Roads to success

an analysis of factors hindering or advancing regional capacity for technological innovation

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Abstract

This report presents an analysis of factors hindering or advancing regional innovation capacity. A descriptive conceptual framework is developed on the basis of previous research, by means of which eight regions of high technology are described and analyzed. A framework is then developed that provides a systematic overview of the effects of the factors that influence regional capacities for technological innovation. This framework shows that configurations of factors leading to innovative regions are context specific.

Preface

This report is a Master Thesis for the program of Industrial Engineering and Management Science at the Faculty of Technology Management of Eindhoven University of Technology. It describes an analysis of factors that influence regional capacity for technological innovation. This research is part of a larger study that examines the management of the High Tech Campus Eindhoven, which is being performed by a number of students of Eindhoven University of Technology.

I started this Master Thesis project with the intent to gain experience in conducting academic research and in analyzing external influences on processes. Furthermore, I attempted to contribute to the understanding of regional innovation processes. Within the program of Industrial Engineering and Management Science attention to regional innovation processes is uncommon, but this topic suited well with my personal interests. The political component in particular interests me, and I am very satisfied with the experience of this study.

Doing a study like this is only possible with the support of several people and institutes. First of all I would like to thank Philips for the financial support that made it possible to visit all the regions involved in this study. Ton van Lier, my supervisor at Brainport, spent much time discussing the interviews and other aspects of the thesis, which increased my motivation. He also introduced me to key actors in the regions. I would like to thank these actors for the very useful contacts in the region they provided me with. Furthermore, I am grateful for the interviewees' time and their interest in the project. I would like to thank my supervisors at the TU/e, Sjoerd Romme and Hans Berends, for the time we spent together discussing the methods and interpretations of that resulted in this thesis. It was motivating and instructive to cooperate with them and the other members of the research group on the management of the High Tech Campus Eindhoven. I would like to thank my friends Chris-Jan and Albert for their graphic and linguistic support respectively. Finally, Gatske and Christian, my wife and son, without your love and mental support performing this thesis would have been a lonely venture.

Dordrecht, March 2007

Summary

What this study explores

This study is part of a project at the Department of Technology Management of Eindhoven Technical University. In the late 1990s Royal Philips Electronics initiated the development of the High Tech Campus Eindhoven (HTC). This former Philips Research site has swiftly evolved into a technology centre with a global reputation. The research project has the aim to uncover and codify the principles and mechanisms that constitute the emerging strategy of this campus, in relation to the critical success factors of the Eindhoven region.

In this study factors hindering or advancing regional capacity for technological innovation (RCI) were investigated. More specifically, the positive and negative effects of regional factors on RCI and the criticality of factors were investigated and an analysis was made of which factors are necessary for a high RCI. This was done via a description and analysis of eight successful high-technology regions in Europe and Canada: Cambridge (UK), Dublin (Ireland), Eindhoven (Netherlands), Grenoble (France), Helsinki (Finland), Munich (Germany), Øresund (Sweden and Denmark) and Waterloo (Canada). These regions are comparable qua size and score on RCI. The regions differ with respect to the structure of the industry, culture and the political system.

A descriptive conceptual framework was used to describe and analyze these eight regions. About 50 factors were listed on the basis of the literature about factors influencing RCI. These factors were grouped around seven themes: physical infrastructure, institutional infrastructure, networks, people, soft location factors, culture and policies.

In each of the regions involved in this study, opinions about the listed factors were found by interviewing key actors. In accordance with the Triple Helix model, people from government, industry and research institutes and intermediaries between these parties were interviewed. In addition, reports and websites were used for data collection. Critical factors were identified by labelling the factors mentioned spontaneously and by analyzing the case descriptions.

Factors hindering or advancing RCI

The cross-case analysis led to a list of roughly 35 factors that considered as critical in at least one region. The table below shows these factors.

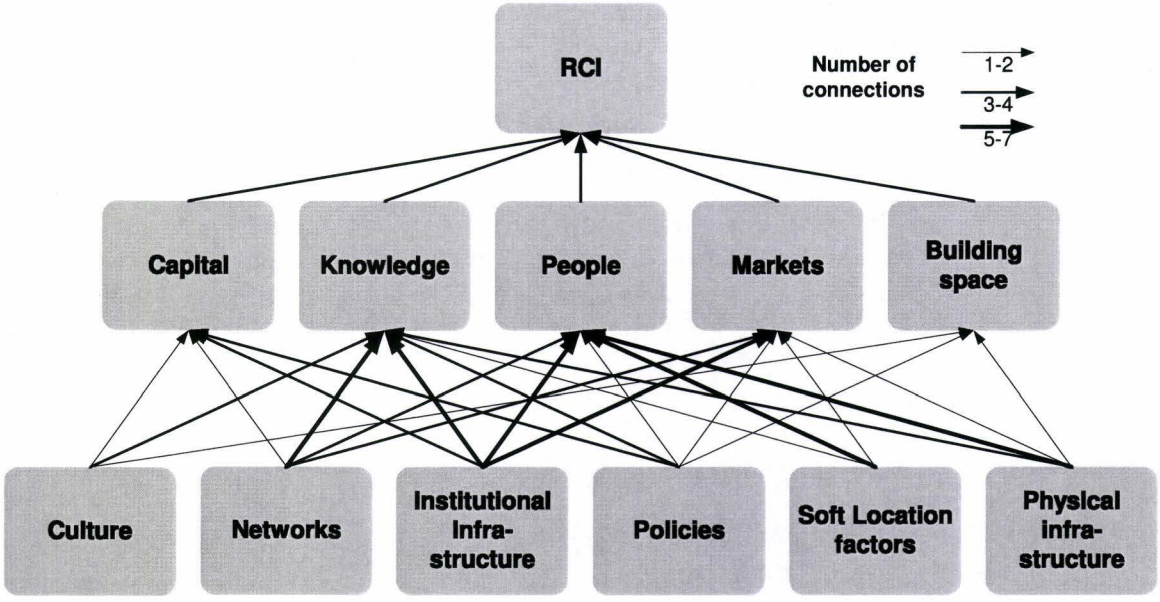
Physical infra-structure	Institutional infra-structure	Networks	People	Soft location factors	Culture	Policies
Roads and parking	Industry concentration	General networks	Availability of highly educated people	Living climate	Attitude region towards high tech cluster	General policies
Air traffic connections	Presence of innovative multinational	Interaction with universities		Leisure facilities	Entrepreneu-rial attitude	Type of financial system
Public transport system	Research institutes	Interaction with research centres		Housing	Willingness to cooperate	Public financial support
Geographic position	Education institutes	Vertical networks		Price level	Short term oriented culture	Cooperation between politicians
Building space	Proximity advantage	Informal ties in networks		Image of the region	Uncertainty avoidance	
	Venture capital				Power distance	
	Seed capital					
	Service providers					
	Intermediary					

In the regions where these factors are critical, a positive relation was generally observed between the score of the factor and its contribution to RCI.

However, most of the listed factors are not critical in all the regions. Within the set of factors critical in all regions only the presence of institutes of education has a high score in each region. Nevertheless, all the regions involved in this study have a high score on RCI. This implies that, excepting the presence of institutes of education, none of the listed factors is necessary for RCI.

Critical conditions for RCI

The observation that most of the factors listed in the conceptual framework are not necessary for RCI is explained by analyzing the effects of the listed factors. Referring to Classic economic theories this study shows that the listed the factors contribute to five conditions necessary for RCI: people, capital, knowledge, building space and markets.



The number of connections in the figure given above shows that there are several possibilities to improve the availability of capital, knowledge, people, markets and building space. As a result, none of the factors is necessary for the availability of these five conditions.

However, the figure shows that some groups of factors are more important than others. Factors related to institutional infrastructure are the most influential ones (22 relations). Closely related to this group are networks (13 relations) connecting the institutes and firms. Institutions and networks enable firms to share knowledge, do business, hire people and attract capital.

Nevertheless, these groups of factors do not contribute to the availability of building space. Instead, this condition is promoted by physical infrastructure and policies. Providing space for new facilities is in many cases a political decision. However, it is also possible that, due to geographic constraints, building possibilities are limited. Having 15 relations, physical infrastructure is quite important. A low-quality road system and public transport system limit travel possibilities, which means that going to work and meeting each other is more difficult.

Policies influence all the conditions, but mainly indirect. Firstly, the governments are responsible for the physical infrastructure, including building space. Besides, legislation influences all the conditions. Public financial support can positively influence RCI if the market fails. Examples of market failure are the non-availability of seed- and pre-seed capital and fundamental research.

Soft location factors, such as an attractive living climate, play an important role in attracting people and firms to come to the region or stay in the region. The image of the region also influences the image of the firms located there.

Culture is a complicated case. The well known Hofstede dimensions – power distance, uncertainty avoidance, individualism and long term orientation – do not explain differences between regions. In smaller regions the attitude of the region towards the high tech cluster is important as is the willingness to cooperate. The former influences the political willingness to provide building space for high-tech firms and willingness to take (financial) risks. The latter influences the willingness to share knowledge.

The figure shows that the critical conditions knowledge and people are influenced by many factors (22 and 23 relations respectively). This means that there are many possibilities to increase the availability of knowledge and people. Building space counts 5 relations and is thus the most critical condition. If there is no willingness at the political level to increase the availability of building space it is very difficult to find other ways to improve this condition.

General insights and implications

On the basis of the analysis summarized above this study provided the following implications and insights that are useful for policymakers:

- The framework presented in this study is a useful tool to analyze a region, investigate weaknesses and discover ways to improve the region.
- Configurations of factors hindering or advancing RCI are context specific. Each successful region has its own 'road' to success.
- The regional innovation system is a very complex system in which many factors and actors interact with each other. Intervening in the innovation system with good intentions but without knowledge of these complex relations can lead to undesired outcomes.
- The government is directly responsible for some factors that influence RCI to a large extent: physical infrastructure, tax and employment legislation and the public science system. Providing these matters is an important task of the government.
- The government can provide services and seed capital for firms, but success of these activities depends on the attitude with which they are provided. A customer oriented and commercial way of thinking is critical.
- However, the role of government in the regional innovation system is limited. Many other factors hinder or advance RCI as well, and governments cannot – or only partly – influence these factors.

Insights and implications for Eindhoven

This study also resulted in a number of insights and implications that are applicable in the region Eindhoven:

- Key success factors of Eindhoven are the cooperative culture, the high-quality networks, the presence of several multinationals and public research institutes and the customer oriented attitude with which the government operates. As a result the knowledge base and the public intermediary infrastructure are very good.
- The High Tech Campus Eindhoven is important for the image of the region in general and the image of firms located at the campus. The campus can also give firms access to excellent facilities, which can attract firms to the region and can improve the knowledge base.
- The region lacks seed- and venture capital – as many other European regions. There are fewer means to increase the availability of capital. The government has to provide more public seed capital. The national government can make tax legislations more attractive for investors.
- The region lacks a large university. The Eindhoven University of Technology is relatively small. This has a negative effect on the availability of highly educated people. Building networks with the Tilburg University can decrease this negative effect.

- Access to people can also be improved by upgrading the physical infrastructure. A high-quality infrastructure enables people to work in Eindhoven and live elsewhere. Besides, it makes establishing connections between firms and between firms and institutes easier.
- Other means to decrease the lack of people are more attractive immigration laws, better leisure facilities and image building in a coherent way.

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1. Introduction

Too much fighting about the share of the pie reduces the total volume of the pie.

prof. dr. Wim Vanhaverbeke about cooperation within a region (Vanhaverbeke 2006)

"What are the benefits of innovation for Mrs. Jansen in Tiel?" In January 2007 newspaper Trouw started a series about innovative regions far from the Randstad. Intermediair – "Booming Eindhoven! – how the city is reinventing itself" – and NRC Handelsblad, two other newspapers in the Netherlands, also paid attention to this phenomenon. These examples illustrate that Dutch innovative regions are in the spotlights.

This media attention, which can be illustrated with much more national and international examples, is an effect of a European wide change in thinking about innovation. More and more politicians understand that regions rather than nations or firms are increasingly involved in global competition (Sternberg 2000; Cooke 2005b; Vanhaverbeke 2006).

One of these innovative regions involved in global competition is Eindhoven. A unique aspect of this region is the High Tech Campus. In the late 1990s Royal Philips Electronics initiated the development of the High Tech Campus Eindhoven (HTC). This former Philips Research site has swiftly evolved into a technology centre with a global reputation.

Striking is that the HTC has opened the gates for firms that fit the profile. The idea behind that policy is called 'Open Innovation', a new way of looking at innovation pioneered by Henry Chesbrough (Chesbrough 2003). It means that new knowledge, products and processes are developed internally as well as externally. Via formal or informal forms of collaboration ideas and technologies are exchanged.

Chesbrough (2003) describes open innovation from the perspective of a single company. However, there is hardly any systematic knowledge about how to organize and manage the ecosystem of a large high tech campus with a large number of residents. Furthermore, relatively little is known about the role of the broader institutional and regional context.

Therefore, in order to acquire a more in-depth understanding of the emerging strategy of the High Tech Campus as well as to contribute to its further development and growth, the Technology Management department of the Eindhoven University of Technology started a project on these topics. This project, called the "8-3-1" project, draws upon the design research methodology developed by Romme (2003) to uncover and codify the principles and mechanisms that constitute the emerging strategy of the HTC, in relation to the critical success factors of the Eindhoven region.

In my graduation project, which is part of this "8-3-1" project, I have performed an analysis of factors hindering or advancing regional capacity for technological innovation (RCI), which is presented in this report.

1.1. Objective of the report

Several studies have investigated the influence of regional factors on innovation. Some quantitative studies have been done by the Department of Economic and Social Geography, University of Cologne under the direction of Rolf Sternberg (cf. Sternberg 2000; Sternberg and Arndt 2001; Fritsch 2003; Fritsch and Schmude 2006). This variable-oriented approach has some limitations: since it links cause and effect, multicausation is not possible (Ragin: 1987: 39). When causal complexity is high, therefore, this method is not useful (Ragin 1987: 67). The outcomes of numerous case studies investigating the influence of regional factors (e.g. Carlsson 2002; Calderini and Scellato 2005) illustrate that causal complexity is the order of the day. These case studies show that a qualitative, case-oriented approach can deal with this causal complexity (cf. Ragin 1987: 35). However, the available case studies only investigate the effect of some factors. The literature review of Becheikh, Landry and Arama (Becheikh et al. 2006) provides an overview of all the factors that may have a significant influence, but the relative importance of the factors cannot be given.

In view of these things, the aim of this study is to describe and explain the success of eight top technology regions including Eindhoven, in order to find the factors hindering or advancing regional capacity for technological innovation (RCI). More specific, the aim is to find positive and negative effects of regional factors on RCI and to find out which factors are necessary for a high RCI. In other words: is it possible to draw a generic profile of an innovative region or are innovative configurations context specific?

1.2. Structure of the report

This study has the following structure. In order to identify all the possible factors hindering or advancing RCI, a literature review is presented first, in chapter 2. This review results in a conceptual framework of factors hindering or advancing RCI. This framework also includes some indicators for RCI. In chapter 3 a methodology for doing a cross-case analysis is developed.

In the fourth chapter the eight regions involved in this study are described using the framework developed in chapter 2. Four of the regions are described extensively; the other regions only get one page. These regions are described more extensively by my colleague Jan Spruijt (Spruijt 2007).

A cross case analysis can be found in chapter 5. This analysis consists of three parts. First a general analysis is made of the influence of each of the factors listed in the conceptual framework. Based on this analysis necessary factors and several critical conditions are identified. In the last section of this chapter the results of the cross-case analysis are compared with the existing literature.

Finally, in chapter 6, conclusions are formulated regarding the research as a whole. In addition, some theoretical implications and implications for policy makers in the region of Eindhoven are formulated. The study ends with a discussion of its limitations and some suggestions for further research.

2. Conceptual Framework

The aim of this chapter is to develop a descriptive conceptual framework that specifies what will and what will not be studied (see for the methodological argumentation section 3.1). This framework has the following elements. First of all, a basic structure is needed. This structure, a combination of two existing approaches, is developed in section 2.2. This structure is the framework for the two following sections. Section 2.3 gives a list of factors hindering or advancing regional capacity for technological innovation (RCI) and section 2.4 discusses indicators for RCI. In the final section the three previous sections are combined in order to present the complete conceptual framework. But first of all it is necessary to define some notions in order to avoid confusion of tongues.

2.1. Definitions

In the description of the objective of this study several terms are used that are not clear by themselves. Therefore, before a framework will be developed with which the regions can be analyzed it is necessary to define some key concepts. This section will discuss and define the terms 'innovation', 'region', 'capacity for technological innovation' and 'factors hindering or advancing RCI'.

Innovation

In the literature two types of definitions of innovation can be found. The first type focuses on the *results* of a process: innovations are implemented technologically new products and processes or significant technological improvements in products and processes (Becheikh et al. 2006). The second type focuses on the *processes* resulting in the products and processes described in the first definition (cf. OECD 1981: 15-16).

In this study I focus on regional influences on the whole process. Combining the 'result' definition and the definition given by the OECD, therefore, I use the following definition:

> Innovation consists of all those scientific, technical, commercial and financial steps necessary for the successful development and marketing of technologically new products and processes and of significant technological improvements in products and processes.

Region

Cooke (2005b) discusses some definitions of regions. The word itself has its origin in the Latin noun 'regio'. This word comes from 'regere', which means 'to govern'. Therefore, definitions that do not include this governance aspect are not valid, Cooke stated. He gives some examples of such definitions. The definitions focus on cultural, social, geographical and functional aspects. Another important aspect is that "a region is nested territorially beneath the level of the country, but above the local or municipal level".

This linguistic argumentation causes some practical problems. Several geographic areas present themselves as a region although these areas do not have governmental bodies. The municipalities in these regions have often set up development agencies that stimulate economic development and do marketing. However, these agencies do not have any governmental power. Moreover, some other regions consist of only one municipality.

These practical arguments lead to the conclusion that a definition of a region that includes also the geographic areas described above is inevitably vague. One of the definitions Cooke (2005b) discusses is the following:

> A region is a unit for geographical, functional, social or cultural reasons.

This is the definition adopted in this study.

Regional capacity for technological innovation

It is not so easy to give a clear definition of regional capacity for technological innovation (RCI). Moreover, articles in which this issue is a main topic do not give an adequate definition (see for example Ceh 2001).

Neely et al. (2001) define the firm's capacity to innovate as the firm's potential to generate innovative technological outputs. Substituting region for firm, a possible definition of RCI is:

RCI is the region's potential to generate innovative technological outputs.

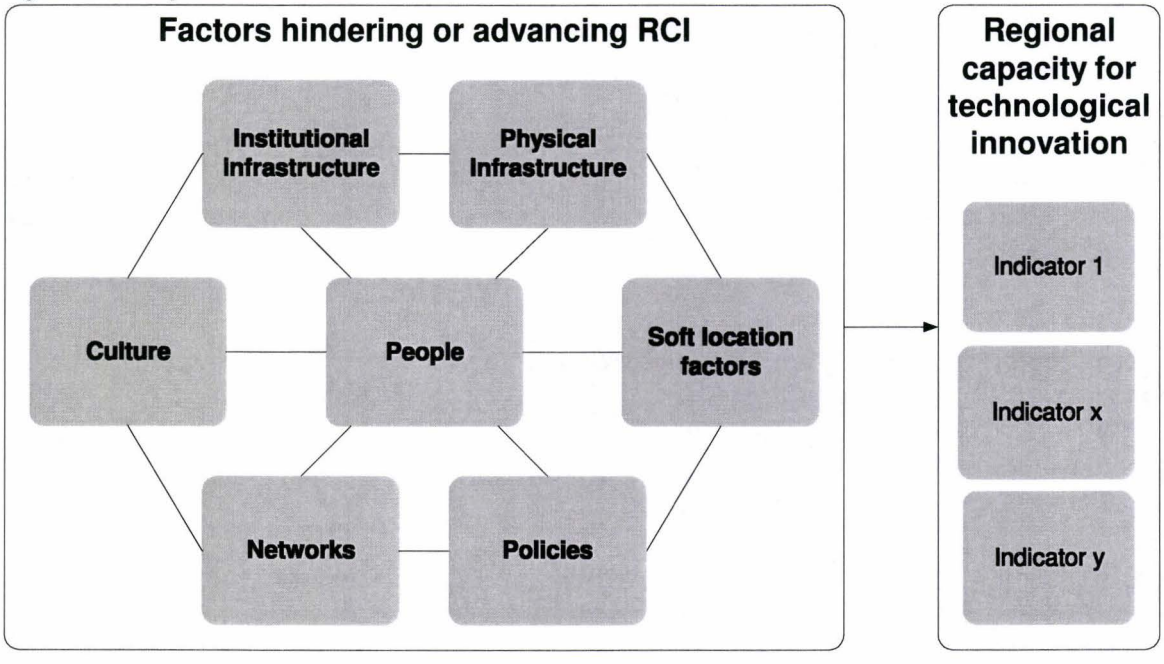
Factors hindering or advancing

Finally it is necessary to give a clear description of what is meant with the phrase 'factors hindering or advancing'. Analogue to a regression analysis a factor i has two aspects: a score X (low, medium or high) and a criticality factor a. The product a_iX_i determines the contribution of a factor i to RCI.

2.2. The conceptual framework: a basic structure

In the literature about regional factors influencing innovation processes two types of frameworks can be found. The first one is the Regional Innovation System (RIS) approach, developed by Cooke (see for example Cooke 2001). With this framework of institutions regions can be described as innovation systems. The second framework focuses on firms and analyzes the influence of internal and external factors on firm innovation. The article of Sternberg and Arndt (2001) is a typical example of this approach.

Figure 1: conceptual framework



The RIS approach is not useful for finding the factors hindering or advancing RCI because this approach focuses on the institutional environment and excludes softer factors. A plus of this method is that interactions between institutions are given. The focus on individual factors is a main characteristic of the second approach. However, this framework focuses on firm innovation and not on RCI. Therefore, this framework cannot be used either.

The framework presented below is a combination of these two approaches. It combines the regional focus of the RIS approach with the focus on factors of the firm-innovation approach. Based on the factors and institutions given by Cooke (2001) and Sternberg and Arndt (2001) seven groups of factors are identified: physical infrastructure, institutional infrastructure, networks, culture,

people, soft location factors and policies. These groups of factors interact with each other. The whole system influences RCI.

In section 2.3 each of the seven groups of factors hindering or advancing RCI is elaborated on. Section 2.4 discusses indicators for RCI.

2.3. Factors hindering or advancing RCI

The investigation of factors hindering or advancing RCI is to a large extent based on the systematic review of literature from 1993 to 2003 of Becheikh et al. (2006). Factors added to their list are derived from articles written by Cooke, Sternberg and Arndt and Whitley. Additional information is derived from several case studies. This information is given with the aim to illustrate why a factor is included in the descriptive framework. Formulating hypotheses is not the aim of the explanation (see 3.1).

Physical infrastructure

Infrastructural objects like roads, railways, airports and telecommunication matter but the influence is always described only briefly. Especially the linkages a region has with the global world are seen as important (Sternberg 2000; Cooke 2001; Cooke 2002; Becheikh et al. 2006). Table 1 provides an overview of the factors mentioned in this section.

Table 1: factors influencing RCI related to physical infrastructure

Factors hindering or advancing RCI	Literature
Roads and parking	Sternberg 2000, Cooke 2001, Cooke 2002, Becheikh et al. 2006
Air traffic connections	
Public transport system	
Data networks	

Institutional infrastructure

The institutional infrastructure involves the number of institutional partners and their variety. Factors that belong to the institutional infrastructure listed by Sternberg and Arndt (2001) and Niosi and Banik (2005) are industry mix, large firms with strong industrial R&D activity, number of institutions of higher education, partially state-owned research institutions outside the university sector, science parks and other technology-transfer institutions. Government is also part of the institutional infrastructure but has its own section (see below).

Some of these institutions require brief elucidation. Industry mix is defined as the number and size of firms active in high- or medium tech sectors. Industry concentration within sectors, as described by Becheikh et al. (2006) and Caspar and Whitley (2004), is an important part of industry mix, but does not constitute the entire factor because sector borders are becoming more and more diffuse (Simard and West 2006). Positive effects of such a concentration (Cooke 2002): a concentration of producers supports local suppliers of specialized inputs, who thus help generating external economies of scale; agglomerations generate localised skills-pools benefiting workers' and firms' flexible labor market opportunities and information spillovers are implied.

The presence of large firms with strong industrial R&D activity can be seen as another important aspect of industry concentration. Innovative multinationals are important for regional networks (Sternberg and Arndt 2001). The wireless-sector case illustrates and supports this (Calderini and Scellato 2005).

Science parks are categorized as a sub-factor of proximity within the region because science parks are concentrations of institutional partners within the region. Proximity can contribute to many advantages (Cooke 2001; Carlsson 2002; Becheikh et al. 2006): tacit knowledge transfer, reduction of communication costs, reinvestment in the cluster, low entry barriers, tolerance, restlessness, meritocracy, collaboration, variety, product obsession, interpersonal interactions and the development of trust and social capital between partners, which reduces the risk and uncertainty related to innovation. These factors comprise the culture of this economic community.

For new-economy sectors, like ICT and Biotechnology, the presence of innovation support organizations like incubators, intermediaries, venture-capital firms, patent lawyers, merchant banks and consultants is necessary to exploit and commercialize scientific findings (Cooke 2001). Intermediaries include the technology transfer institutions already mentioned but also other institutions that bring partners together.

Table 2 provides an overview of the factors mentioned in this section.

Table 2: factors influencing RCI related to institutional infrastructure

Factors hindering or advancing RCI	Literature
Industry concentration	Cooke 2001, Becheikh et al. 2006
Presence of innovative multinational	Sternberg and Arndt 2001, Calderini and Scellato 2005
Education institutes	Sternberg and Arndt 2001, Cooke 2001, Cooke 2002, Niosi and Banik 2005
Research institutes	Sternberg and Arndt 2001, Niosi and Banik 2005
Business associations	
Incubators	Cooke 2001
Venture capital firms	
Merchant banks	
Service providers	
Intermediaries	
Proximity advantage	Cooke 2001, Cooke 2005b, Carlsson 2002, Becheikh et al. 2006

Networks

The huge amount of literature on networks indicates that networks are very important for RCI. Networking is possible with all the partners listed under institutional infrastructure. Each of these networks will be shortly described.

Interaction with universities is important for knowledge. Knowledge spillovers from universities are geographically localized (Jaffe et al. 1993) and therefore important for the innovation process because universities transfer knowledge through research or the education carried by their students. This conclusion is widely accepted (Neely et al. 2001; Cooke 2005b; Calderini and Scellato 2005; Becheikh et al. 2006; Simard and West 2006).

It is difficult to find remarks about public research institutes only. Remarks are made about both public research institutes and universities. As in the description of interaction with universities, research institutes transfer knowledge through research. The research institutes do not educate students, but transfer of knowledge via employees is possible.

Interaction with industrial and professional associations is advantageous to all partners involved, but especially to small- and medium-sized firms (SMEs) (Whitley 2002). Members are able to gather new knowledge and information more quickly than those not involved in such groups (Carlsson 2002). This is true for both new and traditional economies (Simard and West 2006). However, high levels of industry-network involvement tend to be associated with relatively incremental innovations since radical, transformative innovations threaten current organizational competences (Whitley 2002, 2003).

Horizontal networks in new economies are made of big and small players alike, across multiple industries (Simard and West 2006). Leading corporations in new economy sectors outsource research to smaller technology firms. These firms cluster to access knowledge spillovers, opportunities for tacit knowledge exchange and other untraded interdependencies (Cooke 2001). Such a setting is highly innovative and not destructive for firms (Cooke 2004). Since valuable knowledge is hard to move, multinationals have to be present in these knowledge centres to sense the new technological or market developments (Vanhaverbeke 2006). When the level of inter-firm dependence is high, it is possible (e.g. Japan) but not necessary (e.g. Germany) to work in isolation from the public science system (Whitley 2002).

According to Whitley (2003) and Vanhaverbeke (2006), vertical interaction with suppliers and customers is useful to develop incremental innovations.

Interaction with intermediaries and service providers contributes to interaction between industry and academy, which is useful for exploiting and commercializing scientific findings (Cooke 2001; Cooke 2005b; Calderini and Scellato 2005). Service providers can also give business support, which is useful for start-ups.

Many authors conclude that there is a strong relation between the availability of venture capital and innovation (Cooke 2001; Carlsson 2002; Cooke 2002; Chesbrough 2003; Cooke 2005b; Niosi and Banik 2005; Simard and West 2006). Reasons for this strong relation are not only the availability of capital, but also the services provided by venture-capital firms. These firms can find a new CEO, help to establish the client's network with other producers and customers, improve marketing capacities and give strategic advice. These services illustrate that services of intermediaries, incubators, service providers and capital providers overlap.

Ties within networks as described above can be divided into formal and informal ones (Simard and West 2006). Informal ties are very important to develop trust and soft relations (Sternberg 2000; Vanhaverbeke 2006). However, relations that are too close can result in closed networks which are not able to pick up interesting external knowledge.

The importance of networks increases when local networks are integrated into international and global networks (Sternberg 2000; Sternberg and Arndt 2001; Cooke 2004; Simard and West 2006). This is especially important for SMEs.

Table 3 provides an overview of the factors mentioned in this section.

Table 3: factors influencing RCI related to networks

Factors hindering or advancing RCI	Literature
General	Sternberg 2000, Cooke 2001, Calderini and Scellato 2005, Vanhaverbeke 2006, Simard and West 2006, Becheikh et al. 2006
Interaction with universities	Cooke 2005b, Calderini and Scellato 2005, Simard and West 2006, Becheikh et al. 2006
Interaction with research centres	Todtling and Kaufmann 2002, Simard and West 2006, Becheikh et al. 2006
Interaction with industrial and professional associations	Whitley 2002, Carlsson 2002, Becheikh et al. 2006
Horizontal networks	Cooke 2001, Cooke 2004, Simard and West 2006, Becheikh et al. 2006
Vertical networks	Carlsson 2002, Todtling and Kaufmann 2002, Simard and West 2006, Becheikh et al. 2006
Interaction with intermediaries, consultants and service providers	Cooke 2001, Cooke 2005b, Calderini and Scellato 2005, Becheikh et al. 2006
Interaction with venture capital firms	Carlsson 2002, Cooke 2005b, Niosi and Banik 2005, Simard and West 2006
Interaction with incubators	Cooke 2001
Formal and informal ties in networks	Vanhaverbeke 2006
Integration local network in global networks	Sternberg and Arndt 2001

Culture

Empirical research with respect to a firm's surrounding culture is extremely rare (Becheikh et al. 2006). The few existing studies use the Hofstede dimensions to operationalize culture (Hofstede 2001). The four dimensions that may influence innovation processes are power distance, individualism versus collectivism, risk avoidance and long-term versus short-term orientation (Becheikh et al. 2006). However, the results are mixed and often not significant. Masculinity versus femininity, the fifth Hofstede dimension, is not regarded as a factor influencing RCI.

Two factors that can not be categorized by means of these dimensions are failure acceptance and the attitude of a city or region towards innovation. Failure acceptance, related to risk avoidance, means whether or not an entrepreneur is seen as a loser when he is not successful. The attitude of a city or region towards innovation refers to openness for new developments.

Table 4 provides an overview of the factors mentioned in this section.

Table 4: factors influencing RCI related to culture

Factors hindering or advancing RCI	Literature
Power distance	Becheikh et al. 2006
Individualism	Becheikh et al. 2006
Risk avoidance	Becheikh et al. 2006
Long term orientation	Becheikh et al. 2006
Failure acceptance	
Attitude city/region towards innovation	

People

Availability of highly qualified people is mentioned often (see for example Sternberg and Arndt 2001; Cooke 2001; Calderini and Scellato 2005; Becheikh et al. 2006). Technological innovation requires intelligent people who can invent, develop and commercialize. Without capable people this process cannot take place.

The availability of highly educated people has a quantitative and a qualitative aspect. The education level of the population gives an indication of the quality of people; the unemployment rates in the region give an insight into the number of people available.

Table 5 provides an overview of the literature mentioned in this section.

Table 5: factors influencing RCI related to people

Factors hindering or advancing RCI	Literature
Availability specialized workforce	Sternberg and Arndt 2001, Cooke 2001, Calderini and Scellato 2005, Becheikh et al. 2006

Soft location factors

Soft location factors like housing and leisure facilities are important for attracting and keeping workers (Sternberg and Arndt 2001). In their article about Singapore, Bhasin and Kim Low Cheng (2002) provide some other examples of soft location factors: language, international schools, career development services, housing and price level.

Another one is living climate. This factor includes things like weather, pollution and quality of the healthcare infrastructure.

The examples given by Bhasin and Kim Low Cheng (2002) and Sternberg and Arndt (2001) refer only to individual people. But it is also possible to investigate 'soft' location factors for firms. A factor one could think of is the image of a region with respect to innovation.

Table 6 provides an overview of the factors mentioned in this section.

Table 6: factors influencing RCI related to soft location factors

Factors hindering or advancing RCI	Literature
Living climate	
Leisure facilities	Sternberg and Arndt 2001
Housing	Sternberg and Arndt 2001, Bhasin and Low Kim Cheng 2002
Language	Bhasin and Low Kim Cheng 2002
Price level	Bhasin and Low Kim Cheng 2002
Career development services	Bhasin and Low Kim Cheng 2002
International schools	Bhasin and Low Kim Cheng 2002
Image of the region	

Policies

A general remark about government policies is made by Sternberg and Arndt (2001). They point out that technology policies have influence on innovation, but mostly implicitly and unintentionally. The unintended effects are far greater than the intended ones. Sternberg and Arndt advise governments to focus on the innovating firms in their local innovation policy.

First of all, legislation influences innovation processes. Employment legislation influences the availability of people. Employment barriers can for instance make it difficult to attract people from

abroad (Bhasin and Kim Low Cheng (2002). Caspar and Whitley (2004) point out that legal constraints on hiring and firing influence the expectations of scientists, engineers and technicians. Their expectations will be towards long-term employment and generally consultative jobs.

The type of financial system influences the investment climate. Tax advantages for entrepreneurs and investors can have a positive influence. High company- and wage taxes on the other hand, can hinder firms.

Intellectual property policies also have an influence (West 2006; Fabrizio 2006). These policies influence the way in which knowledge transfer from universities takes place and in what way firms can patent their findings.

Financial support from governments can take the form of subsidies, grants, awards or loans (Becheikh et al. 2006). This support encourages firms to increase innovation, especially SMEs (Cooke 2001). If possible, a regional credit-based system has considerable value, especially in regions in which the private sector strongly avoids risks (Cooke 2001). Public budgets are also important (Cooke 2001, 2002). There are three kinds of budgetary competence (Cooke 2001). Decentralized spending means that the region is the channel via which the central government spends the budgets; autonomous spending means that the region itself is allowed to determine how to spend the money; the last one is taxation authority of regions.

According to Whitley (2002), two orientations of science and technology policies can be distinguished: diffusion and mission. Diffusion-oriented policies focus on the improvement of technologies throughout entire sectors. Mission-oriented policies focus on the achievement of major public goals. Highly diffusion-oriented science and technology policies are attractive for incremental innovators. Collaboration between firms, business associations, state agencies and both public and private research organizations is strong. Mission-oriented policies are attractive for radical innovators. Diffusion-oriented science and technology policies encourage vertical networks. Diffusion-oriented institutes stimulate strong collaboration; mission-oriented institutes encourage intellectual diversity.

Another topic Whitley (2003) addresses is the coordinative role of the state. The state's coordinative role affects the extent of cooperation between firms and their ability to share risks. When the degree of involvement in directing firms' strategies through preferential access to cheap credit, technology licences, foreign exchange and for the controlling market entry and exit for the achievement of long-term economic goals is low, inter-firm relations are largely adversarial and limited in scope and duration. These institutional networks are more attractive for radically innovative project-based firms, but less attractive when continuous organizational commitment is needed. When the level of coordination is high it is easier to develop networks that are attractive for incremental innovators. When the state's coordinative role is significant, coordination operates via powerful business associations.

Besides current policies the quality of the process of policy development is important as well. The quality of the system gives an indication of the extent to which the regional governmental bodies are able to adequately anticipate new developments.

A related topic is the political system and cooperation between politicians. Policies are developed at different governmental levels and often innovative regions cross the borders of municipalities. As a result horizontal and vertical cooperation at the political level influences the development and realization of policies.

Table 7 provides an overview of the factors mentioned in this section.

Table 7: factors influencing RCI related to policies

Factors hindering or advancing RCI	Literature
General policies	Sternberg and Arndt 2001, Cooke 2001, Carlsson 2002, Becheikh et al. 2006
Employment legislation	Bhasin and Low Kim Cheng 2002, Caspar and Whitley 2004
Type of financial system	Whitley 2002
Public financial support	Cooke 2001, Todtling and Kaufmann 2002, Becheikh et al. 2006
Intellectual property policies	West 2006, Fabrizio 2006
Orientation science and technology policies	Whitley 2002
State's coordination role	Whitley 2003
Policy development	
Political system and cooperation between politicians	

2.4. Regional Capacity for Technological Innovation

This section investigates and discusses indicators for RCI. An overview of traditional indicators for RCI can be found in the article of Oughton et al. (2002) on the regional innovation paradox and the consequences of this paradox for government policies.

Table 8: indicators for RCI

Indicators at regional level	
R&D expenditure as a percentage of GDP	Business R&D expenditure as a percentage of GDP
Government R&D expenditure as a percentage of GDP	R&D expenditure in education as a percentage of GDP
Gross domestic product per capita (ppp)	Patents per head of the population

The authors conclude that the regional innovation capacity can not be judged by these standards of the old regional policies. They argue that a new set of indicators is needed that allows researchers to assess longer-term changes in RCI and measure 'soft' processes like institutional linkages and network formations. Only in that way changes in a regional architecture can be captured. The conventional linear indicators listed in table 8 do not provide insight into these mechanisms. Sternberg (2000) has a similar opinion. He suggests that written or oral surveys of the participants are a are the only remaining method.

Within the context of this study such a written or oral survey is not possible. Developing an adequate survey and measuring RCI in each region requires other studies and is beyond the scope of this study.

This study therefore uses the traditional indicators listed above, while noting that conclusions based on these indicators have little value.

2.5. Conclusions

In sections 2.3 and 2.4 the elements of the conceptual framework developed in section 2.1 have been elaborated upon. The framework presented in table 9 gives a clear overview of all the elements of the descriptive conceptual framework. It is important to notice that indicators for RCI are not as adequate as desired. This framework does not make it impossible to add new factors. If during the interviews new factors appear that fit within the framework developed in this chapter, those factors will be included.

Table 9: expanded conceptual framework

Conceptual framework	
Factors hindering or advancing RCI	
Physical infrastructure	
Roads and parking	Public transport system
Air traffic connections	Data networks
Institutional infrastructure	
Industry mix	Banks
Presence of innovative multinational	Incubators
Education institutes	Intermediaries
Research institutes	Consultants and service providers
Venture capital firms	Proximity advantage
Industrial and professional associations	
Networks	
General	Interaction with intermediaries
Interaction with education institutes	Interaction with venture capital firms
Interaction with research institutes	Interaction with banks
Interaction with industrial and professional associations	Interaction with Incubators
Horizontal networks	Formal and informal ties in networks
Vertical networks	Integration local network in global networks
Interaction with consultants and service providers	
Culture	
Power distance	Long term orientation
Risk avoidance	Failure acceptance
individualism	Attitude city/region
People	
Availability specialized workforce	
Soft location factors	
living climate	Price level
Leisure facilities	Career development services
Housing	International schools
Language	Image of the region
Policies	
General policies	Orientation science and technology policies
Employment legislation	State's coordination role
Type of financial system	Policy development
Intellectual property policies	Political system and cooperation between politicians
Public financial support	
Regional capacity for technological innovation	
R&D expenditure as a percentage of GDP	Business R&D expenditure as a percentage of GDP
Government R&D expenditure as a percentage of GDP	R&D expenditure in education as a percentage of GDP
Gross domesit product per capita (ppp)	Patents per head of the population

3. Methodology

As argued in the first chapter, due to the causal complexity a qualitative, case-oriented approach has been chosen to describe and analyze eight high-technology regions. The discussion of the methodology in this chapter is structured by using the roadmap given by Eisenhardt (1989). Each of the different steps listed in table 10 will be elaborated. Figure 2, inspired by Yin's model for the replication approach to multiple case studies (Yin 1994: 49), gives a visualization of this roadmap.

Table 10: roadmap for doing case studies borrowed from Eisenhardt (1989)

Step	Activity	Reason
Getting started	Definition of research questions	Focusing
	Defining a priori constructs	Focusing and grounding of construct
	Neither theory nor hypotheses	Retains theoretical flexibility
Selecting cases	Specified population	Constrains extraneous variation and sharpens external validity
	Theoretical, not random, sampling	Focuses efforts on theoretically useful cases – i.e., those that replicate or extend theory by filling conceptual categories
Crafting instruments and protocols	Data collection methods	Grounding of theory by methodology Enhancing reliability and construct validity
Entering the field	Analysis simultaneous with collection	Speeding up analysis and providing insight in process
	Collecting data flexibly and opportunistically	Enabling advantage of emerging themes and allow context specificity
Analyzing data	Within case analysis	Gaining familiarity with data and preliminary theory generation
	Cross-case pattern search using divergent techniques	Forces investigators to look beyond initial impressions and see evidence through multiple lenses
Forming propositions	Finding and confronting evidence iteratively	Sharpens construct definition, validity, and measurability
Comparing with literature	Comparing with literature (both similar and conflicting)	Building internal validity, raising the theoretical level, sharpening theoretical generalizability, and sharpening construct definition
Reporting	Writing report	Communicating results

3.1. Getting started

For this study a deductive approach has been chosen (Miles and Huberman 1984: 34). The case-study research is based on the conceptual framework developed in chapter 2. This descriptive framework specifies what will and what will not be studied (Miles and Huberman 1984: 29).

The literature research has been done in the following way. I familiarised myself with regional influences on firm innovation using the book of Chesbrough, West and Vanhaverbeke (Chesbrough et al. 2006). Particularly the third part of this book - Networks Shaping Open Innovation - was relevant. Via these book chapters I found several relevant articles.

After this first acquaintance I searched for articles in the database of ABI Inform with the search term 'region' combined with 'performance', 'research and development' and 'innovation', resulting in fourteen relevant articles. I performed a citation search on some of these papers and found several relevant articles in literature lists of papers. This resulted in about twenty-five relevant articles. In analyzing the collected papers I searched for factors hindering or advancing innovation and for explanations why a factor has influence or not.

On the basis of the paper analysis the model was formulated. Model formulation has mainly been done on the basis of one literature review, case studies and comparative studies. After formulating the model I undertook a second search for literature to find more information about specific factors hindering or advancing regional capacity for technological innovation (RCI).

3.2. Selecting cases

In order to find regions with which Eindhoven can be compared, two types of selection criteria were developed. The aim of the first set of criteria is to guarantee the comparability of the different regions. The aim of the second set of criteria is to guarantee some striking differences between the regions, which is necessary to answer the research question (Eisenhardt 1989).

Using the typology of Vanhaverbeke and Cloodt (2006) the unit of analysis is the regional innovation system.

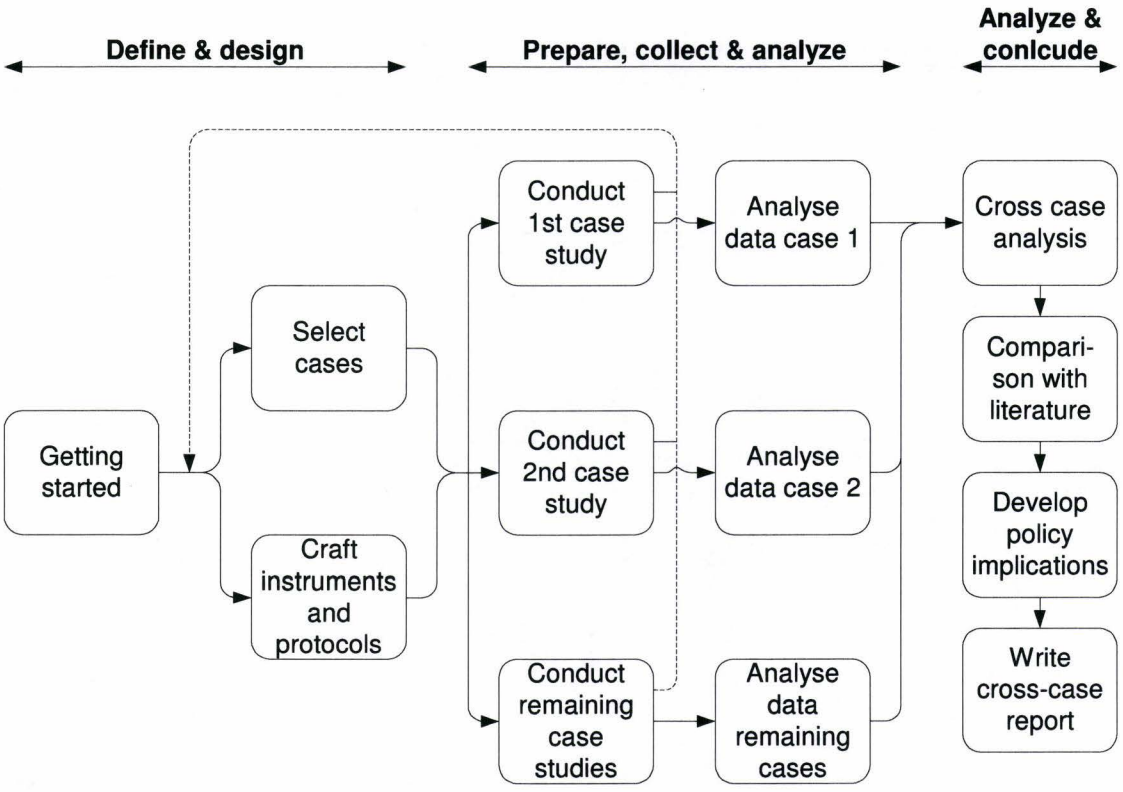


Figure 2: visualization case study process adapted from Yin (1994)

3.3. Crafting instruments and protocols

The following data collection methods were used: interviews, documents (reports and presentations), websites and statistical databases. Because these data sources are mostly independent, triangulation by showing that independent measures of particular observations agree with or, at least, do not contradict is possible (Miles and Huberman 1984: 234). This improves the construct validity (Yin 1994: 34, 91-93).

Both qualitative and quantitative data are involved. According to Eisenhardt (1989) the use of quantitative data has some advantages. It can indicate relationships, it can keep researchers from being carried away by false impressions in qualitative data and it can support qualitative findings. With qualitative data quantitative results and relations can be understood.

Multi-case research requires a common class of within-site settings (Miles and Huberman 1984: 37). This is realised in two ways. In each region the same types of persons are interviewed. Furthermore, following the typology of Yin, the interviews themselves are focused interviews (Yin 1994: 84, 85). The interviews are open-ended, but a structured interview scheme, derived from the conceptual framework, is used in four regions in order to collect comparable data. The four other regions were visited by Jan Spruijt (cf. Spruijt 2007). The scope of his interviews was partly a different one. My questions were integrated in his interview schemes.

In order to find the factors *perceived* as hindering or advancing RCI the interviews were structured as follows. After a short introduction the interviewee was asked which factors are hindering or

advancing RCI. After these open questions all the factors listed in the conceptual framework were discussed. The answers on the open questions are seen as spontaneously mentioned factors and marked as important (see section 3.5). In appendix 1 a general lay-out of an interview scheme can be found.

The reliability and validity of the interviews were enhanced in the following way. The interviews were recorded and fully transcribed; and the interviewees have the possibility to check the reported versions of the interview. This improves the construct validity (Yin 1994: 114-146).

3.4. Entering the field

Four data sources were used for these case studies: interviews, documents, websites and statistical databases. Appendices 2-9 give an overview per region of the interviewees, main reports and websites.

Documents and websites are the starting point for data collection. These data sources give a first impression of the region and provide some quantitative data. Using these websites, reports and presentations, specific questions could be added to an interview protocol. In this way one can take advantage of flexible data collection (Eisenhardt 1989). Statistical databases provide quantitative data.

Interviews are the main data source. Different types of persons are interviewed about the same topic in order to investigate various views on the same issue. Following the Triple Helix model, people from government, industry and research institutes and intermediaries between these parties are interviewed.

3.5. Analyzing data

According to Miles and Huberman (1984:21), data analysis consists of three activities: data reduction, data display and conclusion/verification. The last activity will be discussed in the section about forming propositions; the other two are elaborated below.

Data reduction

Coding of sentences and paragraphs of the transcribed interviews helps to carefully reduce and structure the data (Van Burg 2006). These descriptive and interpretively codes defined in advance are derived from the conceptual framework. New codes are introduced if the existing codes are not sufficient. The qualitative research software NVivo 2.0 is used to code the interviews.

Data display

As can be seen in figure 2, there are two levels of analysis: within-case and cross-case analysis. As a result there are two levels of data display: a within-case analysis and a cross-case analysis. Below, each of these levels explained.

Within-case analysis

The purpose of within-case analysis is pure description. It is a basis for generation of insight, necessary to cope with the enormous amount of data (Eisenhardt 1989).

A conceptually clustered matrix is used to display the data. Opinions are summarized for each of the factors hindering or advancing RCI (as investigated in the conceptual model) and the performance of the region.

Below, part of such a table is given.

Table 11: example of a conceptually clustered matrix for within-case analysis

	Interview x	Interview y	Interview z
Group			
Factor a			
Factor b			

Such a matrix has five advantages (Miles and Huberman 1984: 110): information is presented on one sheet; comparison is possible; it opens up ways of further analysis; cross-case analysis is easy; and it provides some standardization.

Identification of important factors

Important factors will be investigated as follows. Keeping in mind the definition of a factor that advances or hinders something (section 2.1), one can describe an important factor i as the product of a score X and a relative importance indicator a. Given the available data sources there are several methods to identify important factors:

1. On the basis of the case descriptions factors hindering or advancing RCI are identified in each region.
2. For each of the factors listed in the conceptual framework interviewees are asked whether or not this factor is hinders or advances RCI.
3. Important factors are the factors mentioned by the interviewees themselves, in their answer on the open question: what are, in your opinion, the strengths and weaknesses of the region regarding to innovation?

A problem of the first method is: how are the factors hindering or advancing RCI identified? Which criteria are used? For each of the factors listed in the conceptual framework a logical argumentation in favour of significant influence can be formulated.

The second method tackles this problem by delegating the identification problem to the interviewees. However, do the interviewees have the expertise to identify important factors? This is not a problem, I think. Besides firm representatives, the interviewees are experts in this field. But practical problems arise as well. The conceptual framework contains more than 50 factors. It is not necessary to discuss all the factors in each interview, but a significant number of factors would be discussed in each interview. Due to the open-ended structure of the interviews (important in order to get insight into the relations between factors) and the number of factors, identifying each of these factors' importance is difficult for both interviewer and interviewee.

The third method is also based on the expertise of the interviewees. Assuming that the interviewees are able to distinguish between important and unimportant factors, their answers on the open question are identified as important. In this way the more complex interview approach of method two is overcome. However, this method also has its disadvantages. Do the interviewees really mention the important factors? And do they mention all the important factors? I think that these problems are overcome by interviewing experts who know the region. Besides, it is possible to base the identification of factors hindering or advancing RCI on the complete set of spontaneously mentioned factors in all regions and on asking the interviewees for an argumentation why a factor influences RCI.

On the basis of these considerations I choose to combine the first and third method to identify factors hindering or advancing RCI. It seems to me that the second method provides a more valid overview of these factors but that it does so at the expense of the open-ended structure of the interview, and that it is relatively complex. The third method is much easier, although the risk of a lower validity is present. This effect is reduced by using the spontaneously mentioned factors as a guide for identifying factors hindering and advancing RCI in the case descriptions (method 1).

Cross-case analysis

Doing cross-case analysis involves a high risk that careless conclusions are drawn (Eisenhardt 1989). Conclusions can, for example, be overly influenced by the vividness of elite respondents. Methods to avoid careless conclusions are (Eisenhardt 1989): selection of categories or dimensions; observation of within-group similarities and inter-group differences.

This cross-case analysis focuses on so-called 'roads to success'. It focuses on the dimension 'important factors' and 'necessary factors'. A conceptually clustered matrix is used once more to display the data. Below, part of such a table is given. In this matrix two data sets are presented. The

color of a cell visualizes whether a factor hinders or advances RCI; the number refers to the score *X* of a factor in a region (1 = low; 2 = medium; 3 = high). This score *X* summarizes the description given in the within-case analysis (see section 3.6).

Table 12: example of a conceptually clustered matrix for cross-case analysis

	Region A	Region B	Region C	Region D	Region E
Important factor x	3	3	2	1	2
Important factor y	3	1	1	3	3
Important factor z	3	3	2	2	2

3.6. Forming propositions

Forming propositions, the iterative process of finding and confronting evidence, takes places at case level and cross-case level. These processes are elaborated in two short paragraphs.

Within-case analysis

The goal of within-case analysis is to formulate a conclusion for each of the factors hindering or advancing RCI. With reference to the description of factors hindering or advancing RCI (section 2.1), this conclusion gives an indication for the score *X* of a factor potentially hindering or advancing RCI.

The conceptually clustered matrix presented in table 11 gives a clear overview of similarities and contradictions. Mainly contradictions will be analyzed. This will be done in the following way.

Step 1: are there hard data that support/reject one of the opinions?

Step 2: is it possible to explain contradictions?

Step 3: is further research necessary to find an answer? How can this research be done?

Cross-case analysis

The aim of the cross-case analysis is firstly to find factors hindering or advancing RCI and in the second place factors or groups of factors necessary for RCI. As described in section 2.1 a factor hindering or advancing RCI is a product of an importance indicator *a* and a score *X*. Based on the data presented in the conceptually clustered matrix an analysis can be made of the influence of a factor on RCI. If, for example, a factor hinders RCI when the score is low and advances RCI when the score is high (factor x in table 12), the conclusion can be drawn that the value of the importance indicator a_x is generic across the region. If a factor advances RCI in region B and has no influence in region A although the scores are similar (factor z in table 12), the conclusion can be drawn that the score on importance indicator a_z is context-specific.

Necessary factors can be found in the following way. It is important to notice that necessary factors are factors present in all cases (Dion 1998) because all the regions included in this study have a high score on RCI. A factor is necessary when both score and importance are high. When the score on a factor is *not* high in every region the conclusion can be drawn that it is possible to have a high RCI without a high score on this factor. When the factor has a high score in every region but is not important in every region, the factor is also not necessary for a high RCI. Thus, necessary factors are factors with a high score of *a* and *X* in all regions.

Finding sufficient factors is not possible because only successful cases are included in this study. You need both successful and failed cases to find sufficient factors (cf. Hak forthcoming). The conceptually clustered matrices in which the important factors are listed for each region are the basis of the cross-case analysis.

The terms *necessary* and *sufficient* refer to the debate on causality and need some explanation, drawing on an encyclopaedia article by David Stanford (Stanford 1995). A condition of the form 'If *a* had not happened, then *b* would not have occurred' says that *a* is *necessary* for *b*: it is impossible for *b* to occur without *a*. If it is impossible for *a* to occur without *b*, then *a* is *sufficient* for *b*. It is possible that *a* is necessary, sufficient or both necessary and sufficient (counterfactual dependence). *A* can be a set of factors.

3.7. Comparison with literature

A comparison of my results with the literature has several purposes. Eisenhard (1989) lists four purposes: building internal validity, raising the theoretical level, sharpening theoretical generalizability, and sharpening construct definition.

This comparison is done at three levels. First, the analysis is related to some general trends in the literature. After that the results are compared with articles on specific factors. Finally, the analysis will be compared with articles that also provide an analysis of factors hindering or advancing RCI.

The articles included in the comparisons are the ones that are the basis of the conceptual framework as well. In addition to these articles some reports are also included. These reports, gathered during data collection, are not strictly scientific but provide interesting conceptual frameworks. These reports are the basis of several governmental programs that aim to stimulate regions. It is interesting to see whether or not the data gathered in this study support their models.

4. Factors hindering or advancing RCI: eight cases

In this chapter the outcomes of the analyses of the cases are presented. The chapter starts with an introduction in which the case selection is explained. In the following sections the regions involved in this study are described.

4.1. Introduction

This chapter contains eight case descriptions. These eight cases are selected on the basis of a set of criteria guaranteeing comparability and some striking differences (see section 3.3). Table 13 gives an overview of these criteria.

Table 13: selection criteria for cases

Criteria guaranteeing comparability	Criteria guaranteeing some striking differences	Other criteria
High scores on the European Score Board criteria (GDP, investment in R&D, density of EPO patents)	Number of multinationals	No language barrier
A more or less comparable size with Eindhoven	Ratio small and bigger companies	Accessibility
	Political system	Established contacts in the region
	Cultural differences	Relevance for Philips
	Density of the region	

Based on these criteria the following regions are selected: Cambridge, Dublin, Eindhoven, Grenoble, Helsinki, Munich, Øresund and Waterloo (Canada).

The regions of Cambridge, Eindhoven, Helsinki and Munich are described extensively in this study. These descriptions are structured in the following way. After a historical introduction and a short review of the performance of the region, the influences of the factors listed in the conceptual framework are described. At the end an analysis is made of the factors hindering or advancing RCI. The other four regions, Dublin, Grenoble, Øresund and Waterloo, are described only briefly. A more extensive description of these regions is given by my colleague Jan Spruijt (Spruijt 2007). The cases presented in this study consist of a short characterization of the region and an analysis of the factors hindering or advancing RCI.

All the case descriptions are based on conceptually clustered matrices as developed in section 3.5. These matrices summarize the outcomes of the interviews. The answers given by the interviewees are structured using the factors hindering or advancing RCI listed in the conceptual framework, though with some mutations. During the interviews some new factors surfaced. Two factors are added to physical infrastructure: building space and geographic location. The Network section now contains interaction with government. Availability of middle management and availability of craftsmen are added to people. The policy section is not complete without marketing of the region and education support programs. Investigating opinions about the factors

Figure 3 : selected regions

state's coordinative role and orientation science and technology policies was difficult because these formulations were too abstract and not ready for use. Therefore these two factors are substituted by the more general factor sector policies, which includes remarks about policies focusing on sectors.

Each section contains a fact sheet that provides some key quantitative data. Except for the demographic and geographic data and data about student populations all the facts are derived from a statistical publication of Brainport (Brainport 2007) which is based on Eurostat data. All these data refer to the year 2003. The geographic and demographic facts are derived from the digital encyclopaedia Wikipedia and refer to 2005 or 2006. Information about student populations is derived from university websites.

4.2. Cambridge

The biggest problem that the cluster has is that there is no ambition, no declared strategy.

Jens Lapinksi, vice-president of Library House

History and current situation

The development of the Cambridge cluster started during the sixties with Cambridge Consultants, formed to put the brains of Cambridge University at the disposal of the problems of British Industry. In 1970 Trinity College established the first Science Park and some ICT firms were established in Cambridge. Together with Scientific Instruments ICT was the basis of the Cambridge Phenomenon observed in 1985: the growth of high technology business activities. In 1991 there were 35,000 high tech jobs in the region compared with 20,000 in 1971. During the nineties the cluster emerged and some formal institutions were founded, like Cambridge Network (1998) and the Greater Cambridge Partnership (1998). This development was mainly driven by private parties. From the governmental side only the fiscal policy has supported the development.

Nowadays the cluster has more than 60,000 jobs in high tech. In 2003 the GDP of the region was €17 billion, a growth of 11% compared with three years earlier. However, the Cambridge Cluster Report 2006 concluded that the growth of the cluster has stalled. The number of high tech firms went down (973 compared with 988 18 months earlier) and less money was invested in companies: £125 million in 2005 compared to £154 million and £133 million in 2004 and 2003 respectively.

Physical infrastructure

Cambridge is a small place, which is an advantage. Networks are local, not across the wider region. The infrastructure, the burning issue for the region, limits travel possibilities. All the interviewees see infrastructure as a big problem. The A14, a two-lane road, acts as commuter road and is part of a Trans European network. Many traffic jams are the result. A south-east bypass is needed but will not be built in the near future. Parking is another problem in the city centre. Rail and bus services are also not impressive. Quality, frequency and punctuality are low. The rail network is good but oriented on London, so travelling by train from Cambridge to Oxford, for example, is not possible.

Very good and important are the air traffic connections. London Stansted is only half an hour by car from Cambridge. This airport provides many daily flights to Europe, the US and the Far East.

Hardly any space for new buildings like houses and office space is available. Cambridge is surrounded by a greenbelt, which is a restrictive planning tool. As a result

Fact Sheet Cambridge

City:	Cambridge	109,000
Region:	Cambridgeshire	553,000
Province:	East of England	5,388.000
Country:	Great Brittain (GB)	50,300,000
Area size:		3046 km²
Universities:		1
Students:		16,500
% of population with tertiary education:		28%
Employment in high-tech:		11.99%
GDP region (million):		€ 16,878
GDP per capita region:		€ 27,878
GDP 3-year growth:		11%
Unemployment rate:		3.5%
Long term unemployment rate:		15
Patents per million population - province (1997):		311

there is no plan for future supply, although the over-demand is obvious.

Institutional infrastructure

Strong high-tech sectors are IT (more than 500 companies), Life Sciences (more than 200) and Industrials (about 80). There is a critical mass of high-tech companies which attracts others. However, companies are generally small. Neither is there space for a big company; the biggest one has 3000 employees. The challenge is to grow the small ones up to medium size, one interviewee said.

Maybe the small firms are bought by US companies too soon: ideas are good but developed elsewhere. This can be an effect of the structure of the capital market. In Cambridge 8% of the European venture capital is available, which is hugely disproportional. This is good for start-ups but is perceived as hindering firm growth because of the time horizon of five years. There is a lack of long-term finance (see also *culture*). Also in the early stage phase is a lack of capital. "Because we have so few technology company successes we have few successful technology investors", the vice president of Library House stated.

Cambridge University accommodates 17.000 students. Because of the high educational level there is a lot of technical talent in the region. This is why the university is so important for the region, a Library House report concludes. Moreover, the university is becoming more and more entrepreneurial, also because governmental funding is limited. As a result Cambridge Enterprise, the Technology Transfer Office, is professionalized.

Public research is mainly done by the University. Several multinationals like Microsoft, Intel and Unilever have excellent private research centres.

The six Science Parks of Cambridge are well known. These parks – all on profit base – are important for several reasons, the interviewees said. First of all the parks provide space for companies. In the city centre there is not enough space for them, although start-ups want to be located there because of the leisure facilities. Science parks are important as flag ships (see also *soft location factors*): science parks provide firms with access to people to hire, and knowledge transfer is possible there. People can meet each other in the lunch room but the devil is in the detail: a small refectory stimulates networking; in a big one people sit down with their own small group. You have to get the little things right, the representative of EEDA said.

The most important business association is Cambridge Network (1998). It has more than 1100 members, is driven by businesses and supported by the university. Other networks are CHASE (1987), an association of small businesses; EBRI (1997, Biotechnology); and the relatively unimportant Chamber of Commerce.

The service sector is well developed. For start-ups there are some free or subsidized services like Business Link. On the private side entrepreneurs have access to world class legal-, accountancy- and banking service.

A governmental organization established during the nineties was the Greater Cambridge Partnership (GCP), an alliance of public, private and community sector interests.

Networks

Cambridge does not accommodate very many intermediary organizations. This does not mean, however, that there is no network activity. Because of the small size of the cluster it can still operate on the basis of informal networks to some extent, the interviewees agree. Everybody goes to the same pubs and restaurants. And people know each other from college. The university is a hub for informal networks.

A formal network like Cambridge Network was created when there were already 100 companies which wanted to talk to each other. Such a network is useful for hiring and communicating. Through them outsiders can be introduced into the community.

The two interviewed representatives of firms do not have main local partners. In IT partners are more and more located in the Far East.

International links are mainly personal and informal. There are quite good links with Silicon Valley. Cambridge Network is well connected and the GCP has some contacts. This organization got funding for an international relationship manager. The representative of this organization stated that formal links help on a sort of ceremonial type; informal links are good for real business.

Culture

The development of the cluster is delayed because there are different opinions about its direction. There is quite an influential green lobby that does not want growth anymore. The GCP has brought these groups together. Nowadays, therefore, there is a common sub-regional strategy which is a compromise.

Some interviewees think that universities tend to do very pure research and it is difficult getting them focused on business problems. But compared with 20 years ago the university shows much more interest now when you say you are running a company.

Failure acceptance is low. There is a very negative attitude to that kind of learning experience, the representative of EEDA said. You never again get a bank loan or suppliers or anything.

Striking are the Hofstede scores on individualism – very high – and long term orientation – very low (Hofstede 2001). The former might explain the lack of formal networks; the latter might be another reason why firms are taken over too early (see *institutional infrastructure*).

People

It has already become a major problem to hire people. Unemployment rates are very low, 3.5%. The critical mass of people and the transferability of people to fulfil the demand for labor is a real issue. Students go to London because the jobs are there, two interviewees argue. The cluster is bigger and it is easier to hire people in London. Technicians needed to support the scientists are also scarce. There are not enough technicians graduating and big projects cause a shortage for a while in some sectors. A third group of which there is a shortage are middle managers. When small companies move up to 50 people these firms need to start having specialist managers. But Cambridge does not have the stock of large high-tech companies and the firms are not prepared to pay enough for experienced managers.

The population is quite well educated. Many people (28%) have tertiary education. More important is the quality of education. The two interviewed representatives of firms both stated that their firms are located in Cambridge because the firms have access to the best people in the world. Due to the university people have very high skills at the highest level.

However, two interviewees mentioned that also in Cambridge less and less people are studying Science and Maths. Six secondary beta education institutes in the region have been closed.

Soft location factors

The living climate is attractive: a beautiful town with many old buildings and lots of green areas. The attractive city centre is important for visitors and firms. Hard working people can go for a stroll and have a break in a botanic garden or a restaurant.

It is a very diverse place in terms of nationalities. Small numbers of many nationalities are present there. Other factors that make the region attractive for people and firms are language and image. Cambridge is a fantastic brand. "Having a CB postcode and 01223 phone number means you are part of the Cambridge Phenomenon", one of the interviewees said. The university is very important for the image. Furthermore, the immigration system is quick and efficient. Generally speaking it is easy to come to Cambridge.

Living in Cambridge is expensive. Houses in particular are expensive because the housing stock is very poor. 300,000 Euros for a very small basic house is quite normal. This makes it problematic to attract younger people to fulfil middle management- and technical jobs.

Policies

Economic development is done by both districts and county. These districts and counties have to work together closely in order to be effective. This is done through the GCP. The East of England Development Agency (EEDA) is a strategic body at the regional level with a budget of 35 million pounds for each of her four products: on the social side regional renaissance and investment in communities; on the commercial side business support, business services (that includes the Business Link network already mentioned) and Innovation and Enterprise.

High tech is the unique selling point of the region, but without the others this sector is nothing. Therefore GCP and EEDA support all sectors, but all the emphasis appears to be on a high tech cluster. The five goals formulated in the sub-regional strategy (see *culture*) are supported by projects funded by the EU, national government, EEDA and individual funding. Each year a business plan is written with minimal outputs.

The UK does not have a tradition of strong regional and sub-regional government. As in many other countries, local and regional bodies have no direct influence over non-local infrastructure type of things. Their budgets are small, so big investments have to be done by the national government. But none of the interviewees is positive about the national government. The planning process is completely inefficient. "There is no ambition, no declared strategy." And about regulations: "The best that they can do is: go away. Do not touch us." The success of Cambridge is driven by business and the university, not government.

But there are also positive things. First of all the tax system encourages private investors. It is possible to transfer money from one small company to another without paying taxes.

Two interviewees mentioned the grant schemes provided by the Department for Trade and Industry (DTI). This department gives pretty good support. Others are very bureaucratic. The vice-president of Library House said that there are 5000 grants companies can apply for, but "it is all nonsense, purely an employment exercise." In his opinion buying products from start-ups (which is done by the defence industry in Israel and the US) is much better than grants and equity funding.

Marketing of the region can be improved. Cambridge is a fantastic brand but it is not coherently presented. The council does not do a lot in terms of promotion. There are no single address and website where people can find information about the region.

Factors hindering or advancing RCI in Cambridge

The six interviewees have spontaneously mentioned 64 factors. Appendix 10 gives a complete overview of these.

A factor hindering RCI is the physical infrastructure. The lack of building space for houses and offices and the bad road infrastructure severely undermine growth possibilities. This problem can be solved by the government. But the political structure and the attitude of the national government do not contribute to a fast solution of this infrastructural problem.

Another important point is the lack of big and medium-sized companies. A reason for that are the limited growth possibilities. But other causes can also be identified. The short-term-oriented culture (see *culture*) and the availability of a disproportionate amount of venture capital (see *institutional infrastructure*) could affect the growth of small firms.

A factor advancing RCI is the very good image of the region. The outstanding university with its magnificent buildings contributes a lot to the image. This university delivers highly educated students. The quality of the people is a reason for firms to stay in the region. However, the quantity of available people is a problem.

Important are the informal networks in which the university is a key player. Due to the small size of the region and the university people know each other well.

A third factor advancing RCI is the financial system. The taxation laws are stimulating investments in R&D in a good way.

Table 14: spontaneously mentioned factors hindering or advancing RCI in Cambridge

Factor groups	Factors hindering or advancing RCI	Strength/ weakness	Number of times mentioned
Physical infrastructure		Weakness	8
	Roads and parking	Weakness	4
Institutional infrastructure			20
	Industry concentration	Depends	3
	Venture capital	Strength	3
	Education institutes	Strength	4
Soft location factors			9
	Housing	Weakness	3
	Image of the region	Strength	3
People			6
	Availability of highly educated people	Strength	4
Policies			9
	General policies	Weakness	3
Others			12
Total			**64**

4.3. Eindhoven

There is an interest in networking without asking directly for the benefits.

Ton Schurgers, director United Brains

History and current situation

The development of the Eindhoven region is closely related with the development of some Dutch multinationals. Royal Philips is the most important one. This company started in 1891 with the production of light bulbs. Very important was the establishment of the Natlab in 1914. This research laboratory is still an important generator of innovations. These innovations are not all kept in house. Nowadays several big employers in the region like Siemens VDO, ASML, FEI and – very recently – NXP were originally Philips companies. The growth of Philips attracted many employees to the region.

DAF is another company that has contributed to the current status of the region. After the Second World War the development and production of cars and trucks contributed to the expansion of the region.

In 1993 DAF went down. Also Philips was not performing well during that period. As a result Eindhoven received lots of money to stimulate economic development. This money was spent very effectively, some interviewees said. Nowadays Eindhoven is one of the peaks in the Dutch Delta.

In terms of absolute GDP the region grows a little bit. Per capita it is stable over the last years.

Looking at the R&D expenditure as a percentage of GDP the region performs well. 2.7% in 2003 is below the Lisbon goal (3%) but far more than the European average (2%). But this money mainly comes from industry (88%). Regarding to the Barcelona standard it has to be 67%.

Fact Sheet Eindhoven

City:	Eindhoven	210,000
Region	Z-O North-Brabant	725,000
Province	North-Brabant	2,416,000
Country	Netherlands (NL)	16,366,000
Area size region:		1,440 km²
Universities:		1
Students:		7,200
Students in science:		7,200
population with tertiary education:		28%
Employment in high-tech:		20.7%
GDP region (million):		€ 20,738
GDP per capita region:		€ 26,473
GDP 4-year growth:		19%
Unemployment rate:		4.2 %
Long term unemployment rate:		31%
R&D (% of GDP in province):		2.68%
- of which business:		2.37% (=88%)
- of which government:		0.30% (=12%)
Patents per million population - province:		885

Physical infrastructure

Regarding roads the main problem is the ring road. Eindhoven lacks a ring road on the east side of the city. The highway on the west side is overloaded and in case of an accident there is no escape. This situation is bad for commuters and business-to-business contacts. However, two interviewees point out that the accessibility in the Randstad is even worse. Connections with ELAt partners Hasselt and Leuven are bad.

Eindhoven airport is the biggest regional airport in the Netherlands with 1.1 million passengers in 2006 and low budget flights to about 20 destinations in Europe.

Railway connections with other Dutch cities are good. There are direct connections with Utrecht/Amsterdam/Schiphol, Rotterdam, Maastricht/Heerlen and Venlo. No direct connection with Germany exists and Eindhoven is not connected to the HSL network. Local public transport is done by buses. There is room for improvement but the system is quite good.

Eindhoven is not 'full': there is space for new buildings and property prices dropped during the last years.

Institutional infrastructure

The region of Eindhoven accommodates many industrial companies. The most important one is Philips. Thanks to Philips the knowledge infrastructure in the region is very strong. The firm itself does a lot of basic and applied research. Strong sectors are Micro Electronics, Automotive, Embedded Systems, Design and Food. Philips, NXP, ASML and DAF have many suppliers in the region. These multinationals stimulate their suppliers to be innovative. Because of these tightly coupled supply chains the region is sensitive to cyclical fluctuations.

In general the education infrastructure is moderate. The technical university is perceived as strong from a qualitative perspective but also as small (6,800 students). Fontys, the University of Applied Sciences has 34,000 students. Both institutes of education have some entrepreneurial courses. The Design Academy, operating in the field of product design and development, has 750 students and is perceived as important for the design cluster in the region and for the image of the city.

Several institutes do research in the Eindhoven region: Dutch polymer Institute, Holst centre, Centre for Molecular Medicine and the Embedded Systems Institute. Very soon TNO Automotive will move to the region.

Pre-seed and seed capital is mainly provided by semi-governmental institutes like Incubator 3+, the Brabantse Ontwikkel Maatschappij (BOM), NV Rede, the SME fund and Stimulus Venture Capital Fund. An employee of NV Rede stated that there are enough instruments but more power is needed because not all challenges can be picked up.

In theory there is enough venture capital but in practice there is a lack of venture capital, a representative of Brainport said. Possible reasons are that the providers of the capital (mainly banks) want to avoid high risks and a lack of channels between providers and start-ups.

NV Rede manages six business centres. Three of them focus on a specific industry or group: ICT, design and starters with a special personal background. These centres provide several services: business advice, some finance and total facility. Other incubators are Innovation lab (TU/e) for university start-ups and the Philips Technology Incubator.

Incubator 3+ is rather an intermediary for techno starters looking for service, a network, accommodation, facility and finance. United Brains (UB) is a similar organization for firms who need knowledge. UB connects knowledge institutes and firms. An example of a specifically intermediary sector is Automotive Technology Centre.

Providers of commercial services are present in the wider region. An interesting service provider on the public side is Syntens. This organization visits 1000 companies a year and give them information about new technological developments.

Proximity is perceived as important. The region is quite small so it is easy to meet each other without ICT. Within the region the High Tech Campus Eindhoven is an important cluster. This

former Philips Research site is now open for companies fitting the profile; these companies can use the facilities. Today about 50 different companies and institutes are located there. This campus continues to serve as a magnet for other firms.

Networks

Almost all the interviewees praise the networks. There is a willingness to cooperate, which is important. Processes become more and more complex so you cannot do it on your own, one said. People know where to find each other and there are many (maybe too many) cooperations but the number of people participating in them is relatively small. "If you know 150 people you know everyone", the director of United Brains stated.

Firm interaction with education institutes and research centres is getting better and better. More traineeships are available than students, for instance. Important in this process is United Brains (see *institutional infrastructure*). Last year United Brains received 400 requests for knowledge.

These requests focus on the more profound topics, the director said. Most of the time firms ask their suppliers and business partners for a solution because firms need the answer very soon. There are some very well developed supply chains in the region. Suppliers have to show creativity and initiative. Therefore it is necessary that firms cooperate more with each other. This happens and is also stimulated by Brainport programs (see *policies*). Within the business centres informal communities exist.

As listed above, many intermediaries exist. For the 'top' and 'subtop' this structure is very useful but two interviewees wonder if the intermediary infrastructure is clear for SMEs. Are there not too many initiatives, so that SMEs feel dizzy? Starters can get a coach who introduces them into useful networks.

Culture

The presence of a cooperative culture is perceived as a main strength of the region. Within the region problems are solved together. Decisiveness is present on the industrial and governmental side. The region is a bit unpretentious but more and more people learn that there are also parties outside the region like the national government that can help. The culture is open. In the past many people came from abroad because Philips attracted a lot of people to come to the region. There is a lot of entrepreneurship in the region.

The relatively high score on uncertainty avoidance (Hofstede 2001) supports the statement of one of the interviewees that the Netherlands is a trade nation: "why shall we take risk before a product is finished?"

People

Nowadays availability of highly educated people is not a big problem but all the interviewees expect that it will be a bottleneck in the near future, especially for the innovative multinationals who participate in the worldwide battle for talent. Also craftsmen are scarce in some sectors. Welders can hardly be found, for example. In general unemployment is low.

Not only the quantity but also the quality of the workforce will be a problem, some of the interviewees said. But on the other hand one of these interviewees mentioned the high education level in the region. Hard numbers support both statements. 28% of the population has tertiary education (2004). That is more than the average of the EU (22%) but below the average of the eight regions involved in this study (29%). However, these numbers do not tell the whole story. Many people do not have a degree in Science.

Also the sensitivity of the region to cyclical fluctuation influences the availability of labor. People dismissed during a depression do not automatically come back in a booming period because they have accepted jobs elsewhere or their skill profile has become obsolete.

Soft location factors

The region has a pleasant living climate. There is space for living and recreation but no dramatic landscape. Housing is not seen as a problem. From a cultural perspective Eindhoven has the soccer club PSV, a good theatre and music centre and good restaurants. However, the city is perceived as a bit dull. The city does not have a pronounced image but the municipality is developing programs to make the city more attractive.

Expats like the open and tolerant culture in the region. Useful for them are the expat guide (written by Brainport) and the Regional International School (RIS), which provides English education for about 450 children. The expats do not like the regulations around immigration. These processes go very slow and it is difficult for them to come to the region.

Life-long learning possibilities, used by 16% of the population, are necessary to upgrade the working population. In this way (future) vacancies can be fulfilled (see *people*).

Policies

The economic development of the region is pushed strongly by the local, regional, national and European governments. As stated above, in the beginning of the nineties the situation in Eindhoven was worrying. The region received several grants with which start-ups and cooperation between firms were supported. Nowadays Eindhoven once more receives grants because the national government has changed her policy: strengthening the strengths instead of decreasing backlogs.

With this money the Brainport program is financed in part. Brainport is a Triple Helix organization: government, industry and knowledge institutes are working together in order to realize the programs listed in the Brainport Navigator. This is a strategic document focusing on basics, people, technology and business. These programs are put on the agenda by firms and knowledge institutes. Many programs focus on the development of horizontal networks and interaction between knowledge institutes and industry. Important sectors are High Tech Systems, Food and Nutrition, Medical Technology and Life Science. There is also a program that stimulates young people (4-20 years) to choose a technical course of study. Other programs try to make the region more attractive for expats.

The idea behind the Brainport Navigator is: you can stimulate and facilitate firms, but you can not press them. This is also the approach of NV Rede. Shareholders of NV Rede are the municipalities in the region of Eindhoven. In the section about the institutional infrastructure the incubator- and financial activities of NV Rede have already been mentioned. Furthermore NV Rede tries to attract firms (and research institutes) to come to the region and helps them with finding accommodation.

NV Rede and Brainport illustrate that regional cooperation works well. The relation with The Hague and Brussels is becoming better and better, the representatives of Brainport said. A problem is the marketing of the region. There is a lot of activity in this field but the labels Brainport, Eindhoven city of Technology, Brabant smart solution, Brabantstad, ELAt exist side by side. Everyone uses his own favourite.

Factors hindering or advancing RCI in Eindhoven

The eight interviewees have spontaneously mentioned 52 factors. Appendix 11 gives a complete overview of these.

The institutional infrastructure is often mentioned spontaneously. Industry concentration and education institutes are especially important. Quality and quantity of R&D is high. The Brainport Navigator confirms this conclusion.

However, the small size of the university negatively influences the availability of highly educated people. Another factor that has a negative influence on the availability of people is the sensitivity to economic cyclical fluctuations.

The utilization of the available knowledge is stimulated by several factors. A cooperative culture, stimulated by government, and the small size of the region have led to strong regional networks, both formal and informal. Especially vertical networks and Triple Helix relations are well developed.

The Brainport Navigator mentions the importance of the institutional infrastructure for start-ups. The data presented above confirm that service providers and intermediaries are quite supportive for start-ups.

Table 15: spontaneously mentioned factors hindering or advancing RCI in Eindhoven

Factor groups	Factors hindering or advancing RCI	Strength/ weakness	Number of times mentioned
Institutional infrastructure			18
	Industry concentration	Strength	5
	Presence of innovative multinational	Strength	3
	Education institutes	Depends	4
	Research institutes	Strength	3
Networks			8
	Vertical networks		3
Policies		Strength	9
	General	Strength	3
Culture			3
	Attitude region	Strength	3
Others			14
Total			**52**

A weakness is the availability of seed- and venture capital. There are enough instruments for providing seed capital, but more high-risk capital is needed. In theory there is enough venture capital, but the reality is that it is difficult to get access to it.

4.4. Helsinki

People in the US said: Finland is the best kept secret in the world.

Martti Hintikka, managing director of Innofinance Oy

History and current situation

Helsinki is the capital city of Finland, a country located in the North-East of Europe, between Sweden, Estland and Russia. 10% of the Finnish people live in Helsinki City and more than 25% in the wider region. This wider region consists of the cities of Helsinki, Espoo and Vantaa.

In 1993 a deep depression afflicted the Finnish economy. The national government decided to invest strongly in research and development. These investments, together with the growth of the knowledge-based information industries, have been the engine of the economic growth of the Helsinki region. Especially Nokia contributed to the economic success, which is reflected in the doubling of the number of people working in ICT.

Nowadays not only the ICT cluster but other sectors also perform well. As a result the average annual growth of GDP is more than 5%. Also in absolute numbers the performance is high.

Physical infrastructure

In general the physical infrastructure is quite good. There is enough building space; the road and railway infrastructure is quite good and the airport provides many connections. However, flights are costly. Helsinki is far away from Central Europe and the home market is small. Stockholm and Copenhagen are the most important air destinations. From there it is very easy to get on intercontinental flights.

Public transport is good but investments are needed, one interviewee said. The local government wants to set up so called science lines connecting the campuses.

An interesting topic is the geographic position of Helsinki. It is far away from Central Europe but close to the Russian market. St. Petersburg, Moscow, Tallinn, Wilna and Riga are developing very fast. "During the coming fifteen years we will still be in the middle of the most dynamic region in Europe", the representative of the City of Helsinki said.

Fact Sheet Helsinki

City:	Helsinki	565,000
Region:	Uusimaa	1,522,000
Province:	Etelä-Suomi	2,575,000
Country:	Finland (FI)	5,247,000
Area size:		6,366 km²
Universities:		9
Students:		about 60,000
Students in science:		15,000
% of population with tertiary education:		38%
Employment in high-tech:		12.3%
GDP region (million):		€ 51,005
GDP per capita region:		€ 33,523
GDP 4-year growth:		21%
Unemployment rate (2004):		7.3 %
R&D in province (% of GDP):		3.55%
- of which business:		2.45% (=69%)
- of which government:		1.10% (=31%)
Patents per million population - province:		384

Institutional infrastructure

Finland has two strong sectors. An established industry is Forest, Pulp and Paper. In this field Finland is a world player. Traditionally it was not a very innovative sector but more and more sector-specific research is done. The other industry is ICT with Nokia as the most important actor. Life science is relatively small with four relatively big players and about 130 SMEs.

Nokia is not only important for the ICT sector. In hard numbers there are 700,000 jobs in the region. Nokia employs 20,000 people directly and 20,000 indirectly. 40% of the R&D expenditures come from Nokia. However, Nokia is less important than five years ago because nowadays other sectors also perform well. In ICT the cluster is global and has networks and management capacity because of Nokia. The Biotech cluster does not have these benefits.

The indirect benefits of the presence of Nokia are even more important, the representative of the City of Espoo stated. Many other companies profit from the strong knowledge-intensive service sector, which is there because of Nokia. Companies are also more proud and aggressive: "Nokia showed that we also can do it". Another advantage is that Nokia opens doors for companies.

The education system is perceived as good. The basic education system is known world-wide. Due to the small size of the country it is necessary to have everyone on board (see *people*). For this reason the education system gets lots of attention from the government. The Helsinki region accommodates nine Universities and eight Universities of Applied Sciences (two interviewees suggest that these education institutes have to merge their activities). Three of them are big: the University of Helsinki (UH) which covers more than ten fields; Helsinki University of Technology (HUT) and Helsinki School of Economics.

These universities are part of a science park. Very big is Otaniemi in Espoo, where HUT is located. All the departments are on walking distance and small as well as large (Nokia) technology firms are nearby. The UH has four science parks. The physical distance between these parks is only half an hour by car or bus. Seen from a European perspective it is one big science park, one said. But there are mental distances: it should be easier to shuffle between universities. Maybe this is related to the different characteristics of the campuses. Otaniemi is country site; Arabis (city centre) has trams and shops. In the view of the founder of Movense companies are on the Otaniemi campus because of the research facilities and cheaper accommodation; and not because of the leisure facilities.

There are several research centres as well. Important is VTT, the technical research centre of Finland, which has one of its three offices in Otaniemi. Firms ask institutes to test their products.

Seed and pre-seed capital is mainly provided by government. This stage is solved from the public point of view in terms of availability of money. It is necessary for these instruments to be

used more effectively. "There is a lot of money but still people do not always really understand what the big goal with the whole thing is", the director of Innofinance said. A culture change is needed but an increased number of private investors (who co-invest with public money) can also help with that. They put in experience and business skills which is very important. Nowadays there are four early-stage venture capital firms. The biggest one is managing 36 million euro.

There is a gap when firms need 5 to 10 million. The director of Innofinance estimates that 60.000 companies between 5 and 10 million want to be acquired. These deals are too big for seed funds and too small for venture capital firms. In Finland, venture capital firms have large funds, so these funds need big investments, or else an immense number of deals is needed.

There are 16 incubators in the region because every municipality and every university wants to have his own incubator and because the EU subsidized them. Some of them are very small. According to the representative of the City of Espoo, six or seven incubators are enough.

An important intermediary is Culminatum. All the main actors are involved in this network. This organization is also responsible for the realization of the regional strategy (see *policies*). There are many other intermediaries. Two interviewees observe a tendency to create new actors in the borderline between universities and firms to help networking. One interviewee believes that "we are creating too many helpdesks and not a desk where the substantial knowledge is."

Networks

Networking is seen as very easy: people have the same culture and the region is small so people know and trust each other (see *culture*). Everything is based on networking, "the most important part of the region". There is a shared vision and people want to do things together. A question is how open the networks are for outsiders. One interviewee wonders whether all the events lead to concrete things. But another one said that events are always good. It can be the speech but also an interesting person you can speak during breaks. And it is good to be without computer and phone.

The universities are seen as key players in the network. First of all, there is a lot of comradeship between students. Within these small circles there are smaller circles. Firm interaction with universities is stimulated by government. Universities receive Tekes money (see *policies*) for projects but they have to get 20% funding from firms. Informal networks are important to get this funding. A problem is that this money attracts big companies. As a result there are many formal and informal links between firms and universities.

Horizontal networks are also stimulated through these projects. In established industries there are not that many horizontal networks, but when companies are at an earlier stage of their development there is a greater sense of doing things together.

Each industry has its own business association, which is important for lobbying with the government. In Biotechnology the business association is also an important source for scientific information.

The attitude towards networking as described above is also present with the government. There is not so much bureaucracy because cooperation is based on trust and not only on agreements, the professor at the HUT argues (see also *policies*).

On the political level there are many formal and informal contacts with Tallinn. On the industrial side Nokia is very active on the international field. But international networks are not only based on Nokia. It is natural to go abroad from this small country.

Culture

It is very easy to contact people and receive response, all the interviewees said. It is like a family. People trust each other and partnerships do not need complicated formal agreements. Also bureaucracy is not huge. The power distance- and uncertainty avoidance scores – respectively very low and relatively low – support these observations (Hofstede 2001).

This culture is influenced by the small size of the country. Everybody knows each other directly or indirectly. So it is much easier to control the whole thing. The reverse side of this culture is that

it is difficult for immigrants and refugees to integrate. Nowadays trust is the key, but when the country is multicultural the trust may not be the cornerstone any longer, the representative of the City of Helsinki stated.

Urbanization is young so the agricultural culture of working hard and long is still in the knowledge work, the founder of Movense said.

Being entrepreneurial is not a typical attitude for Finnish people. Finnish people are highly educated and technology oriented; they are engineers and not marketers. Because of this attracting people from abroad is not a strength of the region. But younger people are more entrepreneurial and people from Tallinn are quite entrepreneurial.

People

Finland has the fastest aging population in Europe. Combined with the small size of the country this leads to a lack of people. The numbers of university graduates are too small. People for the metal industry are also scarce. In other sectors, for example construction industry, many people from Estonia are employed.

There are two solutions to this problem. The first one, education, is used well in Finland. All the people are quite educated; 60% of one generation gets higher education (see also *institutional infrastructure*). The second solution, inviting talented people from all over the world, is applied more and more often (see *policies*).

Soft location factors

The climate in Helsinki is attractive in summer and winter. But during the other periods temperature and weather are not attractive. For people who like a lot of free space Helsinki is attractive.

Compared with other Finnish cities houses are expensive but compared with other European countries it is not so expensive: an average rental price of €10.15 per square metre is quite normal. The general price level is the same as in other parts of Europe.

For foreigners there are international schools. There is a French and a Russian school and several English ones. Language and culture are perceived as drawbacks. Almost everybody speaks English but for integration it is necessary to speak Finnish, which is difficult, some interviewees mentioned.

People see Finnish people as reliable. You can trust them. Because it is so distant nothing happens. That can be an advantage in dynamic times, someone said. Helsinki has also an innovative image but does not attract foreign investments. It is the best kept secret in the world, two interviewees said. Marketing can be done better (see also *policies*).

Policies

Municipalities are very powerful in Finland. Local income taxes are very important in this respect. The municipalities are responsible for teaching, healthcare, buildings and streets (excluding main streets and highways). The national government is responsible for higher education. There are no regional elected bodies.

Innovation is stimulated by both bodies. Two years ago the municipalities formulated a regional innovation strategy. Culminatum is responsible for the realization of this strategy. This organization also coordinates the development of the policy. Six groups, 100 persons in total, formulated strategies for six sectors. Rectors, professors, CEOs and governmental people all came to the meetings. The result is a common vision where to go.

However, in the strategy it is argued that cooperation between the municipalities needs to be improved. The TWA in Helsinki explains that Espoo has a lot of money with which new science parks can be built. Vantaa has less money but Espoo does not want to invest in Vantaa. Helsinki, the third municipality in the region, has the image and profits from the two others. So there is some jealousy. This is one of the reasons why improvement of networks is so important in the

regional strategy. Another reason was that networking is relatively cheap, the representative of the City of Espoo said. Business was involved in the development process, but only with people, not with money.

A huge amount of money is invested in innovation-related projects. 25 Years ago Tekes was started. Ideally Tekes is funding high-risk, high-challenge development projects in which different actors participate. But because Tekes has lots of money it finances many projects, the professor of the HUT said. Sitra, an independent public foundation under the supervision of the Finnish Parliament, invests millions in start-ups through the seed and pre-seed funds described above (see *institutional infrastructure*). Especially ICT receives many investments.

ICT is one of the five sectors chosen by a national committee. The others are Forestry, Metal and Machinery and Welfare industry. These sectors are chosen because a small country cannot be good in everything, one of the committee members said. But also other sectors receive some investments because it is very difficult to choose the key ones. The Biotech case is an illustration of that. Ten years ago Biotech was chosen but although the government has invested a huge amount of money the industry is still not competitive.

Finland has the image that taxation is very high. This is true for individuals, but comparison with other countries is a bit difficult because due to the high taxation people do not have to pay any insurance premiums as in other western economies. For companies it is very difficult to get any incentives because the system is so democratic. Nevertheless the tax level is the same as in other countries. This stimulates people to start their own business, the professor argues. Successful entrepreneurs can use the capital income for which they have to pay less taxation. Also investments in start-ups are stimulated. When people win in one case they can put the money in a new early stage company and can postpone paying taxes.

Researchers at the university are the owners of the patents on things developed by them. They have the possibility to sell them partly to the university.

As mentioned above there is a gap between performance and image that, according to the representative of the City of Helsinki, can be filled through marketing. The region has not done anything about international marketing. We have been too good in doing it by ourselves, one of the interviewees said. But that is no longer the case. The region just started a new agency funded by the City of Helsinki with an annual budget of 3.5 million euro.

Factors hindering or advancing RCI in Helsinki

The seven interviewees have spontaneously mentioned 62 factors. Appendix 12 gives a complete overview.

The most important factor influencing RCI is the attitude of the region. This attitude has two components. The first one, trust, is the basis under the well-developed networks in the region. It is also the reason why public financial support, another important factor, is quite successful. Due to the high trust level bureaucracy is relatively low. This financial support also stimulates networking because companies and universities are pressed to cooperate.

Trust and networks are influenced by proximity. Networking is also physically easy and because the region is small everybody knows each other, so people cannot cheat each other.

Culture also has another component: Finnish people are humble people. As a result an entrepreneurial attitude lacks. This is reflected in the way in which public seed capital is provided. A more professional attitude is needed there. Also marketing is not strong. That is a problem because the region has to attract foreign people in order to avoid a lack of employees, which is expected because of the aging population and the expected growth of the region. The lack of people is also the reason why the high quality of the education system is so important. It ensures that the available people are well educated.

Table 16: spontaneously mentioned factors hindering or advancing RCI in Helsinki

Factor groups	Factors hindering or advancing RCI	Strength/ weakness	Number of times mentioned
Physical infrastructure			9
	Geographic position	Strength	3
Institutional infrastructure			16
	Proximity	Strength	5
	Education institutes	Strength	4
Soft location factors			10
	Living climate	Depends	3
People			5
	Availability of highly educated people	Weakness	3
Policies			10
	Public financial support	Strength	5
Culture	Attitude region	Depends	7
Others			5
Total			**62**

The importance of the presence of Nokia is evident. This multinational provides several benefits to the region (see *institutional infrastructure*).

A weakness is the lack of venture capital. Firms who need investments between 5 and 10 million can hardly find investors.

If the region is successful in attracting foreign people a new dilemma appears. Is it possible to integrate the new people into the society without destroying trust, the main strength of the region?

4.5. Munich

Nothing is missed here.

Bernhard Eller, City of Munich

History and current situation

The economic development of Munich accelerated after the Second World War. Berlin lost its central function due to the Cold War and Siemens and the research organizations Fraunhofer and Max Plank were relocated to Munich. There was space and a nice climate. These factors had a positive influence on the decision to go to Munich, but there were no compelling reasons to choose Munich. "It was chance", said the representative of the City of Munich. After the War also BMW, a firm with its roots in Munich, became a global player.

In 1972 the well-known Olympic Games were held in Munich. Because of this event big investments in infrastructure were made.

During this period the development of the ICT cluster started around Siemens. The institutional infrastructure around this cluster and the pharmaceutical industry formed the basis for the development of the Biotech cluster in the nineties. These sectors respectively provided services like money and highly educated people for this new high-tech industry.

Nowadays the Munich cluster is performing well on all indicators. The GDP, also per capita, is very high. Relating GDP with the investment in R&D (4.6% of GDP), the conclusion can be made that the amount of money invested in R&D is enormous. As a result the number of patents is also high.

Physical infrastructure

In general, the quality of the infrastructure is high. Especially the public transport system is very good. Compared with cities of the same size, Munich has an excellent network of suburban trains, subways, trams and buses. A dissonant tone is that the LMU campus is not connected to the subway system (see also *institutional infrastructure* and *policies*).

In addition, the national and international connections are very good. There are direct railway connections to many main cities in Germany, Austria and Switzerland. The airport is the second airport of Germany and provides direct flights to 85 locations in and outside Europe (2006).

The road connections are good but parking is very expensive. The government has a strict policy against car pollution and wants as few cars as possible in the city centre.

Fact Sheet Munich

City:	Munich	1,300,000
Region	Ober Bayern	4,100,000
Province	Bayern	12,400,000
Country	Germany (GR)	82,400,000
Area size:		17,529 km²
Universities:		2
Students:		67,000
% of population with tertiary education:		30%
Employment in high-tech:		16.3%
GDP region (million):		€ 159,710
GDP per capita region:		€ 34,334
GDP 4-year growth:		14%
Unemployment rate:		4.9%
Long term unemployment rate:		36
R&D (% of GDP):		4.6%
- of which business:		3.7% (=80%)
- of which government:		0.9% (=20%)
Patents per million population - region:		669

Institutional infrastructure

In the Munich region 5000 innovative firms are doing business. Main industries are ICT, automotive and Biotech. Big players in the first two sectors are Siemens and BMW. The region does not depend on these companies but these companies are important because they spin off lots of young talent and do a lot of innovation.

There are two big universities: the LMU and the Technical University. Both are top institutes. They are not very entrepreneurial but they do more and more in this field. Their mutual competition is striking: one interviewee said that people do not go to a meeting at the other university. There is also a good University of Applied Sciences (UAS).

The five Max Plank institutes do substantial amounts of fundamental research and have quite some freedom. These institutes also 'produce' the most and best patents and the best start-ups. The two Fraunhofer institutes do applied research in the fields of microelectronics and communication systems. Another important institute is the German centre for Aerospace. Besides these (semi-) public research institutes many big companies have research units in Munich.

Frankfurt is the official number one banking location but Munich also accommodates many financial institutes (530; loan volume 730 billion). This is not an advantage for firms that need risk capital because banks are not allowed to accept high risks. Compared with other German and European regions there is relatively much venture capital available, but there are two problems. Firstly, this amount is not enough for all potential users. Secondly, since the internet bubble venture capital firms have been reluctant to do first-stage investments. Therefore it is difficult to find investors who want to invest sums between 200,000 and 2 million euro. The state government does a little via the LfA Förderbank Bayern but there is still a lack of (pre) seed capital.

Table 17: financial infrastructure adapted from Munich financial center: top in finance! (2006)

	Number of institutes	Invested money
Financial institutes	530	730 billion
Venture capital firms	50	720 million

Figures for Munich are not available yet but in the whole of Bavaria there are 18 incubators in the fields of ICT (5), Biotechnology (6), Energy and Environment (3), Mechatronic, Logistics, Satellite Navigation and Innovative Materials (all 1). There are also 12 general incubators. The total floor space of 135,800 m² is used by 700 companies (2006).

A very important intermediary is the Chamber of Commerce. This independent organization is the first contact for many firms. It provides companies with information about innovation, patents,

financing, legal matters and practical matters. It collects and presents information about incubators, other intermediaries, research institutes, service providers and support programs. The IHK started in 2006 by connecting companies through company visits on a local level. Two other networks that organize meetings are Bayern Innovativ and the Munich Network. About ten organizations support technology transfer to firms. One of them is the Technology Transfer Office of the LMU. This organization of 25 people organizes entrepreneurial courses (45 students a year) and a business plan competition (since 1996) and the organization supports start-ups from university and organizes seminars.

The European patent office is located in Munich and therefore many top international lawyers are based there. A number of other service providers – both commercial and non-commercial – are also present.

The most important science park is the LMU campus in Martinsried Grosshaden. This campus has emerged by chance. In the sixties the university moved some faculties to Martinsried, near the hospital. A research institute was also built. There was a business park nearby, which was used by firms who wished to be close to the campus. This environment enticed other firms to stay there and in this way the campus has grown organically. The interviewees give several factors that have led to this successful campus. Proximity to the university and the Max Plank institute is very important for biotech start-ups; it is also a nice place with possibilities; there is a critical mass of creative people; it is an open campus and it is easy to meet each other because of short distances and the availability of meeting places like libraries and restaurants. However, a lot of chance is involved in the process.

The TU has a campus in Garching. Moreover, a technology centre was built there, near the university. Firms that fit the profile can come to the campus and use the university facilities. Proximity effects are present here as well.

Siemens has Siemens City. This hosts mainly Siemens buildings, but also Siemens-spin-outs, a Max Plank institute and a lot of smaller software companies. It is a closed campus: people are not allowed to walk in. This campus grows organically and is not strongly pushed by the board of Siemens.

In general it can be said that the institutional infrastructure is very strong. In the words of the representative of the city of Munich: "Nothing is missed here".

Networks

There are a lot of networks in Munich, but opinions diverge on the effectiveness of the networks: "We need better networks"; "sometimes networks are mainly interest groups" and "The experiences are very mixed. (...) [A network] can result in a UFO flying around and there is no relation with the real needs." It is striking in this context that there is a trend that Bavarian policies rely increasingly strongly on networking (see *policies*).

Interaction with universities is very industry-specific. In ICT and automotive mainly big players like Siemens and BMW have close connections. For Siemens Research the local university is the main outside partner. Many professors work for Siemens as well. But in Life Science it is the small firms that have good connections with the universities. In Satellite Navigation a medium-sized firm like GAF AG uses its connections mainly for finding personnel for their projects. There are also intermediaries that stimulate firm interaction with universities. Abayfor is such a program. But it is difficult to find firms for this project, the representative of the IHK said.

Big firms like Siemens interact with institutes like Max Plank, TNO and Fraunhofer. In the Satellite Navigation sector the German Aerospace Center runs projects together with firms.

For university people the technology transfer office is well known. They use it when they want to start a business. In the Biotech sector Bio M performs well in helping firms to receive money from the federal government. Although the Chamber of Commerce is involved in all networks only half of the start-ups in Bavaria in 2003 used their services.

Most of the start-ups receive advice from management and tax consultants. They do not go to free service organizations like the Chamber of Commerce.

The venture capital firms do much more than only provide capital. They provide financial and business support; human resource management is done as well. And last but not least they introduce the start-ups in their networks and help them find a first client.

Table 18 gives an overview of the use of different institutes through start-ups started in 2003 in the region of Bavaria.

Table 18: use and appreciation of institutes by start-ups adapted from Binder (2006)

Intermediary	Appreciation (1=bad; 5=good)	Not used
Chamber of Commerce	3.5	53.8%
Banks	3.0	41/3%
Venture capital firms	2.2	79.4%
Technology transfer offices	3.1	72.6%
Start-up networks	2.7	80.3%
Service providers	4.1	17.2%
Lawyers	3.9	42.2%

Siemens and BMW have good contacts with the local government. They meet regularly. BMW for example has regular meetings with the government about public transport. Siemens also has contacts with national and European governments. Siemens people give their opinion on public developments like the 7th framework program.

At the firm side the international network of the venture capital firm is very important for a start-up, the director of Wellington Partners said. The 60% export share illustrates that firms have many international contacts. Intermediaries have connections with their equivalents in other regions. The local government runs many international projects on a departmental level. The administration itself, however, is not very open-minded.

In the region the network types depend on the sector. In Biotechnology networks are horizontal; in automotive and pharmacy networks are vertical.

The formal networks are a starting point for communication and networking, but results are achieved through informal networks. In Biotech people are employed because of their personal networks. According to the representative of the Bavarian State network efficiency depends on the people and their networks. Through these networks experience is transferred. The informal networks in Biotech are able to learn, but slowly, he said.

Culture

Several interviewees have the impression that the region is open to new technologies. There is applied research in the region but also a lot of basic research. That is typical for Germany, an interviewee suspects. Germany has a tendency to do fundamental research, he said. Compared with the other regions uncertainty avoidance is relatively high and individualism is under average.

People

In Munich 18% of the employees has a Bachelor or Master degree (2004). However, the availability of highly educated people differs between sectors. In Biotech and Satellite Navigations there are no problems; the former can use the Pharma-infrastructure; the latter has a lack of jobs. There is a lack of students in Engineering and Computer Science. The big players are liked by the students – and they can pay high salaries. But that is not the case for SMEs. There are also not enough middle managers. The availability of craftsmen is good. The unemployment rate was a little bit higher in 2005 (7.2% versus 5.9% in 2004) but is still relatively low.

Soft location factors

Munich has a nice climate and an environment for leisure. The landscape is beautiful and there are many recreation possibilities. The city itself has a lot of culture. Well known are the German

Museum and the Opera House. This environment makes it easy to attract people to come to Munich.

The living costs are high. Especially houses are expensive, also around Munich. A normal rental price for a one family house is €15-18 per square metre. For this reason many people live 50 or 60 kilometres outside of Munich.

Since the European patent office was established in the city, there are different international schools. In this respect Munich is comparable with Hamburg and Berlin.

There are various opportunities for career development. There are no big public programs but Munich has the biggest University of Applied Sciences in Germany and also the universities and the Chamber of Commerce have various programs.

Policies

The city administration regards as its main task the provision of general infrastructure: space and transport. The investments in the public transport system are enormous. There is nearly no space for new firms because the social-democratic municipal council does not want growth. For this reason many industrial parks have been built outside the city borders. But more and more the city becomes aware of the importance of the knowledge sectors. In cooperation with the Chamber of Commerce, the city runs a start-up centre which gives basic advice. A platform will be created as well where firms and universities can meet each other. The Bavarian state government also understands the importance of the knowledge cluster. Increasingly, the government invests its money in networking. But the interviewed representative of the Bavarian State is critical. "Networking is cheaper and networking is in the public more visible. But how effective it is? The experiences are very mixed" (see also below).

The government offers free study for foreign students as well, but for non-European people it is difficult to work in Germany because the immigration laws are very strict and procedures are bureaucratic. The government is changing this policy these days, which is especially important for SMEs. For them it is necessary that Germany is attractive for foreign people.

Venture capital has no big tradition in Munich because the tax system supports loan financing. Venture capital firms have no tax advantages, but the government wants to reform that in 2007. Another problem for venture capital firms is that legislation changes continuously, the director of Wellington Partners complains.

There are some public funded (pre)seed funds in the region like EXIST, GoBio and High Tech Gründerform (a relatively non-bureaucratic fund, one interviewee said), but few firms receive money. The funds say they do not receive enough ideas. The state government had some co-investment schemes but there is a lack of money and it is no longer allowed to support start-ups in this way. Federal government and EU have a lot of money. It is possible for firms to get money from national government when they have a good proposal. The European 7th Framework Program is very complicated and focuses rather on big firms like Siemens.

The Bavarian state government has the project Cluster Offensive Bayern. Nineteen clusters have been identified. Within each of these clusters three persons have been appointed to bring universities, firms and institutes together through events and platforms and the combination of current networks. Their total budget is €50 million.

For firms there is European legislation. Small firms do not patent their findings because it is expensive, the representative of the IHK said. Starting four years ago, universities now own patents instead of professors.

The city has sophisticated criteria for land distribution, but the city is not very strict in keeping them. Sector development is stimulated through institutes like Innovations Zentrum Biotech.

At the city level the Department for Labor and Economic Development has a department that analyzes the region. The people there write reports about the region but these reports do not lead to policies; the reports are written for image building. The representative of the City of Munich has the impression that it has not the priority it should have, also in the administration. At the state level

there is no structure either for policy development. Decisions are made quickly and with little feedback from outside. In the words of the Head of the Biotechnology Division of the Bavarian State: "One rule is: the more money available and the more important the measure is the less time you have for planning. (...) Let's say you have five million to spend; give me until tomorrow 12 o'clock what you gonna do with it." One reason for this situation could be that Munich and Bavaria perform well.

There is some competition between the conservative state and the social democratic city. These bodies do not talk very much to each other at the official level. At the personal level the contacts are good. Therefore the cooperation works although it is not very structured.

Factors hindering or advancing RCI

The seven interviewees have spontaneously mentioned 41 factors. Appendix 13 gives a complete overview. Below the main factors are listed.

In table 19 institutional infrastructure and soft location factors are the most important groups. When we keep in mind that there are more factors in the group institutional infrastructure than in the group soft location factors the conclusion can be drawn that Soft location factors are perceived as very important.

Table 19: spontaneously mentioned factors hindering or advancing RCI in Munich

Factor groups	Factors hindering or advancing RCI	Strength/ weakness	Number of times mentioned
Physical infrastructure		Strength	6
	Air traffic connections	Strength	3
Institutional infrastructure			16
	Education institutes	Strength	4
	Research institutes	Strength	3
Soft location factors			14
	Living climate	Strength	5
	Leisure facilities	Strength	3
Others			5
Total			**41**

On the factor level we see that the clusters research and education and living climate and leisure facilities are seen as very important. Also the airport is mentioned by three interviewees.

It is striking that only strengths are mentioned often. In the opinion of the interviewees, Munich has nearly no weaknesses. This opinion is supported in the case study presented above. Networks and the amount of seed capital are not optimal and living costs are high – which is an effect of the attractive living climate. However, due to the high quality public transport system, it is not a problem for people to live in cheaper places outside Munich.

The City of Munich has supported the development of the cluster by huge investments in infrastructure. Apart from this, few things are done. There is no structure for the development of policies either. It is a question whether or not that is a problem. Nowadays the region does not need such a policy: the density and diversity of industry is very high, as is the performance of the region.

4.6. Dublin

There is absolutely no history of commercializing research. And we are not going to learn that from somebody, we have to find an Irish solution to that.

Stephan Brennan, Director of Marketing & Strategy of The Digital Hub Development Agency

Dublin, the capital city of Ireland, is a curious region. Because of the economic growth during the last decade it is called the European tiger. This growth in GDP is the result of the arrival of several innovative multinationals. But these multinationals do not do research in the region. They are located there for production and distribution. The region accommodates 250,000 SMEs but 90% of the export and 80% of private research is realised by the multinationals. So SMEs have no innovation and export culture. In sum it can be said that there is no relation between the growth in GDP, the high number of start-ups and the high number of patents.

Factors hindering or advancing RCI

The government is aware of this dependency on the multinationals and the lack of private innovation. It raises investment in R&D (37% in two years) and as a result the universities generate lots of patents. But technology transfer is not a success. The patents are not commercialized. Another initiative is Enterprise Ireland, a governmental funded venture capitalist. In addition, several intermediaries and service providers are established.

Although nowadays Dublin is not very innovative, there are several factors advancing RCI on the long term. Dublin airport accommodates Ryan Air, which provides many cheap flights. This makes it possible to have connections with the 'world'. It is also useful as a source of labor. A lot of people commute every week with, for example, Poland. However, three of the interviewees think it is hard to find people.

The university is strong, does fundamental research and trains a lot of people. Another factor related to the institutional infrastructure is the presence of innovative multinationals. Nowadays they do little research, but maybe they can be encouraged to do innovation in the region. The tax climate makes it attractive for them to stay in Ireland.

Dublin is not only attractive for firms but also for employees, especially American people. Culture, language and history make Dublin one of the more attractive places in Europe for Americans. The capital area is attractive for young people.

The high number of SMEs shows that people are entrepreneurial. The social system encourages people to 'do it themselves'. This attitude has an opposite side: there is no culture of cooperation, the representative of the Digital Hub posited. However, people know each other and the informal networks are strong, three interviewees said.

Another factor hindering RCI is the infrastructure. There are many traffic jams and public transport is bad and chaotic. Housing is very expensive. This has two effects. For investors it is more attractive to invest in houses than in start-ups; and it stimulates risk-avoidance when people own a house. This results in fewer entrepreneurs.

Fact Sheet Dublin

City:	Dublin	505,000
Region:	Greater Dublin	1,600,000
Province:	Leinster	2,292,000
Country:	Ireland	4,200,000
Area size:		6,980 km²
Universities:		3
Students:		50,000
Students in technology:		9,500
Employment in high-tech:		6 %
GDP region (million):		€ 52,530
GDP per capita region:		€ 38,719
GDP 4-year growth:		49%
Unemployment rate (2004):		4.4 %
R&D in province (% of GDP):		1,21%
- of which business:		0.81% (=67%)
- of which government:		0.40% (=33%)

4.7. Grenoble

In France it is better to be an engineer than a PhD student.

Eric Larrey, director of Floralis

Grenoble, located in the Alps in the South-East of France, grew from a small city 50 years ago to one of the industrial hotspots in France. The region has two strong and big sectors. Nanotechnology employs about 30,000 people and Embedded Systems about 11,000. Both sectors are cyclically sensitive and thus the region is also sensitive to cyclical fluctuations.

Factors hindering or advancing RCI

The geographic location of the region is important, both positively and negatively. Located between mountains the natural environment is very nice and attracts people to come and stay. Another advantage is that it is close to the borders of Germany, Switzerland and Italy. A disadvantage is the lack of building space. Due to the mountains it is difficult to build new building and roads. As a result, the local road infrastructure is a nightmare.

Due to the attractive environment and the high quality of education the universities attract many students. Availability of highly educated people is not a problem: unemployment is relatively high, also among graduates.

The institutes CEA (a government-funded technical research organization), Minatec and Synchrotron provide a very strong research base in microelectronics and nanotechnology. The multinationals Schneider and ST also contribute to that. This research base implies that the observed distrust between university and industry does not hinder RCI.

It is difficult to assess informal networks. The region is small and people know each other. All the interviewees stated that because most of the people came from abroad people feel connected and praised the informal networks. But on the other hand firms have many formal partnerships. Coding the interviews 45 formal and 25 informal codes are ascribed. Another dissonance is the opinion on co-location. Co-location is useful because costs are reduced and not because it is easier to meet people. Looking at the Hofstede scores (Hofstede 2001) France has a high score on uncertainty avoidance (82) and power distance (65). Both scores match with formal networks.

The score on uncertainty avoidance also gives an explanation for the lack of seed and venture capital. Big firms invest in R&D but less capital is available to small firms.

Fact Sheet Grenoble

City:	Grenoble	157,500
Region:	Isere	1,100,000
Province:	Rhone-Alpes	6,000,000
Country:	France (FR)	64,100,000
Area size:		7,431 km²
Universities:		4
Students:		60,000
Students in science:		30,000
% of population with tertiary education:		24%
Employment in high-tech:		11.99%
GDP province (million):		€ 149,445
GDP per capita province:		€ 24,055
GDP 4-year growth:		14%
Unemployment rate:		13.2 %
Long term unemployment rate:		36
R&D (% of GDP):		2.61%
- of which business:		1.78% (=68%)
- of which government:		0.83% (=32%)
Patents per million population - province:		885

4.8. Øresund

For Danish people Malmö is the dark place on earth. But it changes. There is also more news regarding Malmö in the newspapers in Copenhagen.

Lars Sickert, New Technologies Analyst of Tetra Pak

The Øresund region is quite a young cluster. In 2000 the Øresund Bridge connected Malmö with Copenhagen. Before this bridge was built, the mental distance between Copenhagen and Malmö was the same as the distance between Copenhagen and other cities in Europe, one interviewee said.

With 14 universities and 3.6 million inhabitants the region is quite big. Important sectors are ICT (100,000 employees) and Biotechnology (30,000). The Danish side is the most important part of the cluster. It accommodates 68% of the people and generates more than 60% of the GDP.

The dominance of the Danish side is also reflected in the way in which the bridge is used. In the morning the trains in the direction of Copenhagen are full. Many Swedish people living in the Malmö region work in Denmark. Moreover, due to tax advantages many Danish people live in Sweden and work in Denmark.

Factors hindering or advancing RCI

First of all the bridge advances RCI. It has resulted in much more critical mass especially of employees. It seems to me that Swedish people supply the lack of people in Denmark.

Since the mental distance between the two parts is smaller, cooperation is possible, but this possibility is not used to the full. The interviewees mention several reasons for this. A practical constraint is the high toll level. It is expensive to cross the bridge. Another constraint is the political situation. Copenhagen is a capital area which receives lots of money from the Danish government. Malmö is a provincial area and receives less attention from the Swedish government in Stockholm. This results in a skewed situation. A third constraint is the cultural situation. For Danish people Øresund is Denmark and a bit of Sweden. For Swedish people it is much more one region. This raises a barrier for cooperation between Swedish and Danish people. Besides this the physical distance is still large: two hours travel time is quite normal.

The institutional infrastructure is perceived as good. The universities are strong, big and entrepreneurial and there are several incubators. The number and quality of service providers, organized by the Øresund Science Region, is high. Besides, there is critical mass in industry. Connections between industry and university are quite good.

Copenhagen itself is an attractive capital city with lots of leisure facilities. Nevertheless it is very expensive.

Fact Sheet Oresund

City:	Copenhagen	503,000
	Malmo	253,000
	Lund	102,000
Region:	Oresund	3,598,000
Country:	Denmark	5,400,000
	Sweden	9,100,000
Area size:		20,859 km²
Universities:		12
Students:		150,000
Employment in high-tech:		6.8 %
GDP region (million):		€ 98,434
GDP per capita region:		€ 27,358
GDP 4-year growth:		16.9%
Unemployment rate (2004):		5.8 %
R&D in province (% of GDP):		3.30%
- of which business:		2.41% (=73%)
- of which government:		0.89% (=27%)

4.9. Waterloo

I think that we really help each other. It grows very fast but still people are very willing to do those kinds of things.

Tim Jackson, Partner of Tech Capital Partners

Waterloo is a relatively small region located in the south-eastern part of Canada, near Toronto and the US. Four high-tech sectors are dominant in the region. ICT is the biggest one (62%); Science, Technology and Engineering, Advanced Manufacturing and Life Sciences have more or less the same size. Most of the firms are small SMEs: 82% of the firms has less than 50 employees. Only 5% has more than 250 employees.

Factors hindering or advancing RCI

The region accommodates three high-quality and entrepreneurial universities which generate lots of spin-outs. According to one of the interviewees there is an entrepreneurial culture in the region because of the universities. Importantly, these institutes also attract people to the region. Several interviewees complain that it is quite difficult to hire people. "The amount of talent is fixed and that is a problem. We have to get people from outside", the executive chairman of Open Text stated.

The proximity of Toronto has some advantages. Toronto is important for leisure, people and capital. Moreover, the airport is important for connections with the 'world'. Firms therefore have access to some world-class facilities although the accommodation costs are relatively low.

The informal networks in the region are quite strong. The small size of the region is very important in this respect. People know each other and trust each other. This cooperative culture expresses itself in the interaction between education and research and industry. It is quite easy for public institutes to find sponsors for projects. "I think there is something to give back. Firms give money back to the community", the director of industry and government relations of IQC said.

The small size of the region has a reverse side as well. Industry is diverse but small, so it seems to me that there is no critical mass. This is a problem because it is not possible to be world-class in everything, although they think they can. A related problem is that there are no large firms. The government wants to attract these firms but is not successful in this respect.

More successful are the tax advantages for R&D investments and the public financial support for the Research and Technology Park that accommodates many start-ups.

Fact Sheet Waterloo

City:	Waterloo	96,000
Region:	Waterloo Region	485,000
Province:	Ontario	12,687,000
Country:	Canada	32,623,000
Area size:		1,382 km²
Universities:		4
Students:		about 65,500
Students in science:		26,000
Employment in high-tech:		10.0%
GDP region (million):		€ 12,200
GDP per capita region:		€ 25,154
GDP 4-year growth:		13%
Unemployment rate (2004):		5.6 %
R&D in province (% of GDP):		1.9%
- of which business:		1.5% (=79%)
- of which government:		0.4% (=21%)
Patents per million population - region:		370

5. Roads to success: a cross case analysis

This chapter presents a cross-case analysis of the eight regions involved in this study. The analysis starts with an analysis of the contribution to regional capacity for technological innovation (RCI) of each of the seven groups of factors. This analysis is based on the case descriptions presented in the previous chapter. For each of the groups of factors a table is made in which the results of the case descriptions are summarized. Based on this cross-case analysis in section 5.1, I try to find conditions critical for RCI in section 5.3. Finally, the results of the analysis will be compared with scientific literature and regional reports.

5.1. Factors hindering or advancing RCI in eight regions

The analysis presented in this section focuses on the effects of a factor on RCI. What are the positive (and sometimes negative) effects of a high score of a factor? What is the effect of a low score? In addition, some regional exceptions are explained when the reason is known in order to explain why the criticality of factors differs between regions.

Before a cross-case analysis is made of each of the seven groups, a short explanation of the tables summarizing the case studies is necessary. The analysis depends heavily on these tables. The tables are derived from appendix 14, which provides an overview of all the factors hindering or advancing RCI discussed in this section. The number in a cell refers to the score of the factor in that particular region; the colors refer to hindering or advancing (which is the product of criticality indicator *a* and a score *X*, see section 2.1). A red cell means hindering, a green one advancing. Some cells are yellow, which means that the impact of the factor on RCI depends on other circumstances. Sometimes factors consist of more than one element and these elements have different influences on RCI. It is also possible that the effect of a factor is double. Mountains for example can attract people (advancing) but also limit building possibilities (hindering). These specific situations are explained in the text.

Physical infrastructure

In general a low-quality physical infrastructure constrains RCI. Bad roads, traffic jams and low-quality public transport limit employees, entrepreneurs and researchers in going to work and meeting each other. A lack of building space limits the growth of firms and accommodation for new employees cannot be built.

A high quality infrastructure, on the other hand, does usually not advance RCI. It can be seen as a necessary basic prerequisite. Also air traffic connections are classified in this way. Due to the growth in low-budget flights, air-traffic connections are now part of the basic infrastructure, like railway connections.

So, there is a positive but regressive relation between physical infrastructure and RCI.

Table 20: factors hindering or advancing RCI related to physical infrastructure

Advancing / Hindering / Depending	Physical infrastructure	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
	Roads and parking	1	1	2	1	3	2	3	3
	Air traffic connections	3	3	2	2	3	3	3	2
	Public transport system	1	2	2	2	3	3	3	1
	Geographic position								
	Building space	1	1	2	1	3	1	2	2

There are some exceptions, as table 20 shows. The Øresund Bridge (and the train crossing the bridge) advances RCI because that is an extraordinary factor. Without the Bridge there would be no

Øresund region. However, crossing the bridge by car is costly. Without the air traffic connections Dublin would be a remote place. The high-quality public transport system of Munich is outstanding; much better than may be expected from a city with that size. As a result, it is possible to be located outside the geographic region without losing the regional advantages. The geographic position has both positive and negative effects. It can have a positive influence on the living climate and the leisure facilities like in Cambridge and Grenoble, but it can limit building possibilities, as the Grenoble case shows. Access to markets and people (or not) is another effect of geographic location.

Institutional infrastructure

It is not possible to describe the relation between industry concentration and RCI because industry concentration has several aspects. Critical mass and diversity of firm size within sectors contribute to a pool of employees, availability of middle management and the attractiveness of a cluster to companies from outside. The presence of different sectors with critical mass makes the region less sensitive to cyclical fluctuations. This is important because cyclical fluctuation has a negative effect on the availability of workforce. The number of aspects explains the various colors in the table. In Dublin, industry concentration is high, but the innovation level is low. In Waterloo the concentration is moderate, but the structure is very diverse, so there is no critical mass. In Cambridge there is some critical mass, but firms are quite small.

The presence of an innovative multinational has some extra advantages and positively influences RCI. Multinationals create a supply chain and stimulate suppliers to be innovative, bring about a knowledge-intensive service sector of which the other firms can profit, and their international networks give firms access to new markets; and they constitute a positive example. A disadvantage can be the sensitivity of a multinational to cyclical fluctuations, which affects a whole supply chain. Dublin is the exception here, see table 21. The multinationals are there, but do their innovations elsewhere.

Education institutes are first of all providers of young talent; this is their most important role. These institutes can also have a number of other roles. A high-quality university is good for the image of a region. Entrepreneurial universities are very useful for firms that want to receive external knowledge. Finally, many informal networks originate at the university. As a result, there is a positive relation between the quality and size of the university and RCI.

The same is true for research institutes. Research institutes also provide a strong knowledge base. Another positive effect of the presence of research institutes is that they attract researchers and firms. A low score on research institutes does not hinder RCI. In view of the relation between the scores of research institutes and education institutes it is possible that a lack of research institutes does not hinder RCI because education institutes provide a good science base in these regions. I have no data on the impact of the research institutes in Waterloo.

Public intermediaries and service providers are mainly important for start-ups. Introduction into networks and business support are their main tasks. Important is the attitude; many public institutions are not oriented towards the needs of the customer. The customer needs professional aid based on a commercial way of thinking, like in Eindhoven. So the relation between the presence of intermediaries and service providers and RCI depends on the attitude of the institutions.

Availability of capital is important for start-ups. It gives them the possibility to grow. A risk-taking attitude of the venture capitalist firms is necessary. In some regions like Eindhoven and Øresund capital is available but provided by banks and insurance companies which avoid risks. The Cambridge case illustrates that a disproportional amount of venture capital can lead to short term oriented strategies because of the time horizon of 5 years. For the availability of capital it is important that there are no other investment areas that give higher returns. That is the case in Dublin with its very dynamic property market. In the Øresund region the lack of venture capital does not hinder RCI because risk capital comes from abroad. In many cases seed- and pre-seed capital is not commercially interesting. Therefore, the government has to provide it. A commercial

attitude, however, is necessary to create healthy companies. In Eindhoven the amount of seed capital is not very high, but the commercial attitude with which the available capital is provided is very supportive. This attitude is lacking in Helsinki. So, due to the number of aspects influencing the importance of venture capital and seed capital, the relation between availability of venture capital and RCI cannot be stated in one sentence.

Physical proximity in a region makes it easy to know and trust each other. Because of the small size it is possible to control the whole thing; misbehavior has dramatic effects for the person himself. As a result, many things in smaller regions are driven by informal networks. Hiring people, for example, is easy. A striking paradox in this respect is that growth has a negative effect on trust, the important growth factor. Grenoble is the exception here. Due to the formality of the region proximity does not have the listed positive effects in this region. So, when there is informality in a region there is a positive relation between proximity and RCI.

Campuses, places of proximity within the region, can give firms access to facilities, people and knowledge. Campuses can also be important for the image of the region. Thus, the relation between the presence of campuses and RCI is positive.

Table 21: factors hindering or advancing RCI related to institutional infrastructure

Advancing / Hindering / Depending	Institutional infrastructure	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
	Industry concentration	2	3	3	2	2	3	2	2
	Presence of innovative multinational	1	3	3	3	3	3	3	2
	Seed capital		2	2	2	3	2	2	2
	Venture capital	3	2	1	1	1	3	1	3
	Education institutes	3	3	2	3	3	3	3	3
	Research institutes	1	2	3	3	1	3	2	3
	Proximity advantage	3	2	3	2	3	2	1	3
	Service providers	3	2	3		3	3	3	2
	Intermediaries	1	2	3	3	2	3	2	3

Networks

Some kind of formal or informal networking is important in each region. There are positive relations between the scores on networking and RCI. But there are some striking differences between the regions.

Generally speaking there are two types of formal networks. Firstly you have partnerships in which money and business are involved. For this type of network formal agreements are always necessary. Supply chains are a good example of this type. The second type are networks that organize meetings for their members so that they can meet each other. Business associations belong to this type.

In smaller regions like Cambridge, Helsinki and Waterloo the second type of formal networks is not very important. People meet each other in an informal way. Pubs and restaurants are important meeting places in these regions. Via these contacts they share tacit knowledge. Also real business contacts, the first type of formal networks, originate via the informal ones. In bigger regions like Munich and Øresund formal networks of the second type are more important because it is no longer possible to know all the people.

Both types of formal networks create opportunities to develop informal contacts. And these informal contacts determine whether or not formal contacts are successful. In the next section some cultural influences on informal networks are described which explain the score of Grenoble.

It is not so easy to develop successful networks of the second type. Networks initiated by government are often not oriented towards the needs of the customers as the situation in Munich shows. Bottom-up developed networks like Cambridge Network and several initiatives in Eindhoven are more successful.

Interaction with universities is important for knowledge transfer. If the university is small (Eindhoven) or if there is distrust between university and industry (observed in Grenoble) interaction with research institutes can be a substitute. In Dublin some sectors have good connections with universities but in general there is no tradition of commercializing research.

Table 22: factors hindering or advancing RCI related to networks

Advancing / Hindering / Depending — Networks	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
General	2	3	3	2	3	2	2	3
Interaction with universities	2	2	2	2	3	2	3	3
Interaction with research centres	1	2	2	3	1	3	2	2
Vertical networks	1	2	3	-	2	3	2	2
Informal ties in networks	3	3	3	1	3	3	2	3

Culture

The Hofstede (2001) dimensions provide an explanation for some differences regarding networking, entrepreneurial attitude and availability of capital. Figure 4 lists the Hofstede (2001) scores for the countries in which the regions are located. The analysis of the influences of these dimensions is based on this figure. In table 23 the scores are summarized. The general conclusion is that it is hard to find relations between the Hofstede dimensions (Hofstede 2001) and RCI. Only the power distance scores suggest that there is a negative relation with RCI. For the other cultural factors positive relations are found.

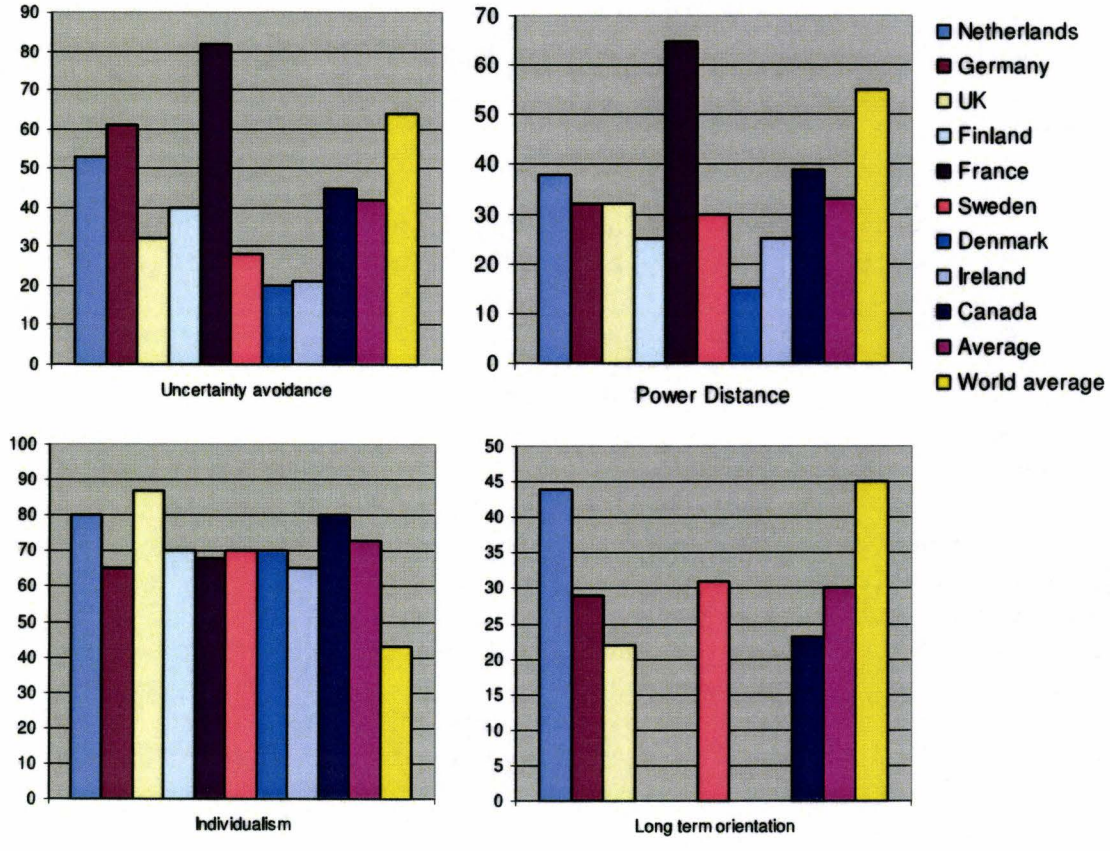


Figure 4: scores on cultural factors derived from Hofstede (2001)

As figure 4 shows, the power distance score is low in each region except France. In these seven regions people say that it is easy to make contacts. Informal networks are well developed there.

Uncertainty avoidance is extremely high in France. Grenoble is a region with many formal networks although the region is relatively small. Also Munich (Germany) and Eindhoven (Netherlands), both located in countries with a high score, have many formal networks. Whether or not uncertainty avoidance strongly influences the availability of risk capital and an entrepreneurial attitude is not clear. The scores of the two regions mentioned suggest a relation; but in the Øresund region (Sweden, Denmark) the scores are very low although private investors are scarce. An entrepreneurial attitude, important for commercializing ideas, is present in Dublin (Ireland), Waterloo (Canada) and Cambridge UK). Ireland and the UK have a low score but Waterloo has not. However, people in Waterloo said that the attitude there is not typical for the country.

It is possible that the low score on long-term orientation negatively influences the firm growth in Cambridge. But Germany also has a low score. Maybe the financing infrastructure has a positive influence there.

All the regions have a high score on individualism, although networks are important in each region. Maybe the high score of the UK gives an explanation for the low formal networking activity in Cambridge, the lowest of all regions.

Willingness to cooperate is very important in smaller regions. In this way the scarcely available resources can be optimally used. This happens in Eindhoven and Helsinki.

Because of the optimal use of the limited resources a positive attitude towards the high-tech cluster is also important in these small regions. The different opinions regarding the growth strategy in Cambridge, for example, limit development in this region.

Table 23: factors hindering or advancing RCI related to culture

Advancing / Hindering / Depending — Culture	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
Attitude city/region towards high tech cluster	2	2	3	2	3	3	1	2
Entrepreneurial attitude	1	3	2	1	1		1	3
Willingness to cooperate	1	2	3	2	3		2	3
Short term oriented culture	3	3	2			3		
Uncertainty avoidance	1	2	2	3	1	3	1	2
Power distance	1	1	1	3	1	1	1	1

People

Availability of people, especially of highly educated people, is important in all regions. Both quality and quantity are important. Quality is a reason for firms in niche markets to stay in a region. Quantity is necessary to fulfil need.

It is difficult to say whether or not availability of people hinders RCI. "There is always a lack of highly educated people", one of the interviewees said. This can be an explanation for the situation in Dublin and Waterloo, where availability is respectively moderate and good but some shortage is felt. Most of the time there is a balance between demand and supply. Especially in the bigger regions there is critical mass so it is easier to hire people. Only if over- or under-supply is very obvious it is possible to say that availability of highly educated people advances or hinders RCI. Oversupply in the quantitative respect is the case in Grenoble. As a result wages are low. Causes for under-supply are a small and aging population in a remote place (Helsinki) and sensitivity to cyclical fluctuations (Eindhoven). Methods to alleviate under-supply are described under *physical-* and *institutional infrastructure, soft location factors* and *policies.*

Based on this analysis we can conclude that a positive relation exists between the availability of people and RCI.

Table 24: factors hindering or advancing RCI related to people

Advancing / Hindering / Depending	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
People								
Availability of highly educated people	2	2	1	3	1	2	2	3

Soft location factors

Living climate and leisure facilities are strongly related. Combining these two we see that both are important to attract and keep people. Waterloo is the exception here. That the living climate does not advance RCI here can be caused by the unfamiliarity (image) of many people with the region.

However, not everyone wants the same facilities. Younger people prefer capital areas like Dublin and Copenhagen. For families more rural areas like Waterloo are attractive. Helsinki and Grenoble are attractive for people who like sports and nature. Leisure facilities close to the place of work are important for relaxation and good for work performance.

Relatively cheap houses are important to keep younger people and people with lower education.

International schools are not mentioned as hindering or advancing RCI. In all regions international schools are present. It is like physical infrastructure: absence of such a school is an important constraint on attracting foreign people; but foreign people do not come to the region because of international schools.

A positive image advances RCI. Cambridge is a good example of that. The image of Cambridge attracts firms and people and gives firms more prestige in business contacts. Creating a positive image is possible through coherent marketing campaigns. That is not well done in some of the regions (see *policies*).

The data presented in table 25 suggest that there is a positive and progressive relation between soft location factors and RCI, with housing as an exception.

Table 25: factors hindering or advancing RCI related to soft location factors

Advancing / Hindering / Depending	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
Soft location factors								
living climate	3	3	2	3	2	3	3	3
Leisure facilities	2	3	2	3	1	3	3	2
Housing	1	1	2	2	2	1	2	3
Price level	2	3	2	2	2	3	3	3
Image of the region	3	2	1	3	1	3	3	1

Policies

Policies, both regional and national, can hinder and advance RCI. There is a positive relation between the quality of the policies (and public institutions) and RCI, but to what extent regional policies influence RCI depends on the type of policies and on the size of the region. In smaller clusters much more coordination is possible. Therefore the high scores in Eindhoven and Helsinki are very positive and the low score in Cambridge is very negative. The other colors and scores on general policies are determined by context-specific factors

Hindering RCI is a lack of investment in physical infrastructure, a primary responsibility of the government. Also legislation, especially employment legislation, can hinder RCI. An example is strict legislation on immigration.

Low firm taxes can attract bigger firms to come to the region (Dublin). It can also stimulate entrepreneurship if firm taxes are lower than tax on wages. Tax advantages can stimulate people to invest, as the situation in Waterloo and Cambridge shows.

About public financial support it can be said that investments are necessary if the market fails. That means that the government has to provide seed- and pre-seed capital in many cases (Munich and Cambridge are exceptions here). This happens in Helsinki and Dublin and to some extent in Eindhoven. Fundamental research is also not commercially interesting for most of the firms. In smaller regions it is possible to stimulate interaction between firms and between firms and knowledge institutes by partly funding projects that are too risky for firms to undertake on their own or without subsidy. The risk component is very important in this respect.

Public intermediaries and service providers can be very important in smaller regions and to some extent also in bigger ones; but the attitude of the service provider is very important. A customer oriented and commercial way of thinking is critical. In this respect Eindhoven and Øresund are a good example to Cambridge, Helsinki and Munich.

The extent to which cooperation between politicians positively influences RCI depends on the local situation. In Munich it is not necessary at the moment; in the Øresund region better cooperation between Swedish and Danish politicians could improve the performance of the cluster.

Table 26: factors hindering or advancing RCI related to policies

Advancing / Hindering / Depending — Policies	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
General policies	1	3	3	2	3	2	2	2
Type of financial system	3	3	2	2	2	2	2	2
Public financial support	1	2	2	3	3	1	2	3
Cooperation between politicians	2	3	3	2	2	1	1	2

Conclusions

The analysis presented in this section shows that the factors listed in the conceptual model can have several positive (and sometimes some negative) effects. In general a positive relation exists between the score of a positively formulated factor and contribution to RCI. Some factors are critical in all regions, but often the criticality of factors differs between regions. These differences between regions are the result of the fact that not all the possible positive effects of a factor are present in a region. Another reason for the differences is that one effect can be caused by several factors. This is elaborated in the next section, in which the listed effects in this section are systematized.

5.2. Critical conditions for RCI

This section analyzes the conditions necessary for RCI. The section is structured as follows. Firstly the factors listed in de conceptual framework that are necessary for RCI are identified. After that a model is presented with which it can be explained why so few factors are necessary for RCI. The explanation itself is given in the third part of this section. Finally, some other conclusions are derived from the model developed in this section.

Factors necessary for RCI

From the cross-case analysis given above it emerges that several factors are critical in all or most of the regions, but only a few factors can be identified as necessary. (Appendix 14 provides a compilation of all the tables presented in the previous section.) Only the presence of high-quality education institutes can be observed in every region. Distinguishing bigger (Munich, Dublin and Øresund) and smaller regions, in smaller regions informal networks are seen as necessary conditions. The other factors listed in the framework are not necessary for RCI.

Conditions critical for RCI: a model

The observation that most of the factors listed in the conceptual framework are not necessary for RCI can be explained by systematizing the effects of the factors described in section 5.1. As shown in table 27, many of the factors presented above contribute directly or indirectly to five conditions necessary for innovation: availability of people, availability of capital, availability of knowledge, availability of markets and availability of building space. The relations presented in table 27 are visualized in figure 5.

Why these five conditions? Without capital business is impossible. Especially in high-tech sectors investments in facilities and growth opportunities are necessary. Besides capital a physical location where people can live and work is needed. These people are necessary to invent, develop and commercialize ideas. Because it is not possible to invent and develop everything internally, access to external knowledge is necessary. But without customers, developing and commercializing ideas is useless. A possible sixth factor is an entrepreneurial attitude. If there is no willingness to do something with the five other factors nothing will happen. But one could also argue that this attitude is an element of the condition people. By 'people' I mean the right people, and besides their education level their attitude is also part of the 'right people'. On the basis of the data and the argumentation given above, therefore, I consider these five conditions as necessary.

These conditions refer to the factors of production as described in classical economic theories of Adam Smith, Karl Marx and John Stuart Mill. These authors mentioned three factors: land or natural resources, labor and capital goods. With the emergence of the knowledge economy, more recent studies distinguish physical capital from intellectual capital (cf. Drucker 1993: 13). Matching these factors with the conditions listed above, people matches with labor, capital with physical capital, knowledge with intellectual capital and building space with land. These four production factors and four conditions refer to the input of the process; the fifth condition, markets, refers to the output of the process.

Roads to success: an explanation for the absence of factors necessary for RCI

Different factors can have similar effects, table 27 shows. Counting the number of contributions to the five conditions, 22 factors contribute to people, 11 to capital, 23 to knowledge, 13 to access to markets and 5 to building space. As a result, it is possible that different configurations of critical factors lead to a similar score on one of the conditions.

I will not fully elaborate this in this section; some examples will be sufficient. Besides education institutes multinationals are important magnets for people. But the absence of a multinational does not per se hinder RCI. A nice environment and comfortable living climate can also attract people.

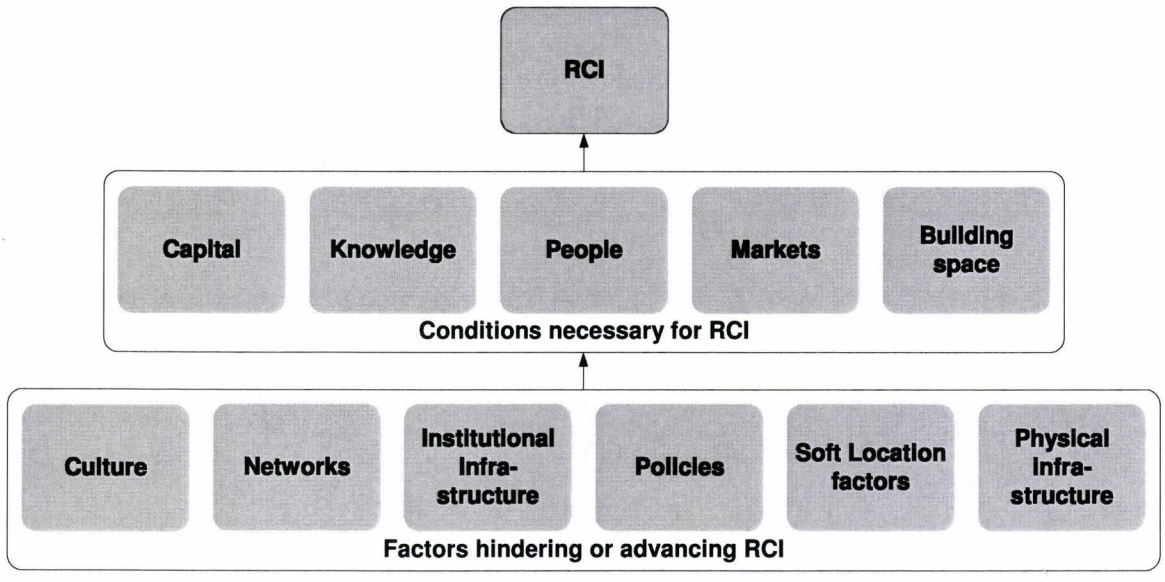


Figure 5: relations between factors hindering or advancing RCI, conditions necessary for RCI and RCI

Physical proximity of venture capitalists can be very useful. But if these firms are not located in the region it is possible that high-quality air traffic connections compensate for this because it is possible for venture capitalists to fly to the region. Universities are important sources of knowledge. But innovative multinationals and public research institutes can also provide this knowledge.

This analysis gives an explanation for the absence of factors necessary for RCI. It shows that none of the listed factors is necessary for RCI because of its effects. The five conditions are necessary for RCI but there are several possibilities to gain an acceptable score on these conditions. As a result, the criticality of factors differs between the regions.

Table 27: factors listed in conceptual framework influencing critical conditions

	People	Capital	Know-ledge	Markets	Building space
Physical infrastructure (15)					
Roads and parking	■	■	■	■	■
Air traffic connections	■	■	■		
Public transport system	■		■		■
Geographic position	■		■	■	■
Institutional infrastructure (22)					
Industry concentration	■		■		
Presence of innovative multinational	■		■	■	
Seed capital		■			
Venture capital		■		■	
Education institutes	■		■		
Research institutes	■		■		
Proximity advantage	■		■	■	
Service providers	■		■	■	
Intermediaries	■	■	■	■	
Networks (13)					
General	■	■	■	■	
Interaction with universities	■		■		
Interaction with research centres	■		■		
Vertical networks			■	■	
Informal ties in networks	■		■	■	
Culture (6)					
Attitude city/region towards high tech cluster					■
Entrepreneurial attitude					
Willingness to cooperate			■		
Short term oriented culture		■			
Uncertainty avoidance		■	■		
Power distance			■		
Soft location factors (7)					
living climate	■				
Leisure facilities	■				
Housing	■				
Price level	■				
Image of the region	■		■	■	
Policies (11)					
General policies	■	■	■	■	■
Type of financial system		■	■	■	
Public financial support		■	■		
Cooperation between politicians	■				
	People	Capital	Know-ledge	Markets	Building space

An analysis of influential factors and critical conditions

In the previous section the conclusion was reached that most of the factors listed in the conceptual framework are not necessary for RCI. However, this section shows that there are some gradual differences between the importance of factors hindering or advancing RCI. The section consists of two parts. In view of table 27, an investigation can be made of the respective influences of factors; this is the first part. Secondly, it is possible to make an analysis of the difficulty to create an acceptable score on each of the five conditions.

Influential factors

From the rows of table 27 it is obvious that the institutional infrastructure is very important for people, capital, knowledge and markets. Besides, networks and physical infrastructure are important. This makes sense: you need some kind of networking and infrastructure in order to be able to make use of the institutional infrastructure. Policies influence all the factors, but in a more indirect way. Soft location factors are mainly important to attract and keep people.

Critical conditions

From the columns of table 27 it appears there are many possibilities to have access to people and knowledge. Several sets of factors leading to an acceptable score can be constructed. Fewer factors give access to markets and capital. As a result there are fewer sets of factors leading to an acceptable score. Building space is critical: there are no alternatives.

I assume that the change of hindering RCI is negatively related with the number of possible sets of factors. This assumption is based on the following argumentation. When there are so many possible sets of factors it is not very difficult to gain an acceptable score on these conditions. When there are less possible sets the score on this factor will be low or high. A position in the middle is less probable.

If this is true we can conclude that building space is the most critical condition; capital is the second and markets the third critical condition.

5.3. Comparison with literature

In this section I compare the results presented above with current literature. The literature review of Becheikh et al. (2006) provides an overview of the outcomes of several studies. This review will serve as a guide. The results are summarized in figure 6. Besides, several case studies will be included.

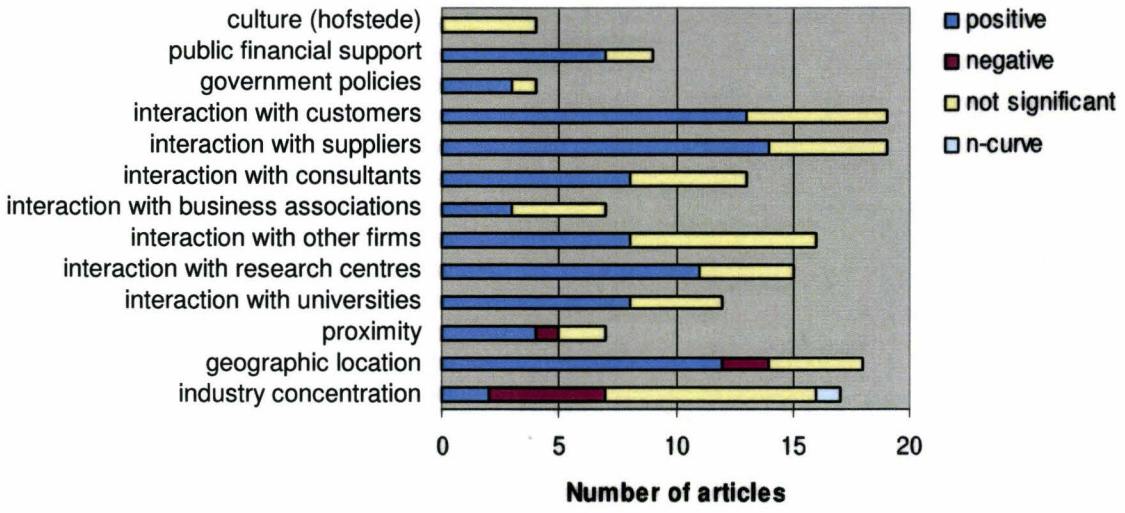


Figure 6: factors hindering or advancing RCI derived from Becheikh et al. (2006)

This section is structured as follows. First, the findings regarding the factors listed in the conceptual framework (section 5.1.) are compared with the findings in literature. Based on this comparison some remarks are made about the relation between scientific attention and importance of factors. After that the general conclusions (section 5.2.) are placed in a broader perspective.

Supporting and conflicting findings regarding specific factors

The findings regarding the specific factors consist of two parts: the criticality and influence factors have and the more detailed description of the effects of factors. The findings regarding the criticality and influence of factors are supported by the literature; regarding the effects most of the literature supports, although some studies conflict with, my findings. Some of the results are not mentioned in the literature. Below each of these groups is elaborated.

Supporting findings

Starting with the criticality and influence the main conclusion of the analysis in section 5.1 and 5.2 is that there is a positive relation between factors and RCI, but the criticality of the listed factors differs between the regions. For most of the factors listed in figure 6 positive and insignificant effects are found. So, the results listed in figure 6 support the conclusions stated in this study.

Most of the findings regarding the effects of factors are in line with the literature. With regard to the institutional infrastructure, the effects of industry concentration depend on the type of industry, Becheikh et al. (2006) state. In industries with low technological entry barriers and a high competition level new entrepreneurial firms are the main innovators. Arguing in this way industry concentration is positive in these industries but not in other industries. The data do not contain enough firm representatives to support or reject this statement. Cooke (2002) gives some other arguments in favour of industry concentration. A concentration of producers supports local suppliers of specialised inputs who thus help generate external economies of scale. Agglomerations generate localised skill pools benefiting workers' and firms' flexible labor market opportunities. A third reason is that information spillovers are implied. And Niosi and Banik (2005) found that clustering has a positive effect on the size of labor pools. The arguments of Cooke and Niosi and Banik are supported by my data.

The positive effects of proximity mentioned by Becheikh et al. (2006) – tacit knowledge transfer, reduction of communication costs, interpersonal interactions, trust and social capital between partners – are the same as the effects listed above.

Institutional thickness, a general term for education and research institutes, providers of service and capital and intermediaries, is considered important by several authors (Sternberg and Arndt 2001; Cooke 2001; Niosi and Banik 2005). From my analysis it follows that especially the knowledge and capital institutes are important. The other institutes are important in a number of cases only.

The availability of highly educated people is considered very important by almost all the interviewees. This opinion is supported by Sternberg and Arndt (2001), Cooke (2001), Calderini and Scellato (2005) and Becheikh et al. (2006).

Conflicting findings

For three factors more or less conflicting findings are found. The positive or insignificant influence of governmental policies and public financial support observed by Becheikh et al. (2006) does not contradict my findings. However, my findings are not as positive as the findings they present. The way in which support is given is very important.

Another difference is the importance of research centres. Only three regions perceive interaction with research centres as important whereas most of the studies involved in the literature review of Becheikh et al. (2006) classify this relation as significantly positive. I cannot explain this difference.

In line with the findings of Becheikh et al. (2006), no negative effects of networks are found. However, there are some striking differences. Vertical networks are less important in this study. This can be an effect of the types of industries involved. Vertical networks are typical for established industries (Cooke 2001). This study mainly included emerging industries.

Unmentioned effects

Some findings are not mentioned in the literature. Starting with physical infrastructure, only geographic location is investigated by Becheikh et al. (2006). According to this study, the significant effect of this factor follows from infrastructure and specialized workforce. These results are in line with my findings, but this study also shows that the geographic location itself influences the availability of workforce and the quality of the infrastructure.

I found no study discussing the importance of building space.

As this study shows, an innovative multinational is important for networks (Sternberg and Arndt 2001; Calderini and Scellato 2005). But I found no studies mentioning the other advantages of innovative multinationals I listed.

In line with the findings of Becheikh et al. (2006) the analysis of cultural influences shows that the explanatorily value of the Hofstede dimensions is limited. Regarding the other culture-related factors included in this study I found no literature.

As stated in the chapter about the conceptual framework less attention is paid to soft location factors in the literature. This study does not support this lack of scientific attention.

Scientific attention and importance of factors

It is clear from the tables in chapter 2 that the literature pays most attention to networking. One of the most important groups in this study is networking. A second important group, institutional infrastructure, is closely related to networking. But the other groups – physical infrastructure, culture, people, soft location factors and policies – are also perceived as important. The conclusion can be drawn that the distribution of the articles over the factors does not give an indication for the importance of these factors.

It is striking that a more balanced view is presented in reports underpinning regional governmental policies. The Brainport Navigator (Brainport 2005), for example, refers to a study of Euricur, an institute of the Erasmus University in Rotterdam (Euricur 2004). In this study the following framework is presented (figure 7), which is based on literature research.

The arrangement of the factors in this framework is interesting. An arrangement like this could enrich the analysis presented in section 5.2. It shows how regions can excel – the activities of a knowledge city, and which factors hinder – the foundations.

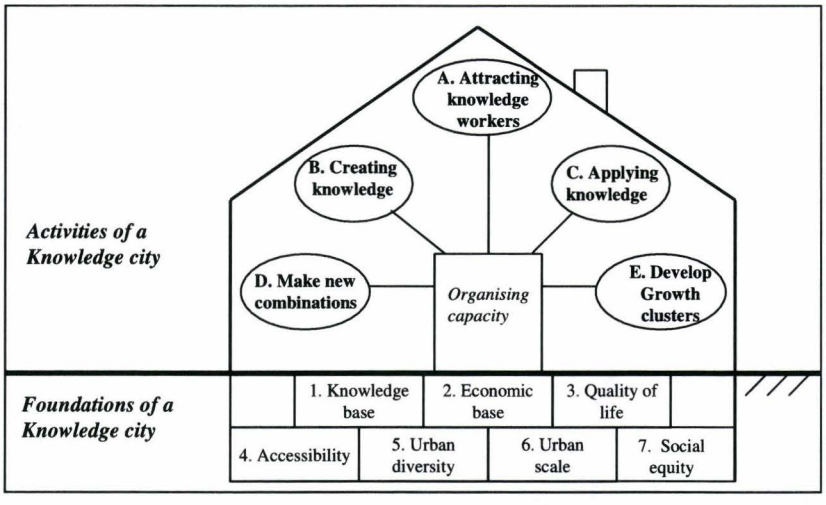


Figure 7: framework of factors hindering or advancing RCI borrowed from Euricur (2004)

Relations between factors and RCI

Becheikh et al. (2006) conclude that the majority of the studies reviewed presuppose that the relationship between factors and innovation is linear. In their view such an approach considerably limits the interpretation of the results and thus a better understanding of the phenomenon of innovation. They recommend that future research discriminates between innovative firms themselves. Suggested discriminatory variables are size, industry, region and country culture.

The outcomes of this study underline the validity of this recommendation. Configurations of innovation determinants are context-specific (see appendix 14 for an overview). However, the qualitative case-study approach used in this study provides insights into the influence determinants have on conditions formulated on a higher level (section 5.2.). At this level the same conditions are important in each region.

6. Conclusions

This concluding chapter consists of three sections. In section 1 the main conclusions regarding the research question formulated in section 1.2 are formulated. The implications of these conclusions for policy makers, especially in the region of Eindhoven, are given in section 2 and 3. This chapter and study ends with some reflections on the methodology and some suggestions for further research.

6.1. Conclusions

The aim of this study was to describe and explain the success of eight top technology regions, including Eindhoven, in order to find the factors hindering or advancing regional capacity for technological innovation (RCI). More specifically, the aim was to find positive and negative effects of regional factors on RCI and to find out which factors are necessary for a high RCI. Answering these questions, four general and a number of more specific conclusions follow from the analysis presented in the previous chapter.

Starting with the roughly 50 individual factors clustered in seven groups, we can conclude that the majority of these factors has a significant influence in at least one region. The effects, described in the literature, of the significant factors listed in the conceptual framework, recur in this study. In general a positive relation exists between the score of a factor that was positively formulated and its contribution to RCI. The findings of this study, therefore, do not conflict with the current literature at this level.

Moreover, some additional factors and effects were found. The added factors can be categorized as elements of one of the seven groups of the conceptual framework. Table 28 provides an overview of all the factors that are perceived as critically in at least one region.

Table 28: factors hindering or advancing RCI

Physical infra-structure	Institutional infra-structure	Networks	People	Soft location factors	Culture	Policies
Roads and parking	Industry concentration	General	Availability of highly educated people	Living climate	Attitude region towards high tech cluster	General policies
Air traffic connections	Presence of innovative multinational	Interaction with universities		Leisure facilities	Entrepreneu-rial attitude	Type of financial system
Public transport system	Seed capital	Interaction with research centres		Housing	Willingness to cooperate	Public financial support
Geographic position	Venture capital	Vertical networks		Price level	Short term oriented culture	Cooperation between politicians
Building space	Education institutes	Informal ties in networks		Image of the region	Uncertainty avoidance	
	Research institutes				Power distance	
	Proximity advantage					
	Service providers					
	Intermediary					

Thirdly, no systematic overview of these factors and their effects is available in the literature on influences on RCI. Figure 8, a summary of table 27, which was presented in section 5.2, provides such a systematic overview of the groups of factors and their effects. This figure shows the number of relations between the groups of factors identified in the conceptual framework and the five conditions critical in each region: availability of capital, knowledge, people, markets and building

space. All the factors listed in the conceptual framework contribute to these conditions in one way or another. The arrows visualize these effects of the factors on the five conditions.

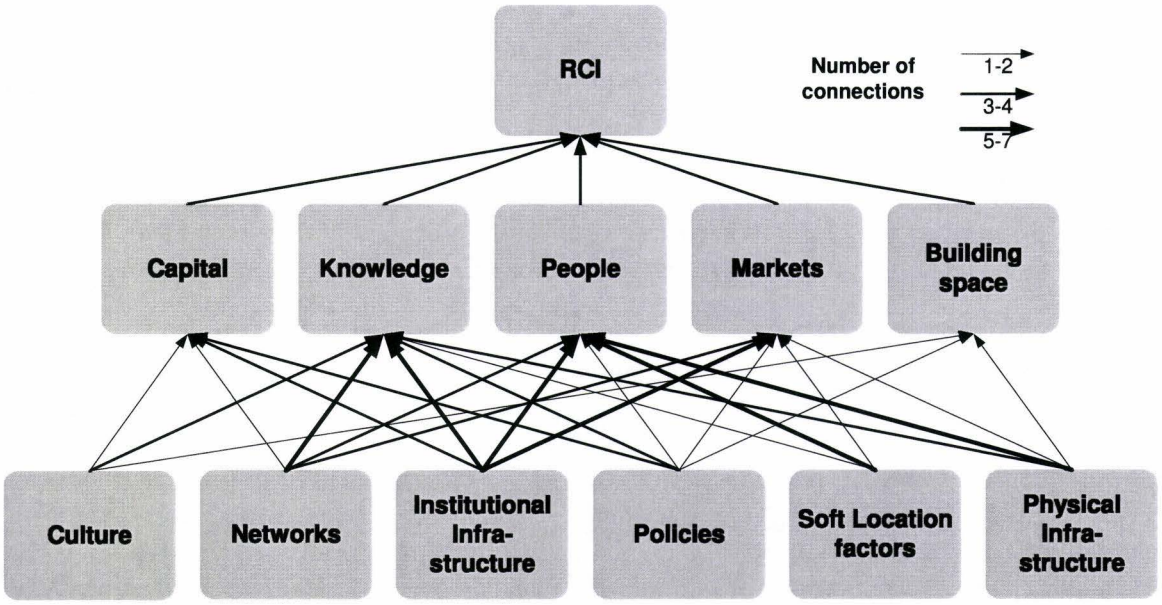


Figure 8: relations between groups of factors and critical conditions

Finally, the current literature suggests that factors hindering or advancing RCI are generic across regions but this study shows that configurations of factors leading to RCI are context-specific. There are two exceptions: education institutes are critical in all regions; informal networks are critical in small regions like Waterloo and Cambridge. This conclusion can be explained by means of figure 8. Analyzing the effects of the factors listed in the conceptual framework I found that these factors contribute to five conditions that are important in each region. Without capital business is impossible. Especially in high-tech sectors investments in facilities and growth opportunities are necessary. In addition to capital a physical location is needed where people can live and work. These people are necessary for the invention, development and commercialization of ideas. Since it is not possible to invent and develop everything internally, access to external knowledge is necessary. However, without customers the development and commercialization of ideas is useless. The number of arrows connecting the six groups of factors and the five conditions, however, illustrates that different factors can have similar effects. The analysis of factors hindering or advancing RCI also shows that, due to causal complexity, similar factors can have different effects. As a result, it is possible to have a similar score on RCI with different configurations of factors. There are different roads to success.

Based on figure 8 some conclusions can also be formulated regarding the conditions and groups of factors. With respect to the influences of factors this figure demonstrates that factors related to institutional infrastructure are the most influential ones (22 relations). Closely related to this group are networks (13) connecting the institutes and firms. The networks give firms the possibility to share knowledge, do business, hire people and attract capital. Seen from this perspective these two groups of factors deservedly get lots of attention in the literature.

However, these groups do not promote building space. Physical infrastructure and policies support this factor. With 15 relations physical infrastructure is quite important. A low-quality infrastructure limits travel possibilities, which means that going to work and meeting each other is more difficult.

Policies influence all the conditions. First of all, the government has to provide a high-quality infrastructure, including building space. In addition, legislation influences all the conditions. Public financial support is necessary if the market fails. Examples are the availability of seed- and pre-seed capital and fundamental research.

Soft location factors like an attractive living climate can attract people to come to the region or stay in the region. The image of the region also influences the image of the firms located there.

Culture is a difficult one. The well-known Hofstede dimensions (Hofstede 2001) do not explain differences between regions. In smaller regions the attitude of the region towards the high-tech cluster is important as well as willingness to cooperate.

Looking at the figure from the perspective of the critical conditions, I conclude moreover that knowledge and people are influenced by many factors (both 23 relations). With 5 relations, building space is the most critical factor.

6.2. General implications for policy makers

In 1999 the Dutch philosopher Hans Achterhuis wrote a very interesting essay with the telling title *Politics of good intentions* (Achterhuis 1999). Using ideas of Niccolò Machiavelli (1469-1527) and Hannah Arendt (1906-1975) he evaluated the NATO intervention in Kosovo in particular and political intervention in general.

In writing his *Discorsi* and his *Il Principe*, Achterhuis thinks, Machiavelli wrote books about political craftsmanship. Having mastered this craftsmanship, politicians can do good and bad things, but that is not initially important. An important aspect of political craftsmanship is the insight that political acting is not the same as engineering. Basing himself on Arendt, Achterhuis points out that, contrary to engineering, a politician does not control the construction process. Politicians act in the fog.

Doing good things without craftsmanship will result in undesired outcomes. In Achterhuis's opinion, the Kosovo intervention is an example of what he called politics of good intentions.

This study shows that the ideas of Achterhuis are also valid for policies influencing innovation. The regional innovation system is a very complex system in which many factors and actors interact with each other. The role of government in this system is limited, as figure 8 shows. Many other factors hinder or advance RCI as well, and governments cannot – or only partly – influence these factors. "Tinkering on the edges", one of the interviewed policy makers said. Understanding this limited role of political intervention is important for having realistic ideas about the effects of policies.

However, policies can have enormous impact, both positively and negatively. Craftsmanship is needed to avoid politics of good intentions with contrary effects. In this context political craftsmanship means: knowledge of the innovation process and of the interactions within the regional innovation system.

This study provides some important insights into this process. First of all, the framework as visualized in figure 8 gives policy makers a useful tool to analyze a region. Concerning the content a high-quality physical infrastructure is very important for RCI. Providing a high-quality infrastructure, especially building space, is therefore an important task for the government. A second group of factors for which the government is responsible is legislation. Tax and employment legislation influence the availability of capital and people, respectively.

A third important responsibility of the government is the public science system, including research institutes and education institutes. Education institutes are the only factor important in each region. The public science system is very important for the availability of knowledge and people in the region.

In addition to these factors for which the government is directly responsible, other domains for political intervention can emerge. In general it can be said that governments have to intervene when the market fails. Ideally, the aim of this sort of policy is to make themselves superfluous.

A typical example of market failure is the availability of capital. In most of the regions involved in this study providing pre-seed and seed capital is not commercially interesting, although it is very important for start-ups. The government can fill that gap, but craftsmanship is important here. Money is only one side of the solution. A professional attitude and commercial way of thinking (like in Eindhoven) help start-ups.

Such an attitude is also necessary when governments want to stimulate networking by creating networks and establishing intermediaries. When these networks and intermediaries are not oriented towards the needs of the innovative firms they are often useless.

Political craftsmanship also includes the insight that the government is not acting as an engineer in the innovation system. This study shows that no "one size fits all" approach exists. Each region has its unique solutions with inevitable side effects. This insight also implies that the effects of governmental policies cannot be measured like the performance of an engine. Eurostat indicators like GDP, number of patents and investment in R&D give a weak indication of the performance of the region and give little insight into the contribution of policies or other changes in the institutional environment to the performance of the region.

Summarizing these implications for policy makers, the first and main task of governments is to do the basic things well. Provide a high-quality physical infrastructure, invest in the public science system and make good laws. Secondly, governments can intervene when markets fail, but the success of such an intervention depends on the attitude of the government.

6.3. Brainport Eindhoven

The general remarks given in section 6.2 make it difficult to infer what Eindhoven can learn from the other regions, because solutions are context-specific. Nonetheless, the generic framework presented in section 5.2 gives some interesting insights in the situation in the Eindhoven region.

When we apply the summarizing figure presented in section 6.1 to the situation in Eindhoven a clear overview of the situation in the Eindhoven region emerges (figure 9). This figure shows that capital and – especially – people are critical. Building space does not hinder RCI but the opposite does not apply either.

The lack of capital and people is first of all caused by some weaknesses in the institutional infrastructure. Public seed capital is provided in a commercial way, which is good, but more money is needed. Venture capital is scarce. The lack of highly educated people is influenced by the small university.

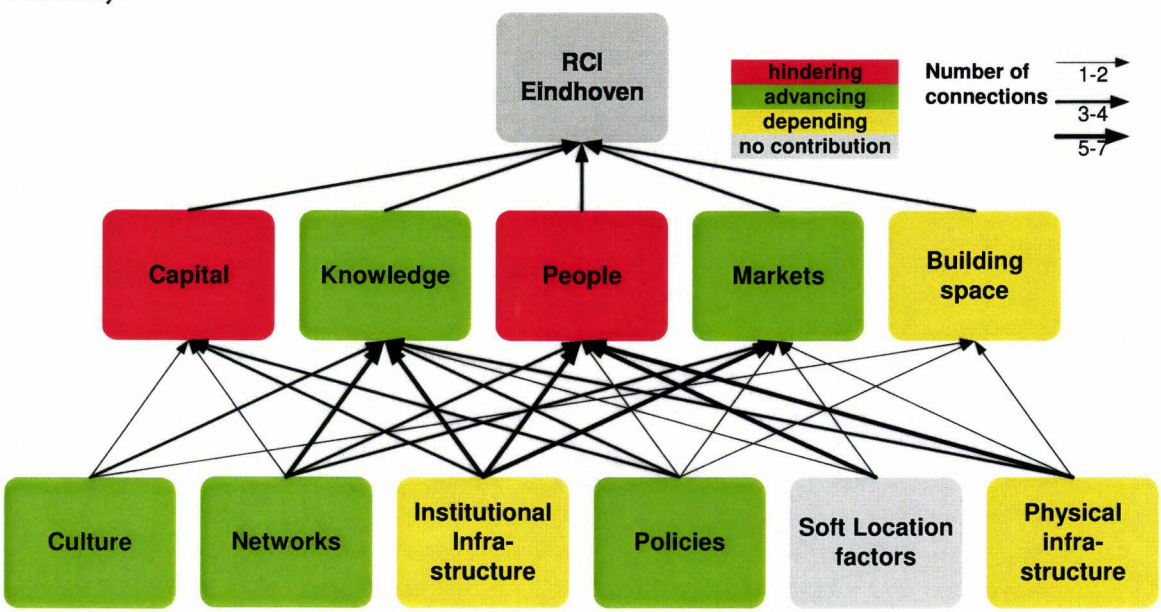


Figure 9: relations between groups of factors and critical conditions in Eindhoven

This figure also shows that there are ways to solve these problems. Starting with networking – influencing culture is difficult – a number of things can be done. The networks in the region are good, but – as one interviewee said – there is always room for improvement. Maybe it is possible to build networks that connect actors in the region with international venture capitalists. Networks can also attract people. The negative effects of the small technical university can be overcome by building networks with education institutes in the wider region. In view of the available road system and the public transport connections, ties with Tilburg University and RWTH Aken seem useful. Tilburg University accommodates 11,000 students and the distance is only 36 minutes by train. For partnerships with other universities like Maastricht, Aken, Nijmegen, Utrecht and Rotterdam, more than one hour of travel time is inescapable with the current connections.

There are fewer means to improve the institutional infrastructure. Enlarging the university is difficult; providing venture capital cannot be done by public bodies. Seed capital is still not commercially interesting, so more money should be provided by the government, like in Helsinki. Quite critical in this respect is that the commercial attitude in which the money is provided nowadays should be kept. Opportunities to attract venture capitalists should be utilized but this seems very difficult to me because of the lack of venture capital felt throughout Europe. Many regions are looking for a solution – without success. The image of big employers in the region like Philips, DAF and ASML is very important to attract people. Government cannot improve firm image but at the High Tech Campus public and private parties meet each other. Strengthening the image of such a place is important for the image of the firms located on the campus but also for the image of the region. Other advantages of this campus are access to facilities for small companies and proximity effects. Diversifying the industrial activities in the region will make the region less sensitive to cyclical fluctuations but it seems to me that it is difficult for politicians to realize that.

Laws cannot create venture capital but they can make the investment climate more friendly. The national government can make tax legislation more attractive to investors. Another topic the national government is responsible for is immigration legislation, a typical example of politics of good intentions. The current policy is very restrictive for all non-European people, which makes it very difficult for foreign knowledge workers to come to the Netherlands and to Eindhoven. Providing space for industry is also a political decision, but at the municipality level. It is important to notice that the supportive attitude present at the local governmental level. This attitude is a good basis for adequately anticipating future developments.

Soft location factors are important to attract people but none of the listed factors attracts people to Eindhoven at this moment. It is a question whether or not this can be changed. Providing more leisure facilities is possible but it is largely an image question. And image building is a long term process. A coherent marketing plan is essential in this respect. Some interviewees mentioned the different labels used to promote the region. From a marketing perspective this is foolish. Choosing one label will help the promotion of the region among people, firms, research institutes and the national and European governments.

Access to people can also be improved by upgrading the physical infrastructure of the region, as the Munich case illustrates. A high-quality infrastructure enables people to work in Eindhoven and live elsewhere. Besides, it makes establishing connections between firms and between firms and institutes easier. Table 29 provides an overview of the recommendations listed.

Comparing these recommendations with the strategy presented in the Brainport Navigator (Brainport 2003) we see the same items on the problem side, although the rankings differ sometimes. On the solution side we see that most of the suggested solutions are in line with the four domains in the Navigator: people, technology, business and basics. The people domain lists several initiatives to solve the lack of people. Technology lists initiatives to diversify the industry. In the business domain providing more public seed capital is one of the key factors. Another key factor is attracting firms to the region. In the basics domain key factors are image, accessibility, leisure facilities, quality of life and building space.

Solutions at the level of the national government (legislation) are not listed in the Navigator because this strategy focuses on regional possibilities. A solution at the regional level that is not listed in the Navigator is building networks with Tilburg University. The Navigator focuses on ELAt, but Aken and Leuven are quite far away and public transport connections are weak.

Table 29: overview recommendations for Eindhoven and comparison with Brainport Navigator

Problems			Suggested solution
Description	*Score (1 = low; 5 = high)*	*Score Navigator*	
Availability of seed capital	3	2	Provide more public seed capital
Availability of venture capital	2	2	Build networks connecting regional actors and international venture capitalists
			Make tax legislations more attractive for investors
Availability of people	2	3	Build networks with Tilburg University
			Make immigration laws attractive for knowledge workers
			Strengthen the image of the region through coherent marketing plan
			Improve leisure facilities
			Strengthen and use the image of the HTC
			Use the image of large innovative firms in the region
			Improve road- and public transport infrastructure
Sensitivity for cyclical fluctuations	3	3	Attract new firms to region by giving them access to facilities at HTC and attractive location possibilities.
Building space	3	3	

We can conclude that the problems and solutions investigated in this study are present in the Navigator, except networking with Tilburg. This study shows that solutions related to availability of people and capital should have priority.

6.3. Reflections

Reflections on methodology

The conceptual framework of this study was useful for describing the regions. During the data collection phase several new factors were added to the framework, but all of these factors fit well into one of the groups of factors. Because the scope of this study is very broad the framework contains very different factors. As a result the description of the factors is a bit superficial. Identifying more classifications by means of which the scores on factors can be described would sharpen the within- and cross-case analyses.

The complex relations between factors hindering or advancing RCI found in this study show that the choice for a qualitative case-study approach was a good one. The use of the same semi-structured interviews in the four regions I visited makes it possible to compare these regions in detail. The comparison of these four regions with the four others has less value because the scope of the interviews in the four other regions differs from the scope of my interviews.

The fact that this study is mainly based on interviews also leads to some limitations. When the score on a specific factor is based on interview data only, what is measured is a perception. If, for example, nobody is aware of the possible quality of the public infrastructure in Munich, it cannot function as a benchmark. The infrastructure in a region can be qualified as good, although it is moderate compared with other regions. The question is, then: what is meant by qualifications like "good", "bad" etc? This effect is decreased by asking the interviewees what they mean by their qualifications, by posing the same question to all the interviewees in a particular region and by adding questions to the interview schemes derived from reports about the region. In this way the reports are included as well.

Another limitation is that the investigated causal patterns are only based on interviews. We cannot be sure that there is a causal relation in reality. However, in the comparison of the outcomes with findings in the literature only additions and no contradictions were found.

A third limitation is that the interviewees were mainly policy makers and intermediaries. These interviewees are experts in the innovation field but they are not the innovators themselves. This is important because Neely et al. (2001) found that opinions regarding the role of the external environment of policy makers and managers differ significantly. For a more balanced view, therefore, more firm representatives should have been interviewed. However, it is difficult to find firms that are willing to participate. They do not see the benefits of doing so.

Conceptually clustered matrices were very useful to analyse data. Information is presented on one sheet so a comparison of opinions of different interviewees was easy. This made it more difficult to ignore negative opinions. Because the structure of the matrices was standardized, cross-case analysis was not very difficult.

Identifying critical factors was done through listing and combining the factors mentioned spontaneously in the four regions I visited. This overview of factors that were mentioned spontaneously has functioned as a guide through the data. With this guide I have analysed the conceptually clustered matrices in order to find reasons why these factors are important. This iterative process has led to the analysis presented above. One may wonder whether or not the factors mentioned spontaneously are a good starting point for identifying important factors. Does this approach lead to blind spots? I think this was avoided by interviewing different kinds of persons in each region and by combining the factors mentioned in four regions.

Case selection is another important issue. The analysis of critical conditions for RCI is based on the assumption that the cases involved in this study are successful cases with a high score on RCI. But in section 2.4 it is argued that current indicators for RCI are not valid for measuring RCI. It is therefore possible that some of the selected cases do not have a high score on RCI. If that is the case the analysis of critical conditions is not valid.

Further research

The external validity of this study can be improved by comparing this analysis with similar analyses of comparable cases. These studies could give deeper insight in the cause-effect patterns described in this study by using another way of data collection.

A second topic for further research is the measurement of the performance of regions. Current linear indicators like GDP, investment in R&D and the number of patents do not give insight into the effects of changes in softer processes (Oughton et al. 2002). And as this study shows, these processes considered very important for RCI. A new set of indicators is therefore needed.

Thirdly, this study only investigates necessary factors for RCI. It would be interesting to also identify sufficient factors. This can be done by comparing the successful cases discussed in this study with cases of failure.

Finally, combining these three topics for further research, a conceptual framework explaining the success and failure of innovative regions can be developed.

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Appendices

Appendix 1: General lay-out of interview scheme

Interview with [Policy Maker]

Purpose interview

1. collect data about policies
2. get an idea of the process of policy development

Topics interview

1. information about strengths and weaknesses of the region
2. information about policy development (process)
    a. involved parties
    b. process
        i. situation analysis
        ii. goal setting
        iii. action plan
        iv. actions
        v. evaluation
    c. communication
3. information about policies (content)
    a. goals
    b. policy 'vehicles' (ways through which goals are realised)
    c. resources
    d. results

Interview scheme

Introduction
Purpose interview: gather data about external influences on innovation processes.
Time: 1 hour
Record: interview will be recorded and worked out. Outcomes will be changed down
Confidentiality: see purpose. Data will be used for scientific report. This will be read by supervisors of TU/e, Brainport and Philips Research/HTC

Interlocutor
name:
function:
tasks:

Department
employees:
history:
Operations:
Can you characterize your department in one sentence?

Body
Region
What are the strengths of this region regarding to innovation?

What are the weaknesses of this region regarding to innovation?

What's your opinion about: [list of factors listed in conceptual framework]

Policy development
Can you give a description of current policies?

Can you give an overview of the process of policy development?

(Ask about: which parties are involved, how is a situation analysis made, goal setting, action plan, communication, actions, evaluation)

What are the goals of this policy?

What are the 'ways' through which these goals are realised?

How many resources (money, people) are available for the realisation of this policy?

How successful is this policy?

Finish
Thank you for your time and answers. Do you have questions or comments?

When you have additional information/... you can always phone or mail me.

Appendix 2: Data sources Cambridge

Data sources Cambridge			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	Guy Mills	Economic Development Officer	Greater Cambridge Partnership / Cam-bridge city council
	Mark Aspinal	Head of Innovation and Enterprise	East of England Development Agency
Intermediaries	Alan Barrell	Entrepreneur in Residence	
	Jens Lapinski	Vice President Analysis and Consulting	Library House
Firms	Mark Moore	Co-founder and Head of Research	Artimi
	Bill Baxter	Managing Director	Inca Digital Printing

Reports	*Remarks*
GCP (2005). Greater Cambridge Three Year Sub-Regional Economic Strategy. 2005-2008. Cambridge (UK): Greater Cambridge Partnership	
EEDA (2005). Corporate Plan. Cambridge: EEDA	
Library House (2004). The Cambridge Cluster Report 2004. Cambridge (UK): Library House	
Library House (2005). Investment trends in UK clean technology 2000-2004. Cambridge (UK): Library House	
Library House (2006a). Beyohd the Chasm: The Venture-Backed Report – UK – 2006. Cambridge (UK): Library House	
Library House (2006b). The Impact of the University of Cambridge on the UK Economy and Society. Cambridge (UK): Library House	
Library House (2006c). London: Anchoring European Technology Investment. Cambridge (UK): Library House	
Library House (2006d). The Cambridge Cluster Report 2006. Cambridge (UK): Library House	
PACEC (2003). The Cambridge Phenomenon – Fulfilling the Potential. Cambridge (UK): PACEC	

Websites	
URL	*Description*
www.alanbarrell.com	On this website a lot of reports and presentations about Cambridge can be found.

Appendix 3: Data sources Eindhoven

Data sources Eindhoven			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	Imke Carsouw	Projectleider Zuid-Oost Nederland	Economische Zaken
	Elies Lemkes	Directeur	Brainport
	Ton van Lier	Manager Strategy	Brainport
Intermediaries	Ton Schurgers	Directeur	United Brains
	Henk Zeeders	Directeur	ATC
Capital providers	Hans Bloemen	Sectorhoofd Advies en financiering	NV Rede
Firms	Jeroen op den Berg	Director new business development	GBO Design
	Carlo van de Wijer	Site Manager	Siemens VDO
Reports			
Aggelen, W. van (2007). Van Brains naar baten – breng Brainport in balans! Amsterdam: ABN Amro			
Akkerman, S. and Welting, A. (red.) (2006). Ontdek innovatief Nederland, Den Haag: Innovatieplatform			
Economische Zaken (2004). Pieken in de delta, Den Haag: Ministerie van Economische Zaken			
Economische Zaken (2006). Pieken in Zuid-Oost Nederland. Uitzicht op de top. Den Haag: Economische Zaken			
Halman, J., Ulijn, J., Vrande, V. and Umbach, F. (2006), The importance of Cooperation and Support for Technology Start-Ups: A comparison of The Eindhoven and Darmstadt Areas, in: Ulijn, J., Drillon, D. and Lasch, F. (eds) Entrepreneurship, Cooperation and the Firm: The emergence and Survival of High Tech Ventures in Europe, Cheltenham (UK): Edward Elgar			
Hinderdael, M., Mills, G. and Skelton, T. (2006). Welcome to Brainport. Working and living in one of Europe's top technology regions. Eindhoven: Brainport			
Horizon (2004). Top Technology. Crossing borders, moving frontiers. Eindhoven: Horizon			
Horizon (2005). De Horizon oogst. Eindhoven: Horizon			
Langendorff, T. Connecting Knowledge. Eindhoven: Philips Research			
Oerlemans, L. and Rutten, R. (2006). 'In de ban van de clustering'. Evaluatieonderzoek naar de Stimulusregeling. Tilburg: Universiteit van Tilburg			
Oort, F. van; Brussel, J. van ; Raspe, O.; Burger, M.; Dinteren, J. van; Knaap, B. van der (2006). Economische netwerken in de regio, Den Haag: Ruimtelijk Planbureau			
Ponds, R.; Oort, F. van (2006). Kennishubs in Nederland. Ruimtelijke patronen van onderzoekssamenwerking, Den Haag: Ruimtelijk Planbureau			
Sistermans, J., Maas, T. and Soete, L. (2005). Brainport Navigator 2013. Eindhoven: Brainport Eindhoven			
Steenhoven, J., Arnoldus, M. and Westerhof, H. (2006). Zes doorbraken voor de polder. Kenniseconomie Monitor 2006. Amsterdam: Stichting Nederland Kennisland			
Swarte, V.P.P. (red.) (2005). Inspirerend innoveren. Meerwaarde door kennis, Den Haag: Kvie			
Thissen, M.; Coevering, P. van de; Hilberts, H. (2005). Wegen naar economische groei, Den Haag: Ruimtelijk Planbureau			
Wetering, A.; Raspe, O.; Oort, F. van (2006). De atlas van kennis en innovatie, Den Haag: Ruimtelijk Planbureau			

Appendix 4: Data sources Helsinki

Data sources Helsinki			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	Eero Holstila	Director	City of Helsinki; Office of Economic Development
	Kari Ruoho	Director Economic Development	City of Espoo
University	Antti Sillanpää	Postdoctoral researcher	Helsinki University of Technology; Dept. of Industrial Engineering and Management; Institute of Strategy and International Business
Capital providers	Martti Hintikka	Managing Director, Partner	Innofinance Oy
Firms	Teppo Jyrkkiö	Managing Director	Philips Medical Systems Finland
	Kimmo Rönkä	Research Manager	Movense
Others	Johan Hendriks	Technologisch Wetenschappelijk Assistent (TWA)	Ambassy of The Netherlands
Reports			
Holstila, E. (2003), Building a creative city. The High Tech Cluster in the Helsinki Metropolitan Region, Helsinki: Culminatum			
Meer, A. van der, Winden, W. van, Woets, P. (2002), ICT Clusters in European Cities during the 1990s. Development Patterns and Policy Lessons, Rotterdam: Euricur			
Oksanen, J. and Kutinlahti, P. (2006), Annual Innovation Policy Trends and Appraisal Report Finland 2004-2005, Brussel: European Commission			
Sjölblom, A. (2005), Homes for innovation, Helsinki: Tekel			
(2003), OECD Territorial Reviews. Helsinki, Finland, Paris: OECD			
(2003), Helsinki Region. Business Guide, Helsinki: Helsinki Region Marketing Ltd.			
(2004), The Regional Economy of Helsinki from a European Perspective, Helsinki: Helsinki City Urban Fact Office			
(2005), Helsinki Regional Economy, Helsinki City Urban Fact Office			
(2005), Innovation Strategy, Helsinki: Culminatum			
(2005), Making Finland a leading country in innovation. Final report of the Competitive Innovation Environment Development Programme, Helsinki: Sitra			
(2006), Statistical Yearbook of the City of Helsinki 2005, Helsinki: Helsinki City Urban Fact Office			

Appendix 5: Data sources Munich

Data sources Munich			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	Bernhard Eller	Economic Development and Employment Strategies	City of Munich; Department of Labor & Economic Development
	Ronald Mertz	Head of Divison Biotechnology	Bavarian Ministry of Economic Affairs, Infrastructure, Transport and Technology
Intermediaries	Monika Nörr	Innovation, Forschung und Technologie, Produktsicherheit	Chamber of Commerce (IHK)
	Frank Strathmann	Leiter der Transferstelle	Technology Transfer Office Technical University of Munich
Capital providers	Rolf Dienst	CEO and founder	Wellington Partners
Firms	Dietmar Theis	Corporate Technology Marketing and Cooperation	Siemens AG
	Tobias Wever	Project Manager	GAF AG
Reports			
(2006). Innovationsförderung in Bayern. Munich: LfA Förderbank Bayern			
(2006). Munich Financial Center: Top in Finance!, Munich: Financial Center Munich Initiative			
Binder, S., (2006). Standortabhängige Erfolgsfaktoren für innovative unternehmuensgründungen in Oberbayern. Munich: LMU			
City of Munich (2002). Munich. The economic Location. Munich: City of Munich			
City of Munich (2005). Munich. City of Knowledge, Munich: City of Munich			
City of Munich (2006). Munich. Because... Munich: City of Munich			
IHK (2003). Metropolregion München – das Kraftzentrum Deutschlands. Deutsche Metropolregionen im Vergleich. Munich: IHK			
IHK (2006). Metropolregion München,Munich: IHK			
Lutz, A. (2005). Networking of Business and Innovation Centres. Munich: Triebwerk Business Development			
Stahlecker, T. and Koch, A. (2004). On the Significance of Economic Structure and Regional Innovation Systems for the Foundation of Knowledge-Intensive Business Services. A Comparative Study of Bremen, Munich and Stuttgart, Germany. Karlsruhe: Fraunhover Institute for Systems and Innovation Research			
Websites			
URL		*Description*	
www.statistik.bayern.de			
www.ihk-muenchen.de			

Appendix 6: Data sources Dublin

Data sources Dublin			
Interviewees			
Type	*Name*	*Function*	*Organization*
Universities	Eoin O'Neill	Director of Entrepreneurship, Trinity Technology and Enterprise Centre	Trinity College
Intermediaries	Greg Swift	CEO	Dublin City Enterprise Board
	Stephen Brennan	Director of Marketing & Strategy	The Digital Hub Development Agency
	Ron Immink	Operations Manager	Invent DCU
Firms	Fergal Marrinan	CEO and founder	Sonas Innovation
Reports			
Name and year			
Lutz, A. (2005). Networking of Business and Innovation Centres. Munich: Triebwerk Business Development			

Appendix 7: Data sources Grenoble

Data sources Grenoble			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	Françoise Dessertine	Innovation and European Projects	City of Grenoble
Intermediaries	Jean-Paul Laurencin	Chargé de la valorisation de la reserche	UPMF
	Bernard Houpin	Directeur du SAIC	UPMF
	Nicolas Letterier	Délégué Général	Minalogic Partenaires
	Adrienne Perves	Technology Transfer	CEA
	Valerie Sabatier	PhD student	Protein'Expert
	Tristan Rouselle	Protein'Expert	CEO and founder
	Eric Larrey	Directeur	Floralis
Firms	Dominique Thomas	Director R&D cooperative programs	ST Microelectronics
	Patric Cogez	Director external relations	ST Microelectronics
	Charles Collet	PhD student	ST Microelectronics
	Jean-Christophe Hutt	VP Innovation & Technology	Schneider Electric
Websites			
URL		*Description*	
www.minatec.com			

Appendix 8: Data sources Øresund

Data sources Øresund			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	O. Rolf Larssen	Managing Director	Copenhagen Capacity
University	Knut Deppert	Associate Professor	Division of Slid State Physics Lund University
Intermediaries	Pieter Telleman	Director	MIC, Denmark University
	Daniel Kronmann	Project Coordinator	Nano Øresund
	Anne Line Mikkelsen	Managing Director	Nano Øresund
	Jenny Bergsten	Innovation	Øresund Science region
	Torben Orla Nielsen	COO	Scion-DTU
Firms	Anonymous		Start-up
	Lars Sickert	New Technologies Analyst	Tetra Pak
Reports			*Remarks*
Øresund Network (2005). Øresund. The human capital of Scandinavia. Malmö: Øresund Network			

Appendix 9: Data sources Waterloo

Data sources Waterloo			
Interviewees			
Type	*Name*	*Function*	*Organization*
Policy makers	John Tennant	CEO	CTT
	Carol Stewart	Manager	Technology Park
Intermediaries	Ms. Bobbi Holte	Director	Accelerator Centre
	Iain Klugman	President	Communitech
Capital providers	Tim Jackson	Partner	Tech Capital
Firms	Brian Doody	COO	Dalsa
	Tom Jenkins	Executive Chairman	Open Text
University	Adele Newton	director of industry and government relations	IQC
	Steve Farlow	Executive director	Wilfried Laurier University
Reports			
Communitech (2006). State of the Industry. Report 2006. Waterloo (CA): Communitech			
BMO (2006). Waterloo Region and Guelph: A High-Tech, High-Growth Future.			

Appendix 10: Overview important factors Cambridge

This overview is derived from NVivo 2.0. The totals are counted by me.

1 1) /physical infrastructure/roads and parking	4	
1 2) /physical infrastructure/air traffic connections	1	
1 3) /physical infrastructure/public transport system		2
1 5) /physical infrastructure/building space	1	
1 6) /physical infrastructure/geographic position	1	
Total		9
2 1) /institutional infrastructure/industry concentration	3	
2 2) /institutional infrastructure/presence of innovative multinational	2	
2 4) /institutional infrastructure/venture capital	3	
2 5) /institutional infrastructure/bank capital	1	
2 6) /institutional infrastructure/seed capital	2	
2 7) /institutional infrastructure/education institutes	4	
2 9) /institutional infrastructure/research institutes	2	
2 10) /institutional infrastructure/service providers	1	
2 11) /institutional infrastructure/proximity	1	
2 13) /institutional infrastructure/intermediaries	1	
Total		20
3 2) /soft location factors/leisure facilities	1	
3 3) /soft location factors/housing	3	
3 4) /soft location factors/language	1	
3 5) /soft location factors/price level	1	
3 8) /soft location factors/image of the region	3	
Total		9
4 1) /people/education level	1	
4 3) /people/availability of highly educated peop	4	
4 4) /people/availability of craftsmen	1	
4 5) /people/availability of middle management	1	
Total		7
5 1) /networks/interaction with universities	1	
5 8) /networks/formal and informal ties	1	
5 10) /networks/general	1	
Total		3
6 2) /policies/financial system	1	
6 5) /policies/intellectual property policies	1	
6 7) /policies/general policies	3	
6 9) /policies/development process	2	
6 3) /policies/public financial support	2	
7 1) /culture/dominance researcher role model	1	
7 2) /culture/flexibility and pluralism public sci	2	
7 3) /culture/failure acceptance	1	
7 4) /culture/attitude region	2	
Total		15
Total		**63**

Appendix 11: Overview important factors Eindhoven

This overview is derived from NVivo 2.0. The totals are counted by me.

(1 1) /physical infrastructure/roads and parking	2	
(1 3) /physical infrastructure/public transport system		1
(1 6) /physical infrastructure/geographic position	1	
Total		4
(2 1) /institutional infrastructure/industry concentration	5	
(2 2) /institutional infrastructure/presence of innovative multinational	3	
(2 7) /institutional infrastructure/education institutes	4	
(2 9) /institutional infrastructure/research institutes	3	
(2 11) /institutional infrastructure/proximity	1	
(2 12) /institutional infrastructure/general	2	
Total		18
(3 1) /soft location factors/living climate	1	
(3 2) /soft location factors/leisure facilities	2	
(3 6) /soft location factors/career development services	1	
(3 7) /soft location factors/international schools	1	
(3 8) /soft location factors/image of the region	2	
Total		7
(4 1) /people/education level	1	
(4 3) /people/availability of highly educated peop	2	
Total		3
(5 1) /networks/interaction with universities	1	
(5 3) /networks/interaction with business associatio	1	
(5 4) /networks/horizontal networks	1	
(5 5) /networks/vertical networks	3	
(5 8) /networks/formal and informal ties	1	
(5 10) /networks/general	1	
Total		8
(6 4) /policies/sector policies	1	
(6 7) /policies/general policies	3	
(6 8) /policies/cooperation between politicians	1	
(6 3) /policies/public financial support	2	
(6 11) /policies/marketing of the region	2	
Total		9
(7 4) /culture/attitude region	3	
Total		**52**

Appendix 12: Overview important factors Helsinki

This overview is derived from NVivo 2.0. The totals are counted by me.

(1 1) /physical infrastructure/roads and parking	2	
(1 2) /physical infrastructure/air traffic connections	1	
(1 3) /physical infrastructure/public transport system		1
(1 5) /physical infrastructure/building space	2	
(1 6) /physical infrastructure/geographic position	3	
Total		9
(2 1) /institutional infrastructure/industry concentration	1	
(2 2) /institutional infrastructure/presence of innovative multinational	2	
(2 3) /institutional infrastructure/incubators	1	
(2 4) /institutional infrastructure/venture capital	1	
(2 7) /institutional infrastructure/education institutes	4	
(2 9) /institutional infrastructure/research institutes	2	
(2 11) /institutional infrastructure/proximity	5	
(2 12) /institutional infrastructure/general	1	
Total		16
(3 1) /soft location factors/living climate	3	
(3 2) /soft location factors/leisure facilities	2	
(3 4) /soft location factors/language	2	
(3 5) /soft location factors/price level	2	
(3 9) /soft location factors/employment barriers	1	
Total		10
(4 1) /people/education level	1	
(4 3) /people/availability of highly educated peop	3	
(4 4) /people/availability of craftsmen	1	
Total		5
(5 1) /networks/interaction with universities	2	
(5 3) /networks/interaction with business associatio	1	
(5 8) /networks/formal and informal ties	1	
(5 10) /networks/general	1	
Total		5
(6 2) /policies/financial system	1	
(6 7) /policies/general policies	1	
(6 8) /policies/cooperation between politicians	1	
(6 3) /policies/public financial support	5	
(6 11) /policies/marketing of the region	2	
Total		10
(7 4) /culture/attitude region	7	
Total		**62**

Appendix 13: Overview important factors Munich

This overview is derived from NVivo 2.0. The totals are counted by me.

(1 1) /physical infrastructure/roads and parking	1	
(1 2) /physical infrastructure/air traffic connections	3	
(1 3) /physical infrastructure/public transport system	2	
Total		**6**
(2 1) /institutional infrastructure/industry concentration	2	
(2 2) /institutional infrastructure/presence of innovative multinational	2	
(2 4) /institutional infrastructure/venture capital	2	
(2 7) /institutional infrastructure/education institutes	4	
(2 9) /institutional infrastructure/research institutes	3	
(2 10) /institutional infrastructure/service providers	2	
(2 11) /institutional infrastructure/proximity	1	
Total		**16**
(3 1) /soft location factors/living climate	5	
(3 2) /soft location factors/leisure facilities	3	
(3 3) /soft location factors/housing	2	
(3 5) /soft location factors/price level	2	
(3 7) /soft location factors/international schools	1	
(3 8) /soft location factors/image of the region	1	
Total		**14**
(4 3) /people/availability of highly educated peop	1	
(5 2) /networks/interaction with research centers	1	
(6 7) /policies/general policies	1	
(7 2) /culture/flexibility and pluralism public sci	1	
(7 4) /culture/attitude region	1	
Total		**2**
Total factors mentioned		**41**

Appendix 14: Summarizing table all regions

Advancing / Hindering / Depending	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo
Physical infrastructure								
Roads and parking	1	1	2	1	3	2	3	3
Air traffic connections	3	3	2	2	3	3	3	2
Public transport system	1	2	2	2	3	3	3	1
Geographic position								
Building space	1	1	2	1	3	1	2	2
Institutional infrastructure								
Industry concentration	2	3	3	2	2	3	2	2
Presence of innovative multinational	1	2	3	3	3	3	3	2
Seed capital		2	2	2	3	2	2	2
Venture capital	3	2	1	1	1	3	1	3
Education institutes	3	3	2	3	3	3	3	3
Research institutes	1	2	3	3	1	3	2	3
Proximity advantage	3	2	3	2	3	2	1	3
Service providers	3	2	3		3	3	3	2
Intermediaries	1	2	3	3	2	3	2	3
Networks								
General	2	3	3	2	3	2	2	3
Interaction with universities	2	2	2	2	3	2	3	3
Interaction with research centres	1	2	2	3	1	3	2	2
Vertical networks	1	2	3	-	2	3	2	2
Informal ties in networks	3	3	3	1	3	3	2	3
Culture								
Attitude city/region towards high tech cluster	2	2	3	2	3	3	1	2
Entrepreneurial attitude	1	3	2	1	1		1	3
Willingness to cooperate	1	2	3	2	3		2	3
Short term oriented culture	3	3	2	-	-	3		
Uncertainty avoidance	1	2	2	3	1	3	1	2
Power distance	1	1	1	3	1	1	1	1
People								
Availability of highly educated people	2	2	1	3	1	2	2	3
Soft location factors								
living climate	3	3	2	3	2	3	3	3
Leisure facilities	2	3	2	3	1	3	3	2
Housing	1	1	2	2	2	1	2	3
Price level	2	3	2	2	2	3	3	3
Image of the region	3	2	1	3	1	3	3	1
Policies								
General policies	1	3	3	2	3	2	2	2
Type of financial system	3	3	2	2	2	2	2	2
Public financial support	1	2	2	3	3	1	2	3
Cooperation between politicians	2	3	3	2	2	1	1	2
Advancing / Hindering / Depending	Cambridge	Dublin	Eindhoven	Grenoble	Helsinki	Munich	Øresund	Waterloo