BRAINPORT’S LIFE CYCLE

spatial strategy to facilitate the life cycle of innovative industries to strengthen the position of the Brainport Eindhoven in the knowledge economy

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MSc Thesis Plan

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Preface

This thesis plan has been written in the framework of Urbanism. It forms the proposal for the graduation project at the Faculty of Architecture at the Delft University of Technology. The graduation project is done within the graduation studio Urban Regeneration with guidance of first mentor Herman Rosenboom and second mentor John Westrik.

This thesis plan is the result of a research and design process of eleven months, starting from January 2012. This thesis plan comes along with the final presentation, presented at the 25th of January, 2013.

I would like to thank: my tutors Herman Rosenboom and John Westrik for the pleasant meetings, their advice and guiding me through the whole process. Posad Spatial Strategies for the internship prior to my graduation and their feedback on my work during the graduation. Fellow students of the Urban Regeneration graduation studio for their useful critiques. My parents and brother for their support not only during my graduation, but during my whole study period. Lisanne for her encouragements.
Samenvatting

Dit afstudeeronderzoek betreft de Brainport regio, gelegen in het zuidwesten van Nederland. In dit onderzoek wordt deze regio gedefinieerd als de steden Eindhoven en Helmond en omliggend gebied. In het rapport ‘Piekken in de De’ in 2004 werd de concentratie van kennisintensieve bedrijven voor het eerst aangemerkt als ‘brainport’. Hiermee is de Eindhoven regio samen met de airport in Amsterdam en seaport in Rotterdam één van de drie mainports van Nederland en daarmee een economisch kerngebied van nationaal en internationaal belang.

De ambitie van de Brainport regio is om haar positie in de kennis economie te versterken. In onderzoek naar de positie van een stad en regio in de kennis economie kwam met name het belang van creativiteit en innovatie naar voren als belangrijkste middel om competitief te blijven. Hierdoor speelt het stimuleren van de ontwikkeling van creatieve en innovatieve bedrijven een grote rol, van begin tot het eind. Volgens de theorie van Saris en Modder kent de ontwikkeling van deze bedrijven vier fasen. Deze vier fasen onderscheiden zich van elkaar door het type ondersteunend ruimtelijke klimaat waar zij behoeft te aan hebben: de breedplaats, creatieve werkplaats, transactiemilieu en het productiemilieu. Deze vier fasen zijn ondergebracht in een assenstelsel waarbij elke fase enkel is kenmerkt door een experimenteel of marktgericht karakter en anderzijds een introvert of extravert karakter.

De Brainport regio biedt echter niet de verschillende soorten klimaten waar deze creatieve en innovatieve bedrijven behoeft aan hebben. De probleemstelling betreft dan ook het huidige beleid, waarin bedrijven gehuisvest zijn op traditionele bedrijventerreinen aan de rand van de stad. Deze terreinen bevinden zich zowel beginnende als gevestigde bedrijven. Het doel van dit onderzoek betreft dan ook een ruimtelijke strategie voor het faciliteren van de levenscyclus van innovatieve bedrijven om de positie van de Brainport Eindhoven regio in de kennis economie te versterken.

Uit het theoretisch onderzoek zijn op het schaal niveau van de regio, stad en buurt verschillende aspecten naar voren gekomen die voor een stad en regio in de kennis economie essentieel worden geacht. Vervolgens is de Brainport regio getoetst op deze voorwaarden en is bepaald in hoeverre de regio hieraan al voldoet of juist nog tekort schiet.

Deze analyse heeft geleid tot een nieuw netwerk voor de stad Eindhoven waarin de volgende onderdelen zijn opgenomen die van groot belang zijn voor de ontwikkeling van creatieve en innovatieve bedrijven:

- **Startermilieus:** Bestaat uit de eerste drie milieus van de levenscyclus van innovatieve bedrijven (broedplaats, creatieve werkplaats en transactiemilieu), omdat juist deze milieus behoefte hebben aan een stedelijk ondersteunend klimaat.
- **Productiemilieus:** Ondernemingen die zich in de laatste fase van ontwikkeling bevinden hebben het minst behoefte aan een stedelijk ondersteunend klimaat. Daarom komen deze het best tot hun recht op de traditionele bedrijventerreinen, business en science parcs op snelweglocaties aan de rand van de stad.
- **Kennisbronnen:** Gebouwen en gebieden die een ontmoetingsfunctie hebben en waar kennis wordt uitgewisseld tussen gelijkgestemden en andere partijen. In Eindhoven zijn dit universiteiten als de TU/e en de Design Academy, congresscentrum Evoluon, maar ook belangrijke interactiegebieden als de binnenstad en Strijp-S.
- **Openbaar vervoer netwerk:** De onderdelen uit het netwerk zijn onderling verbonden door middel van het HOV-netwerk (Hoogwaardig Openbaar Vervoer). Naast dat het verschillende milieus verbindt, verbindt het deze ook met belangrijke infrastructurale knooppunten zoals het centraal station en Eindhoven Airport.

Het afstudeerproject eindigt met een ruimtelijke uitwerking van het startersmilieu voor ondernemingen in de high tech sector. Deze is gelegen langs de Hoogstraat, in de buurten Oude Spoorbaan en Schrijversbuurt in het zuidwesten van Eindhoven. Dit stedenbouwkundig ontwerp laat zien hoe bestaande klein schalige bedrijventerreinen nieuw leven wordt ingeblazen door hier creatieve en innovatieve bedrijven in te huisvesten.

Deze strategie van binnenstedelijk ontwikkeling biedt een alternatief voor het huidig beleid waarin nieuwe werk milieus worden gerealiseerd op traditionele bedrijventerreinen op uitleglocaties. Het belangrijkste voordeel van deze strategie is dat uitgaat van de bestaande context en op deze manier streeft naar een bijdrage levert aan de bestaande stad. Doordat de bedrijven zo ook profiteren van de reeds aanwezige bedrijvigheid en voorzieningen, profiteren zowel de bedrijven als de stad van deze ontwikkeling.
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1 INTRODUCTION
figure 1.1 national contribution of the southeast of the Netherlands on innovation

source: Brainport Development, 2011

figure 1.2 (inter)national context of the Brainport

- Population: 18%
- Foreign investments: 25%
- Researchers: 26%
- Export: 35%
- Private R&D: 45%
- Patents: 54%

Netherlands
Southeast of the Netherlands

Groningen
Dusseldorf
Cologne
Duisburg
Dortmund
Rotterdam
Amsterdam
The Hague
Utrecht
Gent
Brussels
Leuven
Mechelen
Antwerp
Breda
Den Bosch
Tilburg
Helmond
Eindhoven
1.1 Introduction

Appointment of Brainport status

The city of Eindhoven in the south of the Netherlands used to be a city deeply affected by economic and social decline due to processes of deindustrialisation. But since the mid-2000s, Eindhoven and its surrounding region have successfully transformed into the technology node of the Netherlands. Nowadays it is even the second engine of the Dutch economy, after the airport in Amsterdam and before the seaport in Rotterdam (Gemeente Eindhoven, 2010).

To remain of national and international value, the Dutch cabinet wants to strengthen and even expand the region as a top technology cluster. Therefore, the Dutch government has appointed in ‘Pieken in de Delta’ report the Eindhoven region as Brainport. This term consists of the non-geographical defined network of research and development related industries, universities, institutes and campuses in the south-east of the Netherlands, concentrated around the city of Eindhoven (S+RO, 2011). Because the Brainport network is also represented very well in the neighbouring city of Helmond, the area consisting the cities of Eindhoven and Helmond and surrounding area will used in this research and design project as the Brainport region.

Brainport’s ambition

The ambition of the Brainport is to position itself among the top three technology centres of Europe and top ten technology centres worldwide (Brainport Development, 2011). In achieving this ambition, the Brainport wants to increase its innovative capacity, since innovation is one of the main production forces in the knowledge economy to remain competitive (Saris and Modder, 2005; Romein and Trip, 2010). Therefore the growth of existing or attraction of (new) creative and innovative industries are of crucial importance for the Brainport region to remain of (inter)national importance (Brainport Development, 2011).

Life cycle of development for creative and innovative companies

To ensure a region of a sustainable future in the knowledge economy, Saris and Modder (2005) claim the importance of a ‘life cycle of development’ for creative and innovative industries. This life cycle consists of different phases of development, where the companies will be supported in...
Figure 1.4: Map of the south-east of the Netherlands showing the Brainport related companies.
Source: brainport.nl & Google Maps.
their development through the right supportive urban environment. Hereby the entrepreneurship of innovative companies in the region is being stimulated for starting as well for already established companies. Independently from their phase of development, they should all be able to move along the life cycle of development of innovative companies (Saris and Modder, 2005) in the region itself. The Brainport region should present itself as the region in which new companies can start and established companies can grow.

**Creative environments**

The development of the creative and innovative companies along the life cycle of development should be stimulated by the right supportive urban environment. According to Saris and Modder (2005) companies, depending their phase of development, have the need for different environments that stimulates the innovation. These environments are called ‘creative environments’.

Four types of creative environments are distinguished, from the first to the final phase of development: the breeding place, creative workshop, transactional environment and place of production (figure 1.5). This distinction relates to the degree to which a company needs a supportive urban environment to generate innovation. The importance of their direct surrounding, local interaction and network differs between companies in the start-up and production phase (Heebels and van Aalst, 2010).

Therefore, implementing the life cycle of development for innovative industries seems to be the strategy for the Brainport region to increase its innovative capacity. It will offer a diverse variety of creative environments, which stimulates the development of innovative companies. This is needed to increase the innovative capacity of the Brainport region and therefore strengthen its position in knowledge economy. This development will contribute to its ambition to be among the top technology centres in Europe and even worldwide.
Definitions of creative environments

Incubator/breeding places
The experimental incubators are small core enterprises (1 to 3 persons) that need urban environments with a great deal of variety (Saris and Modder, 2005). Breeding places are partly located in the inner cities of the large cities, but mostly on the outskirts of the city centres and even partly in suburban areas (De Stad, 2005a).

Creative workshops
Companies make the step from a breeding place towards a creative workshop, once they leave the experimental phase and start building up a network by collaborating with other parties (Blokhzijl, 2008). Entrepreneurs in creative workshops need complementary companies and interaction and look for affordable urban spaces that offer diversity, space and openness (Saris and Modder, 2005). Creative workshops are mostly located in the city centres (De Stad, 2005a).

Transactional environments
In the transactional environments companies are located that decide to start marketing their products by making the first contact with potential clients and customers (Blokhzijl, 2008). Therefore, the core creative entrepreneurs and the distributional, organizationally oriented companies interact and meet their clients. The average size of the companies is a bit bigger (Saris and Modder, 2005). Transactional environments are located in the city centres as well in suburban and peripheral areas (De Stad, 2005a).

Places of production
Once companies start to have commercial successes, they enter the final phase of development. The activities of companies located at the places of production are mostly concerned with trading, reproduction and expanding their network. The pure creative process has ended and now focusses on reproduction and the commerce of the product (Blokhzijl, 2008). The market oriented production companies do have more employees and are strictly focused on production costs (Saris and Modder, 2005). Places of production are mostly located on the so-called highway locations all over the country (De Stad, 2005a).
A view at the city centre of Eindhoven, Flickr, 2012.
1.2 Problem field

**Lack of variety of creative environments**
An urban network with a strong innovative capacity consists of a rich diversity of these environments (De Stad, 2005b). This makes the innovative companies able to move along the life cycle of development. However, the Brainport region lacks this diversity of creative environments. The majority of the innovative companies are located on monofunctional business and science parcs on the edge of the city. On these business and science parcs there is a clustering of any kind of company, independently their size, sector and phase of development. Although these business and science parcs appear to operate well for innovative companies in the final phase of development, innovative companies in an earlier phase of development require a different environment. Innovative companies in the start-up phase for example require a more dense, urban environment with enough meeting places which stimulates external interaction and face-to-face contact (Black, 2004). Therefore, it is important to position the different creative environments at the right position so it benefits the most from its (potential) local qualities. But because of the lack of diverse creative environments in the Brainport, this will interfere the development of innovative companies in the region and thus decrease the innovative capacity of the entire region. Therefore there is a need for different creative environments to stimulate the innovative capacity of the Brainport.

**Scale disadvantage**
The lack of critical mass is one of Brainport’s main problems, since this is a crucial factor in a region’s foundation in the knowledge economy. It is needed for the region’s permit of certain foundations (van Winden et al., 2007), such as (inter)national accessibility and certain (international) amenities. These foundations are essential is the region also wants to retain companies in the final phase of development. The absence of these foundations can eventually lead to the departure of those innovative companies out of the region once they have reached the final phase in the life cycle of innovative industries. “You have to leave if you want to grow.” An example of this is the departure of Philips’ headquarter out of Eindhoven in 1997. The board of Philips decided to move its headquarter to Amsterdam because it wanted to be positioned in the country’s economic centre (Amsterdam), proximity to Schiphol airport which has better air connections than the Welshap airport of Eindhoven and top employees preferred living in Amsterdam more than in a provincial town like Eindhoven (Poorthuis, 1997).

This shows the importance of critical mass to retain innovative companies in different phases of their development. But because provincial cities can not hope to come metropolitan areas at short notice (van Winden, 2007). Therefore they may engage in strategic networks with other cities to compensate for it scale disadvantages (van Winden et al., 2007).

This shows that the Brainport region does not have the diversity of creative environments that especially innovative companies in the first phase of development require. A more diverse collection creative environments will increase a region’s innovative capacity. Besides that, the region also does not have to have the foundation that is needed to retain companies once they reach the final phase in the life cycle of development.
figure 1.7 Location of industrial sites in Eindhoven and Helmond

figure 1.8 Monofunctional areas business and science parcs: De Hurk (above) and the High Tech Campus (below) Eindhoven
source: photos by author
To remain competitive in the international competition in the knowledge economy, the Brainport region lacks the ability to create and retain innovative companies. The first cause is the lack of diverse creative environments, which are needed because companies in different phases of development require a different supportive surrounding. Therefore, companies to not have the right ability to move along the life cycle of innovative industries that will increase a region’s innovative capacity. Besides the lack of diverse creative environments, the absence of critical mass creates the problem that the region does not possess the requirements that companies especially in the final phase of development need. This is shown by the departure of Philips’ headquarters in 1997 from Eindhoven to Amsterdam.

These problems need to be solved if the Brainport wants to remain competitive in the international competition in the knowledge economy. A worst-case scenario can lead to the departure of more companies, which will deeply affect the economic position of the Brainport. This will also be very disadvantageous for the Netherlands which wants to make the shift from a manufacturer economy towards a knowledge economy. The Brainport is out of the three economic centres the one providing the most innovative output, which makes the strengthening of Brainport’s position is also of national interest. Therefore this project will focus how the life cycle of innovative companies can be implemented in the Brainport to strengthen its position in the knowledge economy.

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figure 1.9 position of Eindhoven with foundations compared with the cities of Amsterdam and Munich in the knowledge economy

source: van Winden et al., 2007
REGION
cities of Eindhoven and Helmond
and surrounding area

CITY
city of Eindhoven

NEIGHBOURHOOD
district of Eindhoven
In this research and design project the Brainport is defined as the cities of Eindhoven and Helmond and surrounding area. The overall aim of the project is to develop a strategically programmatic and spatial interpretation for the life cycle of innovative companies in the Brainport Eindhoven to strengthen its position in the knowledge economy. But besides the innovation related strategy for the Brainport Eindhoven, the project has to be fully integrated with the urban planning related current problems and upcoming challenges of the region as well.

By using literature research and analysis of the Brainport region, a vision will be created which relates to how the life cycle of innovative companies can be implemented in the Brainport to strengthen its position in the knowledge economy. This vision will be used for a proposal at the scale levels of the region, city and neighborhood scale within the context of the Brainport.

At the regional scale level, the life cycle of innovative industries will be used to address the determinative conditions for a city and its surrounding region in the knowledge economy. This vision will deal with the requirements deriving from the theoretical framework and analysis. This means issues such as the expected spatial regional growth of the region and (inter) national accessibility will be addressed so it stimulates the region’s innovative capacity.

At the scale of the city, the life cycle of innovative companies will be further developed in the context of the city of Eindhoven. Therefore the composed vision and regional strategy will be used. The aim is to implement a structure of different creative environments which is needed in the life cycle of innovative companies in the city of Eindhoven. The (potential) local qualities of each neighborhood and conditions according to the literature, will hereby contribute in achieving a structure where the creative environments are located in at the best possible location. A preliminary thought is to use the (partly realised) Bus Transit Rapid system as the main structure for the network of creative environments.

Final product
From the strategy on the scale of Eindhoven will follow which neighborhoods have the (potential) quality to contribute to the life cycle of innovative industries for the Brainport. This strategy will be used to make an urban design at the neighborhood scale. The urban design will be a spatial interpretation of a creative environment for innovative companies in the start-up phase of development. The aim is to design an environment which consists of the spatial conditions that stimulates the innovation of entrepreneurs in this first phase of development, such as meeting places for (spontaneous) face-to-face contacts and supporting facilities. Expected is that the design at neighborhood scale will be the transformation of an industrial site in the city of Eindhoven.
1.5 Research questions

1.5.1 Main research question

What spatial strategy can facilitate the life cycle of innovative industries to strengthen the position of the Brainport Eindhoven in the knowledge economy?

1.5.2 Sub-research questions

1. What spatial conditions are on what scale level determinative for a city and its surrounding region in the knowledge economy and how can these be addressed along the life cycle of development innovative industries?

2. To what extent does the Brainport region meet the requirements in the knowledge economy and how can these challenges be addressed along the life cycle of development for innovative industries?

3. What spatial characteristics stimulate innovation for companies in the start-up phase of development in the life cycle of development for innovative industries?
**main research question**
What spatial strategy can facilitate the life cycle of innovative industries to strengthen the position of the Brainport Eindhoven in the knowledge economy?

**problem field**

**project aim**

**research questions**

---

**THEORETICAL FRAMEWORK**

**sub-research question 1**
What spatial conditions are on what scale level determinative for a city and its surrounding region in the knowledge economy and how can these be addressed along the life cycle of development for innovative industries?

- Literature review: linking theory of spatial conditions of a city in the knowledge economy with the life cycle of innovative industries
- Overview of the determinative factors per scale level explained per creative environment

**sub-research question 2**
To what extent does the Brainport region meet the requirements in the knowledge economy and how can these challenges be addressed along the life cycle of development for innovative industries?

- Analysis at scale level of region, city and neighborhood on the factors derived from theoretical framework
- Conclusions per scale level which results in the assigning of suitable environments for starting companies

**sub-research question 3**
What spatial characteristics stimulate innovation for companies in the start-up phase of development in the life cycle of development for innovative industries?

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**ANALYSIS**

**strategic programmatic and spatial interpretation of conclusions derived from theoretical framework and analysis**

**strategy for the facilitating of starting companies in a network for the city of Eindhoven**

**EVALUATION**

Feedback on answering of main research question

---

**DESIGN**

**sub-research question 3**
What spatial characteristics stimulate innovation for companies in the first phase of development in the life cycle of development for creative and innovative industries?

- Research by design using the strategy as starting point
- Urban design at neighborhood scale of starting environment for creative and innovative companies in the first phase of development

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**CASE STUDIES**

**strategy at regional and city scale level urban design at neighborhood scale of creative environment for innovative companies in start-up phase of development**

**vision enhancing the interests of top-down policies as well for bottom-up initiatives**

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**SECTION**

**method**

**final product**

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**introduction**

**1.6 Methodology**

**1.6.1 Methodology scheme**
1.6.2 Methodology approach

This graduation project is divided into several phases of which the approach per phase will be explained on this page. Each phase has its method, collecting of information and (expected) product.

Theoretical framework

Method
Through reviewing literature, in the theoretical framework a link will be made between the spatial conditions for a city to strengthen its position in the knowledge economy and the spatial requirements of the life cycle of development for innovative industries. This will result in a collection of determinative factors at the regional, city and neighbourhood scale that will be linked with the different phases of development of an innovative company.

Collecting of information
For the spatial conditions for a city to strengthen its position in the knowledge economy, the foundation theory of van Winden et al. (2007) will used as the main source. In his theory, van Winden explains what the determinative factors are for a city to strengthen its position as a knowledge city. Hereby also theories as the skilled city theory of Glaeser and Saiz (2003) and the creative class theory of Florida (2002) are used as well, since their works have been very influential in the human capital theories to stimulate the city’s economic growth. More theories will be used to strengthen or contradict one’s opinion, in order to have a broader perspective on each specific theme.

For the implementation of the life cycle of development for innovative industries, the theory of Saris and Modder (2005) will be used as the main theory. Saris and Modder explain four different kinds of creative environments which are represented in the life cycle where companies concerning innovations activities move along.

In additional literature, whether supportive or contradictory, the theory of Black (2004) is an interesting source, because it contains the requirements for small firms innovations. This will be used especially to investigate the need for a supportive environment for companies in the start-up phase in the life cycle of development.

Because there has not been made a very strong link between the spatial conditions for a city in the knowledge economy and the life cycle for innovative companies, personal interpretation is needed in order to make this link.

(Expected) final product
The outcome of this theoretical framework will be presented in an overview with the determinative factors per scale level explained per creative environment. The determinative factors deriving from the theoretical framework will be further used in the next section, the analyse of the Brainport on those specific factors.

Analysis

Method
The determinative factors deriving from the theoretical framework will be analysed in the context of the Brainport. Hereby the SWOT method will result in the strengthens, weaknesses, opportunities and threats of those specific determinative factors.

This will show what extent the Brainport region meets the requirements derived from the literature framework. Thereafter, the possibilities will be investigated how these requirements can be met in a realistic way for the Brainport. Besides the analysis of the Brainport region itself, comparative case studies will be used to learn from the strengthens and weaknesses of comparative examples in practice.

Collecting of information
The majority of the analysis, especially at the regional and city scale level, will be done through urban analysis. Policy documents will be used to take into account the visions on the relevant themes. For statistics, the website of the Statistics Netherlands (CBS) and municipalities will be used.

(Expected) final product
The majority of the analyses, especially at the regional and city scale level, will be presented in maps. Combined maps will be used to link multiple relevant information to each other and therefore easily readable and useful for further investigation.

Vision

Method
The theoretical framework and analysis will be used as foundation for creating the vision for the Brainport. The aim of creating the vision is how the strategically programmatic requirements of the life cycle of development for innovative industries can be implemented in the context of the Brainport. The vision will also take into account the interests of larger as well for smaller involved actors.

To realise a realistic strategy and design for the Brainport, the conclusions derived from the theoretical framework will be used as aim, but cannot be literally copied.

Collecting of information
By using the mixed scanning method, the interests of the involved parties at different scale levels will be taken into account for creating the vision. This means there should be a right balance between top-down and bottom-up interests. The top-down interests will mainly consist of analysing policy documents of the province and municipalities.
The bottom-up interests will be done interviewing the Brainport related businesses, which is partly done and can be found in the appendix of this thesis plan.

(Expected) final product
The goal is to investigate through analysis to what extent the conclusions derived from the theoretical framework are possible in the context of the Brainport. Therefore this will be a strategically programmatic vision which shows how the life cycle of development for innovative companies can be implementated in the Brainport. The actual spatial interpretation of this vision will follow in the design phase.

Design
Method
The created vision will form the foundation for the design phase. During the design phase, there will be a constantly reflection to the theoretical framework and analysis as well. To achieve a good alignment between the different scales, it is needed to work on the three scale levels at the same time. This will lead to a consistent design proposal.

Collecting of information
All the previously done work will be used as the foundation for the design phase. The vision, derived from the theoretical framework and analysis, will be used for the design phase. For implementing the conditions derived from the vision, personal interpretation is needed for the spatial translation towards a design.

(Expected) final product
The design phase is distinguished into the regional, city and neighbourhood scale. After having created a strategy for the Brainport region and the city of Eindhoven, the urban design will be a spatial interpretation of an creative environment for innovative companies in the start-up phase of development. The aim is to design an environment which consists of the spatial conditions that stimulates the innovation of entrepreneurs in their phase of development. This includes the stimulation of meeting places for (spantaneous) face-to-face contacts and supporting facilities. Expected is that the design at neighbourhood scale will be the transformation of an industrial site within the city of Eindhoven.
introduction

1.7 Planning
Several critics state that cities are facing problems if the only focus is attracting or retaining highly educated people. This can result in the exclusion of lower educated people. However, I think that a high amount of highly educated people will stimulate the economy of a city and its surrounding region, where eventually also the rest of the residents can benefit from. Research about the *trickle-down effect* (Aghion and Bolton, 1997) has shown that highly educated people tend to spend more money, which leads to an increase in a city's employment. Especially bars, cafes and theatres are places where people spend more money and therefore increase the employment in these sectors. And because the jobs in these sectors mostly are completed by lower educated people, they also benefit from this development.
2 THEORETICAL FRAMEWORK
This section consists of the theoretical framework, where the following sub-research question will be answered:

*What spatial conditions are on what scale level determinative for a city and its surrounding region in the knowledge economy and how can these be addressed along the life cycle of development for innovative industries?*

To answer this sub-research question, literature of the spatial conditions for a city to strengthen its position in the knowledge economy will be linked with the life cycle of development for innovative industries. This will result in a collection of important conditions at the regional, city and neighbourhood scale that will be linked with the different phases of development of a innovative company.

For the spatial conditions for a city to strengthen its position in the knowledge economy, the *foundation theory* of van Winden et al. (2007) will used as the main source. In his theory, van Winden explains what the determinative factors are for a city to strengthen its position as a knowledge city. Hereby also theories as the *skilled city theory* of Glaeser and Saiz (2003) and the *creative class theory* of Florida (2002) are used as well, since their works have been very influential in the human capital theories to stimulate the city’s economic growth. Furthermore, more theories will be used to strengthen or contradict one’s opinion.

For the implementation of the life cycle of development for innovative industries, the theory of Saris and Modder (2005) will be used as the main theory. Saris and Modder explain four different kinds of creative environments which are represented in the life cycle where companies concerning innovations activities move along.

In additional literature, whether supportive or contradictory, the theory of Black (2004) is an interesting source, because it contains the requirements for small firms innovations. This will be used especially to investigate the need for a supportive environment for companies in the start-up phase in the life cycle of development.

Because there has not been made a very strong link between the spatial conditions for a city in the knowledge economy and the life cycle for innovative companies, personal interpretation is needed in order to make this link.

The outcome of this theoretical framework will be presented in an overview with the determinative factors per scale level explained per creative environment. The determinative factors deriving from the theoretical framework will be further used in the next section of analysis, to analyse the Brainport on those specific factors.
The literature review for the regional scale results in determinitive factors that stimulate the innovative capacity of the urban region in the knowledge economy. These are linked with the creative environments required in the life cycle of development of innovative industries.

- knowledge base
- industrial base
- regional urban structure
- accessibility
- landscape and recreation
1 Knowledge base

In the shift from a manufacturer economy towards a knowledge economy, the human capital is seen as the most important indicator for economic growth (Glaeser and Saiz, 2003; Florida, 2002; Marlet, 2009). According to Glaeser and Saiz’ skilled city theory, in the knowledge economy the amount of highly educated people is positively related to the growth of employment in urban regions, especially in the business and financial services. Highly educated people appear to be more productive, spend more capital on local services and are more likely to start up their own business. They can also adjust themselves better to new economic circumstances, ideas and technologies than lower educated people. This explains why many companies prefer to be located in these skilled cities (Glaeser, 2001) and stimulate their development, which will stimulate the region’s development as well.

Although Glaeser and Saiz’ skilled city theory has been largely supported by many professionals and is used in many research studies to measure a region’s human capital, professionals claim the creative class theory of the American theorist Richard Florida a more precise indicator for the human capital of a urban region. The main difference between the theories is that Glaeser and Saiz’ skilled city theory measures human capital based on the level of education, while Florida’s creative class theory measures human capital based on the actual profession people execute (Florida, 2002). A highly educated person can be unemployed, while someone who did not finish his school can be high productive and create innovation. “A slightly better handle on actual skills, rather than using only an education-based measure - not measure what people do, rather than just what their training may say about them on paper” (Florida, 2004). The main essence of the creative class is that not only the level of education causes innovation and a high productivity, but also creativity in work.

However many professionals accept Florida’s creative class as a better indication to measure human capital, there is also lots of critique about the standard Florida uses to determine which professions belong to the creative class. In his method, even professions like a teacher at the primary school belongs to the creative class. This obviously explain why according to Florida, 35 percent of the American population is belongs to the creative class (Florida, 2002).

Knowledge resources

Following the before mentioned human capital theories, multiple theories have been written about how a region can improve its ability to create innovation.

In the knowledge economy, van Winden et al. (2007) stresses the activities of universities, polytechnics and other public and private R&D labs as the main knowledge sources in the urban region. A good alignment between research, education and regional business sectors ensure economic development in the urban region. Businesses can benefit from the research activities from the universities and R&D labs that functions as knowledge sources, which they can use for their own activities.

However, the reliance on these knowledge sources, depends very much on a company’s phase of development (Black, 2004). Feldman (1994) supports this difference by noting a more reliance of small firms on external knowledge sources than larger firms. Therefore especially companies in the start-up phase have the incentive to locate near research universities to acquire knowledge useful to their own innovative activities (Black, 2004).

The more companies move along the life cycle of innovative industries, the more they have the capacity to internalize their knowledge production (Feldman, 1994). This makes the further developed companies rely less on external knowledge source and therefore more independently in their location choice.

2 Industrial structure

One of the debates in the literature, without a very clear outcome, is about the pros and cons of diversification or specialisation of the urban economy (Duranton and Puga, 2000). However, many agree on the fact that cities with a weak industrial structure (specialised in traditionally industry and port activities) have a economic base which is associated with a lower-educated workforce, fewer high-level amenities and a housing stock of poor quality. This makes it extremely difficult for these cities to retain or attract knowledge workers or knowledge-intensive companies (van Winden et al., 2007).

In the debate about diversification or specialisation, empirical studies has shown a larger economic growth in cities with a more diversified sectoral economy than cities with a specialized economy (van Oort, 2002). The scale of the urban region appears to be a crucial factor whether it sustains a broad range of economic sectors. Therefore medium sized and provincial urban regions tend to be more specialised and metropolitan areas more diversified (van Winden et al., 2007).

According to Jacobs (1961) medium sized and provincial cities can not ensure themselves economic growth at the long term, because cities with a very specialized sectoral structure only tend to flourish in a sector specific period. A diversified economy is less vulnerable in rapidly changing economic circumstances. Creative and innovative industries seem to benefit from a diversified economy as well, since this offers more scope for incubation and crossfertilisation between sectors, leading to innovations and new businesses (van Winden et al., 2007). Especially startings firms benefit from this development (Black, 2004).
3 Accessibility

According to van Winden (2007), the knowledge economy is a networked economy where corridors appear to be very important. In general, especially metropolitan cities score well on accessibility (international airports, HST connections): they are linked-up globally. With fast international transport connections it gives the city access to metropolitan amenities and international infrastructures and communities, which helps them to attract talent from abroad. Van Winden explicitly calls the lack of these international transport connections a key barrier for provincial towns to economic development.

Research of Baum et al. (2007) agrees with van Winden. He says that a city’s (inter)national, regional and multimodal accessibility is a very crucial condition to be successful in the knowledge economy (Baum et al., 2007). This means good connectivity by airplane, (inter)national train, regional and local transportation networks are required. Additional to the theory of van Winden, Baum et al. stresses the importance of the different levels of transport that should be closely connected with each other (Baum et al., 2007).

Concluded can be that a city and surrounding region’s accessibility becomes of increasing importance in the knowledge economy. Especially for companies in the final phase of development, who in most cases have an international network, the importance of these connections on (inter)national scale seem to increase.

4 Regional urban structure

The regional urban structure of the region influences the flows of knowledge that affect the innovative capacity of a city. Florida (2002) stresses the importance of proximity as one of the main conditions for a regional model in the knowledge economy. According to Florida, proximity in the regional urban structure stimulates the exchange of knowledge, access to ideas and generation of innovation. The innovative capacity is much higher in an urban context with high density than in a more sprawled structure. Black (2004) agrees with the importance of proximity, by explaining that the impact on a region’s innovative capacity also diminished as the distance increase.

This indicates that innovative companies especially those in the first phase of development have the need for this access and exchange of ideas and face-to-face contact. This makes regional urban models such as the compact model, network model and polycentric model desirable in the knowledge economy (Baum, 2007). These models tend to avoid a sprawled structure and focus on maximizing proximity, which is needed in the knowledge economy. For provincial towns it also overcomes scale disadvantages, spatial as well for non-spatial connections (van Winden, 2007).

Since a provincial town cannot hope to become a metropolitan area at short notice, it could look for opportunities as collaborating with neighboring cities and regions, for instance by improving its mutual transport connection, sharing facilities, education programmes of their universities and culture.

5 Landscape and recreation

Ullman (1954) was one of the first to name the importance of natural amenities for the attractiveness of a city and surrounding region. Later on, Gebriel et al. (2003) also named the presence of these natural amenities of high value to strengthen a city and surrounding region in the knowledge economy. Cities being positioned in a region with an attractive natural setting, are the most popular places for people to work and live. Therefore Gabriel et al. also find the accessibility from the city to the nature, a river of the sea as an important condition. People tend to pay more for their place of residence if its position in an attractive natural environment. Mills and Hamilton (1994) strengthen this opinion with the phrase of ‘half of the pay for a view of the bay’.

Also the opportunities for outdoor recreation (parks, sports pools, recreational lakes, zoos and amusement parks) seem to stimulate the growth of certain cities. parks (Marlet, 2009). It seems to be a reason for people to decide to live in a certain city (Cushing, 2004). Although there is no empirical evidence for this (Enbar, 2004), especially highly educated and creative people have the preference of individuals sports. They can do this any time of the day, without any appointment (Florida, 2002). Therefore the proximity and accessibility to natural amenities are appreciated when it fits in their daily pattern and can be accessed without having it scheduled.
2.2.2 City scale

The literature review for the city scale results in determinative factors that stimulate the innovative capacity of the city in the knowledge economy. These are linked with the creative environments required in the life cycle of development of innovative industries.

- urban amenities and quality of life
- scale
- urban diversity
- culture
- aesthetics

1 Urban amenities and quality of life

In the manufacturing economy, during the industrial revolutions in the nineteenth and early twentieth century, companies were located close to mines, rivers and harbours. The presence of raw materials and accessibility of the area explained the concentration of economic activity (Righart, 1991).

But with the global shift from the manufacturing economy towards a knowledge-driven economy, new theories have been written about determinative factors for countries, regions and cities to remain competitive. Among these theories, the one of Glaeser (2001) and Florida (2002) are seen as the most influencing theories. Both theories emphasize the changed relationship between the companies and its employees.

Florida finds that in the manufacturing economy, ‘people used to follow their jobs slavishly to places’. But now, in the knowledge economy, the people are seen as the main transmitters of knowledge. The urban knowledge economy thrives on talented people who create new knowledge and ideas. From this perspective, Florida finds that the quality of life in a place is a key determinant to attract and retain these people.

Florida (2002) found empirically that urban amenities are the key assets of urban competitiveness: “Talented people do not simply select a place to work based on the highest salary, they are typically concerned with a whole series of place-based characteristics.”

In line with Florida’s theory on the importance of urban amenities, Dijkstra (2004) names the following as attributes of quality of life: an attractive built environment, high-quality houses, attractive city parks, attractive natural surroundings, the absence of pollution; a rich variety of cultural institutions and also high-quality hospitals and (international) schools.

The presence of these urban amenities makes the urban region a more attractive place for talented people to live and work. Therefore it puts companies in a better position to attract human capital in the national and international competition.

2 Scale

In his research van Winden (2007) measures the scale of a city according to its amount of inhabitants instead the actual size of the city. According to location theories of companies, cities, and especially cities in an urban agglomeration, have a clear advantage in the knowledge economy. Their characteristic of a more densely and varied population and a high variety and amount of amenities for their citizens (Marlet, 2009) makes them more able to attract and retain companies and knowledge workers.

An important explanation for this is the appearance of labor pooling market, which especially occurs in cities (Baum et al., 2007). This is the accessibility firms have to a variety of skilled laborers, which in turn provides employment opportunity for the laborers. This requires critical mass, which explains why cities, and especially cities in an urban agglomeration, have an clear advantage in the knowledge economy.

Van Winden confirms the importance of scale for cities in the knowledge economy with three arguments. First, scale matters for companies: in a larger city, it is easier to find specialised staff and suppliers and make connections scale matters to attract and retain knowledge workers. Secondly, scale matters to attract and retain knowledge workers. Being in a large metropolitan area increases the variety of jobs available and hence the chance of finding the right job. Thirdly, a large urban size supports facilities and amenities that are conducive to attracting knowledge workers and firms: larger cities tend to have bigger airports from which more destinations can be reached and many of them are nodes on a high-speed rail network; and size is needed to support international sub-cultures and amenities such as international schools.
3 Urban diversity

In the theories on a city and surrounding region’s competitiveness, Gläser (2001) stresses the importance of the consumer cities, which are characterized with the presence of a large variety of urban amenities. This has been discussed in this paragraph under ‘urban amenities and quality of life’.

Florida (2002) however disagrees with this theory and finds that successful cities are the ones with the highest concentration of talented and creative people, which creates a tolerant urban climate. Florida calls these cities, cities with ‘low barriers to entry’. The attraction of these groups of people will lead towards an increase of the creative and innovative capacity of a city and surrounding region.

Van Winden et al. (2007) agrees with Florida’s theory of an tolerant urban climate by mentioning that the diversity of inhabitants and types of economic actors promotes creativity and facilitates the interactions that generate new ideas. The places that attract diverse groups of people (by ethnicity, nationality, gender and sexual orientation) have an environment that is easy to plug into and low entry barriers for talent.

Even though there is no evidence that this also counts for the Dutch context (Marlet, 2009), it is conceivable that a city stimulates its entrepreneurship if it does not exclude certain types of people.

5 Culture

Among the urban amenities, culture appears to be one of the most valuable amenities for attracting human capital (Marlet, 2009). But within this category, different kinds of culture have a different impact on a city and surrounding region’s position in the knowledge economy (Clarke, 2003).

According to Marlet (2010), big events tend to be more focussed on tourists and results only in temporary publicity of a city. Small scale culture, especially performing arts, is more focussed on its residences. This assumes that culture focussing more on its residences, will contribute to a city’s attractiveness.

Continuing on Marlet’s theory on events, Oldenburg (1999) finds in his research the importance of cultural amenities as meeting places. These are places where people with diverse backgrounds gather. This gathering stimulates the exchange of knowledge and creates certain ‘buzz’ for the generation of ideas (Heebels and van Aalst, 2010). Linking the need of entrepreneurs in the start-up phase of development of external knowledge sources, makes cultural amenities especially for companies in the starting phase of development of high importance.

Besides the kind of cultural activities that take place, the location also matters. In her book, Cerutti (2011) mentions that there is a certain pride for the local inhabitants, when historical heritage is used in a new way for these cultural activities. Besides this, the old industrial site becomes a symbol for a new image for a whole area, and that way contributes to the cultural and economical development of an area.

6 Aesthetics

The aesthetic quality of a city is invaluable for a city’s attractiveness. This puts the cities blessed with a historical inner city in a better position to attract human capital. Especially young urban people feel attracted to historical buildings, because they have the need to identify themselves with historical buildings and environments. This creates a certain pride as a resident (Marlet, 2009).

The value of historical buildings explains why theatres, bars and restaurants are more attractive once they are located in a historical building (Florida, 2002). Apparently there is a certain need for authenticity. And combining areas with historical buildings within walking distance with cultural amenities and restaurants, so-called walking cities (Gläser, Kolk and Saiz, 2001), are very appreciated.

The presence of old buildings in an unutilized or decaying status creates the opportunity for the localization of starting firms. These buildings have in general lower rental prices and because starting firms have less financial resources, they are especially looking for an affordable place (Jacobs, 1961).

Although there is no clear answer, larger firms are more likely to be located in newly constructed buildings. Since they have more financial resources, they have the ability to settle down in a building which perfectly meets their requirements. They prefer a more efficiently organized environment, which mostly are the typical business and science parks (Heebels and van Aalst, 2010).
2.2.3 Neighborhood scale

The literature review for the neighborhood scale results in determinative factors that stimulate the innovative capacity of a neighborhood in the knowledge economy. These are linked with the creative environments required in the life cycle of development of innovative industries.

- location
- real estate prices
- antiquity of built environment
- urban structure
- accessibility
- third places

1 Location

Proximity as well on the regional scale, city scale and neighborhood scale matters the exchange of knowledge, access to ideas and generation of innovation (Maldonado, 2010). However, the need for proximity at the very small scale differs between companies depending on their phase of development. According to Saris and Modder (2005), companies depending on the phase of development differ to what extent they offer a supportive urban environment that generates innovation. This so-called sense of place (Florida, 2002; Heebels and van Aalst, 2010; Smit, 2011) appears to be valuable in the location choice of innovative companies.

Especially innovative companies in the first phase of development have the need for a supportive environment that stimulate face-to-face contact. But because their need for affordable spaces (Saris and Modder, 2005), the actual start-ups tend to localize more on the outskirts of the city centre (De Stad, 2005a).

As the companies move along the life cycle of development and become more market orientated, they have the need for environments with lots of interaction between (potential) customers and clients (Black, 2004; Saris and Modder, 2005). Therefore these companies prefer to be located in inner cities (De Stad, 2005a).

When companies reach the final phase of development, the companies become more focused on production costs and therefore prefer an efficient organized environment (Saris and Modder, 2005), such as business and science parks. Because of their size, these companies do not benefit any more from external interaction (Black, 2004). Therefore they a mostly located on the so-called highway location all over the country (De Stad, 2005a).

2 Real estate prices

The different creative environments of innovative companies are distinguished by the degree to which they need an supporting environment. The higher companies have the requirements to their supportive environment, the higher the real estate prices. In the very first phase of development, companies are more in the experimental phase. Therefore they do not require very much from their environment and prefer to be located in an area with affordable spaces.

But the more market orientated the innovative companies become, the higher the requirements to its surrounding (De Stad, 2005a). Here, the companies have the need for a dense area where there is high potential of customers and clients. These locations are mostly inner cities, where the real estate prices are relatively high.

Companies in the final phase of development have less requirements for its surrounding, it only needs to be efficient (De Stad, 2005a). They have no need for an surrounding environment which stimulates interaction with (potential) clients of other companies (Black, 2004). Therefore the price per square meter is cheaper in the final phase of production.
3 Antiquity of built environment

There does not seem to be a clear answer whether an environment with a large proportion of historical buildings stimulates innovative activities more than an environment with a smaller proportion. However, a city with a large proportion of historical buildings, is in a better position to attract human capital and innovative companies (van Winden et al., 2007). And on a smaller scale, Saris and Modder (2005) indicate the antiquity of the built environment as an indicator which distinguishes innovative companies depending on their phase of development.

Companies in the first phase of development have limited financial resources, which explains why they at first prefer to be located in existing buildings. They do not have the financial resources yet to allow themselves a new constructed building. Besides that, starting companies, especially the ones with young urban people, feel more attracted to historical buildings because they feel a certain identity with it (Heebels and van Aalst, 2010). Although innovative companies in the final phase of development do have the financial resources for a new constructed building, it can not be stated clearly they only prefer new constructed buildings. Since the last decade, more headquarters also prefer to be located in existing historical buildings where they can identify with. However, the existing buildings need to have the functional capacity that large firms require.

4 Urban structure

In her notorious book *The life and death of great American cities* (1961), Jane Jacobs investigated what spatial conditions stimulate the creativity and therefore also innovation. According to Jacobs, the street, where many different kinds of people came together, was the source for creativity. Since people lived close together in small private spaces, the street provided the venue for a more or less continuous conversation and interaction, kept alive by the frequent random collisions of people and ideas (Jacobs, 1961).

According to Jacobs, the following spatial conditions stimulates creativity:

- short blocks, that generated the greatest variety in foot traffic
- wide sidewalks and a tremendous variety of types of buildings (apartments, bars, shops, even small factories) which means that there were always different kinds of people outside and on different schedules
- lots of old, underutilized buildings, ideal for individualistic and creative enterprises ranging from artist's studios to entrepreneurial shops

Smit (2008) follows Jacobs by claiming that there is an increasing need for areas where living and working are mixed, instead of the monofunctional clustering of functions.

Especially market orientated innovative companies can benefit from dense environments with a increasingly high diversity of people, which are in fact their (potential) clients and customers. But although Jacobs’ theory has many fellow thinkers, not everybody agrees. According to Glaeser (2004), not everybody has the need for a dense, amenity rich, hip area for social interaction. He suggests that especially young urban people prefer this type of environment. But once they become more established, the more people have the need for more formal and less dense environments as well.

5 Accessibility

Research of Smit (2008) has shown the importance of a place that is good reachable not only for themselves, but also for their (potential) customers and clients. However, it differs depending on a company phase of development (Heebels and van Aalst, 2010).

The companies in the first phase of development find themselves in an experimental phase where they do not yet receive (potential) customers and clients (Heebels and van Aalst, 2010). Therefore in most cases, the accessibility of their company is only important for themselves.

However, the importance of accessibility changes when innovative companies are moving along the life cycle into a more market orientated phase. Their surrounding should become more representative and easily accessible for (potential) customers and clients (Saris and Modder, 2005). This also stimulate the optimal use of the place (Marlet, 2009), where a more spontaneous visit are made possible simply when passing by. Hereby the surrounding is the company's business card.

For companies in the final phase of development, its accessibility is still of high importance. Especially once companies have a national of even international network, those companies rely more on greater transport connections such as (inter)national train and air connections to receive clients and customers.
6 Third places

From the perspective that in the knowledge economy social interaction have become more important, Oldenburg (1999) stresses the importance of the so-called third places. Third places are neither home nor work, but venues like coffee shops, bookstores and cafés which are less formal settings for interaction.

The importance of third places also arises from the changing nature of work. More people do not work on fixed schedules and more work in relative isolation (Florida, 2002). Therefore these third places especially function as well as place to work for companies with a limited amount of employees.

These third places also cause a spontaneous, unplanned coming together of people, which can result in the exchange of knowledge, generation of ideas and thus innovation. Meeting in third places are therefore also crucial to obtain assignments and network.

However, research done by Smit (2008) and Heebels and van Aalst (2010) nuance importance of the use of public space as network facility. The addition they make as a result of their research is that these third places are of different importance for different phases of development. Companies in the first phase of development have a higher need for face-to-face contact and social interaction and thus benefit more from the proximity to third place. The more established innovative companies rely less on external resource of knowledge and there face-to-face contact and public opportunities are less relevant (Heebels and van Aalst, 2010).
This chapter of the theoretical research has resulted in the composition of multiple conditions on the scale level of the region, city and neighborhood. The determination of these conditions form the answering of the research questions which was mentioned in the introduction of this chapter.

Through this theoretical research, different theories on the same subject have been weighed. But although complementary, supporting and contracting theories have been used for the creating of an standpoint, the outcome of the research should however not be taken too deterministic. It forms an indication of a desired situation.

The results of this chapter will be used in the following chapters, where the Brainport region will be analyzed on the conditions derived from this chapter.
3 REGIONAL ANALYSIS
3.1 Introduction

This chapter consists of the analysis on regional scale level, the Brainport region. The region has been defined in paragraph 1.4 as the cities of Eindhoven and Helmond and surrounding area. From the theoretical framework derived a collection of determinant conditions on the scale level of the region, city and neighborhood for a city and surrounding region in the knowledge economy. In this section of the analysis on the regional scale level, the Brainport region will be analysed to what extend it meets these requirements that derived from the theoretical framework.

The analysis will be done through the mapping method and the collecting of relevant data. Finally, each section ends with a conclusion on that specific subject. This chapter ends with a conclusion in paragraph 3.8 where the findings of the different sections of this chapter will be linked together. This will result in a written vision for the Brainport on the regional scale level.
3.2 Knowledge base

The knowledge base of a region is not only determined by the kind of knowledge that is in a region, but also how this knowledge excels through the exchange of it so it can result in new ideas and thus innovation (Glaeser and Saiz, 2003). The exchange of knowledge between individuals, but especially between different businesses, institutions and local government is very important (van Winden et al., 2007). This collaboration between three aforementioned actors is named ‘triple helix’ and is seen as the driving force for a region in the knowledge economy. This term consists of a close collaboration between the local government, business and institutions. In this way, a region benefits from the physical proximity between these actors, which allows innovation and ideas to excel in technological and social ways and also to convert into concrete results and projects. Because this proximity between the participants is crucial, smaller regions are in general able to realise a better triple helix cooperation.

A good triple helix cooperation is the case for the Brainport region as well (van Winden, 2007). The organization comprises a group of professionals, who work regularly with representatives of the local governments, businesses and institutions to discuss each other’s needs and ideas. This often leads to the initiation of new projects, such as the realization of a broadband network throughout the entire region and the Brainport Health Innovation project, a platform for parties in the health care sector to share ideas and bundle initiatives. The role of the different participants within this triple helix cooperation of the Brainport region will be analyzed further in this section.

![figure 3.1: Few of the participants in the triple helix cooperation Brainport region]
Institutions

The role of institutions within the triple helix cooperation is the attracting of (potential) talent to the region. On the universities, polytechnics and other research labs they gain cutting edge knowledge on the latest innovations in all kinds of disciplines, which makes them very interesting for the businesses in the Brainport region.

The Brainport region consists of two universities with a very strong specialisation. With this specialization they have a very strong focus and can therefore focus on specific groups and makes them able to attract students from all over the country and even from all over the world.

The region’s largest and most renowned university is the Eindhoven University of Technology (figure 3.2). With over 7,000 students it is a medium sized university, specialised in fields as Biomedical Engineering, Chemical Engineering and Mechanical Engineering. The university gains lots of international recognition and besides that, the university supports graduates for setting up their own business by providing workspaces on the university campus.

The region’s second largest university is the Design Academy. Founded as the Akademie voor Industriële Vormgeving Eindhoven in 1947, it has undergone a name change into Design Academy in 1997. Especially since this decade, the academy gets much international recognition for its education and its graduates. One of the most well known former students of the academy is Piet Hein Eek, famous for its furniture designs.

The growth of the Design Academy also has its influence on the character of the entire region. It changed the Brainport from a region strongly specialised in the technological sectors, into a region with also a design character. A concrete example of this is the redevelopment of the former Philips area, Strijp-S into an area for new creative, innovative businesses.

This development of changing the Brainport region into a region with a more diverse character is still going on. The region has defined five focal sectors (high tech, design, lifetec, automotive and food technology) where it wants to specialize in. This decision is also being carried out by the institutions through offering bachelor and master programmes specialised in these sectors. A recent example of this is the establishment of the university of applied sciences Fontys Automotive in 2012, which gives talent the possibility to learn for a career in the automotive industry in the Brainport region.

### Figure 3.2: Amount of students of the educational institutes in and around the Brainport region

<table>
<thead>
<tr>
<th>Educational type</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>&lt; 5 000</td>
</tr>
<tr>
<td>University of applied sciences</td>
<td>5 000 - 10 000</td>
</tr>
<tr>
<td></td>
<td>10 000 - 15 000</td>
</tr>
<tr>
<td></td>
<td>&gt; 15 000</td>
</tr>
</tbody>
</table>

Source: website of educational institutes
Leiden Ranking

The quality of the scientific output of universities is being presented in the Leiden Ranking. This is a research ranking, based on bibliometric indicators, that has been developed by the Centre for Science and Technology Studies in Leiden, the Netherlands. Hereby the average number of citations of the publications of a university, normalized for field differences, publication year, and document type will result in a MNCS value (Mean Normalized Citations Score). This indicates the average times that a publication of a university have been cited above world average (1.00).

As shown in the figure 3.3, the Dutch Universities have in general a higher MNCS score than the Belgium and German universities. The Eindhoven University of Technology has a MNCS value of 1.28, with which after the University of Utrecht and the Wageningen University it is the third Dutch university.
Business

The businesses in the Brainport region were once characterized by the many traditional family businesses, such as Philips, DAF and VDL. Through constant innovation they have gained international recognition and some of the Brainport companies even became world market leaders. Nowadays the Brainport region is the Dutch powerhouse for research and development activities (figure 3.5). Many national and international knowledge intensive businesses find their way to the Brainport region for locating their research and development department. One of the reasons for this is the presence of human capital in the region. The province of North Brabant is, after the Randstad region, the region with the strongest concentration of highly educated people in the Netherlands (figure 3.6). This results a strong position for the region in the knowledge economy. Beside that, the Brainport has a long history with innovation and research and development, which creates a certain path dependency. This has resulted in a concentration of companies concerned with these activities and therefore new companies are more likely to be located in a region as the Brainport instead of somewhere else.

Remarkable about these knowledge intensive companies is their amount of investments in research and development. Of the Dutch-based companies with the most expenditures on research and development, the top three is located in the Brainport region (figure 3.4). This is distinctive for the Brainport region, since the majority of the investments in research and development in the Brainport is being done by the private sector. Innovative companies like TomTom and Philips have their research and development and product development largely concentrated in Eindhoven, while they do many of their production activities at other locations. Another example is the supply chain of ASML, which among others consists of several hundred companies located in other regions in the Netherlands and Europe.

figure 3.4 top 10 private R&D expenditures
source: Technisch Weekblad, Top 30 bedrijfs-R&D in Nederland, 2010
figure 3.5  concentration of R&D activities
source: Pieken in de Delta, 2004

figure 3.6  educational level (age 15 - 64)
by municipality
source: CBS, 2011
Local government

The local government of the Brainport region is represented by parties as Brainport Development and cityregion Eindhoven. They ensure the interest of the Brainport region as an important cornerstone of the Dutch economy in which High Tech Systems & Materials, Food, Automotive, Lifetec and Design are the focal sectors. These parties do not have an executive role, but are primarily advising.

Brainport Development is a development company, that works together with representatives from the triple helix cooperation as industries, knowledge institutions and the government to strengthen the Brainport top technology region. Brainport Development encourages and develops regional and (inter)national projects and programmes. Beside that it serves commercial exploitation and advertising of the region and facilitates regional industry through business advice and funding, incubation facilities, business premises and business centres.

The cityregion Eindhoven (Samenwerkingsverband Regio Eindhoven) is a cooperative agreement among the municipalities around the city of Eindhoven. The SRE is specialized in the fields of spatial planning, traffic and transport, housing, environment, recreation and tourism, education, health, culture and socio-economic affairs. The purpose is to bring about a balanced development of the region, in which there are rural districts in addition to a clearly defined urban district, each with its own set of problems and opportunities. Although the cityregion Eindhoven is far more than just an economic agreement, it does includes economic cooperation.

A recent example of a project initiated by Brainport’s local government is the HOV2 project that will expand Eindhoven’s high quality public transport axis towards the surrounding municipality of Nuenen. On figure 3.7, the city region Eindhoven (SRE) and the municipalities of Nuenen and Eindhoven celebrate the agreement on signing the letter of intent for the new public transport axis that will run from the central station of Eindhoven vai the High Tech Campus Eindhoven to Nuenen.

figure 3.7 On February 25, 2010 the agreement for the project HOV2 was signed by Drs. H.J.A. van Merrienboer, alderman municipality of Eindhoven, Ir. J.A. Mulder, alderman municipality of Nuenen and Drs. A.A.M. Jacobs, portfolio holder Traffic & Transportation of cityregion Eindhoven (SRE) source: hov2.nl
Conclusion

Collaboration between institutions
The Brainport region benefits from a good triplex helix cooperation, which very often leads to concrete projects that strengthen its position in the knowledge economy. The institutions in the Brainport region are according to their amount of students not larger, but yet more specialized than those in surrounding regions. Therefore, the knowledge base in the Brainport region can be characterized as medium sized and specialised. Because of the modest scale, a possibility for the institutions in the region is to set up collaborations with institutions in surrounding regions. A partnership where the Brainport and the Eindhoven University of Technology is already working on, is the so-called ELAt (Eindhoven, Leuven and Aachen triangle), a cross-border collaboration between the universities of Eindhoven, Leuven and Aachen. However, the realisation of such collaborations also include spatial interventions like public transport connections, which are currently not sufficiency enough. Further research about this is being presented in the section of accessibility.

Retaining of talent
The position of the Brainport as a knowledge region can be largely explained by few large companies who invest many budget in research and development activities. But the contrast is very large with smaller and starting companies, who are finding significant problems in their development. This problem can be explained by the fact that for many talent, the region only functions as a stopover in their career. With its renowned universities and academies with a clear specialisation, the Brainport region attracts talent from all over the world. However, very few of them also decide to stay in the region after graduation to start a career.
Cities with a sectoral diverse economy can expect the most sustainable economic growth in the knowledge economy on the long run (van Oort, 2002). Therefore large cities and especially those in metropolitan areas are in an advantageous position. Regions with a specialized economy only tend to flourish in a sector specific period, while regions with a more diverse economy are able to attract more groups of people and are less vulnerable for sector-specific downturns.

Eindhoven and surrounding region have always been dominated by the high tech sector, which has given the region its character of top technology region and appointment of Brainport status in 2004. However, this dominance of one sector can have bad consequences on the entire region in times of stagnation.

In line with the top sector policy by Ministry of Economic Affairs to make specific sectors the subject of renewed attention in the coming years, the local government of the Brainport has also marked five focal sectors, which should result in a more diverse industrial structure of the region. The focal sectors for the Brainport region are: high tech systems & materials, design, automotive, lifetec and food.

In the current situation, there is still a clear dominance of the high tech sector in the Brainport economy (figure 3.8). Therefore, the economy of the Brainport region needs to not only focus on expanding its high tech sector, but also on the growth of the other sectors (figure 3.9). A process that already has been put in motion with developments, such as Strijp-S in Eindhoven for the design sector and the planned Automotive campus in Helmond for the automotive sector.
The drawings on this page show where the Brainport related businesses per sector are located. In general, most of the businesses are positioned around the city of Eindhoven on traditional business and science parcs. Only the design sector is an exception to this. The businesses in this sector are mainly located on inner city sites, such as the city centre and Strijp-S. The phase of development of the Brainport related businesses appears to have no influence on their location. Independently their phase of development, most businesses are located on traditional business en science parcs. But as derived from the research, starting companies have need for a very different supportive urban environment than companies in a more advanced stage. However, this life cycle of development does not seem to be applied on the Brainport region.
As being discussed in the section on the knowledge base of the region, the large businesses with their expenditures on research and development are largely responsible for the strong position of the Brainport as a top knowledge region. The Brainport region appears to be largely dependent on the research and development investments of those firms. The risk of the reliance on those large firms however is the moment when a company decides to move its research department or headquarter to another location. Like the departure of Philips in 1997, when it moved its headquarter from Eindhoven to Amsterdam. This had a catastrophic impact on the entire region. Therefore the reliance on those large firms should be decreased and opportunities should be given to the birth of new firms. But according to figure 3.10, the birth of new firms in the focal sector of the Brainport this is still appears to be a problem. A cause of the problem can be the lack of an life cycle of development for those companies. If the companies would be located on locations with the right supportive urban environment depending their phase of development, it would stimulate their development. The industrial structure of the region would become much stronger and less dependent on only a few large companies.

figure 3.10 establishment of new starters in the region (in % of total number of companies)
source: USA 2009
Conclusion

Diverse economy
With the five focal sectors, the Brainport region is changing from a region strongly specialized in technology into a region where also other sectors are well represented. At the moment, the high tech sector is still very clear the dominant sector in the Brainport region. But the previously shown figures show the growing development of the other focal sectors and thus a more diverse economy for the Brainport region in the long run.

Decrease in starting up new businesses
The reliance on large firms and a decreasing development of the birth of new firms in the region can have serious consequences on the economy of the Brainport region. It results in a monotone image in sense of company size in the region. To achieve diversity, also in sense of company size, the birth of new firms should be stimulated. This can be done by locating them on sites where the firms have need for in their phase of development, which will stimulate them in their development. Especially the starting companies prefer to be located in the city, since they have need for a more urban supportive environment. This will also have a positive effect on the city life, because the locating of starting environments in the city and thus paired activities will also bring more diversity in the city itself.
Research shows that the knowledge economy is a network economy, which makes different types of transportation very important. In this section these different types of transportation will be analysed. Beside that, also their mutual connectivity will be included in this analysis.

(International) train network

Being connected to the international train network is a very important condition for a city and region in the knowledge economy. But even though the Brainport region is very well connected to the national Dutch railway network (figure 3.12), it is not being provided by any international train connection (figure 3.11). The lack of an international train connection results in a bad connectivity to surrounding cities and regions. This is shown on the map with the travel distance from Eindhoven central station within half an hour and one hour.

The lack of an international train connection can have influence on companies’ decision for their establishment. Whereas cities and regions that do have an international train connection are more attractive to settle down.

The realisation of an international train connection appears to be done through intensive lobbying or being strategic located between important regions. The strategic location of cities as Breda and Arnhem has delivered them an international train stop. Brainport’s very desire is also to be included in the international train network. If the Brainport indeed wants to realise the so-called ELAt collaboration with the cities of Leuven and Aachen, their mutual connectivity should be optimized.

The desired international train connection can be realised in different directions. As can be seen on the maps, the Brainport region is located within different rails.

An east-west connection from Breda to Düsseldorf will also mean a connection with the corridor Amsterdam to Paris and the corridors of Amsterdam to Frankfurt.

An north-west connection from Amsterdam via Utrecht to Liège will also make a connection with the corridors between Brussels via Leuven and Aachen to Cologne. This will mean a better connection with the ELAt and therefore this option is perhaps more important.
figure 3.12 traveling distance by train from Eindhoven within 30 minutes and 1 hour
source: ns.nl
Air connections

National and international connectivity is one of the key assets in the knowledge economy. This connectivity also includes the connectivity by air. With the Eindhoven Airport, the Brainport region has an international airport with many important destinations, for leisure as well as for business purposes. However in the past, the Eindhoven Airport was mainly an airport with holiday destinations. Therefore, the airport was mainly being used for leisure purpose and in particular in times of vacation. Eindhoven Airport did not yet have the right destinations so people would also use the airport for business purposes. This weak connectivity to the international flight network was for Philips even one of the reasons in 1997 to move its headquarter to Amsterdam. There it could benefit from the proximity to Schiphol Airport, which did have good air destinations for business use.

The last decade, the position of the Eindhoven Airport has been improved. Through the additions of new destinations towards important business hubs, the airport has gained a much stronger position in the international flight network. Examples of recently added destinations are Stockholm-Skavsta in 2007 and London City Airport in 2008. Figure 3.13 shows an overview of the current destinations of Eindhoven Airport. The increasement of its flight destinations has lead to a growth of the amount of passengers that use the Eindhoven Airport. As shown in figure 3.14, the amount of passengers has more than doubled the last five years. This growth is expected to continue. Therefore the airport is since 2011 until 2013 under construction to expand its current capacity so it can serve even more passengers that will make use of the airport.
Figure 3.15: Highway network in the Brainport region and surrounding areas.
Road structure

Decades of provincial decentralization policies have led to a dense road network, so that all regional facilities were very well accessible from anywhere in the region. During this era, the connectivity by car was very important and explains why the majority of the traditional industrial sites, business and science parks are located on highway locations. But however these parks are very well accessible by car, they are not connected with the adjacent cities, which appears to be of increasing importance in the knowledge economy.

Figure 3.17 shows the road network of the Brainport region and traveling distance to its surrounding within thirty minutes and one hour. Despite the isolated positioning of the Brainport region with respect to surrounding metropolitan areas as the Randstad, Flemish Diamond and Ruhr area, these areas are accessible within a one-hour drive. Striking is the bad connectivity to Belgium. And with taking into account the importance of the desired ELAt cooperation with the Belgian Leuven and German Aachen, especially the travel time to Leuven is currently insufficient.

Among the highways connecting the Brainport region with its surrounding (figure 3.15), especially the A2 highway will become of major importance for the accessibility of the Brainport region in the knowledge economy. As shown in figure 3.16, this axis runs from Amsterdam, via Utrecht and Eindhoven to Maastricht. The recent years the A2 highway axis is developed as into an axis with a high concentration of employment. Because of the concentration of the business services and logistics in the Amsterdam region, the ICT service sector in the Utrecht region and the ICT hardware sector in the Eindhoven region, makes this into a strong axis for the Netherlands in the knowledge economy.

In the Pieken in de Delta (2004) report the A2 axis forms together with the A4 and A12 axes the ‘Triple A connection’. Among these Triple A connections, the A2 highway axis is marked as the most important zone of economic growth for the Dutch economy. Because of the high concentration of employment in knowledge intensive industries such as business services, high tech industry, ICT sector and ICT hardware industry, this axis is seen as the ‘kennisas’ of the Netherlands (Pieken in de Delta, 2004).
Figure 3.17: Traveling distance by car from Eindhoven within 30 minutes and 1 hour.
Conclusion

The accessibility of the Brainport region differs a lot in sense of types of transportation and scale levels. On a national level, the region is well connected through a good functioning highway and train network. With many highways coming together from different directions around the city of Eindhoven, many Dutch cities as Rotterdam and Utrecht are reachable within acceptable travel time. The same goes for the train network, which connects the region very well especially towards the Randstad and Dutch cities in the south of the Netherlands such as Maastricht.

The accessibility of the Brainport region on an international level is however the lacking the most. This includes good connectivity with surrounding Belgium and German cities. With the ambition to set up an intensive collaboration network (ELAt) with the Belgian city Leuven and German city Aachen, especially these connections are currently by car as well as by train insufficient. Therefore there is a strong desire for an international train stop, which will improve those connections. The lack of critical mass in sense of population seems to explains the absence of these kinds of transportation, which provides the support for those types of transportation.

The only kind of transportation that does connect the Brainport region on a international level is Eindhoven Airport. Through the addition of several air destinations which will be mainly use for business, the Brainport has improved its international business climate and strengthened its image as an international transportation hub. Especially large firms (places of production) benefit from this development, since they are more focused on their international network and connections.
Population

The municipality of Eindhoven, the largest municipality of the Brainport region, is in terms of population the fifth largest municipality of the Netherlands. Currently the city has over 215,000 inhabitants and expected is this population to grow to nearly 230,000 inhabitants in the coming decade (figure 3.18).

The structure of the city’s population is also expected to change the coming ten years according to figure 3.19. The change consists of mainly an increasement in number of inhabitants in the age groups between 25 and 35 years, 50 and 60 years and 65 and 75 years. A small decreasement occurs in the age group between 40 and 50 years. This development is advantageous for the Brainport region, since the increasement of population is happening mostly in the age groups which are considered as the region’s labor force (age between 15 and 65 years).

Degree of urbanity

Proximity in the urban model stimulates the coming together of people and thus the exchange of knowledge and generation innovation (Glaeser, 2003). Because a higher density creates a closer proximity, cities and especially cities in metropolitan areas provide the right setting for this.

Figure 3.20 shows the urbanity of the Netherlands at municipal level. The urbanity of cities as Amsterdam, Rotterdam, Utrecht and The Hague belong to the first category of ‘very strongly urbanized’. Tilburg is the only city in the province of North Brabant that also belongs to the first category, despite the fact that Eindhoven is the largest city of the province. The urbanity of the Eindhoven belongs to the second category of ‘strongly urbanized’. This is however not very surprising, since Eindhoven lacks the metropolitan atmosphere that it needs to attract knowledge workers. Even though many investments have been done in attractive housing and work environments and cultural facilities, the current supply of cultural amenities has no international allure and is not enough to make the inner city of Eindhoven into a lively area (Maldonado, 2010b).
This means that if the Brainport region, with Eindhoven as its main city, wants to achieve this desired strongly urbanized atmosphere, it should also strive for a more compact regional urban model. The expected increasing population of the Brainport region and thus paired increasing demand for new housing and working environments in the region can be used to achieve this desired very strongly urban atmosphere.

**Housing market**

Besides a strongly urbanized built environment, a city and region should consist of an interesting mix of different living and working environments. And from the perspective to attract more (potential) knowledge workers to the region, especially living and working environments preferred this group are needed. Knowledge workers seem to in general have a preference for living in inner city locations. They are attracted to the proximity to night life, facilities and transportation nodes (Glaeser, 2003). And therefore it is important to offer more of these working and living environments in the inner city.

The city of Eindhoven, as Brainport’s main city, however does not offer the environments preferred by (potential) knowledge workers. Especially the housing market of the Brainport region is dealing with several problems. The current housing stock and production is not corresponding with that type and amount of demand (Waterstaat, 2008). Especially in the city centre the potential supply will not fulfill the expected demand and thus this will become a big problem (figure 3.21). And because this is also the kind of environments preferred by knowledge workers, the lack of those environments can expel knowledge workers and thus Brainport’s positioning in the knowledge economy.

**Policy for new developments**

The past and current policies of the Brainport region for facilitating new living and working environments are however contradictory to the aforementioned strategy of proximity and compactness. In the region, new living and especially working environments have mainly been constructed on the outskirts of the city.

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**figure 3.20 degree of urbanization on municipal level**

source: RIVM & CBS, 2009
Decades of these policies have led to a more sprawled regional urban structure, which also explains why the urbanity of Eindhoven belong not to the first but second category. This model has been the ideal setting during the industrialization period, due to the need for a clear separation between heavy industrial activities and city life. But now, in times of de-industrialisation and upcoming ‘clean’ industries, this clear separation is not needed any more and the activities and city life can be more mixed.
But still, the current policies keep separating the businesses activities from the city life. As shown on figure 3.22, new developments as the Brainport Avenue are again being planned on the outskirts of the city, which will result in an even more sprawled regional urban model.

Conclusion

A compact regional urban model is desired in the knowledge economy, because it stimulates the coming together of people and thus the exchange of knowledge and generation of ideas. However, the regional urban model of the Brainport region does not meet these conditions at all. With Eindhoven as its main city, the region lacks a real centre with a very strongly urbanized atmosphere. And with the current policies this will not happen, since new developments are constantly being planned on the outskirts of the city. This will lead to an even more sprawled regional urban model.
If the Brainport region wants to achieve a more compact regional urban model, it should change its current policy of developing newly constructed expansion areas into a (inner) city redevelopment strategy. Occurring trends as an increasing population and the need for more inner city live and work environments, might provide the opportunity to achieve the desired compact regional urban model.
figure 3.22 map of Brainport Avenue
source: Samenwerkingverband Regio Eindhoven
Natural amenities are of high value to strengthen a city and surrounding region in the knowledge economy. Cities being positioned in a region with an attractive natural setting, are the most popular places for people to work and live. This means the accessibility from the city to the nature, a river of the sea is important (Gabriel et al., 2003; Ullman, 1954).

Figure 3.23 shows the network of nature and recreational areas within and around the Brainport region. The green areas of ‘Kampina en Oisterwijkse Vennen’, ‘Leenderbos, Groote Heide & De Plateaux’ and ‘Strabrechtse Heide & Beuven’ are part of the Natura 2000 ecological network. This network consists of protected areas in the territory of the European Union with the purpose to maintain its high level of biodiversity. Therefore, especially these areas are important for recreational and ecological quality of the region.

On a smaller scale, the green and blue structure of the city of Eindhoven is characterized by a close integration with the urban areas. Green and blue corridors are flowing from the outlying areas into the city. This interesting combination of green and blue areas with the urban areas is often named as shining shards in a green sea (‘glanzende scherven in een zee van groen’) (S&R0, 2011). As the map of figure 3.24 shows, the river Dommel, Eindhovens Kanaal and Beatrixkanaal are flowing into the city.

The quality of the surrounding landscape is an important value for a region and its inhabitants. But as discussed in the previous section, current policies keep developing newly constructed business and science parcs on the outskirts of the city, through what the quantity and quality of the region’s green and blue structure are at risk. It could change the current image of the region from a green landscape with a big variety of urban typologies into a continuous urban chain (SRE, 2007b). Therefore new developments should be planned so it does not threaten the quality of the surrounding landscape and green and blue structure.
figure 3.24 green and blue structure of Eindhoven and surrounding...
Conclusion

The Brainport region is surrounded by very valuable landscapes, of which some even belong to the protected Natura 2000 network. The quality and quantity of these natural amenities appear very important for the people to work and live in a region. Therefore this also influences a city and surrounding region's position in the knowledge economy. However, the policies of the Brainport region keep developing new live and work environments as expansion areas on the outskirts of the city. This will also affect and threaten the quality and quantity of the green areas. Therefore it is important that the (current and) planned developments aim for the maintenance of the quality and quantity of these areas.
In general, the Brainport region meets the requirements of a region in the knowledge region very well. However, the modest size of the region, lack of diversity and its policy for the positioning of new developments on the outskirts of the city are crucial problems that inhibits the region to further development and thus strengthening of its position in the knowledge economy.

The Brainport is a medium sized region according the number of its inhabitants. This modest size results in certain advantages and disadvantages for the positioning of the Brainport region in the knowledge economy. One of the benefits from the medium size of the Brainport region is the close proximity of participants that leads to a good triple helix cooperation between the local government, institutions and businesses. This has very often resulted into concrete projects that strengthens the position of the Brainport in the knowledge economy. An recent example of this is the realisation of a broad band network throughout the entire region.

The disadvantage of the modest size of the Brainport region is the lack of concrete mass that is needed for further development of a region in the knowledge economy. More concrete mass in sense of a higher population and density enables a region to have a more sectoral diverse economy and support for certain world class amenities. But since a medium sized region as the Brainport cannot expect to become a large metropolitan area at short notice, this will remain a problem for a long time.

With strategies by the national and local government as the marking of five focal sectors, the region is hoping its economy to become more sectoral diverse. But with the clear dominance of the high tech sector, the region can be characterized as a region with a specialised economic structure. According to the figures, the other focal sectors will become more represented through time, which in the end indeed will result into a more diverse economy for the Brainport region. Therefore developments as the region’s population growth and the attraction of more businesses to the region will contribute to the development for the region to become of the size that is desired in the knowledge economy.

The desire for more critical mass in the Brainport region is also needed to improve its accessibility by all kinds of transportation types. The lack of an international train stop therefore remainss a great loss, since the presence of an international train connection is almost essential to gain a strong position in the knowledge economy.

One of the main problems of the Brainport region is the current policy of keep developing new living and working environments as expansion areas on the outskirts of the city. This means that the current policies do not result in a desired compact regional urban model and it threatens the quality of the surrounding landscape, which is also of importance in the knowledge economy.

Therefore, the expected population growth the Brainport region and thus paired need for more live and work environments can contribute to the desire for more critical mass, lack of an very strongly urban atmosphere and need for more diverse live and work environments in the inner city. Hereby also the quality of the surrounding landscape in the region will be maintained, which is also an important conditions for people to decide to live and work in a certain place.

Diversity in the Brainport region seems to be needed in sense of more economic sectoral diversity, but also in other aspects, such as diversity in firm size (reliance on large firms) and diversity in live and environments (positioning of monotone business and science parcs on the outskirts of the city).

The aforementioned life cycle of development stimulates the development of small, starting firms as well for further development firms by offering them different, supporting live and work environments, depending on their phase of development. Because the different phases of development calls for different live and work environments, this will also lead to more diversity in the region and city.

Concluded can be that current policies of the Brainport region needs to make the shift from keep developing new live and work environments as remote areas on the outskirts of the city towards a strategy that focuses more on the (re)development of the existing structure and especially inner city locations. The city of Eindhoven will therefore be analysed in the following chapters, whereby the emphasis will be already on the possibilities for this inner city (re)development.
4 CITY ANALYSIS
4.1 Introduction

This chapter consists of the analysis on the scale level of the city. The city scale has been defined in the paragraph 1.4 as the city of Eindhoven.

From the theoretical framework derived a collection of determinant conditions on the scale level of the region, city and neighborhood for a city and surrounding region in the knowledge economy. In this section of the analysis on the city scale, the city of Eindhoven will be analysed to what extend it meets these requirements that derived from the theoretical framework.

The analysis will be done through the mapping method and the collecting of relevant data. Finally, this chapter ends with a conclusion in paragraph 4.7, where the findings of the different sections of this chapter will be linked together.

Theory elements

- urban amenities and quality of life
- scale
- urban diversity
- social equity
- culture
- aesthetics

city analysis
city analysis

4.2 Urban amenities and quality of life

The quality of life in a city and surrounding region instead of simply offering employment, is becoming of increasing importance in the knowledge economy to attract talented people. According to Florida (2002) urban amenities are the key assets in this urban competitiveness.

For the mapping of the urban amenities (figure 4.2), information of the Tourist Information Center Eindhoven has been used. Very clear visible in this map is positioning of the majority of the urban amenities in the city centre and city’s new creative district Strijp-S. This means that new live and work environments at the outskirts of the city can not benefit from proximity to any of these amenities. These expansion areas are forced to create their own amenities on their own terrains. Example of this is the High Tech Campus (figure 4.1), where all the facilities are located along The Strip. Here, all the facilities such as conference rooms, canteen, meeting and presentation rooms are accommodated.

Starting companies in the first phase of development prefer to be located close to existing amenities instead of expansion areas, where new amenities are needed. This will also influence the real estate prices.

figure 4.1 all facilities of the High Tech Campus in Eindhoven are located along The Strip
source: flickr.com

figure 4.2 majority of amenities in Eindhoven is concentrated in the city centre and Strijp-S
source: Tourist Information Office Eindhoven
Scale in sense of critical mass is a very important aspect for a city in the knowledge economy. More critical mass is parallel to more dense and varied population which will also provide the support for a higher variety and amount of amenities. Therefore cities and especially large cities in metropolitan areas have a clear advantage.

Compared to other cities and regions, Eindhoven and the Brainport have due to its modest size still the image of a provincial town. And according to the figures 4.3, it also cannot expect to become a large city or metropolitan area at short notice. The prognoses show that the population in the Brainport region will slightly grow the coming thirty years, but much less than cities in the Randstad area and in the hinterland as Arnhem and Groningen.

The prognosis for the development of the labor force (figure 4.4) is a slight shrinkage in 2040 compared to 2010. These figures are further elaborating on the figures presented in the section of the regional analysis, which showed an increasement of the labor force in the coming ten years, especially in the age groups of 25-35 years and 50-60 years. This means that the city of Eindhoven at first can expect its labor force to grow the coming decade, before it will slightly shrink the twenty years thereafter.

According to the figures, it can be concluded that Eindhoven and the Brainport region is and will remain a city and surrounding region of modest size. It cannot expect to become a large city region in the coming decades and therefore the support for certain world class amenities will remain unsufficient. This will be disadvantageous for especially companies in the final phase of development, since they have more need for world class amenities, such as an international train connection and worldwide air connections. The lack of these world class amenities was already one of the reasons of the departure of Philips out of Eindhoven to Amsterdam in 1997 (Poorthuis, 1997). Therefore, the ambition should be to facilitate the future residents or new businesses that do find their way the coming years to Eindhoven and the Brainport region, in the existing context. Even though it will not lead to a large city region with the desired critical mass, it will anyhow grow towards a more compact model.
4.4 Demographic diversity

Florida (2002) calls for cities with ‘low barriers to entry’, which consists of the hospitality and business climate for a city in the international context. This will stimulate the attracting of foreign people, when they can easily find their way in a city for living and working.

To be an attractive place to live and work also for foreigners and expats, the city and surrounding region should have an attractive international climate. Hereby, cities and especially large cities in metropolitan areas are in an advantageous position, since they have more critical mass and therefore also a larger population, which is most cases also creates a larger diversity in its population.

Hereby, the modest size of a provincial town as Eindhoven is a clear disadvantage. Also the isolated position of Eindhoven from the Randstad remains a large problem. A international known city as Amsterdam will at first be a much preferred by foreigners to settle down instead of an international unknown city as Eindhoven.

The importance of this issue, has already been proved by Philips, when it moved its headquarter in 1997 from Eindhoven to Amsterdam, because the positioning in Amsterdam would attract more international top employees. It is therefore quite understandable that foreigners prefer the international climate of Amsterdam more than Eindhoven and North Brabant.

But still, Eindhoven and the Brainport region is willing to improve its international climate. Therefore, a new expat center for foreign employees was established on 2010 in Eindhoven (figure 4.5). Now, foreign employees can pick up their residence permit and register with their city of residence in just one visit to the new Expat Center Brabant in the Kennedy Business Center in Eindhoven. With this ‘one-stop shop’ the region is hoping to give a positive boost to the region’s hospitality and its business climate so it will make the region a more attractive place to live and work for foreign employees.

The lack of an attractive international climate only appears to be a problem for companies further developed in the life cycle of development, since they pay more attention to setting up an international network. This is however not the case for starting companies in the first phase of development.

figure 4.5 The new Expat Center Brabant in the Kennedy Business Center in Eindhoven opened on February 25, 2010. The first residence permit was distributed to a foreign Philips employee. source: hollandexpatcenter.com
4.5 Culture

Culture is seen as a valuable amenity for positioning of a city and surrounding region in the knowledge economy. Besides that a rich variety and amount in the cultural offer contributes to the image of the city, cultural facilities have become in the knowledge economy also popular places for people to gather and exchange of knowledge. Therefore it is important for a city and surrounding region to have a rich variety in culture.

According to the figure 4.6, Eindhoven’s culture offer that is slightly above the average of the fifty largest municipalities of Eindhoven. In comparison with neighboring cities in the province of North Brabant, only the city of ‘s-Hertogenbosch has a higher cultural index. In comparison with cities with a similar population, the size and diversity of the cultural offer of cities as Utrecht and Groningen is much higher. Hereby, the city’s rich history and presence of a historical inner city tends to contribute to the cities’ cultural offer and identity.
The city of Eindhoven gains its unique cultural identity from its industrial past with a dominant high tech industry. The economic structure was dominated by large firms such as Philips, which at first kept its activities hidden from the public. But as those companies started to incorporate design more into their traditional industrial processes, the interesting synergy between those two disciplines resulted in an unique, distinctive image for the city in the international competitiveness.

Eindhoven’s design orientated is constituted by two design institutions of international prestige. The first is the Design Academy Eindhoven (DAE), the former design school of Philips, which educated most well-known Dutch designers, and where many prestigious designers teach. The second design asset of Eindhoven is Philips Design, the design department of Philips Electronics, which is one of the largest and longest-established design organizations in the world. It counts with more than 400 workers which work not only for Philips but also for other prestigious brands as Nike, Levi’s, Orange and Securitas.

By organizing many events, Eindhoven and the Brainport wants to carry out its image as top technology and design region. An example of such an event is Lichtjesroute (figure 4.7), where the liberation of Eindhoven during the World War II is being celebrated by an route of lights throughout the city of Eindhoven. Hereby also the newest innovation in the field of light industry are being exhibited.

Another example of the successful incorporation of design into the high tech sector is the Dutch Design Week (figure 4.8). The Dutch Design Week hosts lectures, workshops, fashion shows, seminars, and design exhibitions. This event started in 2002 with 20 participants, it has grown in the last ten years towards a worldwide event with 300 events spread over 83 locations, in which more than 1,500 designers participated. All of these events are very important for international branding of Eindhoven and the Brainport region for carry out its image as a top-technology and design region. Not only for the public, but also for entrepreneurs and artists these events are important for the branding and exposing of their products or designs to the public.
4.6 Aesthetics

The aesthetic quality of buildings and areas is invaluable for a city’s attractiveness. People prefer to live and work in attractive buildings and areas where they can identify themselves with. This so-called ‘sense of place’ creates a certain pride as a resident and especially occurs in historical buildings (Florida, 2002). The history of the city is therefore determinative to define the sense of place in the case of Eindhoven.

The history of the Eindhoven is marked by its industrial character. Families with their roots in the region established companies in Eindhoven and surrounding, of which some of them have even grown towards the status of world market leader. Noticable hereby was also their benefit to the city’s development not only by offering employment, but also by providing educational, cultural and recreational facilities for their employees. This industrial past is still visible in the current image of the city. Large manufacturing buildings of Philips and DAF have been maintained after they lost its original function. The majority of these buildings have been revived through transformation of the buildings. The transformation of these former industrial buildings and terrains have successful contributed to the new image of the city. Hereby the renovation of the following buildings and areas are seen as the most determinative ones.

The White Lady (‘Witte Dame’) on the Emmasingel was originally used by Philips for the production of light bulbs. Since 1998 it houses several educational and cultural institutions such as the Design Academy Eindhoven and the Eindhoven city library. The Clock Building (‘Klokgebouw’) is another example of a successful renovation. It was constructed as plastic and metal modification factory in the 30s, again by Philips. Now, the Klokgebouw is a concert hall and one of the icons of Eindhoven. A project which is currently under construction, is the transformation of former industrial terrain Strijp-S. This used to be a strictly enclosed area only accessible for Philips employees (figure 4.9). But after the departure of Philips out of this area, the area was given ‘back to the city’ and currently being transformed into a new city district (figure 4.10).

After the transformation of the Strijp-S area, new developments are still needed for the attraction and accommodation of creative and innovative businesses (Buck Consultants, 2009). Where Strijp-S is a very large area and being transformed only for creative and artistic business, there is need for more small-scale sites where a better synergy with its surrounding can be achieved. From this perspective, the city of Eindhoven offers more small-scale industrial sites, which are perfectly suited for the accommodation of new, starting companies. This also brings us back to 1891, where Gerard Philips and his son Frederik lived in Zaltbommel, but decided to establish Philips in Eindhoven because only there a vacant premises could be obtained.

figure 4.9 & 4.10 Strijp-S, located west of the city centre, is a former industrial terrain of Philips (above) and transformed after the departure of Philips into a new city district for creative businesses (below). source: eindhoveninbeeld.com (above) and flickr.com (below)
4.7 Conclusion

According to the figures presented in this chapter, the provincial town Eindhoven can not expect to become of such a size that creates the critical mass that is needed in the knowledge economy. Critical mass is for example needed for the support for certain world class amenities and more demographic diversity. However, these problems only appear to be relevant for companies that find themselves in the final phase of development.

One of the conclusions that did affected the climate in Eindhoven and Brainport region for starting companies already rised in the previous chapter of the analyses on the regional scale. With its policy of developing monotone business and science parcs on the outskirts of the city, its lacks a rich diversity of live and work environments. Hereby especially live and work environments for starting entrepreneurs, who prefer a supportive urban environment, are missing.

The analyses presented in this chapter show that the city of Eindhoven actually offer lots of attractive possibilities for the accommodation of these starting companies. Hereby aspects as the image that Eindhoven and the Brainport region wants to carry out play an important role. In the case of Eindhoven and the Brainport region, this image has gradually changed during the last centuries from a industrial region into a top technology and design region, which determines its current cultural and aesthetic image. The redevelopment of the Clock Building and the Strijp-S area are successfull examples of projects which strengthened the position of Eindhoven and Brainport region to attract creative and innovative companies. This combination is unique yet successfull and will bring Eindhoven and the Brainport region a prosperous future. Therefore similar transformation projects seem to almost guarantee success for Eindhoven and the Brainport region for attracting creative and innovative companies.
5 NEIGHBORHOOD ANALYSIS
neighborhood analysis

5.1 Introduction

The previous chapter concluded with the presence of still some industrial sites which might be suited for facilitating of starting creative and innovative companies. Therefore this chapter will start with the introduction and further mapping of these industrial sites in paragraph 5.2.

From paragraph 5.3, those industrial sites will be tested according to the conditions that derived from the theoretical framework on the scale level of the neighborhood (paragraph 2.2.3). This will happen through the assigning of a color which explains to what extent each industrial site meets that specific condition.

Finally, in paragraph 5.8, the sum of the different ratings on the different conditions per industrial site will results in a final score. This will lead to the selection of the industrial sites with the best score and thus meet the requirements on the neighborhood scale the most. These locations have the highest potential to be developed into a starters environment and will be integrated into a new redevelopment strategy for city of Eindhoven.

The industrial sites will be tested and assigned a color which explains to what extend it meets that specific condition:

- Low potential
- High potential

Theory elements:
- Location
- Real estate prices
- Year of construction
- Urban structure
- Accessibility
- Third places
5.2 Industrial sites

Expected demand of business locations

In the report ‘Nota bedrijventerreinen gemeente Eindhoven’ by Buck Consultants International commissioned by the municipality of Eindhoven, an estimate is made for the expected demand for new business locations until 2030. These calculations (figure 5.1) conclude that even with the completion of the planned developments until 2030, there still remains a shortage of 65 - 115 acres. Therefore, besides the completion of the planned developments, the possibility for the redevelopment of these small-scale industrial sites is needed to meet the demand of 2030.

**quantitative demand for business locations until 2030** 300 - 350 ha

**potential available surface for business locations until 2030** 235 ha
- available surface on existing locations 80 ha
- planned developments 155 ha

**quantitative shortage for business locations until 2030** 65 - 115 ha

figure 5.1 overview of the expected supply and demand for business locations until 2020 in Eindhoven

source: Nota bedrijventerreinen Eindhoven, 2009
Large industrial sites

The ‘Nota bedrijventerreinen gemeente Eindhoven’ was executed in 2009 by Buck Consultants International in commissioned by the municipality of Eindhoven.

The report is makes a distinction between large industrial sites (larger than 5 acres) and small-smale industrial site (smaller than 5 acres) within the municipal boundaries of Eindhoven.

As presented in figure 5.2, the city of Eindhoven concerns 17 of these large industrial sites, including planned developments as the Brainport Innovation Campus, Eindhoven Noord and GDC Eindhoven Acht. In the report, the large industrial sites are divided in the report into three categories that are shown on the map with corresponding legend on this page.

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**Legend**

- **Category A** sites with a (yet to develop) specific character, adjusted to the economic structure of Eindhoven
- **Category B** sites with an important role in facilitating mixed SMEs
- **Category C** sites, often centrally located, whose current profile is under the influence of spatial-economic developments in the city

**Figure 5.2** Overview map of industrial sites in Eindhoven

*Source: Nota bedrijventerreinen Eindhoven, 2009*
Importance of centrally located small-scale industrial sites

Beside the formal industrial business and science parks, the city of Eindhoven consists of 32 small-scale industrial sites (figure 5.6). The majority of these industrial sites have arisen traditionally, grown and remained on the current location. Through time, the sites became more and more being surrounded by other functions, especially by housing. In some locations there is a clear demarcation of the sites, but mostly however there is a courtyard or a business strip in the middle of a residential area.

Small business locations are very valuable for the city of Eindhoven. Not only because of the (mostly unskilled) employment which it offers, but mainly because of the starters and incubation function and the vibrancy of the neighborhood. In the ‘Kleinschalige bedrijfslocaties in Eindhoven’ report by Buck Consultants International, the importance of the small-scale industrial sites for the city of Eindhoven are the following:

I High occupancy of the areas (very limited vacancy);
II The relatively high labor intensity (more than the national average of 50 jobs per hectare);
III A large number of companies that does not have an option for being located somewhere else than the current location (because of low rents, proximity to peers and potential customers and clients);
IV Important role for the local economy and the economic activities in their direct surrounding.

Concluded can be that the small-scale industrial sites in the current situation are very valuable for Eindhoven. However, the current occupation will not provide a sustainable future in the long term for the businesses itself and for the city economy. The main reason for this is the global shift from a manufacturing economy towards a knowledge economy, which makes industrial activities of decreasing importance. Therefore especially these small-scale industrial sites are seen as potential development areas.

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<th>Centraal stedelijk gelegen terreinen</th>
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<tr>
<td>Rapenland</td>
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<tr>
<td>Vlokhoven / De Tempel</td>
<td>18,1</td>
</tr>
<tr>
<td>Woenselse Heide</td>
<td>10,9</td>
</tr>
<tr>
<td>Herzenbroeken</td>
<td>11,7</td>
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</table>

<table>
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<th>‘Kwaliteitslocaties voor de toekomst’</th>
<th>surface (ha)</th>
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</tr>
<tr>
<td>Biesterweg / Ericastraat</td>
<td>0,3</td>
</tr>
<tr>
<td>Aalsterweg / Orchideeënstraat</td>
<td>1,9</td>
</tr>
<tr>
<td>Hallenweg</td>
<td>0,9</td>
</tr>
<tr>
<td>Gestelsestraat / Bayeuxlaan</td>
<td>0,7</td>
</tr>
<tr>
<td>Scherpakkerweg</td>
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</tr>
<tr>
<td>Van Kanstraat</td>
<td>0,8</td>
</tr>
<tr>
<td>Cederlaan</td>
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</tr>
<tr>
<td>Visserstraat</td>
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</tr>
<tr>
<td>De Greefstraat / Willem Rosestraat</td>
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</tr>
<tr>
<td>Kruburg</td>
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<th>Gemengde bedrijfszones ‘de markt aan zet’</th>
<th>surface (ha)</th>
</tr>
</thead>
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</tr>
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<td>Verburggenstraat</td>
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</tr>
<tr>
<td>Gabriel Metsuilaan</td>
<td>0,4</td>
</tr>
<tr>
<td>Rivierstraat</td>
<td>0,5</td>
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<td>Hessen Kasselstraat</td>
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</tr>
<tr>
<td>Laagstraat</td>
<td>0,1</td>
</tr>
<tr>
<td>Kersbergenstraat / Bachlaan</td>
<td>0,3</td>
</tr>
<tr>
<td>Merovingersweg / Engelsbergenstraat</td>
<td>0,3</td>
</tr>
<tr>
<td>Karolingersweg</td>
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</tr>
<tr>
<td>Friezenkampstraat</td>
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<tr>
<td>Van Gentstraat</td>
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</tr>
<tr>
<td>Rosseelstraat</td>
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| Total surface                            | 73,9 ha       |

figure 5.3 overview of the small-scale industrial sites in Eindhoven
source: Nota bedrijventerreinen Eindhoven, 2009
figure 5.4 Nachtegaallaan

figure 5.5 Hallenweg

figure 5.6 Overview map of small-scale industrial sites in Eindhoven

source: Nota bedrijventerreinen Eindhoven, 2009
Conclusion

The overview of the small-scale industrial sites in figure 5.3 shows that the locations have a total surface of 73,9 acres. Together with the planned developments, this will comply with the expected shortage for business locations in 2030.
This means that the redevelopment of the small-scale industrial sites offers the opportunities to facilitate companies in the first phase of development according to their preferred supportive environment. Beside that, the total surface of these sites are also needed to fulfill the expected demand for business locations until 2030.

Therefore in following paragraphs of this chapter, these industrial sites will be tested according to the conditions that derived from the theoretical framework on the scale level of the neighborhood (paragraph 2.2.3). This will happen through the assigning of a color which explains to what extent each industrial site meets that specific condition.
Companies in the very first phase of their development have the need for a more supportive urban environment than further developed companies. Therefore the positioning of these companies, depending on their phase of development, in environments that offers the support is important for their development.

Places of productions as the High Tech Campus can easily be positioned on the outskirts of the city. They do not have the need for a supportive urban environment because they do not rely on external knowledge sources. However, starting companies do have this need for face-to-face contact. Hereby, different kinds of face-to-face contact can be distinguished that helps the companies in their specific phase of development. Companies in the breeding place (very first phase in the life cycle of development) benefit from the interaction and knowledge exchange with their peers, while companies in the creative workshop (second phase in the life cycle of development) benefit more from the interaction and knowledge exchange with counterparts. Companies in the third phase of development, the transactional environment, benefit more interaction and knowledge exchange with the public.

The map on this page (figure 5.7) shows the division of different kinds of environments in the city of Eindhoven. If indeed starters have the need for a supportive urban environment, then their development will be stimulated more by positioning them in areas where the most kind of interaction and knowledge exchange occurs that helps them in their specific phase of development. Therefore areas such as the inner city, city centre and the edge of the city centre are much more prefered for the positioning of starting companies than for example expansion areas on the outskirts of the city.
5.4 Real estate prices

Starting companies in the experimental phase have less financial resources, which is why companies prefer at first to be located in an area with affordable spaces. Once a company moves along the life cycle of development and becomes more marked oriented, they have more requirements to their surrounding environment. They have more financial resources to afford to be located in more densely areas where there is a high concentration of potential customers and clients.

Figures 5.8 shows the average real estate prices of each neighborhood in Eindhoven. Where in most cases the inner city is city’s most attractive and thus most expensive area, this is not the case in Eindhoven, probably due to the bombardment of the city centre in 1940. This radically affected the aesthetic quality of the historical inner city and thus the real estate prices as well. In Eindhoven especially the neighborhoods with rural living on the edges of the city such as Eckart and Eikenburg are the most expensive neighborhoods. This division on the real estate prices can suggest that residents in Eindhoven and surrounding prefer more quiet living on the edge of the city instead of the urban living in the inner city. This can be strengthened by the argument that people who already live in Eindhoven or moved to Eindhoven, do this because of its peaceful live and work environment close to the city and not because of the need for a strongly urbanized live and work environment.

The relatively low real estate prices of the city centre and adjacent neighborhoods as Strijp, Oude Spoorbaan and the Rochusbuurt are beneficial for the accommodation of starters in an urban environment. Since starting companies benefit more from a supportive urban environment, this is in the case of Eindhoven also one of the most affordable places.
Both the year of construction of the individual building and the urban structure of its surrounding affect the preferences of creative and innovative companies, depending their phase of development.

Figure 5.9 shows the historical development of the city of Eindhoven, where the establishment of Eindhoven from the annexation of several villages is very clear visible in the year of construction. The map shows the oldest developments along the former village roads which connected the former town Eindhoven with surrounding villages Strijp, Gestel, Stratum, Tongelre and Woensel.

The construction of a new ring road in 1960 stimulated the mutual connections between the six former villages. This ring road created an artificial centrifugal model that cut through the radial structure of the villages. The construction of the new ring road also shifted the attention from ribbon development along the village roads between the former villages (figure 5.10 and 5.11) towards modernistic developments along these new infrastructural corridors (figure 5.12 and 5.13).

With very limited financial resources, especially companies in the first phase of development prefer to be located in existing buildings than in newly constructed buildings. Therefore the positioning along historical development lines is more likely than along for the ring road for example. Few of the small-scale industrial sites are indeed located along these historical lines, such as the ones in Gestel along the Hoogstraat and in Strijp along the Strijpsestraat. These industrial sites are therefore best suited the re-development (refurbishment, renovation or restauration) of these buildings or areas for the accommodation of creative and innovative companies.
earlier than 1900
1901 - 1920
1921 - 1940
1941 - 1960
1961 - 2006

figure 5.9 historical development of Eindhoven
source: Het geniale landschap, 2006
figure 5.10 historical map of 1929 showing ribbon development along the first roads
source: watwaswaar.nl

figure 5.11 crossing of the Hoogstraat and the Gestelsestraat
source: eindhoveninbeeld.com

figure 5.12 historical map of 1963 with the new road structure and apartment buildings adjacent to it
source: watwaswaar.nl

figure 5.13 ring road (Karel de Grotelaan)
source: Google Maps
The accessibility of workplaces is not only important for the entrepreneurs itself, but also for their (potential) customers and clients. Entrepreneurs with a well connected workplace can more easily receive (potential) customers and clients. Also the optional use of the location will increase when more people are passing by and therewith increase the chance for spontaneous visits.

Companies in the experimental phase of development do not already have need for contact with (potential) customers and clients. But as the companies move along the life cycle of development towards the phase of creative workshop and transactional environment the accessibility of the place becomes of increasing importance.

Through the realisation of a Bus Rapit Transport network, Eindhoven strives to improve its local and regional accessibility. The network will connect the industrial sites, business and science parcs on the outskirts of the city with the city centre, where all BRT axes cross at the central station. At the moment, only the axes from the central station towards Eindhoven Airport (figure 5.14) and nearby located expansion area Meerhoven are completed and in use. The map 5.15 shows the proposed axes, of which some are currently under construction.

The accessibility of starting companies, especially the ones in the creative workshop and transactional environment phase, can be improved through the positioning in the vicinity of a BRT stop. But as the proposed plan connects very well the industrial sites, business and science parcs on the outskirts of the city, it will not connect the majority of the small-scale industrial sites. Therefore another possibility might be to change the proposed route of the future BRT axes so it will also connect the small-scale industrial sites that will be transformed into starter environments.
figure 5.15  Bus Rapid Transport network with existing and proposed axes

source: HOV-netwerk in de regio Zuidoost-Brabant, 2010
5.7 Third places

In the knowledge economy, where social interaction becomes of more importance, Oldenburg (1999) stresses the importance of the so-called third places. Third places are neither home nor work, but venues like coffee shops, bookstores and cafés which are less formal settings for interaction.

In general, the majority of these functions are located in the city center. However, larger cities can also consist of concentrations of these functions outside the city center, but this is not the case in Eindhoven (map 5.16). To a smaller extent, there are some concentrations of third places present along the historical lines.

Being far located from third places means less chance for this kind of (optional) social interaction. Therefore industrial sites or business and science parcs such as the High Tech Campus are forced to create their own facilities. But because entrepreneurs in the very first phase of their development have very little financial resources, they prefer to rely on already existing facilities instead of the construction of new facilities. The construction of new facilities will furthermore also increase the real estate prices in the area, which should be avoided especially for starting entrepreneurs.

With the positioning of starting companies in the city centre or along the historical lines where concentration of third places are present, they can rely on already existing concentrations of those functions. This is especially for starting companies much more preferred located along the outskirts of the city, where they are forced to develop their new facilities and would also increase the real estate prices.
Figure 5.16: Concentration of third places in Eindhoven

Source: Google Maps
The small-scale industrial sites are ideally suited for the accommodation of creative and innovative companies in the breeding place, creative workshop and transactional environment. In this chapter, the small-scale industrial sites are rated (figure 5.17) according to the conditions derived from the theoretical framework on the neighborhood scale level. The rating resulted in an overview of scores of each industrial site.
This method results in the determination of the sites that meet the requirements the most and are therefore best suited for the redevelopment into a starter environment (figure 5.18). These starter environments will be included into a new strategy of inner city redevelopment for the city of Eindhoven, which will be further explained in the next chapter. This is a network which consists, beside the yet to develop starters environments, of the already present knowledge sources and places of productions on the outskirts of the city. The mutual interconnectedness in this network will be provided by a Bus Rapid Transport network.
6 URBAN KNOWLEDGE NETWORK
The starter environments that have been determined in the previous chapter, will be integrated in a new strategy of inner city redevelopment for the city of Eindhoven. Within this network the different companies depending on their phase of development will be facilitated throughout the city of Eindhoven. Many of the already present industrial, business and science parcs located at the outskirts of the city, will be maintained on their current locations. These sites are only intended for places of production, firms in the final phase development in the life cycle for creative and innovative industries.

Creative environments as the breeding place, creative workshop and transactional environment benefit more from a supportive urban environment. Therefore these environments will be more centrally located. Together, these starting environment form a network.

As concluded from the case study of the Bilgi University in Istanbul (X.X), a network consisting of different areas is only functioning when their programmes is complementary to each other. Only then, this will results in an exchange between the nodes and create an actual network.

The starting environments in Eindhoven should therefore have their own specific character to achieve this exchange as well. The assigning of specific characters can be realised in line with Brainport’s ambition to achieve a more diverse economy. Therefore it has marked the high tech, design, lifetec, automotive and food sector as Brainport’s focal sectors. The assigning of the starter environments each with different sector-specific character is therefore the perfect opportunity to stimulate the development of starters in these sectors.

The proximity to concentrations of employment of the different sectors will be used to determine what sector-specific character should be assigned to what starting environment. Therefore in the next paragraph, the concentrations of employment of the focal sectors will be presented.
Bilgi University (Istanbul, Turkey)

The theoretical research shows that the life cycle of development (Saris and Modder, 2005) consists of four creative environments. These creative environments should create a strong network where not only the creative environments itself benefit from, but also its direct surrounding and the city as a whole.

Through the case study on the Bilgi University of Istanbul, the following research question will be answered:

**How does the network of multiple clusters collaborate and how are they integrated at the scale level of the city and its direct surrounding?**

The Bilgi University is distributed over three campuses in the European part of Istanbul. All three campuses are built on former industrial sites in central, yet underdeveloped urban quarters and provide affordable land for the growing university while offering its academic community easy access to the social and cultural activities of the city.

Together the campuses form a network of clusters, with knowledge and culture production driving the regeneration of these areas and fostering direct exchanges with the surrounding. The aim was to create a network of specialized clusters that can benefit from the advantages of the city while simultaneously giving socio-economic impulses to the surrounding urban quarters. By deliberately placing its campuses in a historic or semi-historic urban context, the university is creating more sustainable university centres and a more inspiring work environment.
Santral Kampüsü

The new Santral campus is advantageously located on a peninsula at the Golden Horn, located in a relatively poor part of Istanbul. The site is being transformed from an industrial wasteland into a thriving academic and cultural park, reactivating the area and fostering direct exchanges with the surrounding neighbourhoods.

With the opening of this campus, the Bilgi University has found a way to assist young artists and to give them the chance to establish themselves in the international art scene. The old industrial buildings have been converted to accommodate a library, a museum and the first contemporary arts museum in Turkey, all of which will be open to the public. In addition, several new school buildings have been added to house cafés, art galleries and artist’s residences.

Dolapdere

On the Dolapdere campus the faculty of Economics and Law are located. Through the bus service the campus benefit from its proximity to Taksim, a famed shopping, tourist and leisure district.

Kustepe

The Kustepe campus is located in the heart of the multicultural area of Ortaköy, which is renowned for its art galleries, nightclubs, cafés, bars and restaurants. With its large ensemble and public spaces surrounded by a smaller and denser housing structure, the Kustepe location has a catalytic function for the surrounding neighborhood as well.
The Bilgi University has three campuses distributed over the city of Istanbul. Each campus has its own identity, which is determined by the faculties that are located at the campuses.

The campuses have their own facilities, based on the requirements of the faculties on that location. Besides the faculty-specific facilities, the general facilities such as outdoor sports and student support offices are spread over all the campuses. Because the students from the university are allowed to make use of all facilities, exchange between the different campuses occurs.

This exchange is being achieved by a shuttle bus service owned by the university, which provides a fast connection between these three university campuses. Besides only connecting the university campuses, the shuttle bus service also connects the campuses with important city nodes, such as transportation hubs and business and culture districts.
conclusion

The strength of the network in this case study is the exchange between different nodes and the contribution of each node on different scale levels. The programme of the nodes in the network are complementary to each other, which results in exchange between the nodes. If the nodes would have been similar to each other, no exchange would have occurred. The network is being supplemented by connecting it with other important external nodes. This makes the network being more integrated at the larger scale level and better accessible from more directions. At last, the nodes have a strong connection at the smaller scale level due to its crucial role in its surrounding. This is mostly being achieve by a programme where is also need for in its direct surrounding.
The case study in the previous paragraph shows that nodes in a network with a different, complementary programme result in exchange. The clusters in the case of the Bilgi University in Istanbul have each a different character through the clustering of similar studies on the different sites.

In this research, the different campuses with their own character can be compared with the starter environments for creative and innovative companies in Eindhoven. For the realisation of complementary clusters, Brainport’s aim to also specialize in other sectors than the high tech sector can be used for the assigning of a different character to the starter environments. These sectors are design, lifetec, automotive and food technology. Together with the high tech sector, the aforementioned sectors are named focal sectors and the region wants to attract and establish companies preferably in the those sectors.

Each starter environment will therefore specialize in one of these focal sectors. The determination of which starter environment will be specialized in what sector, will be done in this paragraph. The proximity to companies in the same sector play hereby a crucial role. Therefore this will be determined through the concentrations of employment in the focal sectors.

On the following analysis maps, the circles represent the amount of employees. Based on the concentrations of employment in that specific sector, the nearest starter environment(s) will be highlighted in the sector-specific color. Finally, this will result in the most appropriate combination of the assigning of a sector to each starter environment.
figure 5.X starters environments with sector-specific character
6.4 The urban knowledge network

Besides a mutual connection between the sector-specific starter environments, the new strategy also includes external points in the network. The case study on the Bilgi University in Istanbul shows how the university campuses are not only mutually connected, but also with transportation hubs and important city districts. A shuttle bus service provides an excellent connection between the network, which makes the network also better accessible from different directions.

The urban knowledge network of Eindhoven will therefore also include the so-called knowledge sources, which consists of the city centre, creative districts, universities and research labs. The knowledge sources are important for the entrepreneurs because of the gathering of people and opportunity to exchange knowledge with their peers, counterparts or the public.

The starter environments (breeding place, creative workshop and transactional environment) and the places of production are part of Brainport’s life cycle of development and will be mutually connected by the Bus Rapid Transport network. Currently few of the BRT axes are already completed and some of the planned new transport axes will be changed so it provides an excellent connection between the elements of the network.
knowledge sources

starter environments

places of production

BRT network

Máxima Medical Center
Eindhoven University of Technology
Design Academy
city centre
Evoluon
Strijp-S

design
high tech systems & materials
automotive
food

lifetec
7 LOCAL ANALYSIS
7.1 Introduction

The analyses of the previous chapters has lead to the composition of a strategy for the city of Eindhoven, the urban knowledge network. Within this network, a number of centrally located small-scale industrial sites are being transformed into starter environments, where each starter environment is marked by one of the focal sectors of the Brainport region. In this graduation project, one of these starter environments will be taken further into depth and translated into a spatial design. Because the high tech sector has always been and for a long time will be the most dominant sector in the Brainport, the starter environment of this sector will be designed in this project.

The final map presented in the previous chapter shows that starter environment for entrepreneurs in the high tech sector covers parts of the neighborhoods Oude Spoorbaan and Schrijversbuurt. In this chapter of the local analysis, these two neighborhoods will be further analysed on their historical development, local qualities and programmatic mapping. This will be used in the next chapter for the composition of the local design concept.
figure 7.1 historical development of neighborhoods Oude Spoorbaan and Schrijversbuurt

source: watwaswaar.nl
7.2 Historical analysis

figure 7.2 year of construction of neighborhoods
Oude Spoorbaan and Schrijversbuurt
source: watwaswaar.nl
1937 - former railway connection between Eindhoven and Hasselt (Belgium), also known as ‘Bels lijtje’, was constructed in 1866 and closed in 1959.

1950 - aerial photo of the railway track, which runs from the left upper corner to the lower right corner, where it crossed the Hoogstraat.
1960 - crossing of the railway track with the Hoogstraat.

1963 - crossing of the Hoogstraat and the Gestelsestraat (right), with on the right cafe 't Rozenknopje.
cafe ‘t Rozenknopje is one of the oldest establishments of Eindhoven. It has been a prominent point on the corner of Hoogstraat and Gestelsestraat for over 100 years that, in contrast to its surroundings, the cafe has undergone hardly any changes.

1970 - the railway house at crossing of the Hagenkampweg and the Hoogstraat still remains and currently functions as an information centre for the neighborhood.
Most of the activities, public programme and public functions in the plinth are located along the area’s main street, the Hoogstraat.

However, the public character is not positioned along the entire Hoogstraat. The Hoogstraat is divided into more city-like parts, with public programme and lots of activities and more village-like parts, where the Hoogstraat has a more residential character.
Hoogstraat, 1929 - source: watwaswaar.nl
8 DESIGN PRINCIPLES
8.1 Introduction

The previous chapters form the ingredients for the composition of the concept for the local design, which will be presented in this chapter. The concept consists of a collection of maps, where each map explains a different aspect.

The concept forms the basis for the actual designing of the project area. Hereby, three case studies will form inspiration during this design project, which will be presented in the third paragraph of this chapter. The case studies concern the Binnengasthuisterrein in Amsterdam, Mijnbouwstraat in Delft and the Zomersdijkstraat in Amsterdam.
Connection with its surrounding

The project area is located on the edge of the city center. In the north-south direction it forms a transition between the city centre of Eindhoven in the north and the residential areas in the south. In the east-west direction the area is positioned between green wedges that flow from the outer areas into the city.

Different atmospheres

Green corridors will provide a link in the east-west direction between the surrounding green wedges. The area’s main street, the Hoogstraat, will provide the link between the city centre in the north and the residential areas in the south.
The Hoogstraat has always been the main axis of the area and will be maintained as such. The Gestelsestraat and Hagenkampweg Zuid (former railway) are marked as secondary axes. The crossings of the main axis and secondary axes will be made into important meeting places, emphasized by attractive public space and adjusted programme. These points also stand out from a far distance.

The activities along the Hoogstraat will be clustered into three urban centers. Each urban center has its own character, adjusted to its context. The most southern center will have an inwarded character, meant for companies in the very first phase of development, the breeding place. The middliest located center is meant for companies a step further in the life cycle of development, the creative workshop. The most northern urban center is located most closely to the city center and will therefore have a more outwarded character and is thus meant for companies in transactional environment phase.

Life cycle of development addressed along urban centers

Emphasis on important axes
Bicycle routes in the east-west direction provide a link with the surrounding green wedges. The bicycle route along the Hoogstraat provides a connection between the residential areas in the south and the city centre in the north. The gathering of people on site of the urban centers is stimulated by a pedestrian friendly design of the public space. The area is served with a BRT stop on the north side of the area (crossing of Hoogstraat and Mauritssstraat), which connects the area with the city centre, central station in the north and important technology production centres as the High Tech Campus and De Run in the south.

The project area is on the south, east and north side surrounded by city roads. These roads will be used to discharge the traffic from the project area, so priority can be given to the cyclists and pedestrians on the Hoogstraat. The road system is characterized by loops that flow from the surrounding city roads into the area. The loops allow cars to enter the Hoogstraat on the places where this is permitted. At the place of the creative environments the car is a guest, so priority is given to cyclists and especially pedestrians.
8.3 Case studies

Binnengasthuisterrein (Amsterdam, The Netherlands)

At the neighborhood level, conditions such as urban structure, accessibility and face-to-face contact derived from the theoretical research. Further research on these aspects will be done through a case study on the Binnengasthuisterrein in Amsterdam by answering the following research question:

How does the urban structure contribute to face-to-face contact and the exchange of knowledge?

The buildings on the Binnengasthuisterrein were constructed in the Middle Ages as a nunnery. As a result of the original function, the urban structure of the site with its room for gardens has always been retained. Through time, the Binnengasthuisterrein became the location for the Binnengasthuis hospital. After this hospital in 1981 became part of the Academic Medical Center (AMC), the site became one of the locations of the University of Amsterdam, which now has sixty percent of the complex in use.

The University of Amsterdam has the ‘city as a campus’ policy by developing several clusters in the city of Amsterdam, specialized in the gamma, bèta and alpha studies. At the Binnengastterrein, the education and research in alpha studies are brought together. Knowledge, entrepreneurship and culture go together, which is shown by the presence of lots of facilities such as bookshops, cultural institutions and theaters, art galleries and museums.
enclave and entrances
Because of its original function as a nunnery, the area with its partly closed structure still functions as an enclave. Besides two large openings, people enter the area through archways.

functions
The area is surrounded by many streets with a large collection and variety of retail shops, cafes, hotels and restaurants. On the terrain itself the facilities are divided into internal and external facilities. The internal facilities provide services to the ‘users’ of the university, such as a (student) employment agency and many book shops. The external facilities are more meant for the public, such as a theatre and several museums. This creates an interesting of coming together of diverse group of people and makes the terrain also not only dominated by users of the university, but also by other kind of users.
entrance from the Kloveniersbrugwal

entrance from the Oudemanhuispoort
network of courtyards
The inner courtyards are enclosed places where people from adjacent buildings can meet. The four courtyards are mutual connected, so it creates an network of semi-private spaces within the area.

external routes
Two external routes make the connection between the area and its surrounding. At the center, where the two routes meet, the outdoor space is larger and functions as the central meeting place of the area.
conclusion

The case of the Binnengasthuisterrein in Amsterdam shows very clear the use of an internal and external route. The external route has a more public character and connects the area with its surrounding. In the area itself, public functions are located along the external route, which stimulates interaction between the users of the area and the public. The internal route has a more introvert character which is characterized by a route of somewhat hidden open spaces in the area. It is meant to stimulate interaction between the users of the area. Therefore area’s core functions are located along this internal route and their entrances as well.
Mijnbouwstraat, Delft

The building at the Mijnbouwstraat in Delft houses the Science Centre and gives places to many creative businesses. Many of the current tenants are university spin-offs, mostly engineering and industrial design firms.

The Science Centre Delft, part of the Technical University of Delft, is a technical and scientific exhibition and research center in Delft. The center shows visitors the role of technology in current issues such as climate change, security and serious gaming. Visitors will be involved in all parts of the exhibitions.

Science Centre Delft shows innovations and scientific research which is done at the Delft University of Technology. An important aspect of the center is to provide insight into the process of scientific research of the university. This makes the center into an ideal place for students and scientists to show their research in the Science Centre Delft to the public. Therefore the case of the Science Center in Delft will be used to answer the following research question:

How can the coming together of multiple actors around one programme reinforce each other’s interests?
students’ projects are being exhibited in the Amazing Technology room

Senz Umbrellas, which holds its office at the Mijnbouwstraat complex, is testing its successful storm umbrella in the Science Center
findings

In general, the Science Centre sets the link between the research and project being done at the university and the public. Hereby the most interesting aspect of this case study is the coming together of different kinds of actors. The users of the building at the Mijnbouwstraat are students, entrepreneurs and the public, while they all have a different purpose and benefit for making use of it. Students can exhibit their research or project done at the university, where they can show their work to the public. The building where the Science Centre is located also provides workspaces for university spin-offs. For these entrepreneurs, the Science Centre with its visitors is used as a test site for their own (preliminary) products. For the public, the Science Centre is an interesting place where they can see, experience or play with the newest innovations. Therefore the centre has leisure purposes for the public.
conclusion

This case study shows how one function is being used by different kinds of actors who all have their own interests. The actors itself are partly responsible for the composition of the programme by delivering the input where other actors can benefit from. The actors are interdependent from each other’s contribution, which makes this case study having an interesting interplay between the contribution and benefit of the different actors.
Zomerdijkstraat, Amsterdam

Mixed use neighborhoods, where living and working is in right balance, stimulate the knowledge exchange. In creating these mixed use neighborhoods, creative solutions at buildings level are needed.

An interesting example of this combination of living and working in one building are the studios at the Zomerdijkstraat in Amsterdam. From 1932 to 1934 the architects Piet Zanstra, Jan Giesen and Karel Sijmons designed a housing complex with art studios, with working and living spaces for artists. Bringing together artists in the complex on the Zomerdijkstraat resulted in an artistic microclimate which led to common model evenings, joint exhibitions and a strong mutual influence.

The research on the studios at the Zomerdijkstraat will be used to answer the following research question:

What building typology creates a mixed use environment and takes into account the preferences of private and public use?
Zomerdijkstraat, Amsterdam

isometry of the Zomerdijkstraat complex after its renovation in 1990 by the architect Bertus Mulder

map of one-level studio

map of two-level studio
Due to the transparent facades on the atelier side, the artists' creations can be seen from street level. This creates a pleasant interaction between the passers and artists and their work. The artists can already gain publicity by exposing their work and the passers can see the activities that are happening in the neighborhood.

In the current situation, passers can only see the artists and their work, but there is still a certain distance between the passers and the artists. The passers can not see or maybe touch the products from a closer distance. And the artists do not have the ability to explain their work or talk to people who might be interesting in their sculpture or painting.

The artist studios can be made more interesting for entrepreneurs and the public with the following interventions.

A public programme on ground level might be an interesting alternative. A place with the artists working and living in the complex can exhibit and sell their work. Perhaps if the complex was located along a shopping street or a bit busier street than the Zomerdijkstraat, more people will pass by and notice their work.

The architecture of the facade should be improved. This plays a crucial role in the attractiveness of the complex and makes people decide to walk in or not.

Studios of different sizes, which allows the entrepreneurs to rent or buy a studio where the entrepreneur has need for.

Flexibility of spaces in the complex for allowing businesses to grow within the complex itself. This can be achieved by extending the structure of the building in height or extending towards adjacent spaces.
This case study shows the gradient in functions from strictly private section (living) towards a more public section (working with a exhibiting). Hereby the public part of the complex is located along the side where lots of activities are going on and thus more people can see the activities going on in the complex. The private section is located along the more quiet side of the complex, which is mostly prefered for the living area of a complex.

<table>
<thead>
<tr>
<th>exhibiting</th>
<th>working</th>
<th>living</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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conclusion
9  DESIGN
9.1 Introduction

This chapter consists of the urban design for a starter environment for companies in the high tech sector. It is located in the neighborhoods Oude Spoorbaan and Schrijversbuurt, along the Hoogstraat, in the southwest of Eindhoven. This design for the area will continue on conceptual schemes presented in the previous chapter. The case studies which were presented in the previous chapter as well, serves as inspiration for different kinds of interaction which characterizes the creative environments.

The design area consists of three small-scale industrial sites which will be transformed into creative environments, from south to north: breeding place, creative workshop and transactional environment. The three environments differ from each other by their phase of development, presented on this page, which determines the area’s introverted or extraverted character and experiment or market orientation. The urban design of each creative environment will firstly be introduced by design principles, which explains the basic ideas of the transformation of the each small-scale industrial site. Thereafter, the urban design of each environment will be presented by an axonometric drawing. Additional to this, the design of each environment is further visualized through an artist impression.

The chapter ends with an overview map of the total area and an aerial view showing the integration of the creative environments in the design area and surrounding.
9.2 Breeding place

Design principles

The breeding place, located in the south of the design area, is according to the life cycle of development characterized as an introverted environment in the experimental phase. The spatial interpretation of the breeding place will therefore strive to stimulate the interaction the entrepreneurs itself. Therefore internal meeting places and shared programme play a crucial role, so entrepreneurs can here meet and exchange ideas which helps them in this phase of development. Because the entrepreneurs in the breeding place do not yet have the need for interaction with the public (selling and/or exhibiting), the programme consists of mainly workplaces and shared programme with no public programme.

The Hoogstraat as the area’s central road, which connects the area in the north with the city centre and in the south residential areas. The importance of the Hoogstraat is emphasized with a row of trees. At the place of the breeding place (and the creative workshop and transactional environment) the row of trees is extended into the area perpendicular to the Hoogstraat.
breeding place - quality public space
breeding place - programme

- 2 working units: 2x 50 m² ground surface
- 1 working unit: 70 m² ground surface
- 2 working units: 2x 25 m² ground surface
- Shared facilities / workspace: 695 m² ground surface
- Central building with facilities: 2x 108 m² ground surface
- Housing: 2x 76 m² ground surface
- Housing: 2x 55 m² ground surface
- Housing: 2x 75 m² ground surface

- Addition of 15 parking places
- Addition of 16 parking places
- Removal of 60 parking places
shared facilities / workspace
695 m² ground surface

housing
2x 55 m² ground surface

shared facilities / workspace
805 m² ground surface

housing
2x 75 m² ground surface

addition of 10 parking places

shared facilities / workspace
1935 m² ground surface

addition of 15 parking places

housing
2x 50 m² ground surface

addition of 16 parking places

removing of 60 parking places
Design principles

The creative workshop, in the middle of the design area, is according to the life cycle of development characterized as an extraverted environment in the experimental phase. The spatial interpretation of the creative workshop will therefore strive to stimulate the interaction among the entrepreneurs and between entrepreneurs and the public. Therefore both internal and public meeting places play a crucial role, so the different kinds of interaction helps the entrepreneurs in this phase of development. The programme consists of more public programme than in the breeding place, because in this phase of development the need for interaction with the public and opportunities for selling and exhibiting emerges.
creative workshop - quality public space

internal meeting place
Hallenweg as attractive promenade
meeting place as the crossing of Hoogstraat and Hagenkampweg Zuid
A walkthrough from Hoogstraat public building for exhibitings, presentations, selling and horeca facilities.

- **255 m² ground surface**
  - Mixed living and working units with flexible interior
  - 8 × 345 m² ground surface
  - 1 × 380 m² ground surface
  - 1 × 230 m² ground surface

- **Shared facilities**
  - 475 m² ground surface

- **Removing of 12 parking places**

- **Adding of parking box with 30 parking places**

- **Working units**
  - 6 × 96 m² ground surface

- **Public functions**
  - (Canteen, horeca facilities)
  - 225 m² ground surface

- **Shared facilities**
  - (Rental meeting and presentation rooms)
  - 365 m² ground surface

- **Creative workshop - programme**
walkthrough from Hoogstraat

public building for exhibiting, presentations, selling and horeca facilities
255 m² ground surface

mixed living and working units
with flexible interior
8 x 345 m² ground surface
1 x 380 m² ground surface
1 x 230 m² ground surface

shared facilities
475 m² ground surface

removing of 3 parking places

removing of 12 parking places

removing of 7 parking places

addition of parking box with 30 parking places

shared facilities
480 m² ground surface

working units
2 x 200 m² ground surface

working units
1 x 135 m² ground surface
2 x 136 m² ground surface
1 x 55 m² ground surface

shared facilities
365 m² ground surface

shared facilities
645 m² ground surface

public functions (canteen, horeca facilities)
225 m² ground surface

removing of 20 parking places

business

public function
(shared) facilities
housing
Design principles

The transactional environment, located in the north of the design area, is according to the life cycle of development characterized as an extraverted environment in the market orientated phase. The spatial interpretation of the transactional environment will therefore strive to stimulate the interaction between the entrepreneurs and the public. Therefore public meeting places and public programme plays a crucial role, which helps the entrepreneurs in this phase of development. The environment consists of dominantly public programme such as spaces for selling, exhibiting and entertainment.
transactional environment - quality public space
place for events / exhibitions
removing of 35 parking places
removing of 16 parking places
large exhibition space
430 m2 ground surface
horeca function
630 m2 ground surface
public building for exhibiting, presentations, selling and horeca facilities
420 m2 ground surface
working units
4x 75 m2 ground surface
large exhibition space
705 m2 ground surface
working units
1x 360 m2 ground surface
1x 335 m2 ground surface
1x 295 m2 ground surface
large exhibition space
430 m2 ground surface
working units
3x 245 m2 ground surface
working units
2x 210 m2 ground surface
working units
2x 95 m2 ground surface
transactional environment - programme
working units
3x 245 m² ground surface

public function
280 m² ground surface

addition of two new volumes
with 90 parking places

removing of 35 parking places

removing of 16 parking places

large exhibition space
430 m² ground surface

horeca function
630 m² ground surface

public building for exhibiting, presentations,
selling and horeca facilities
420 m² ground surface

working units
4x 75 m² ground surface

large exhibition space
705 m² ground surface

working units
1x 360 m² ground surface
1x 335 m² ground surface
1x 295 m² ground surface

working units
2x 210 m² ground surface
2x 95 m² ground surface
9.5 Overview

Sections

The design of the Hoogstraat is characterized by two types of street profiles. At the place of the creative environments, the majority of the area’s activities will take place. Therefore the street profile will have a more urban atmosphere. The height of the buildings is a bit higher and public programme in the plinth is preferred. The interaction among entrepreneurs or between entrepreneurs and the public is being stimulated through a wide sidewalk where people can easily pass or stop for a talk. The profile of the road gives priority to the cyclists. The width of the road is smaller, so two cars cannot pass. Instead of that, the car will have to wait behind the cyclist for the other car to pass.

At the remaining parts of the Hoogstraat, the street profile will have a more village atmosphere. Therefore the current housing can be maintained as well. The height of the buildings is according to the normal height of the housing, which reaches up to a maximum of three stories. The design of the road gives priority to the car. Therefore the road is wider than at the place of the creative environments, so two cars can pass. Parking is possible on one side of the road.
9.6 Feasibility

The strategy presented in this graduation project argues with the current policy of developing new science and business parks on the outskirts of the city. Instead of this, centrally located small-scale industrial sites in the existing city of Eindhoven are considered as an interesting opportunity to accommodate creative and innovative companies, especially the starting companies.

But besides only presenting a different spatial strategy for the accommodating of these companies, it should also show that the same (or even more) amount of square metres can be realised with this alternative strategy.

The calculations of the spatial design for the starter environments for entrepreneurs in the high tech sector, show that the total surface covers $19,289 m^2$ (1.9 acres).

Even though no spatial design and thus no programmatic calculations for the other starter environments can be made, it can be estimated (figure 10.1) that this will not be enough to meet the requirements for business locations until 2030.

The calculation on the next page show with what density (Floor Space Index: total covered area on all floors of all buildings on a certain plot divided by the area of the plot) the site was built. As a comparison on figure 10.2: a project site such as the Strijp-S area is constructed in a much higher density (FSI 1.26) than can be achieved with the redevelopment of the small-scale industrial sites (FSI 0.56). The density of the transformed small-scale industrial sites for the high tech starter environment is however comparable with the High Tech Campus Eindhoven. New developments on the outskirts of the city, such as the Brainport Innovation Campus are built with a very low density (FSI 0.15). This assumes that with the inner-city redevelopment strategy presented in this project, which is an alternative strategy to the policy of developing areas on the outskirts of the city, can be built in a much higher density.

Concluded can be that with inner-city redevelopment strategy, which is presented in this booklet, the quantitative shortage for business locations can not be met. However, more total covered area can be realised with this alternative strategy than with the new developments on the outskirts of the city such as the Brainport Innovation Campus.
**Programmatic overview**

<table>
<thead>
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<th>Area</th>
<th>Public</th>
<th>Business</th>
<th>(shared) facilities</th>
<th>Housing</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeding place</td>
<td>108</td>
<td>220</td>
<td>3435</td>
<td>366</td>
<td>4129 m²</td>
</tr>
<tr>
<td>Creative workshop</td>
<td>650</td>
<td>6320</td>
<td>1965</td>
<td>900</td>
<td>9835 m²</td>
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<tr>
<td>Transactional environment</td>
<td>2465</td>
<td>2860</td>
<td>-</td>
<td>-</td>
<td>5325 m²</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19289</td>
<td>(1,93 ha)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Floor Space Index = \[
\frac{\text{total covered area}}{\text{plot area}} = \frac{1,93 \text{ ha}}{3,46 \text{ ha}} = 0,56
\]
10 EPILOGUE
10.1 Conclusion

The aim of this research and design project is a ‘*spatial strategy that facilitates the life cycle of innovative industries to strengthen the position of the Brainport Eindhoven in the knowledge economy*’.

In the current situation the majority of the Brainport businesses are, independently their phase of development, positioned on traditional industrial, business and science parcs on the outskirts of the city. This is however contracting to the theory of the life cycle of development. This theory assumes that being located in an urban supportive environment especially stimulates the development of innovative industries in the first phase of development, because they can benefit from the proximity to knowledge sources and other facilities. But with current policies of keep developing new live and work environments on the outskirts of the city, this will prevent the innovative industries from further development.

Sub-research question 1 *What spatial conditions are on what scale determinitive for a city and its surrounding region in the knowledge economy and how can these be addressed along the life cycle of development for innovative industries?* is answered through the theoretical research which is presented in the second chapter. This research has led to the composition of several conditions for the city and surrounding region on the scale level of the region, city and neighborhood.

In the chapters thereafter, the Brainport region is analysed on these conditions to answer sub-research question 2: *To what extent does the Brainport region meet the requirements in the knowledge economy and how can these challenges be addressed along the life cycle of development for innovative industries?*

The analyses show that the Brainport region actually does provide lots of opportunities to facilitate the life cycle of innovative industries. In the city of Eindhoven, there are many small-scale industrial sites that will become vacant and are suited for the accommodating of creative and innovative companies. This has been illustrated in this project by the ‘urban knowledge network’.

The urban design of a starter environment is an spatial interpretation for answering sub-research question 3: *What spatial characteristics stimulate innovation for companies in the first phase of development in the life cycle of development for creative and innovative industries?*

One of the main advantages of the strategy proposed in this project is taking the existing context as starting point for the accommodation of creative and innovative companies. Especially starting entrepreneurs have limited financial resources, so they will more likely prefer an existing accommodation more than a newly constructed. The accommodating of these entrepreneurs in the existing context also has advantages for the residents in the surrounding neighborhood, since the expected business activities will contribute to the activity level of the area as well. And last but not least, this strategy connects the international oriented Brainport with the local identity of the city of Eindhoven.

The life cycle of innovative industries is in this project implemented in the Brainport region. This can however also be applied to other cities and regions whose aim is to strengthen its position in the knowledge economy.
10.2 Evaluation

This paragraph contains an evaluation on the content of the graduation project.

Academic research
The chapter of the theoretical framework results in a series of determinitive conditions on three scale levels for a city and surrounding region to strengthen its position in the knowledge economy. For each condition, I strove for the comparing and weighing of different author’s opinion concerning that specific condition. This needs to results in an opinion which is well thought through.

I think some improvements can be done on this part. In some cases, a theory or opinion of only one author has been used. Even though the theory of this single author has been studied extensively, another (supportive or contradicting) opinion would have been useful.

Theme of the graduation studio
This graduation project is written within the graduation studio Urban Regeneration. One of the main goals of this studio is how it takes account for the ever changing requirements of users and dynamics of population characteristics. Hereby it aims to provide an improved physical environment and social and economic opportunities for citizens.

The research and design in this graduation project is oriented on the Brainport region. The existing context is used as starting point for a strategy of facilitating the life cycle of development of innovative industries. Hereby the graduation project reflects the theme of the studio.
Asheim, B. (2005) *Face-to-face, buzz, and knowledge bases sociospatial implications for learning, innovation, and innovation policy*.


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De Stad B.V. (2005b) *Proeftuin voor de creatieve economie*.


Hoog, M. de (2012) De Hollandse Metropool, Bussum, THOTH.


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Planbureau voor de Leefomgeving (2011) De concurrentiepositie van Nederlandse regio's.
Samenwerkingsverband Regio Eindhoven (2007a) *De geniale brainportlocatie*.
Strambach, S. (2011) *The role of KIBS in cumulative and combinatorial knowledge dynamics*.

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12 APPENDICES
Komen de meeste werknemers van het bedrijf uit het binnen-of buitenland? En wonen zijn ook in de regio?

HT: De meeste werknemers komen uit de regio zelf. Er is één buitenlandse werknemer, uit India, die ook in de regio woont. De voorkeur ligt niet bij buitenlandse werknemers, met name vanwege integratieproblemen. Daarbij komt dat tijdelijke buitenlandse werknemers (expats) een inwerktijd nodig hebben, wat de hele investering niet waard is. Daarbij komt dat tijdelijke werknemers daarna hun opgedane kennis kunnen gebruiken in hun thuisland om zo iets concurrerends te maken.

Interessant is om te kijken wat de bereidheid per opleiding is om te verhuizen voor werk. Hoger opgeleiden (kenniswerkers) zijn meer bereid om te verhuizen voor werk.

ASML (net als Assembléon en afgeleiden van Philips) is wel op zoek naar kenniswerkers uit het buitenland.

Met wat voor factoren (ruimtelijk, economisch) willen jullie potentiële werknemers overhalen voor Frencken Group te komen werken?

HT: Meeste werknemers komen uit de regio zelf, hoewel potentiële werknemers niet worden overgehaald om in de regio komen wonen en werken.

Hoe functioneert de Brainport voor jullie? Wat zijn de voordelen en waarin schiet het tekort?

HT: Het netwerk van de Brainport is gecreëerd om krachten te bundelen. Bedrijven hebben tot op een zeker niveau met dezelfde problemen te maken.

Hoe vindt samenwerking met andere bedrijven van de Brainport plaats?

HT: Eens in de zoveel weken vinden overlegmomenten plaats, waarbij wordt gepraat over problemen en kansen van de Brainport bedrijven als geheel.

Hoe komen jullie in contact met andere bedrijven voor kennisuitwisseling?

HT: Frencken Europe is een redelijk naar binnen gericht bedrijf, omdat het echte R&D werk, door andere bedrijven eerder in het proces wordt gedaan.

Wanneer of onder welke voorwaarden zouden jullie vertrekken uit de regio?

HT: Wanneer de klanten waar Frencken Europe afhankelijk van is, research and development bedrijven, ook wegtrekken uit de regio. Daarbij komt dat Frencken Europe moeilijk kan wegtrekken omdat hun werknemers veelal afkomstig zijn en wonen in de regio. Wanneer zij zouden verhuizen naar elders, zouden ze daar helemaal opnieuw moeten beginnen.

Hoe belangrijk is de (binnen)stad Eindhoven voor het bedrijf en werknemers?

HT: Alleen voor aspecten als bereikbaarheid is de stad belangrijk voor het bedrijf. Al is dit wel heel slecht voor het De Hurk terrein. Zelf woont Henk Tappel in het land en heeft weinig binding met de stad Eindhoven.

Lopen jullie tegen de nadelen van Eindhoven als provinciestad aan? Zo ja, welke?

HT: Eindhoven heeft niet de (stedelijke) uitstraling van Amsterdam, Utrecht en zelfs Enschede.

Hoe belangrijk is de kwaliteit van de omgeving van het bedrijf (De Hurk). Is er behoefte aan een andere werkomgeving?

HT: Op dit moment werkt De Hurk gewoon goed voor een bedrijf als Frencken Europe. Af en toe heeft het last van vrachtwagens van omliggende bedrijven. Nu is het bedrijventerrein volgens HT moeilijk te mengen met andere functies. Bij het High Tech

Campus zou dat eerder mogelijk is. Wel geeft TP aan moeite te hebben met de zichtbaarheid, bekendheid en profilering van het bedrijf, vanwege zijn geïsoleerde ligging.

Overig

Kennisuitwisseling vooral op High Tech Campus mogelijk én nodig. Ideaal klimaat voor de zogenoemde nerd.

5 minuten fietsen naar TU/e, science parcs

De mensen van de Brainport “kennen elkaar” > fijn ondernemen

Gigantische bedrijvigheid van Philips was eerst aanwezig op De Hurk

In Enschede bevinden zich wel woningen voor expats op de universiteitscampus

Kart maken van R&D bedrijvigheid, 1e lijn toeleveranciers, 2e lijn toeleveranciers, 3e lijn toeleveranciers.

Frencken Group (nu Frencken Europe) was één van de eerste bedrijven gevestigd op De Hurk

Na de WOII floreerde de tabakindustrie zeer, daarvan zijn nu nog steeds afgeleiden in de regio en in De Hurk

Kenniswerkers: mensen die omzet genereren

De komende 10 jaar komt Nederland 40.000 technici tekort, waarvan 30.000 vakleiden.

Brainport heeft zijn wereldwijde voorsprong van 10 jaar geëerd van Philips. Taak is om deze voorsprong te behouden, door de ‘assen’: innovatie, kenniswerkers en vaklieden, (internationale) bekendheid, zichtbaarheid en profilering.
Wat is de rol van de SRE en hoe is het politiek gepositioneerd?
JvZ: SRE werkt van onderop samen met 21 gemeenten. Tot voor kort had de SRE de WGR+ status, waarbij het ook verantwoordelijk was van de RSP (Regionaal Structuurplan regio Eindhoven). De plus-status is onlangs afgenomen, waardoor het geen wettelijke bevoegdheid heeft. Daarom stelt het nu programma's op, maar voert het geen beleid. Het levert het de input voor de bestuurlijke organen.

Wat is jullie beleid voor nieuwe bedrijflocaties? Meer verspreid of juist meer geconcentreerd en dicht bij de stad?
JvZ: De organisatie Brainport Development is daadwerkelijk verantwoordelijk voor het aannemen van nieuwe bedrijvigheid en toewijzen van bedrijflocaties. Visie van de SRE is het tot openbaar gebied maken van de huidige science parcs, business parcs en universiteitscampussen. Aan de TU/e campus worden nu ook andere functies en voorzieningen toegevoegd. Ook de toekomstige Brainport Innovatie Campus langs de A2 wordt meer gemixt.

Wat is jullie visie op het aantrekken van kenniswerk, waarmee wordt de regio gepromoot? Is hierbij een verschil tussen de nationale en lokale politiek?
JvZ: Strategie over aantrekken kenniswerk door Brainport Development. Wel kan ik me voorstellen dat de regio voor expats aantrekkelijker wordt wanneer er al een expat center of community aanwezig is.

Wat zijn volgens de SRE de huidige problemen en toekomstige uitdagingen van de regio Eindhoven?
JvZ: Er zijn in de stad veel in onbruik geraakte kantoorpanden en fabrieksgebouwen. Hier zijn de beleggers en particulieren verantwoordelijk voor. Daarnaast is er een veel te hoog aanbod van bedrijventerreinen. “De opgave ligt in de stad.”

Waarom wordt het A2 Avenue project, het vlaggenschip van de Brainport, aan de rand van de stad gesitueerd?
JvZ: JvZ ziet A2 Avenue als onderdeel van de stad, maar erkent wel dat de andere business en science parcs afgeleggen liggen en geen onderdeel zijn van de stad. Het is door middel van Strijp-S verbonden met het stadcentrum. Bij Strijp-S is Trudo een belangrijke partij. Het is een corporatie, waardoor het zich kan veroorloven om de huren kunstmatig laag te houden.

Wie is verantwoordelijk voor de toewijzing van nieuwe bedrijflocaties en woongebieden? Lokale overheids of marktpartijen?

Heeft Eindhoven ook een incubator (broedplaats voor startende ondernemingen), zoals YES!Delft?
JvZ: Ja, hiervan bevinden zich er twee op de High Tech Campus, één in Helmond en één in Eersel.

Overig
JvZ over Cambridge en Oxford: “Daar kan de Brainport Eindhoven nog veel van leren”
Brainport Development is vooral bezig met “wat” vraag, maar de “waar” en “hoe” is bij hen ondergeschikt.
JvZ over incubator/broedplaats in de stad: “Een gouden kans, daarvan zouden er meer moeten zijn”
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OEM (Original Equipment Manufacturer) van de Brainport: Philips Health Care, DAF, Océ, ASLM en FEI
Samenwerking tussen A2-steden: Amsterdam, Utrecht en Eindhoven
Ekkersrijt Brainport’s grootste bedrijventerrein, gebruikte woonboulevard als trekker om meer divers te worden