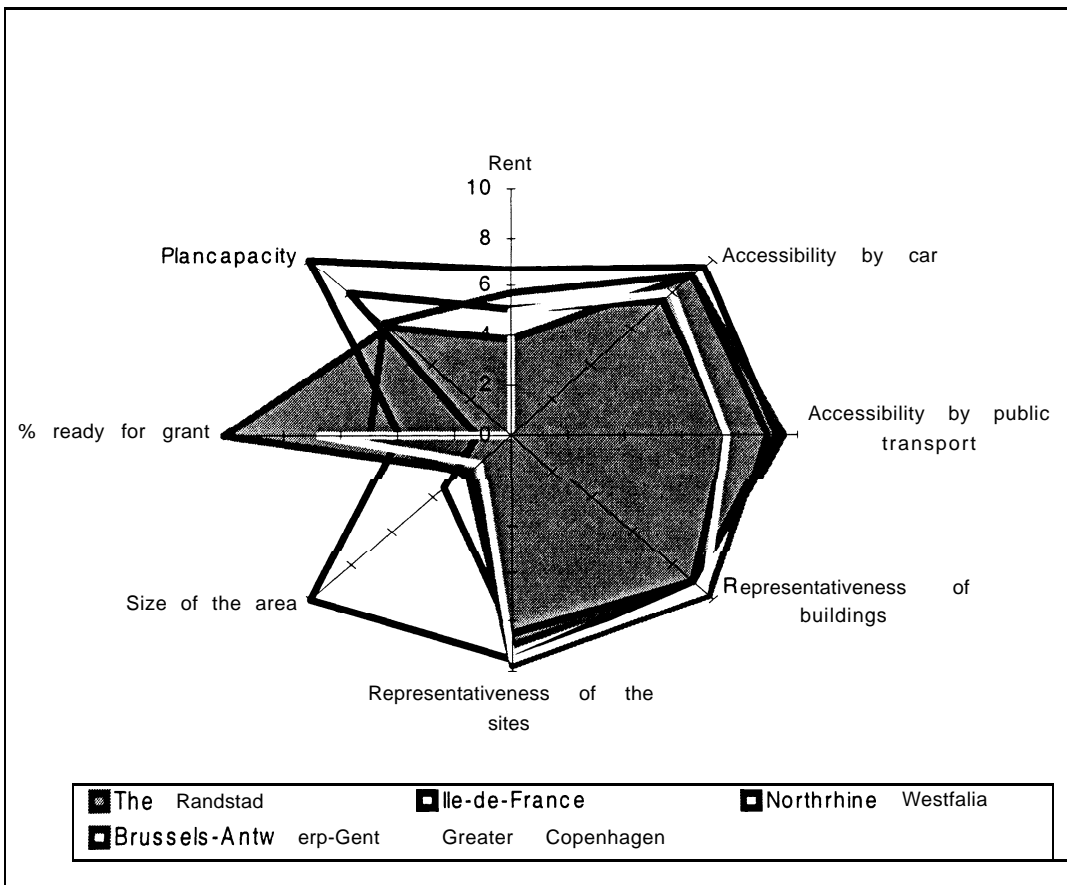


Figure 7 European Headquarters.

## **57 Findings from a qualitative comparison**

What general conclusions can be drawn from this qualitative comparison of the inspected sites?

All sites in all regions are well accessible by car. In The Randstad the sites are relatively accessible by waterways and the sites in Brussels-Antwerp-Gent are relatively well connected to multi-modal terminals.

The representativeness of sites and building hardly differ between the regions. Between the types of activities there are differences: obviously the sites and buildings for office activities are most representative.

Considering the size of the sites, the percentage of land directly available for grants and the planned extensions for the five economic activities, some interesting regional differences were found during the field inspections.

Overall Ile-de-France performs best. The sites are large, the percentage of the sites directly available for grants is about average, and there are relatively large extensions planned for most activities. An exception is the lack of direct available land for assembly and production activities.

Northrhine Westfalia scores near average on all aspects. Exceptions are the relatively large extensions planned for sites suitable for distribution & VAL activities, assembly & production activities and – to a less extent - office locations.

Brussels-Antwerp-Gent scores slightly below average on most aspects for most activities. The relatively low percentages of land directly available for distribution & VAL activities and assembly & production activities are compensated for by fairly large planned extensions. The scores of The Randstad are most diverse. For chemical industry, distribution & VAL activities and assembly & production activities, relatively large sites do exist, where still much land is available for direct grants (however, no extensions are planned). On the other hand, The Randstad scores poorly on all aspects considering high-tech activities and also scores below average considering the size and planned extensions of land suitable for office activities.

In general Greater Copenhagen is an out-layer: the inspected sites are relatively small, much land is directly available and no extensions are planned. Given these results Greater Copenhagen does not seem to be an important player in the North-western European economic field. However, it certainly will be an important player within the Nordic region. Its position will be further strengthened after the completion of the Scandinavian international bridge and tunnel projects (Scanlinks).

Considering the price of land, it is remarkable that if price data are available, the prices in The Randstad are by far the highest. Land prices are the lowest in Brussels-Antwerp-Gent and Northrhine Westfalia. Moreover, the latter regions are the only regions where investment subsidies are available.

To offer more structural – quantitative - explanations behind these qualitative findings, a more rigorous method, viz. rough set analysis, is applied in the next section.

## **6 Explaining the Differences: a Meta-Analytic Comparison**

### **6.1 The rough set analysis technique**

Rough set analysis is essentially a decision support tool from operations research, which tries to formulate decision rules of an “if-then” nature. Based on a multidimensional survey table of objects, it aims to determine which combinations of a classified set of values characterising these objects are consistent with the occurrences of a class value of a response variable.

Clearly, there may be multiple decision rules that fulfil this consistence requirement. So rough

set analysis seeks to trace these decision rules – based on some sort of combinatorial logic – and tries to identify which background variables show up in these decision rules and with which frequency. These variables then become the critical determinants of the phenomenon under investigation. Unique of the rough set analysis is that it is able to deal with hard – quantitative – and soft – qualitative – information as long as the information of each variable is internally consistently classified (see for an extensive introduction in the rough set analysis techniques: Van den Bergh et al., 1997 and Button and Nijkamp, 1997).

In this study the dependent variable is the suitability of a site for the selected economic activities. In Table 6, the suitability of the inspected 46 sites for – combinations of – economic activities are classified. The rough set analysis tries to explain the suitability of the sites by 11 independent variables as classified in Table 7.

*Table 6 Classification of sites by their suitability for economic activities*

1	At least 3 economic activities (excluding European headquarters)	9
2	Chemical industry and Distribution & VAL	5
3	Distribution & VAL and Assembly & production	6
4	Chemical industry and High-tech activities	3
5	Chemical industry	3
6	Distribution & VAL	5
7	High-tech activities	5
8	European headquarters	<b>10</b>

*Table 7 Classification of the independent variables*

Variable	Class 1	Class 2	Class 3	Class 4	Class 5
Size site	c 50 ha	50 – 100 ha	100 – 200 ha	> 200 ha	
% granted	< 25%	25 – 50%	50 - 75%	> 75%	
% planned	0	1 – 100%	> 100%		
Land price	< 50 dfl	50 – 100 dfl	100 - 200 dfl	> 200 dfl	
Accessibility by car	<= 8	8 < x <= 9	> 9		
Accessibility by public transport	<= 8	8 < x <= 9	> 9		
Multi-modal terminal	Yes	No			
Representativeness	<= 8	8 < x <= 9	> 9		
Subsidy	Yes	No			
Greenfield/brownfield	Greenfield	Brownfield			
Region	Brussels	Ile-de-France	Westfalia	Randstad	Copenhagen

The rough set analysis generates decision rules which show how combinations of values of independent variables lead to a unique value of the dependent variable. For instance, if a site is between 0 and 50 ha, and if the site has a multi-modal terminal connection, then it is always a site that is suitable for distribution and VAL activities. None of the other classified dependent variable values can be explained by those two values of the independent variables. Of course, there may be more decision rules that explain sites which are suitable for distribution & VAL activities. Although only eight types of sites are classified, the model generates 34 decision rules (see Table 8).

Based on these 34 decision rules, rough set analysis seeks the minimal set of decision rules that explains all variation in the dependent variable (the classification of sites). Out of these minimal sets, the importance of the independent variables can be distilled. If an independent



variable appears in all the minimal sets it means that the classification of sites cannot be explained without this variable. Such a variable is called a core variable. Table 9 shows that there are 12 minimal sets and table 10 shows that variable 1 (size site) and 7 (multi-modal terminal connection) are the only two core variables. That the variable “multi-modal terminal connection” is a core variable, comes as no surprise: only for a few economic activities (distribution & VAL and assembly & production) such a connection is of importance.

Table 8 Generated decision rules from rough set analysis

Reg. 1	A4=2	A6=3	D=1				
Reg. 2	A4=3	A6=2	A9=2	D=1			
Reg. 3	A4=3	A6=3	A9=1	D=1			
Reg. 4	A1=1	A4=2	A6=1	A9=2	D=1		
Reg. 5	A1=3	A4=2	A5=3	A6=1	A9=2	D=1	
Reg. 6	A1=3	A4=2	A5=2	A6=1	A9=2	D=1	
Reg. 7	A1=1	A4=2	A5=1	A6=1	A7=1	A9=2	D=1
Reg. 8	A1=4	A4=1	A5=1	A6=1	A7=1	A9=1	D=1
Reg. 9	A1=2	A3=1	A4=2	<b>A11=1</b>	D=2		
Reg. 10	A1=1	A3=1	A4=2	<b>A11=5</b>	D=2		
Reg. 11	A1=3	A3=1	A4=2	A5=1	<b>A11 = 3</b>	D=2	
Reg. 12	A6=1	A7=1	<b>A11 = 2</b>	D=3			
Reg. 13	A6=1	A7=1	<b>A11 = 5</b>	D=3			
Reg. 14	A1=4	A6=1	A7=1	<b>A11=1</b>	D=3		
Reg. 15	A1=4	A6=1	A7=1	<b>A11 = 3</b>	D=3		
Reg. 16	A1=2	A3=2	A6=1	A7=1	<b>A11=1</b>	D=3	
Reg. 17	A1=1	A4=1	A8=2	D=4			
Reg. 18	A1=1	A2=1	A4=3	A8=1	D=4		
Reg. 19	A1=2	A4=1	D=5				
Reg. 20	A1=2	A2=3	A4=2	D=5			
Reg. 21	A1=4	A2=2	A4=1	A7=2	D=5		
Reg. 22	A2=4	A4=4	D=6				
Reg. 23	A1=1	A2=1	A3=2	A4=2	D=6		
Reg. 24	A1=4	A2=1	A3=1	A4=3	D=6		
Reg. 25	A1=2	A2=1	A3=1	A4=3	D=6		
Reg. 26	A1=2	A2=1	A3=2	A4=2	A5=2	A6=1	D=6
Reg. 27	A1=1	A3=1	<b>A11 = 4</b>	D=7			
Reg. 28	A1=1	A2=3	A3=1	<b>A11 = 3</b>	D=7		
Reg. 29	A1=1	A2=3	A3=1	<b>A11 = 5</b>	D=7		
Reg. 30	A1=3	A2=1	A3=2	A5=3	<b>A11=1</b>	D=7	
Reg. 31	A2=1	A7=2	A8=3	D=8			
Reg. 32	A2=2	A7=2	A8=2	D=8			
Reg. 33	A2=1	A4=4	A7=2	A8=2	D=8		
Reg. 34	A1=2	A2=2	A4=3	A7=2	A8=2	D=8	

Table 9 Minimal sets

{1,4,6,7,9,10,11}	{1,4,5,7,8,11}	{1,3,4,6,7,10,11}	{1,2,4,5,7,8}
{1,2,5,7,8,9,11}	{1,3,4,7,8,9,10,11}	{1,2,4,6,7,8,9,10}	{1,2,3,4,7,8,10}
{1,2,3,7,8,9,10,11}	{1,4,5,6,7,11}	{1,2,3,5,7,8,9}	{1,2,4,5,6,7}

Table 10 Appearance of the independent variable in the minimal sets

1	Size site	12	7	Multi-modal terminal	12
2	% granted	7	8	Representativeness	8
3	% planned	5	9	Subsidy	5
4	Land price	9	10	Greenfield/brownfield	6
5	Accessibility by car	6	11	Region	7
6	Accessibility by public transport	5			

## 6.2 The European benchmark

Since our analysis aims to develop a European benchmark of industrial sites and office locations, the role of the region as one of the explanatory variables is crucial. Therefore, we need to analyse the individual decision rules as given in Table 8. The region is the independent variable 11 (printed bold). In 12 out of the 34 decision rules, the region plays a role. Table 11 shows the relation between the classification of sites and the region as an explaining variable. The region where the site is located is important for three types of sites: chemical industry / distribution & VAL, distribution & VAL / assembly & production and high-tech. Important to note is that apparently the region where the sites are located there is not all that much difference between the selected regions for the other five classes of economic activities. This implies, for instance, that the suitability of a site to locate a European headquarters is not dependent on the region where the site is located.

Table 11 Appearance of the regional variable (11) in the decision rules

1	At least 3 economic activities (excluding European headquarters)	0
2	Chemical industry and Distribution & VAL	3
3	Distribution & VAL and Assembly & production	5
4	Chemical industry and High-tech activities	0
5	Chemical industry	0
6	Distribution & VAL	0
7	High-tech activities	4
8	European headquarters	0

In our benchmark, we are most interested in the classes of sites suitable for combinations of economic activities where the region is a differentiating factor. These classes will now be discussed below.

### 6.2.1 Chemical industry and distribution & VAL

Sites suitable for chemical industry in combination with distribution and VAL activities are different in three regions Brussels-Antwerp-Gent, Greater Copenhagen and Northrhine Westfalia. In all three regions these sites lack planned extensions and the price of land is relatively low (between 50 and 100 dfl). The differences between the three regions are explained by the different size of the sites. The smallest sites are located in Greater Copenhagen (0 – 50 ha), the sites in from Brussels-Antwerp-Gent are one category larger (50 – 100 ha) and the sites in Northrhine Westfalia are the largest (100 – 200 ha). Furthermore, the sites in Northrhine Westfalia suitable for chemical industry in combination with distribution and VAL activities are relatively poorly accessible by car.

### 6.2.2 Distribution & VAL and assembly & production

The rough set model generates five decision rules with a regional factor that differentiate for sites suitable for distribution & VAL and assembly and production activities. All five decision rules have a poor accessibility by public transport and a location near a multi-modal terminal in common. These two factors are enough to select sites suitable for distribution & VAL and assembly and production activities in Ile-de-France and Greater Copenhagen. For Northrhine Westfalia and Brussels-Antwerp-Gent an additional factor concerns the size of the sites: the sites should be larger then 200 ha. However the final decision rule also concerns Brussels-Antwerp-Gent and in this rule the site should be relatively small (50 - 100 ha), but some extensions are planned. In other words: in Brussels-Antwerp-Gent sites suitable for distribution & VAL and assembly and production activities are either large or small (with some planned extensions), however they have a poor accessibility by public transport and a location near a multi-modal terminal, in common.

### 6.2.3 High-tech

Three out of four of the decision rules generated for sites suitable for high-tech activities have in common that the size of the site is small (0 - 50 ha) and that they lack planned extensions. This concerns sites in the regions The Randstad, Northrhine Westfalia and Greater Copenhagen. Northrhine Westfalia and Greater Copenhagen have as additional characteristic in that over 50% of the sites are available for grants.

Brussels-Antwerp-Gent is the subject of the fourth decision rule. In this region sites suitable for high-tech activities are relatively large (100 - 200 ha), between 25 and 50 % is not yet occupied, nevertheless extensions are planned. Finally, the sites are relatively accessible by car.

## 6.3 Other explanatory decision rules

In Table 12 an overview is given of the number of times an explaining variable is used in the decision rules (see Table 8). The size of the sites and the price of the land are most differentiated between the classes of sites. The involvement of the region belongs to a second group of variables that are often used. Note that the fact that the site is newly developed (greenfield) or a restructured area (brownfield) does not show up as an explanatory factor in the decision rules.

Table 12 *Involvement of the independent variable in the decision rules*

1	Size site	25	7	Multi-modal terminal	12
2	% granted	16	8	Representativeness	6
3	% planned	<b>11</b>	<b>9</b>	Subsidy	7
4	Land price	23	10	Greenfield/brownfield	-
5	Accessibility by car	7	11	Region	12
6	Accessibility by public transport	14			

A part of these variables were already discussed in Section 6.2 where they were included in decision rules in which a region was incorporated. Table 13 shows the variables included in decision rules in which no regional feature is part of the explanation of the suitability of sites for the classes of economic activities.

At this stage, there are a few examples which are interesting to highlight. For example, sites suitable for *at least three of the four economic activities* (excluding office activities), are different from all other classes by their relatively low prices of land, a poor accessibility by public transport, a location near a multi-modal terminal and the lack of investment subsidies.

Obviously, those sites are not located in Brussels-Antwerp-Gent and Northrhine Westfalia, because in those areas investment subsidies are available for most economic activities. Other interesting findings are the small size of sites suitable for high-tech activities and the high land prices, as well as the lack of a multi-modal terminal connection in combination with the highly representative character of locations suitable for office activities.

*Table 13 Other decision rules explaining the differences between the suitability of sites for classes economic activities*

At least 3 economic activities (excluding EHQ)	<ul style="list-style-type: none"> <li>. 50 – 100 dfl</li> <li>• bad accessible by public transport</li> <li>• connected to multi-modal terminal</li> <li>• no investment subsidy</li> </ul>
Chemical industry / Distribution & VAL	<ul style="list-style-type: none"> <li>. 50 – 100 dfl</li> <li>• no planned extensions</li> </ul>
Distribution & VAL / Assembly & production	<ul style="list-style-type: none"> <li>• bad accessible by public transport</li> <li>• connected to multi-modal terminal</li> </ul>
Chemical industrv / High-tech activities	<ul style="list-style-type: none"> <li>• 0-50ha</li> </ul>
Chemical industry	<ul style="list-style-type: none"> <li>. 0 – 100 dfl</li> </ul>
Distribution & VAL	<ul style="list-style-type: none"> <li>• 0 – 25% directly available</li> </ul>
High-tech activities	<ul style="list-style-type: none"> <li>• 0-50ha</li> <li>• no planned extensions</li> </ul>
European headquarters	<ul style="list-style-type: none"> <li>• 0 – 50 % directly available</li> <li>. &gt;100dfl</li> <li>• not connected to multi-modal terminal</li> <li>• highly representative</li> </ul>

## 7 Policy Perspectives

This study focuses attention on the spatial planning procedures and the supply and quality of industrial sites in core regions of various North-western European countries. The emphasis is on differences in the suitability of location of industrial sites in those regions with a view to the identification of success conditions for mobile or footloose investment projects belonging to five distinct types of economic activities.

The planning time required to change the designated use of land varies significantly between the countries considered and even within various single countries where long delays in the spatial decision process may be caused by – several – long-lasting rounds of public consultation. Changes in the designation of land can be realised relatively fast in Greater Copenhagen and take a long time in The Randstad. However, for international investors this may be less important, because they demand a direct supply of land at a fair price/quality ratio and a fast building permit to be able to invest in company buildings within a year. Another important factor is the trust of investors in the government institutions involved in the granting of land and building permits.

A sufficient quantity of supply of land of a desired quality at a desired location conform that the market demand can be realised by both short and long planning horizons. In case of a short planning horizon, a short period to change the designation of the land use is required. In case of a long planning horizon, the planned supply must be flexible, constantly monitored and

strategic reserves must be allocated in order to facilitate unforeseeable opportunities, the so-called 'white elephants'.

Considering the development of industrial sites by public private partnerships, in general two types of PPP-constructions are found: one with low and one with considerable public involvement. In case of low public involvement, the only governmental activity is the legal facilitation of the requested land and building permits. Examples of such PPP-constructions are found in Belgium. In PPP-constructions with a considerable public involvement, the governments are particularly active in the developing of the land and they cover part of the financial risks (for instance, the restructuring costs). The private party often takes care of the acquisition of firms, parts of the financial aspects and the management of the site. PPP-constructions of this type are found in Belgium, Germany and recently, The Netherlands. For interested private parties for PPP-constructions it must be made crystal-clear what the tasks, responsibilities and risks of each partner are. This requires solid legal imbedding and trustworthy government institutions. Short planning procedures to change the designation of land use are in favour of expected profitability of investment projects.

Landscaping is an important factor in the development of sites with a high quality standard. It is not only important to develop a well designed industrial site; it should also fit in perfectly with the surroundings. Examples of such sites are found in Southeast England, Ile-de-France and Northrhine Westfalia. In particular when working and living are spatially concentrated, due attention to the design of industrial sites should play a prominent role.

Not only landscaping but also the segmentation of industrial sites is of increasing importance. Segmentation can take place between industrial sites, but also within a site. Segmentation between sites leads to a clear distinction between sites for different economic activities. In most of the inspected regions such segmentation between sites was found. Segmentation within one site was found less often. In Greater Copenhagen no designed segmentation was found, in Germany there were some first developments, in Belgium segmentation is only applied on sites of the highest quality, and in France only on the largest sites, whereas in The Netherlands, internal segmentation appears to be most common.

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