DELFT
For knowledge and people
Connecting the knowledge city with its citizens
Final report

Graduation project

MSc Urbanism
Faculty of Architecture
TU Delft

Christiane de Koning

July 2009
# Table of content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>7</td>
</tr>
<tr>
<td>Summary &amp; Samenvatting</td>
<td>8</td>
</tr>
</tbody>
</table>

## Part I - Project

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>16</td>
</tr>
<tr>
<td>2. Situation</td>
<td>17</td>
</tr>
<tr>
<td>2.1 Problem field</td>
<td>17</td>
</tr>
<tr>
<td>2.2 Aims of the graduation project</td>
<td>22</td>
</tr>
<tr>
<td>3. Project</td>
<td>23</td>
</tr>
<tr>
<td>3.1 Relevance</td>
<td>23</td>
</tr>
<tr>
<td>3.2 Research questions</td>
<td>24</td>
</tr>
</tbody>
</table>

## Part II - Research

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Knowledge city</td>
<td>28</td>
</tr>
<tr>
<td>4.1</td>
<td>28</td>
</tr>
<tr>
<td>4.2</td>
<td>45</td>
</tr>
<tr>
<td>4.3</td>
<td>50</td>
</tr>
<tr>
<td>5. Sustainability</td>
<td>58</td>
</tr>
<tr>
<td>5.1</td>
<td>58</td>
</tr>
<tr>
<td>5.2</td>
<td>72</td>
</tr>
<tr>
<td>6. Delft</td>
<td>76</td>
</tr>
<tr>
<td>6.1</td>
<td>76</td>
</tr>
<tr>
<td>6.2</td>
<td>80</td>
</tr>
<tr>
<td>6.3</td>
<td>83</td>
</tr>
<tr>
<td>6.4</td>
<td>90</td>
</tr>
</tbody>
</table>
## Part III - Design criteria

7. Requirements of the knowledge city
   7.1 Formal spatial requirements
   7.2 Functional spatial requirements

8. Case study: Schie canal banks
   8.1 Existing situation
   8.2 Design criteria

## Part IV - Design

9. Redesigned Schie canal banks
   9.1 Design concept
   9.2 Overall design
   9.3 Design of the Axes

10. Conclusion: Knowledge City on the Schie canal banks

References

Appendix

A. Environmental maximisation method

B. Socio-demographic research: Population of Delft
Graduation project
The project is situated in the city of Delft. The city council promotes the city since the beginning of 1990 as Delft Knowledge City. The Knowledge City Center of Technology (Kenniscentrum Technology) writes (*1).
The main problem is that not all citizens can benefit from this knowledge-based urban development. (*2)

This project will focus on all citizens, by creating a sustainable type of urban development for the ‘knowledge’ people and the ‘non-knowledge’ people. The gap between the university and the population needs to be closed.

(*1) www.delteventjes.net
(*2) A.K. Reinhard, M. Meertens and A. Ruisbroek A knowledge-based urban paradox: the case of Delft

Research
The main research will focus on the social side of knowledge cities. How the university-cities deal with the ‘non-knowledge’ people in the city. This research will focus on national cities, like Eindhoven or Twente, and international cities. The research will also deal with the difference between the university campus and the university city.

Strategy
- Keyprojects
- Sustainability
- Social sustainability
- Social sustainability plays a main part in this project. From the four P’s of Koos Duijvestein, people is the most important one in this project. The other P’s, planet, project and prosperity, are more important on the scale of the keyprojects.

MOTIVATION

Social relevance
In Delft, there is a gap between the ‘knowledge’ and the ‘non-knowledge’ people. Many of the new large building plans in Delft are only linked to the knowledge city, for example the new Medebank and Technopolis. In contrast to this knowledge based urban designs, another project, Redesign the city (*3), wanted to give a new impetus to Delft in a creative way. On several sessions, the creative industry and the population made designs for five locations in Delft, including the Schie banks.

(*3) www.redesignthecity.eu

Scientific relevance
The research project will focus on the social side of University cities. There are many researches made about university campuses, but this this time the focus is on the social side of these university cities, national and international.

Process

Further studies and mentors
Next to the main research, some other studies need to be done, for example an analysis of Delft (population, businesses, physical, existing strategies and projects).

The first mentor can be from the section of Spatial Planning and Strategy, connected to the Knowledge City. Other mentors can be from Environmental Technology-based design and Urban Design.

Planning cycle
It is important to use the planning cycle during the entire process. By repeating the steps, the design and research can be improved. This planning cycle consist of analysis, design, strategy and evaluation. It can be redone over again.
This final report describes the last project in my education at the faculty of Architecture and the master in Urbanism.

I started this graduation project in February 2008. Within three weeks, a motivation poster about the project had to be presented. The main problem, goals, themes and locations were identified. This poster is shown on the left page. The main theme was Delft as a knowledge city. The entire population should profit from this knowledge strategy from the city council. The Schie canal banks were assigned as the design location, because of the leaving industries and its location in between the university, the city centre and the living areas.

In the next half year, the contours of the project were determined in the Thesis plan. The project did not differ a lot from the start with the motivation poster. The research on the knowledge city led to some interesting starting points.

Unfortunately, the project was interrupted for half-a-year, due to personal problems. At the end of 2008, I started working again. The last half year of the project, the focus was on the translation of the research into the design.

Overall, I really liked working on this large project. I learned very much, not only about the theories, but also on the working process. I think it is a valuable end of my education in Urbanism.

I want to thank my mentors, Roberto Rocco, Kristel Aalbers and Maurice Harteveld for their support, advice and the nice conversations we had. Without their help, I could not have finished this project. Besides, I really had a great time working with this great team of mentors.

I also want to thank my family and friends, who always supported me in this period. I really appreciate all the encouragements and help I received. It meant a lot to me.

I hope you will enjoy reading this report.

Christiane de Koning
Graduation student Urbanism
Faculty of Architecture, TU Delft
July 2009
Summary & Samenvatting

Project
In the last decades of the 20th century, there has been a shift from the industrial towards the post-industrial economy: the knowledge and service economy. In comparison to the pre-industrial city, knowledge is now seen as a strategic and critical resource. Cities also join this trend, by presenting themselves as 'knowledge cities'. The Knowledge City is “a city that was purposefully designed to encourage the nurturing of knowledge”.

The city of Delft presented itself from the beginning of the 1990s as a ‘knowledge city’. The main goals of this policy were economic growth and the establishments of knowledge-based businesses and companies. Delft Kennisstad pays a lot of attention to the business climate, but tends to forget about the people climate. The main actor in the Knowledge City Delft is the Delft University of Technology. The withdrawing of the university out of the city centre led to a physical, social and cultural gap between the knowledge sector and the citizens of Delft. The goal of the graduation project is to create a new sustainable strategy for the city of Delft, based on knowledge, but in a way that all citizens of Delft can benefit from it.

Research
The research part exists out of three parts: the Knowledge City, Sustainability and Delft.

Many cities worldwide present themselves as a Knowledge City. Mainly in cities, knowledge is produced, processed, exchanged and marketed. The city that generates new knowledge and new ideas will be economically more successful. These cities have to transform their spatial conditions in order to fit the demands of the new economic activities.

The exchange of knowledge is an important aspect of the Knowledge City. Citizens play an important role in this process. Human meetings and social interactions cause the generation of knowledge. Designing for the Knowledge City is creating possibilities and facilities for the citizens to exchange their knowledge.

Space is, in times of advanced information and communication technologies and the Internet, actually still very important. Creating knowledge is not an isolated activity. People need places to meet. Not all kinds of knowledge can be exchanged over the internet. Tacit knowledge is the knowledge produced by practice or unaware acquisition of skills through the performance of tasks, which is done during face-to-face contact.
For the spatial design of the Knowledge City, the report lists eight requirements, divided in formal spatial and functional spatial requirements:

- **Scale**: large cities have an advantage in the knowledge economy, because of the higher amount of people and amenities, which attract new knowledge workers and knowledge-based businesses.

- **City structure**: urban areas can have a mixed-use functioning. It is important to have a clustering of knowledge-based activities.

- **Infrastructure**: a city with good accessibility has more and diverse human contacts and urban activities.

- **Urban appearance**: the appearance of the urban area is very important to stimulate creativity for the users.

- **Knowledge-based activities**: they are the core of the Knowledge Cities. There should be many different activities for different types of knowledge workers.

- **Quality of life**: knowledge workers are attracted to cities by the quality of life. They want to live in a vibrant and lively city.

- **Urban diversity**: urban places where different people come together stimulate creativity. Urban diversity creates low barriers for people to express themselves.

- **Meeting points**: these spaces should inspire people and offer the opportunity to meet different people, in order to exchange knowledge.

Planning the Knowledge City is about creating facilities and opportunities for the knowledge workers to work, to inspire them to generate new knowledge and ideas and to create amenities for them to enjoy themselves. The knowledge companies follow the knowledge workers.

The knowledge economy is unpredictable, so it is not easy to plan or design a Knowledge City. The design should be flexible to fit the unpredictable demands. This can be done by soft planning or design. This is not designing by drawing strict lines and building blocks, but by assigning areas and main structures.

The eight requirements are compared to the seven criteria for a sustainable city. These criteria are: a just city, a beautiful city, a creative city, an ecological city, a city of easy contact, a compact and polycentric city and a diverse city.

Many similarities can be found in the knowledge city and the sustainable city. The most relevant ones are the easy contact, diversity and creativity. In both cities, these factors are important in the success factor of the city. Designing a sustainable, knowledge city is indeed possible.

Coming back to the knowledge-based development, there are two recognised purposes. The first one is the “economic growth” and the second one is “individual and social development”. These two purposes create a paradox: the increase of individual capital will lead to more people who can participate in the knowledge economy, but in the knowledge economy, a lower amount of jobs is needed, because of the technological developments. A third purpose is needed to create a more sustainable development: “social and environmentally sustainability”. The three purposes together cover the three types of sustainability.

For Knowledge Cities, it means that the third purpose needs to be added to the spatial requirements. The well being of people is becoming more important. Instead of only knowledge workers, knowledge citizens are the target group. And instead of the knowledge society, the focus is on the learning society. The process of education becomes more important.
The international competition to attract the knowledge workers to a city is very difficult. More people tend to move to other countries more easily. The competition is growing. Knowledge workers are more attracted by the people and companies of a city, than by the campaigns to attract them. There are mainly three things cities can do to attract knowledge workers: invest in organisations, invest in the built environment and organise an event.

The Environmental Maximisation method is used to assign the best solutions for several themes on sustainability for the location of the Schie canal banks. These maximisation maps are combined into an optimisation map, which serves as a base for the design of the location. Important conclusions of this study are: preserve the monumental buildings, encourage use of public transport or slow traffic, make continuous water streams and create green connections.

A healthy and safe environment is necessary in the sustainable knowledge city. It is important that the well being of people gets a lot of attention. People need to feel safe in their living and working environment, in order to come to new ideas and inventions. There are four themes in healthy urban planning: individual lifestyles (physical activity), quality of the environmental stock (pollution), living conditions (equal access) and supportive social networks (community and safety). A higher density, mixed-use, pedestrian friendly environment with accessible local facilities and social diversity will lead to a better public health. However, there is a huge danger of wishful thinking. The assumption of a direct, simple cause and effect is not always right.

Delft is one of the cities of the ‘Zuidvleugel’, South wing, of the Randstad. Delft is one of the cities with a high-quality knowledge centre. Delft is in the middle of the South wing and has good infrastructural connections to the other cities. It is the ‘City of Technology’ in this network. In order to become a knowledge city, the city council of Delft started the foundation Delft Kennisstad. Other important policies are the housing vision, climate plan and ecological plan. In housing, special target groups are students, knowledge workers and starting companies. The environmental plans deal with low CO2-emissions and ecological structures.

The city council made different plans for the Schie canal banks, which do not fit into the Knowledge City concept. The plan of the city council for Technopolis covers only the knowledge-based developments, so it is not complete.

The population of Delft is studied in a social-demographic research. The main recommendations for the design for the Schie canal banks are to create good connections with existing facilities in the city centre, create more high-quality green spaces, create more housing for young people and knowledge workers, create more recreational amenities, create a higher building density and create jobs for lower-educated people.
**Design criteria and design**

The research is translated into the design criteria by drawing the conclusions on the map of Delft and the Schie canal banks. The important matters are summarised here. Delft is too small to be a Knowledge City in itself, so it should cooperate with the other cities in the South Wing of the Randstad. Functions, like housing, working and leisure, should be combined more, instead of separated. Delft already has a good infrastructure. Mobility nodes are important points to create amenities. Clusters of knowledge-based developments should be around the nodes. The quality of life should be improved by adding more recreational and cultural amenities. The diversity in amenities will attract a diversity of people, which is needed in the Knowledge City. The monumental buildings should be preserved. The existing public spaces in the Schie canal banks are not attractive. More and better public spaces should be added to the location.

The design criteria and conclusions from the research are made into a design for the Schie canal banks. The design concept is making five east-west axes, in order to integrate the location better into the surrounding area. These five lines are connected to the monumental buildings and historical locations, because they give them an identity. The lines have different characters, diversity is important in the Knowledge City in order to attract more different people to the area and have them exchange their knowledge. The five main themes for designing the Knowledge City are knowledge, recreation, culture, architecture and green. The themes are related to the activities people will do in the Knowledge City. People need to work (knowledge) and live, but also leisure time is important (culture, green and recreation). The most northern axis, the ´Zicht op Delft´-axis has many cultural facilities. The second axis is connected to the ecological network, so the main character is green. The view line of the Harbour-axis is leading towards the university and the new college buildings. The central axis has the character of knowledge. Axis number four is connected to the old Glue and gelatin factory. In the old industrial buildings, there are cultural activities, parties, expositions and festivals. The last axis is a visual connection. The new railway station is placed at the axis of symmetry of the Kruithuis. This way, the axis has a grand and prominent character.

The new design for the Schie canal banks fits into the Knowledge City concept. Knowledge workers want to work, live and recreate in the Knowledge City. This is possible in the design for the Schie canal banks. There is a good balance between natural and urban areas. A big diversity in types of recreation attracts many different people. Not only knowledge workers will profit from the developments, but also the other citizens of Delft. By creating more amenities, jobs are created for lower educated people. The axes cause a better integration of the location in the city. This way, the city and its citizens can profit from this new design.

Het doel van het afstudeerproject is het creëren van een nieuwe, duurzame strategie voor de stad Delft, gebaseerd op kennis, maar op die manier dat alle inwoners van Delft hier hun voordeel uit halen.

Onderzoek


Ruimte, in een tijd van geavanceerde informatie en communicatie technologieën en het Internet, nog steeds van groot belang. Kennis ontwikkeling is geen geïsoleerde activiteit. Mensen hebben ruimte voor ontmoeting nodig. Niet alle vormen van kennis uitgewisseld worden via het Internet. Impliciete kennis is de kennis die opgedaan wordt tijdens toepassingen of onbewuste uitvoering van activiteiten tijdens het uitvoeren van opdrachten, wat gebeurd tijdens fysieke ontmoetingen van personen.

Voor het ruimtelijke ontwerp van de Kennisstad, het verslag rapporteert acht randvoorwaarden, uiteengezet in fysieke ruimtelijke en programmatisch ruimtelijke voorwaarden:

- Schaal: grote steden hebben een voordeel in de kennis economie, door het grote aantal mensen en voorzieningen, wat nieuwe kennis werkers en kennisgerelateerde ondernemingen aanrent.
- Stadsstructuur: stedelijke gebieden hebben de mogelijkheid voor functiemenging. Het is belangrijk om een cluster van kennisgerelateerde activiteiten te hebben.
- Infrastructuur: Een goede bereikbaarheid van een stad zorgt voor een diversiteit in menselijke contacten en stedelijke activiteiten.
- Uiterlijk van stedelijke omgeving: het uiterlijk van de stedelijke gebieden is erg belangrijk voor het stimuleren van de creativiteit van de gebruikers.
- Kennisgerelateerde activiteiten: Zij zijn de kern van de Kennisstad. Er zouden veel verschillende activiteiten voor de verschillende types kenniswerkers moeten zijn.
- Kwaliteit van leven: Kenniswerkers worden aangetrokken door een stad door haar kwaliteit van leven. Zij willen leven in een vitale en levendige stad.
- Stedelijke diversiteit: Stedelijke plekken waar verschillende mensen samenkomen stimuleren creativiteit. Stedelijke diversiteit is verantwoordelijk voor het verlagen van drempels voor mensen om zichzelf uit te kunnen drukken.
- Ontmoetingspunten: Deze ruimtes moeten mensen inspireren en de mogelijkheid bieden tot het ontmoeten van verschillende mensen, om kennis uit het nieuwe kennis en ideeën te genereren voor het creëren van voorzieningen voor hen om zichzelf te verwaken. De kennisgerelateerde bedrijven zullen de kenniswerkers volgen.

Het plan voor een Kennisstad gaat over het creëren van faciliteiten en mogelijkheden voor de kenniswerkers om te werken, om hen te inspireren om nieuwe kennis en ideeën te genereren en het creëren van voorzieningen voor hen om zichzelf te verwaken. De kennisgerelateerde bedrijven zullen de kenniswerkers volgen.

De acht randvoorwaarden zijn vergelijk met de zeven criteria voor een duurzame stad. Deze criteria zijn: Een rechtvaardige stad, een mooie stad, een creatieve stad, een ecologische stad, een stad met gemakkelijke contacten, een compacte stad en een diverse stad.

Veel overeenkomsten kunnen gevonden worden tussen de Kennisstad en de duurzame stad. De meest relevante overeenkomsten zijn de gemakkelijke contacten, diversiteit en creativiteit. In beide steden zijn deze factoren belangrijk in het succes van de stad. Het ontwerpen van een duurzame Kennisstad is mogelijk.

Terugkomend op de kennisgerelateerde ontwikkelingen, er zijn twee herkenbare doelen. De eerste is de “economische groei“ en de tweede is “individuele en sociale ontwikkeling“. Deze twee betekenen vormen een paradox: de vergroting van individueel capaciteiten zal leiden tot meer mensen die kunnen deelnemen aan de kennis economie, maar in de kennis economie is een lager aantal banen nodig, wegens de technologische ontwikkelingen. Een derde doel is nodig om een duurzamere ontwikkeling te creëren: “sociale en milieukundige duurzaamheid.“ De drie betekenen gezamenlijk kunnen de drie typologieën van duurzaamheid bevatten.

Voor Kennissteden, betekent dat de derde betekenis toegevoegd moet worden aan de ruimtelijke voorwaarden. Het welzijn van mensen wordt steeds belangrijker. Niet alleen de kennis werkers, maar alle inwoners van de Kennisstad zijn de doelgroep. En in plaats van op de kennis maatschappij ligt de focus op de
lerende maatschappij. Het gehele proces van educatie wordt belangrijker.

De internationale strijd van het aantrekken van kenniswerkers naar een stad is zeer moeilijk. Meer mensen lijken makkelijker naar andere landen te verhuizen. De concurrentie groeit. Kenniswerkers worden meer aangetrokken door de mensen en de bedrijven van een stad, dan door de campagnes om de werkers aan te trekken. Er zijn over het algemeen drie dingen die een stad kan doen om kenniswerkers aan te trekken: investeren in stimulerende organisatie, investeren in bebouwing en openbare ruimte en organiseren van een speciaal evenement.

De Milieu Maximalisatie Methode is gebruikt om de beste oplossing voor verschillende thema’s op duurzaamheid voor de locatie Schieoevers aan te wijzen. The maximalisatie kaarten zijn gecombineerd in een optimalisatie kaart, welke ingezet is als basis voor het ontwerp van de locatie.

De belangrijkste conclusies van dit onderzoek zijn: Behoud van monumentale gebouwen, stimuleren van het gebruik van openbaar vervoer en langzaam verkeer, continu stromende water ontwerpen en het creëren en voortzetten van ecologische verbindingen.

Een gezonde en veilige omgeving is nodig in een duurzame Kennisstad. Het is belangrijk dat het welzijn van mensen veel aandacht krijgt. Mensen moeten zich veilig voelen in hun woon- en werkomgeving om tot nieuwe ideeën en uitvindingen te komen. Er zijn vier thema’s in gezonde stedelijke planning: individuele leefwijze (fysieke activiteit), kwaliteit van de milieuvoorraad (vervuiling), leef omstandigheden (eerlijke verdeling) en ondersteunende sociale netwerken (gemeenschap en veiligheid). Een hoge dichtheid, functiemenging, voetgangers vriendelijke omgeving met toegang tot lokale faciliteiten en sociale diversiteit leidt tot een betere publieke gezondheid. Ondanks dit, is er een grote gevaar in het hoopvol denken. Het uit gaan van een directe en simpele oorzaak en gevolg is niet altijd juist.

Delft is een van de steden in de Zuidvleugel. Delft is een van de steden met een hoog kwalitatief kenniscentrum. Delft ligt in het centrum van de Zuidvleugel en heeft goede infrastructurale verbindingen met andere steden. Delft is de technische stad in dit netwerk.


De populatie van Delft is bestudeerd in een sociaaldemografisch onderzoek. De hoofd aanbeveling voor het ontwerp van de Schieoevers zijn het ontwerpen van goede verbindingen met bestaande faciliteiten in het stadscentrum, het creëren van hoog kwalitatieve groen ruimtes, de creatie van huisvesting voor jongeren en kenniswerkers, het creëren van recreatieve voorzieningen, maken van een hogere bebouwingsdichtheid en het creëren van banen voor lageropgeleide mensen.

Ontwerp criteria en ontwerp
Het onderzoek is vertaald in ontwerp criteria door het uittekenen van de conclusies op de kaart van Delft en de Schieoevers.

De belangrijke aspecten zijn hier samengevat. Delft is te klein om een Kennisstad te zijn, hierdoor zou het moeten samenwerken met andere steden in de Zuidvleugel van de Randstad. Functies, zoals huisvesting, werk en vrije tijd, moeten gecombineerd worden, in plaats van gescheiden.


Meer en beter openbare ruimte moet toegevoegd worden op deze locatie.

De ontwerp criteria en conclusies uit het onderzoek zijn verwerkt in het ontwerp voor de Schieoevers. Het ontwerpconcept maakt vijf oost-west assen, om de locatie te integreren in de omliggende gebieden. De vijf lijnen zijn verbonden aan de monumentale gebouwen en historische locaties omdat deze de assen een identiteit geven.

De lijnen hebben verschillende karakteristieken, diversiteit is belangrijk in de Kennisstad om meer verschillende mensen naar het gebied te trekken en hen kennis uit te laten wisselen. De vijf thema’s voor het ontwerp van de Kennisstad zijn kennis, recreatie, cultuur, architectuur en groen. De thema’s zijn gerelateerd aan activiteiten die mensen doen in de Kennisstad. Mensen gaan werken (kennis) en leven, maar ook hun vrije tijd is erg belangrijk (cultuur, groen en recreatie).

De meest noordelijke as is de ‘Zicht op Delft’ as en heeft veel culturele faciliteiten. De tweede as is verbonden met het ecologische netwerk, waardoor het hoofdthema groen is. Het zichtlijn van de haven-as leidt naar de universiteit. De andere assen zijn de kennis, recreatie, cultuur, architectuur en groen. De as is verbonden met de oude lijm- en gelatine fabriek. In de oude industriële gebouwen worden nu culturele activiteiten, feesten, exposities en festivals aangeboden. De laatste as is een visuele verbindingen. Het nieuwe station wordt op de symmetrie as van de Kruithuis gesitueerd, OP deze manier, heeft deze as een groots en prominent karakter.


Het onderzoek is vertaald in ontwerp criteria door het uittekenen van de conclusies op de kaart van Delft en de Schieoevers.
This report describes the entire graduation project ‘Delft, for knowledge and people, connecting the knowledge city with its citizens’. The project is done, in order to gain the title Master of Science.

The project deals with Delft as a Knowledge City, which is not functioning well. There is too much focus on the universities and related knowledge-based developments. The main purpose is to make Delft a Knowledge City that pays attention to all citizens.

The design location, the Schie canal banks, is a barrier between the university and knowledge-based companies and the rest of the city. The new design deals with the integration of the area in its context, in order to connect the Knowledge City with its citizens.

Content
The report starts with the situation in the case of Delft. It describes the problem and the goals to be achieved in the project. It also describes the way of working.

The second part is about the research, which is done during the project. The three main categories are the Knowledge City, Sustainability and the case of Delft.

The research was translated into the design. This translation can be found in part three, the design criteria. It is the in between step from research towards design.

The last part describes the design for the Schie canal banks. It is followed by the conclusion, about how the design answers the problem mentioned in the first part.
2. Situation

2.1 Problem field

Shift from industrial economy to knowledge economy
The city has always been a centre of knowledge since its foundation. (Knight, 1995; Ergazakis et al., 2006) In the 20th century, the city came under pressure to accommodate the needs of the production industries. These new production facilities caused the growth of the city in size and population, but also social and environmental problems. Nowadays, many industrial activities, like factories, are declining or have already disappeared from the city. This offers the city new opportunities to develop in another way. (Knight, 1995)

In the last decades of the 20th century, there has been a shift from the industrial towards the post-industrial economy: the knowledge and service economy. In comparison to the pre-industrial city, knowledge is now seen as a strategic and critical resource. The progress of the information and communication technology was an important factor in this change, because this made worldwide communication more simple and fast. (Ergazakis et al., 2006; Fernández-Maldonado & Romein, 2008; Abu-Anzeh & Ledraa, 2007)

Many governments develop strategies that are knowledge-based. Knowledge-based developments are described by Knight as ‘the transformation of knowledge resources into local development. (Knight, 1995) Many cities worldwide present themselves as ‘knowledge cities’. Leif Edvinsson describes the knowledge city as “a city that was purposefully designed to encourage the nurturing of knowledge” (quoted in Dvir & Pasher, 2004). In this type of city, the knowledge-based services are concentrated and collaborating. The knowledge flows and spillovers in between these services are seen as the key factors of technological innovation. Cities try to attract knowledge workers, because an important competition criterion of the knowledge economy is to provide a city climate that attracts, retains and integrates talented and creative individuals. (Florida, 2002) Cities try to have a lively and vibrant environment and quality of local culture, vitality, uniqueness, ethnic diversity and tolerance are important factors of knowledge cities.
The manufacturing industries of Delft were declining, so the city council wanted to improve the employment situation. The focus of this new strategy was on the knowledge sector, because of the research done by Richard Knight, who pointed out that Delft had a privileged position in terms of knowledge. By choosing this sector, Delft followed a national and regional trend. (Fernández-Maldonado & Romein, 2008)

Knight advised to pay attention to the lack of synergy between the knowledge sector and the local community. He found out that 89% of the knowledge workers lived outside of Delft and many people of the local community commuted to other cities. He recommended designing a strategy that would integrate the knowledge-based activities into the city’s life. These activities are dynamic and demanding, therefore they need to be upgraded. (Knight, 1995; Fernández-Maldonado & Romein, 2008)

The city of Delft presented itself from the beginning of the 1990s as a ‘knowledge city’. The main goals of this policy were economic growth and the establishments of knowledge-based businesses and companies. This strategy is now one of the main pillars of the economic policy of the city council. In 2005, the city council decided that Delft will continue to develop itself as knowledge city at least until 2015. Besides, the city wants to grow towards 100,000 inhabitants.

In 2005, a research was done on ‘Delft Kennisstad’ by Van der Geest and Heuts (2005). They concluded that Delft Kennisstad did not reach the goal of economic growth. Although there were many amenities created for the starting businesses, the number of these is still below average in similar cities. The city council did make a lot of effort to facilitate networking between the different knowledge institutes. However, the large amount of projects concerning the knowledge city led to fragmentation. This caused the failure of some of the projects. The researchers advised to continue the ‘Delft Kennisstad strategy’, but to make it explicit how Delft is different from other knowledge cities. The identity of Delft as a knowledge city should be known better. The policy should focus on attracting the creative class to Delft, by concentrating on the overall quality of space, instead of just housing, and by offering specific amenities for these people. This strategy should also pay attention to involve the local population in the city of knowledge.

There are several struggles for Delft in attracting the creative class and the knowledge workers. Many knowledge workers have to commute to Delft, because there is no suitable housing available in Delft. A large amount of the housing stock is built as social housing, but few of the people are qualified for it. (Knight, 1995) Delft has reached its borders, which causes a lack of suitable building sites. This shortage of housing leads to a large outflow of graduated students from Delft. Another problem is the lack of amenities for the creative class. The old city centre is famous and attracts a lot of tourists, but for the creative class it is not satisfactory. They want to meet each other in informal urban facilities, like bars, clubs etc. Innovation is stimulated by these meeting spots. (Fernández-Maldonado & Romein, 2008)

An advantage is that Delft is in the middle of the Southwing of the Randstad. This is a network of several cities that are well connected. The platform of the Southwing describes itself as ‘a network city of authority and justice, knowledge and logistics in a Dutch landscape’. In the Southwing, the Hague is the city of the parliament, government and the international court of justice. Rotterdam has the harbour and is the city of logistics. Delft is the city of knowledge. The platform sees the cities as the engines of the network city. The already existing qualities of the economies of the cities should be intensified. For Delft, the quality is knowledge. (Platform Zuidvleugel, 2003)

This network city has a good interconnectivity between the different
cities. People can easily visit Delft from Rotterdam and The Hague. Also the other way around, the citizens of Delft can easily visit amenities and activities in the other cities.

Delft Kennisstad pays a lot of attention to the business climate, but tends to forget about the people climate. That means that the measurements focus on the business, instead of the citizens, and on the amenities for the businesses, instead of amenities and activities for the population. It was assumed that by a larger knowledge-based production, a new urban development was created and from which all citizens could profit. Knight already pointed out in 1990 that there was a gap between the knowledge sector and the local community. More than 15 years later, this gap still exists. In order to be a sustainable and balanced city, the strategy should focus more on the people and their needs, instead of the businesses. (Fernández-Maldonado & Romein, 2008)

Withdraw of university

The main actor in the knowledge city Delft is the Delft University of Technology. The University of Delft was founded in 1842 and the first accommodation was on the Oude Delft 95. This building was in the middle of the old city centre. More faculties were in the city centre of Delft, for example the faculty of Architecture occupied Oude Delft 89-91 in 1901.

The first expansion of the university was in the Wippolder, nowadays TU Noord area. (figure 2.1) In the beginning of the 20th century the faculties of mechanical engineering and mining engineering moved into the new buildings on the other side of the Schie canal. The main building and the chemistry building were built just before the Second World War. Not all faculties moved out of the centre. The faculty of Architecture moved from Oude Delft 89-91 to Oude Delft 39a, an old military warehouse, because the old accommodation was too small.
Fig. 2.5 - Withdrawing of university
There was a change of mind in the beginning of the 1950s. The university wanted to have a campus, where all faculties were centralised. The Mekelweg became the central road in this new university area. (figure 2.2 and 2.3) Although plans for a new architecture faculty were made around 1956, the building was completed in 1970.

The university moved completely out of the city centre in 1997, when the new library was finished on the campus. The university withdrew even further from the city centre: in recent years, the buildings in the TU Noord area were left. Some of these buildings are already demolished; others will be transformed into housing. (Mácel et al., n.d.; Niemeijer & Buchner, 2005; Monumenten in Delft, n.d.)

The university is now elaborating the campus idea into the new Mekelpark. The public space in between the faculties, the old Mekelweg, is being transformed into a park. This park should connect the different faculties and upgrade the identity of the campus. This new park is mainly designed for pedestrians, cyclist and public transport. (figure 2.4) (Mecanoo, 2006)

The knowledge-based businesses are close to the university. Some are located on the university grounds, but others are right next to it. The new Technopolis innovation park is planned on the south side of the university campus, close to the highway exit Delft Zuid, on the A13 connecting The Hague and Rotterdam. Research and development businesses are attracted to Technopolis, because of the proximity of the university, the good accessibility and a cooperative local government. The complete Technopolis will be around 120 hectares. (Technopolis, 2006)

The gap between the university, the knowledge-based businesses and the city centre is also a physical one. People do not go the Campus, except for the students or the employees of the university and Technopolis is even further away from the city centre. The university is independent and physically, socially and culturally isolated. (Knight, 1995)

By centralising the university buildings, knowledge-based businesses, the people of Delft are discouraged to visit this area. There are no amenities for them to visit. This leads to a social gap, because the people of Delft do not feel connected to knowledge institutes and businesses. The problem is the same the other way around: the knowledge workers are not connected to the city centre of Delft, because of this spatial segregation. The good accessibility of the highway A13 leads to further commuter traffic. (Fernández-Maldonado & Romein, 2008)
Delft
The main problem of Delft Kennisstad is the unbalanced attention on the knowledge business climate. The city citizens (the people that have their origzin in Delft and are not working or contributing to the knowledge-based developments) do not identify themselves with the knowledge city.
This project leads to a new strategy for the city of Delft, based on knowledge, but in a way that all citizens of Delft can benefit from it. This new strategy should be socially sustainable. This means that it should pay attention to the entire population and on their needs, and not only on the knowledge workers. Delft needs to be attractive and needs to have a good quality of place. Another important aspect of social sustainability is health. The design should have special measures to create a healthy environment for the new users.

Another problem is the withdrawing of the independent university and the knowledge-based developments around it. This causes a physical, social and cultural gap between the knowledge sector and the non-knowledge people. The strategy should connect the university and the knowledge-based developments with the local community of Delft. Every citizen should be able to profit from the new strategy.

Personal motivation
An important goal of the graduation project is to obtain the TiDO endorsement (Technology in Sustainable Development). This special endorsement is for students who specialise in sustainability. I already followed several special courses concerning sustainability and I believe it is very important to have a sustainable graduation project. Urban designers have a large influence on the land use. Designed urban structures are fixed for a long period. That is why it is important to have a good design quality that is not harmful to the environment. This project should pay attention to the people and their needs, but it should also focus on the environmental sustainability. This means that it should be environmental friendly for themes like water, energy and ecology.
3. Project

3.1 Relevance

Societal
The main societal problem in this project is the gap between the knowledge sector and the city citizens. Not all people can benefit from the knowledge-based developments. This project should offer a possible solution to this problem. It is important to have a strategy for all citizens of Delft, instead of only for the knowledge workers and the people related to the knowledge-sector.

The city of Delft is busy with the concept knowledge city. In 2005, a research has been done on ‘Delft Kennisstad’ by Van der Geest en Heust. The same year the city council decided to continue the policy on the knowledge city at least until 2015. In March, an article is written in the Stadskrant Delft on the future of the economy of Delft based on knowledge and innovation. (Jouwe, 2008) This article is about Yes!Delft, a housing facility for techno-starters (starting businesses in technology) and some small knowledge-based companies in Delft. The city council supports these initiatives.

Another project is Redesign the city, which tries to connect the creative industry, companies and residents to give a creative impulse to the city. Several locations where redesigned by mixed groups. This movement shows the will to involve the population into designing the urban area and public space. (Redesign the city, 2007)

Scientific
Many studies have been done on the management side of the knowledge city. They deal with policies and strategies. There are few studies about the knowledge city on urban planning and design.

In the graduation project, the link between the knowledge city policies and urban planning should be elaborated. This part of the project is linked to the course Theory of Urbanism, AR3U021. For this course, a paper is written on this topic.
The most important question that needs to be answered is: to what extent does Delft fulfil the spatial, formal and functional requirements of a social sustainable knowledge city?

The research is divided into three main topics:
1. the knowledge city;
2. (social) sustainability;
3. current situation of Delft.

These parts have each different sub-questions. The focus in the theme of knowledge city is on the design requirements and on the needs of the people that fit into the knowledge city, the knowledge workers. The study is also concerning the background of the knowledge city as an introduction to the theme. The design requirements deal with the spatial, formal and functional requirements of a knowledge city and are useful for urban planning. The study on the knowledge workers will deal with the amenities that are attractive to them. Other knowledge cities will be analysed to study what spatial, formal and functional elements make a knowledge city successful.

The requirements of the knowledge city will be on the scale of a city, because the strategy for the whole city corresponds with the knowledge city topic.

Important questions for this topic are: what is a knowledge city and what are its spatial, formal and functional requirements? Who are the knowledge people and what are their needs for amenities and activities? What cities are good examples of knowledge cities and why do they function well?

The requirements for sustainability will be on the scale of an urban design for a neighbourhood, because the urban design for the Schie banks is a large neighbourhood.

The important sub-questions for sustainability are: what is a social sustainable city and what are its formal and functional requirements? What amenities and activities are needed for a social sustainable society? What are spatial, formal and functional requirements for a healthy and safe urban design? What are the environmental factors for an urban design and what is a sustainable solution for these factors for the urban design?

The third topic is on the current situation of the whole city of Delft and on the Schie banks. For the whole city of Delft, the focus is on the functional spatial analysis, with themes like population, economy and amenities. For the Schie banks, a functional and formal spatial analysis will be done, with themes like structures, plans of the city council, existing buildings and amenities. The city council is busy making plans for the Schie banks and other locations nearby. These plans should be studied, analysed and valued.

The sub-questions for this topic are: What is the existing functional and formal spatial situation in Delft and on the Schie banks? What kind of people do live in Delft and in what neighbourhoods? What are the plans of the city council of Delft for the Schie banks and for the surrounding area?

The sustainability part focuses on the important aspects of a social strategy and on the requirements of a social sustainable society. A study will be done on the formal and functional requirements of a social sustainable city and society. Health and safety are other important aspects of the social sustainability. The environmental aspects are also taken into account for sustainability. The design should be sustainable for themes like water, energy, ecology, traffic, waste and living environment.

The sustainability requirements will be on the scale of an urban design for a neighbourhood, because the urban design for the Schie banks is a large neighbourhood.
These three topics should be combined in order to answer the main question. First, the studies on the knowledge city have to be compared to Delft. To what extent does Delft fulfil the requirements of the Knowledge city? This answer will be checked with the social sustainable requirements, in order to see how sustainable Delft is as a knowledge city.

By doing this, the similarities and shortages of Delft will be clear and a new strategy can be formulated. To what extent does Delft fulfil the spatial, formal and functional requirements of a social sustainable knowledge city?

The answer to these research questions can be used to formulate the spatial, formal and functional requirements for the strategy for the city of Delft and the design for the Schie banks.

Fig. 3.3 - Research based on three topics
PART II

Research
4. Knowledge city

4.1 Formal spatial and functional spatial requirements of the knowledge city

Urban planning for the knowledge-based economy (Abstract)
Since the beginning of the 1990s, there has been a shift from the traditional industrial economy towards a knowledge-based economy. This economy is emerging, because of the globalisation, the rise of the amount of jobs in the service sector and the growth of the internet. Knowledge-based services are key triggers of this new type of economy. Knowledge is the most valuable asset to have an advantage in the knowledge economy. Many cities worldwide present themselves as ‘knowledge cities’ and try to attract knowledge-based businesses and knowledge workers. Other cities are busy designing strategies and plans to become a knowledge city.

The cities have to transform their spatial conditions in order to fit the demands of the new economic activities. Although many studies focus on the knowledge management in the new knowledge cities and on governmental policy strategies, there are few consistent studies on the spatial planning of this type of city. In order to become a successful knowledge city, it is important to know what the main formal spatial and functional spatial requirements could be. The formal spatial requirements deal with the physical elements of the city. The functional spatial requirements are the amenities and activities that take place.

The requirements that will be discussed are divided into the formal and functional spatial requirements. The first group exists out of the scale, city structure, infrastructure and urban appearance, and the second out of the knowledge-based activities, quality of life, urban diversity and meeting points.

This paper reviews several papers on planning the knowledge city. These reviewed papers differ in points of view and in this paper they are compared on the base of different intentions and strategies.

The conclusions of the comparison will deliver a preliminary analysis on the formal and functional spatial requirements for designing a knowledge city. This will be relevant for city councils, planners and designers, working on a new knowledge city or improving their existing cities towards a more knowledge-based economy.

These requirements will furthermore form a basis for my graduation project at the faculty of architecture of the TU Delft. This specific project focuses on the city of Delft, which promotes itself as a knowledge city, but it is relatively unsuccessful until now. A new strategy for the city will be developed based on the outcomes of this review paper.
4.1.1 Introduction
The graduation project ‘Delft, for knowledge and people, connecting the knowledge city with its citizens’ focuses on Delft as a knowledge city. Delft promotes itself as a knowledge city, but is relatively unsuccessful until now. (Knight, 1995; Fernández-Maldonado & Romein, 2008)

The main goal of the graduation project is to design a strategy for Delft as a social sustainable knowledge city and to make an urban design for the Schie Canal banks in Delft. In order to design a successful strategy, it is necessary to know what the formal spatial and functional spatial requirements of the knowledge city are.

This chapter deals with the specific aspects concerning the knowledge city to be used in the graduation project. The main research question is: What are the formal spatial and functional spatial requirements of the knowledge city? Formal spatial requirements are about the physical elements of urban planning, for example the structure in a city, infrastructure and appearance of the urban design. The functional spatial requirements are the amenities and activities that take place in a city. These physical and programmatic requirements both form the design requirements of urban planning for the knowledge city.

Many papers are written on the topic of the knowledge city. They mainly focus on the knowledge management and on the governmental policy strategies, but there are few that focus on the urban planning aspects. There are not many papers describing the formal and functional spatial requirements of the knowledge city. This review paper deals with several papers and articles on this topic. The result is useful for the graduation project, but also for other urban planners and designers who are designing for the knowledge city.
Box 1 - List of criteria for a knowledge city

- A city that has instruments to make knowledge accessible to citizens
- A network of public libraries that is compatible with the European standards
- Access to the new communication technologies
- All cultural facilities and services with a central educational strategy
- A city that has a newspaper- and book-reading level that is similar to the average European level
- A city that has a network of schools connected with artistic instruction throughout its territory
- A city that is respectful of the diversity of cultural practices of its citizens
- A city that places the streets at the service of culture
- A city that simplifies, through the provision of spaces and resources, the cultural activity of the community collectivizes and associations
- A city with civic centres that are open to diversity and that foster face-to-face relations
- A city that makes available to citizens from other territories all he tools required for them to express themselves

(Dvir & Pasher, 2004)
4.1.2 Knowledge city

Definition of the knowledge city
Since the beginning of the 1990s, there has been a shift from the traditional industrial economy towards a knowledge-based economy. This economy is emerging, because of the globalisation, the rise of the amount of jobs in the service sector and the growth of the internet. Products and markets have become more global and companies have business all over the world. The possibilities of the internet play a large role in this globalisation. Labour is taken over by computers and is relocated to third world countries. In developed countries, there are more jobs in the service sector.

Knowledge-based services are key triggers of this new type of economy. Knowledge is the most valuable asset to have an advantage in the knowledge economy. The economy will grow if there will be more work. This can be created by the substitution of import. Products that are first made somewhere else will be produced locally. This increased the knowledge of these products in the city. New research and development companies are set up to improve the products. The city that generates new knowledge and new ideas will be economically more successful.

A knowledge city is “a city that was purposefully designed to encourage the nurturing of knowledge”, according to Edvinsson (as quoted in Dvir & Pasher, 2004). Edvinsson made a list of several criteria for a knowledge city. They focus on management and policy requirements and not much on spatial requirements and planning strategies. This list can be found in text box 1.

Ergazakis et al. (2006) describe the knowledge city as “a city that aims at a knowledge-based development, by encouraging the continuous creation, sharing, evaluation, renewal and update of knowledge. This can be achieved through the continuous interaction between its citizens themselves and at the same time between them and other cities’ citizens. The citizens’ knowledge-sharing culture as well as the city’s appropriate design, IT networks and infrastructures support these interactions.” For both writers the exchange of knowledge is an important aspect of the knowledge city. Citizens play an important role in this process. They both talk about design for the knowledge city as creating possibilities and facilities for the citizens to exchange their knowledge.

Berg et al. (2005) see cities as the focal points of the knowledge economy. They argue that mainly in cities, knowledge is produced, processed, exchanged and marketed. Cities have often a knowledge infrastructure of universities and other educational institutes; and there are more well educated citizens. The connection to the global economy is improved by the good accessibility to the electronic infrastructure and the physical infrastructure, like trains and airports. Berg et al. also argue that the creation of knowledge takes place in cities with an existing solid knowledge base. These cities have an advantage in the knowledge economy and this is reflected in the economic life of a city. Cities are not able to prosper without any sources of innovation and knowledge production. (ibid)
Importance of space in the knowledge economy

Recently, the question of place and proximity as necessary elements for growth in times of modern communication technologies has come up. Is it really necessary to create and design knowledge cities if people can also communicate via the internet?

Helbrecht (2004) challenges these assumptions by stating that “knowledge is not an isolated activity”. Different people have to connect, in order to produce, evaluate and spread knowledge. Human meetings and social interactions cause the generation of knowledge. If these contacts have a high frequency and if the different knowledge and information flows are well connected, the individuals and the spatial innovation system become more adaptive and innovative.

From another point of view, Helbrecht says that the individual production of knowledge is a mental and a physical activity. It is the same for innovation and invention. An important motivation for innovation is the physically exploration of things. This experience is lacking by working over the internet. (ibid)

Helbrecht mentions that the ‘look and feel’ of an urban landscape can play a role in knowledge production processes. Companies in the creative sector establish their offices in particular locations in the city. The appearance of urban areas can attract or reject these companies. (Helbrecht, 2004)

Another argument is that not all knowledge can be exchanged via digital connections. There are two kinds of knowledge: explicit and tacit knowledge. Explicit knowledge can be transferred easily in written text. The exchange of explicit knowledge is a conscious process; people are aware of the fact that they gain new information. This is why explicit knowledge can be easily transferred via internet.

Tacit knowledge is the things people learn in a more or less unaware way. In other words, tacit knowledge is the knowledge produced by practice or unaware acquisition of skills through the performance of tasks. This type of knowledge has to do with the personal expertise and experience people have. When people are together, they learn from each other’s behaviour. This type of knowledge cannot be exchanged via the internet, therefore face-to-face contact is crucial.

For the knowledge economy both types are important, so that is why place is important for the knowledge economy. (Berg et al., 2005; Helbrecht, 2004)

The last contention, why space is important in the knowledge cities, is that mutual trust is necessary for knowledge and innovation projects. When sensible and valuable knowledge needs to be transferred, people generally want to have face-to-face contact in order to trust the other party. Cultural proximity is an extra factor for trust. When people understand each other’s norms and values, it is easier to trust each other. (Berg et al., 2005)
Requirements for the knowledge city

Therefore, space remains important in the knowledge economy and cities play an important role in it. Both Ergazakis and Edvinsson mention that the knowledge city has to be designed (see paragraph 2.1). Every urban design has to fulfil some specific requirements in order to be effective, even though it is generally accepted that the spaces where knowledge transfers occur cannot always be planned. This paper deals with the design requirements of the knowledge city.

In the next chapters, these requirements will be sorted out. The requirements are divided into formal spatial requirements and functional spatial requirements. The first part deals with the physical elements of the urban design. In this paper, scale, city structure, infrastructure, urban diversity, aesthetic looks and virtual space are discussed as formal spatial requirements.

The functional requirements are about the amenities and activities of the urban design. Elements in this chapter are knowledge-based activities, quality of life, meeting points, recreation, culture and housing. The choice for these requirements is based on the information found in the literature.
4.1.3 Formal spatial requirements

Scale
The larger the city, the larger the attraction it has on companies and knowledge workers. Berg et al. describe it as “big is beautiful”. In a medium-large or large city, it is easier for companies to find suitable staff and supporting services. Specialised suppliers for knowledge-based companies are present in larger cities. There are more scale economies for knowledge activities. Knowledge workers have a variety of jobs to choose from. Large cities in developed countries are often very well connected to public transport networks and airports. In those cities, it is possible to have many subcultures and amenities fitting those cultures. In other words, many different people can settle in these cities. Creative workers are also attracted by inspiring cities with a thriving cultural life, which is possible in large cities. Smaller cities in the neighbourhood of large metropolitan areas can benefit from the scale advantages. (Berg et al., 2005; Winden et al., 2007)

The optimal landscape for the knowledge city, according to Baum et al. (2007), is “a big city embedded in a functional urban region with significant global dimension”. The core city is part of a global network for the worldwide exchange of knowledge.

In summary, large cities have an advantage in the knowledge economy, because of the higher amount of people and amenities. Knowledge workers and companies are attracted to the city. A network of cities has the same advantage.
City structure
In the 19th century, the industrial development had a great impact on the structure of cities. The factories caused the separation of the workspaces from the living spaces. This separation of work, housing and retail activities has several negative consequences nowadays, like the commuting traffic, unsustainable transport systems and the isolation of child-carers in mono-functional environments. Baum et al. (2007) state that by the organisation of knowledge work in virtual spaces – in electronic media – the need for a space to work is decreased. This gives a real possibility to re-integrate the workspaces in the residential areas. The same counts for the retail activities. Multi-functional neighbourhoods are possible in the knowledge economy, because knowledge activities have a low impact on the environment, so they can easily be integrated in the residential areas. (Baum et al., 2007)

In the knowledge economy, the emphasis lies on how to use knowledge for productive activities. The organisations that produce the knowledge should be clustered together with the organisations that use it. The proximity of these companies makes the communication between them easier, so knowledge can be better transferred. This clustering can be made physically, by close proximity. (Ibid.)
The clustering in the knowledge city causes spatial relationships between different companies. This produces easier cross-fertilisation of ideas. Other advantages of clustering are cost reduction, greater efficiency gains, greater opportunities to share, opportunities for companies to trust each other and a larger pool of talent for companies to draw from. (Yigitcanlar et al., 2008)

Abu-Anzeh & Ledraa (2007) describe the knowledge city as “a networked city where knowledge zones and clusters are their main features.” Although, urban planners have to deal more with flows, instead of zones. It is important to facilitate the flows of people and information, because communication is very important in the knowledge economy. Proximity becomes more important than accessibility, because face-to-face contact is crucial when confidential knowledge is exchanged. Place still fulfils an essential role, especially where different mobility flows come together. Because of this, mobility nodes will be central places in the knowledge city.

In short, in the knowledge economy, the urban areas can have a mixed-use functioning. Working spaces and housing can be close to each other. However, it is important to have a clustering of knowledge-based activities, because the exchange of knowledge is easier in clustered areas. The knowledge city is a polycentric network city, where mobility and their nodes are key factors.
Infrastructure

According to Berg et al. (2005) and Winden et al. (2007), the knowledge economy is a global economy and a network economy. Accessibility is crucial on an international and regional level and has to be multimodal. This means that knowledge cities need to have fast access to airports and high-speed-train stations. On a smaller scale, connections by rail and road to other urban knowledge-centres in the neighbourhood are very important, because they facilitate the face-to-face contact. The infrastructure network has to facilitate the face-to-face contacts, which are important for the knowledge economy.

Baum et al. (2007) state that the conventional transport hierarchy is reversed. They state that the network of pedestrian and bicycle paths serves the knowledge city. The connection to the public transport has to be close and reliable in order to make transport in between knowledge clusters easy. The connections to a higher transport networks, as the motorways, are important to connect to a wider urban region.

It is already mentioned in paragraph 3.2 that mobility nodes are essential spaces in the knowledge city. They are important for the diversity and frequency of human contacts and for urban activities. People are increasingly mobile nowadays. An essential quality of locations is the physical accessibility or the quality of the connection. (Abu-Anzeh & Ledraa, 2007)

Accessibility is very important for the knowledge city, because a city with good accessibility has more and diverse human contacts and urban activities. On different scales, the connections to the transport networks are essential, from pedestrian paths to airports. Nowadays, people are increasingly mobile.

Fig. 4.3 - Accessibility on large and small scale
Urban appearance
The best look for a knowledge city is post-modern, according to Baum et al. "By post-modern is understood a style of eclecticism, ready borrowing, and pastiche, all executed with a certain machined or technological exactitude." The knowledge city has to be diverse, but yet familiar. (Baum et al., 2007) This style of architecture is possible for the knowledge city, but is arguable if it is the best style. Post-modern architecture does not have a special function that can improve knowledge cities.

Evans et al. (2006) state that a city can strengthen the creative spaces by preserving heritage buildings, promoting art for public and natural spaces, as well as using well designed built form. Heritage buildings have an attractive and especially unique character that stimulates creativity. Old buildings get an extra dimension through combining them with interesting, risky new architecture. Highly-visible creative experimentation is encouraged by the combination. This statement is also arguable, similar to the post-modern architecture. It can be a possible solution, but it is not the only one. The urban environment should be a diverse area with different styles and buildings.

More important than the architectural style is that space should inspire creativity. The look of the shared spaces or offices can contribute to the generation of wild ideas, action, positive chaos, open mindedness and barrier braking behaviour. Playful designs can make people think out of the box and break the rules. Different working areas can have completely different atmospheres. (Dvir & Pasher, 2004; Dvir et al., 2006) The urban planner should make a flexible design, so that the users can adapt the space to their demands. They should be stimulated to make an inspiring environment.

Knowledge cities do not have to be built on new – Greenfield – sites. Brownfield sites are more suitable for knowledge-based development. Many old Brownfields are turned into a lively and cultural rich new environment, because they are already inserted in rich urbanised environments, generally well connected to inner city cores and have some inherent qualities that are difficult to be replicated in new developments. It can be a more feasible solution than to build from scratch. The re-use of old buildings links the past, present and future and is inspiring for the people. (Dvir & Pasher, 2004)

In short, the appearance of the urban area is very important to stimulate creativity for the users. Post-modern architecture and a mix of old and new buildings are examples of a building style that is suitable for the knowledge city, but they are not the only possibilities. Brownfields are better suitable for restructuring into a knowledge district.
4.1.4 Functional spatial requirements

Knowledge-based activities
Berg et al. defined the foundations and activities of the knowledge city. The main foundation stone is the knowledge base. This is an outcome of the presence of universities, education institutes and R&D developments (research and development) as well as the educational level of population. The quality, quantity and diversity of these amenities determine the starting position of a city in the knowledge economy. Winden et al. (2007) add that there has to be an interaction between the universities and the business sectors and among the business sectors. Another important aspect is the diversity in skills of the population. These differences in skills result in a higher productivity. The creative class is an important group with different skills. (Berg et al., 2005; Winden et al., 2007)

It is believed that, in order to start up the knowledge-based developments, it is useful to start setting up agencies that promote the development of knowledge and research production. Examples of these agencies are technology foundations, research centres and institutions, technology parks, universities etc. These agencies can be involved in different activities concerning the knowledge economy, like knowledge sharing, attracting and retaining of knowledge workers, economical development and marketing of the knowledge city concept. (Ergazakis et al., 2006). Most of all, these agencies are responsible for the development of new work, either by the invention of new solutions for existing problems, or by the creation of unexpected products and services emerging from unforeseen knowledge spillovers.

Urban innovation engines are used by Dvir & Pasher to describe a system for the knowledge city that can trigger, generate, foster and catalyze innovation. Innovation in the knowledge economy is the generation of new knowledge and ideas that come from the creative thinking of people.

Urban innovation engines that have a link with the knowledge-based activities are the university, the capital market place and the knowledge intensive industrial district and science parks.

Local universities have an instrumental role in knowledge cities. They should not be ‘ivory towers’, but they should try to build links with the city citizens also. Universities are not only producers of knowledge. They draw all kinds of knowledge and non-knowledge activities to their vicinity, because of their generative and catalyst role in urban economies. This means that students must buy books, eat, and convene. The university for example has to be serviced, supplied and cleaned. The university needs to be connected to all kinds of networks, both physical and virtual, and therefore it constitutes a hub in functional and physical networks. For example, universities are part of larger networks of knowledge and practice.

The second example focuses on the financial side, and contains stock exchanges, banks, joint venture funds etc. The last group is the core of the knowledge-based activities. The real work is done over there, so it is crucial for the knowledge city. (Dvir & Pasher, 2004)

Edvinsson uses the ‘Knowledge harbour concept’. A harbour was a gate or port for exchange and flows, but in the knowledge economy, it is a port for the migration of talent. The knowledge harbour will be the one of the essential tools of the new urbanism.
People will be an important aspect of this new tool. The focus should change from shopping centres and trade of goods towards the trade of thoughts. Knowledge-based amenities of this new harbour will be knowledge arenas and research hubs. (Edvinsson, 2006)

Knowledge workers tend to change jobs and occupations rather frequently. They want to advance in their career by changing between employers. This is why they favour cities with a ‘thick labour market’, a city with a large diversity in companies and jobs. (Baum et al., 2007)

Baum et al. (2007) make a division in knowledge workers for different knowledge activities. There are three main groups:

- scientists, engineers and creative professionals
- artistic/creative people, media/journalists
- students (latent knowledge workers)

In order to have a balanced knowledge city, suitable amenities and companies should be present for all these knowledge workers.

The knowledge-based activities are the core of the knowledge cities. There should be many different activities for different types of knowledge workers. The quality, quantity and diversity of these activities determine the success of the knowledge city.

The knowledge-based activities are the core of the knowledge cities. There should be many different activities for different types of knowledge workers. The quality, quantity and diversity of these activities determine the success of the knowledge city.
Quality of life
In order to be a successful knowledge city, cities have to attract talented people. These talented people create the new knowledge and ideas. Berg et al. (2005) refer to Florida, who did a study on the location behaviour of 'talent'. He found out that talent is most attracted to by the quality of life in a place. They are also attracted by agglomeration of services, facilities and other knowledge workers. They want to settle in a city where they can enjoy life and be in contact with people with whom they can interact. Cultural activities and amenities play a big role in the choice for a city. Many policies focus on creating places that have cultural richness, outdoor activities and amenities around the high-tech industries.

Another important aspect is the presence of other talents. Companies tend to follow the talented people, so they are also attracted. So it is important to attract the knowledge workers and to retain them by providing a set of diverse amenities, where they can eat, drink, relax and be entertained. The knowledge city should be recreation intensive. There are many different amenities with different opening hours. The city should have a vibrant environment that is active day and night. (Baum et al., 2007)

Clark, mentioned by Baum et al., makes a division in natural amenities and constructed amenities. Different knowledge workers have different desires for these amenities. Young people tend to have a higher demand for the constructed amenities, while older people have a demand for a balanced set of amenities. This division can be found in table 4.1.

There should be a good balance between the creative energy and the mind retreat. So next to the companies and knowledge-based developments, there should be space for relaxing and recreation. A good relationship with the ecology is necessary. (Edvinsson, 2006; Baum et al., 2007)

Other aspects of the quality of life are an attractive built environment, high quality houses, attractive city parks, attractive natural surroundings and a rich variety of cultural institutions. The quality of the facilities has to be high, like hospitals and schools. The air and noise pollution of traffic systems should be low. (Berg et al., 2005; Winden et al., 2007; Yigitcanlar et al., 2008)

The different knowledge workers, mentioned in paragraph 4.1, have different demands for the living environment. Baum et al. made an overview in table 4.2.
These demands have to be taken into account if a city wants to attract the knowledge workers. Next to these specific demands, the knowledge workers can be attracted with a good quality of life. Baum et al. (2007) name factors for this quality, like variety of amenities, education, climate, environmental quality, housing affordability, crime level and transportation access.

Quality of life should be replaced with ‘quality of space’, according to Florida. This term gives a better sense for the meaning of urban area in the knowledge economy. He names three major dimensions of the quality of space:

- What’s there: the combination of the built environment and the natural environment
- Who’s there: diverse kinds of people, everybody will be accepted
- What’s going on: the vibrancy of street life and people engaging in outdoor activities.

(Baum et al., 2007)

Knowledge workers are nowadays attracted to cities by the quality of life. Next to the basic main amenities, they want to live in a vibrant and lively city. Different knowledge workers have different demands. Quality of life can be replaced by quality of space to put the accent on the urban area.

<table>
<thead>
<tr>
<th>Types of amenities</th>
<th>Specific features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>Climate, humidity, moderate temperature, water access, topographic variation</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Constructed</td>
<td>sidewalk cafes, bookstores, movie theatres, liberal arts, universities, dance studios, bike lanes and trails</td>
</tr>
</tbody>
</table>

Table 4.1 Division of amenities by Clark (Baum et al., 2007)

<table>
<thead>
<tr>
<th>Type of knowledge worker</th>
<th>Demands</th>
</tr>
</thead>
<tbody>
<tr>
<td>scientists, engineers and creative professionals</td>
<td>quality of university milieu, leisure facilities, hedonistic environments, accessibility, life style environments, access to cultural facilities</td>
</tr>
<tr>
<td>artistic/creative people, media/journalists</td>
<td>affordable space, creative milieu, entertainment, creative spaces, urban diversity</td>
</tr>
<tr>
<td>students (latent knowledge workers)</td>
<td>cost of living, prestigious universities, life style environments, cheap accommodation</td>
</tr>
</tbody>
</table>

Table 4.2 Different knowledge workers by Baum et al. (Baum et al., 2007)
Urban diversity
Urban diversity is mentioned multiple times as a requirement of the knowledge city. Urban diversity stimulates creativity, because it triggers the emergence of new ideas through interactions, which are created by the diversity of these inhabitants and the diversity in economic actors. Places that attract a diverse group of people have low entry barriers for talent. Interaction between the people can take place here. Berg et al. describe diversity as “a measure of the degree of system openness”. They quote important researchers like Jane Jacobs and Richard Florida, who agree on the fact that the diversified city is the key to a socioeconomic successful and attractive area. Baum et al. describe urban diversity as a ‘cosmopolitan atmosphere, accepting of strangers and with open channels for the communication/exchange of knowledge’. Similar people will generate similar ideas, according to Dvir & Pasher. Innovative ideas will be created by people from different cultural and academic backgrounds, with different experiences, professions, ages and personalities.

Diverse areas attract inhabitants, companies and visitors continuously and stay attractive. The diversity of people is about the ethnicity, nationality, gender and sexual orientation. Jacobs warned already in 1961 that there would be tensions between groups of inhabitants on micro-level. This happens most often between the resident culture and an unaccepted ethnic minority. (Baum et al., 2007; Berg et al., 2005; Dvir & Pasher, 2004; Dvir et al., 2006; Winden et al., 2007)

Urban places where different people come together stimulate creativity. Urban diversity can be designed by making the area attractive with different amenities for a diverse group of people. Urban diversity creates low barriers for people to express themselves.
Meeting points
In knowledge cities it is important to exchange knowledge. This can happen at meeting points for face-to-face contacts for exchanges of experiences. Knowledge and ideas are created through conversations. Dvir & Pasher (2004) give some examples, like the café, bookstores, bars, hair salons, the big urban event, the museum and the library. A café is a good example of a place where many conversations happen in diverse areas as art, philosophy, psychology and politics. A big urban event can be like the world expo. These events give an extra boost to the economy of cities. Culture is present in the form of a museum. A good idea is to have a museum that is open all day and night. The libraries should be active places where knowledge can be exchanged in between people. These meeting places are also called ‘third places’. After home and work, they are the third place people go to put aside their concerns of the two first places. (Dvir & Pasher, 2004; Ergazakis et al., 2006)

A regional future centre can serve the knowledge city. A future centre is an example of an urban innovation engine with some special elements. At the heart of the future center, there are the community conversations. All stakeholders of the city are involved in these meeting points. Another function of the centre is the workshop arena and the accompanying gallery. New ideas are generated in workshops and presented to inspire other people. The innovation laboratory is close by. This is where the translation happens from ideas to actions. The knowledge and intelligence centre serves the other facilities by providing the right knowledge. The last aspect is the implementation of the projects in the city. The products of the knowledge city will be presented here to the people, so they are linked to the knowledge-based institutes. (Dvir et al., 2006)

Knowledge exchange between people in a knowledge city is one of the most important criteria. This can happen in meeting points for different kinds of people. These spaces should inspire people and offer the opportunity to meet different people.

Fig. 4.10 - Meetings between people
4.1.5 Conclusion and recommendations

Knowledge cities try to attract and retain knowledge workers and companies. This is important because knowledge is a valuable asset in the new knowledge economy emerging from the complexity of production and consumption patterns. The city that has the knowledge will be successful. It is important to create suitable spaces to facilitate the exchange of knowledge in the city and with other cities.

The design of the knowledge city focuses mainly on the people that are going to use the area, on how to attract the knowledge workers. The design requirements can be split up into the formal spatial requirements and the functional spatial requirements. The first group focuses on the physical forms of the city and the second group on the programme and activities, which happen in the knowledge city.

The knowledge city is evolving into a polycentric network city. Between those centres, reliable and fast connections should be made. Larger areas have an advantage, because of the higher amount of knowledge workers (attractive for companies), knowledge companies and activities (attractive to knowledge workers). The working space can be closer to the residential areas than before, so mixed-use functioning in urban areas is a good solution. The appearance of the urban area and the buildings should be of high quality.

The more important requirements are the functional spatial requirements. The knowledge workers are more attracted by the activities and the quality of life, than the physical space. In the design, spatial attention needs to be given to a diverse programme to attract a diverse group of knowledge workers.

The two main elements are the knowledge-based activities and the quality of life. The first element offers jobs, but also other facilities to exchange knowledge with others. By exchanging knowledge, innovation can be stimulated to create new ideas and knowledge. The second element is a characteristic that the urban area should have. Knowledge workers want to spend their leisure time in high quality and concentrated social and cultural amenities. Different people have different demands, so there should be a diverse programme with a good balance between quiet and busy activities. Other functions of the urban areas are to inspire creativity. Next to the exchange of knowledge, inspiration for creativity leads to the generation of new ideas and knowledge. This is the most important goal of the knowledge city.

Planning the knowledge city is about creating facilities and opportunities for the knowledge workers to work, to inspire them to generate new knowledge and ideas and to create amenities for them to enjoy themselves. The knowledge companies follow the knowledge workers.

The knowledge economy is unpredictable, so it is not easy to plan or design a knowledge city. The design should be flexible to fit the unpredictable demands of the knowledge city. This can be done by soft planning or design. This is not designing by drawing strict lines and building blocks, but by assigning areas and main structures.

This conclusion can help urban planners and designers to analyse a city on its potential to be a knowledge city, to analyse what a city is lacking to become a knowledge city and to make a design for the knowledge city. The list of ten requirements can be used to define a programme, which will attract the knowledge workers.

This conclusion is also useful for the graduation project: Delft, for knowledge and people. Delft should be analysed on the requirements of this paper. It has already some of the qualities of a knowledge city, but it is interesting to see what is lacking in Delft, in order to become a successful knowledge city.
4.2 Reflection about new trends in urban planning and design

The Knowledge city versus the Sustainable city
As mentioned in the preceding chapters, the city of Delft presents itself to the world as a ‘knowledge city’. The city council pays a lot of attention to attracting knowledge-based businesses, but tends to forget the citizens who are not working for, contributing to or having benefits from the knowledge city. (Fernández-Maldonado & Romein, 2008) In this graduation project, a new strategy will be designed to help Delft become a knowledge city, at the same time paying attention to all citizens of Delft. This strategy needs to be knowledge-based, because this is an existing strength of the city. Besides, the strategy needs to be (socially) sustainable, because all citizens should profit from it. In order to design this strategy, acknowledged criteria in urban planning related to sustainability will be used to assess the idea of a knowledge city as a planning concept. This paper is a tool in this assessment.

Rogers and Gumuchdjian (1997) describe their view on the sustainable city in their book ‘Cities for a small planet’. Their concept of the sustainable city will be compared to the requirements of the knowledge city, as covered in the preceding chapter. The requirements were divided into two groups:

Formal spatial requirements
- Scale
- City structure
- Infrastructure
- Urban appearance

Functional spatial requirements
- Knowledge-based activities
- Quality of life
- Urban diversity
- Meeting points

For each topic, the conclusions will be compared to the seven criteria for a sustainable city of Rogers and Gumuchdjian (1997). These criteria are:
- a just city
- a beautiful city
- a creative city
- an ecological city
- a city of easy contact
- a compact and polycentric city
- a diverse city

This comparison uses these criteria for the sustainable city. For each criterion, we will describe how these stand in comparison to the requirements of the knowledge city, analysed earlier.
A **Just City**, where justice, food, shelter, education, health and hope are fairly distributed and where all people participate in government.

This first element is crucial, but it is a criterion that is clearly satisfied by our case study, Delft. In most cities in North Western Europe, people have fairly equal rights and more or less equal access to facilities. Our case study can be considered a Just City, despite the obvious differences between some of the neighbourhoods. Some more attention should be paid to the poorer areas of the city, to fairly distribute opportunity and aspiration over the inhabitants. A good number of non-western immigrants live in the area with a lower income and higher unemployment rate. Nowadays, many immigrant job seekers have more problems finding an internship or a job than Dutch job seekers. It is not possible to change this problem in urban planning, but the society needs to change. However, the unemployment rate is higher for low educated jobs, so creating these type of jobs could improve the situation.

In the knowledge city, the most important element is continuous education. All people in a knowledge city should have an equal chance on education, so there should be opportunities on all levels, from primary school to university. This is already happening: even more colleges are coming to Delft, next to the university. It is important that the colleges and the university will collaborate, so students can more easily go from college to university. Education should also be available on lower levels to all people.

Participating in the government is mainly a matter of democratic elections in the Netherlands. All citizens older than 18 years are able to vote for European, national, regional and local governments. These elections occur usually once every four years. However, the participation in government can be increased through participatory tools. In planning, the influence of the people is high, because every citizen can legally object to building plans. In most cases, the building project will be delayed, but not cancelled. The city council of Delft tries to involve their citizens in creating a new vision for the city for 2030. Meetings are organised, where citizens can give their opinion about what should be in the vision. In a local newspaper, people are informed and invited to participate. See figure 5.1.
A Beautiful City, where art, architecture and landscape spark the imagination and move the spirit.

This criterion can be compared to the ‘urban appearance’ from the review paper on the spatial requirements of the knowledge city. It is important that the urban appearance inspires creativity. New ideas will be generated in inspiring environments that make people think in different and unexpected ways. The urban appearance should be beautiful and this is similar to the beautiful city, described by Rogers and Gumuchdjian. In the beautiful city, art, architecture and landscape are also used as inspiring elements. In this particular case, the criteria for the sustainable city and the knowledge city are very similar.

In the graduation project, the focus will be on the urban design, because the design can just slightly influence the architecture, for example setting boundary conditions and style demands. Public art can be used in the programme and facilities, instead as just a superficial element. Public art can play a major role in the quality of life of the knowledge city. First of all, art makes the public space more beautiful and attractive, so people like to spend more time in the place. People want to live and work in nice areas, so an attractive public space can attract people and businesses. Public art can also lead to discussion and conversation between people and bring people together. In addition, art can play a major role in education. It is easily accessible for all kinds of people. This is a main goal of the knowledge city.

A Creative City, where open-mindedness and experimentation mobilises the full potential of its human resources and allows a fast response to change.

This criterion is probably the most similar to the knowledge city. An important aspect of the knowledge city is the creation of new knowledge; which is in fact a creative process. The generation of new ideas is essential for the knowledge city, so the knowledge city is in essence a creative city.

In literature, important aspects of this city are tolerance, experimentation and flexibility. Citizens should be tolerant to each other and accept their differences. This open-mindedness can take place if there is enough urban diversity. If everything and everybody are similar, then there will be no exceptions on them. People who are different will be excluded, what should be avoided. The barriers for people to express themselves should be low. Lots of experimentation should be carried out in the knowledge city, to produce new knowledge. There should be amenities for experimentation in many ways, like scientific labs and art and practice studios. Just as the creative city, the knowledge city is rapidly changing and is therefore not predictable. The urban plan and design should be flexible to adapt to changes in the knowledge city and society and principles of strategic planning should be adopted.
An **Ecological City**, which minimises its ecological impact, where landscape and built form are balanced and where buildings and infrastructure are safe and resource-efficient.

There are three main kinds of sustainability: environmental, social and economic. They relate to the themes planet, people and prosperity. The ecological city is part of the environmental sustainability. However, the knowledge city is not focusing on this type of sustainability. The other two are more relevant here, because the knowledge city is about creating an attractive working environment in which people feel good and are able to exert their potentialities in full, therefore contributing to social cohesion and economic development.

However, the environmental sustainability should not be forgotten. The natural environment plays a major role in the quality of the urban appearance and the quality of life. The balance between the constructed and natural amenities is necessary for a successful knowledge city. So the balance between the landscape and the built form of the ecological city of Rogers is a bit similar to that. Ecological connections can for example be combined with natural amenities, such as parks and recreational areas.

In addition, nowadays a lot of knowledge production is about finding sustainable solutions. Sustainability is a hot topic and it inspires people to be creative and inventive to search for solutions for a sustainable planet. The source of these studies can be found in environmental sustainability, because people want to create a world which can provide for future generations.

A **City of Easy Contact**, where the public realm encourages community and mobility and where information is exchanged both face-to-face and electronically.

This criterion of the sustainable city is a very important requirement for the knowledge city also. New knowledge and ideas are created when people meet and exchange their knowledge. This requirement is equally important for the knowledge city and the sustainable city.

Besides, different kinds of contact are needed in both cities. Not all knowledge can be transferred electronically. There are basically two kinds of knowledge: explicit and tacit knowledge. Explicit knowledge can be transferred easily in text, for instance. People gain tacit knowledge in a more inductive and spontaneous way. Tacit knowledge is gained by practice or by acquisition of skills. This type of knowledge needs to be transferred face to face. (Helbrecht, 2004) This is why space still matters and this is an essential argument to provide quality public spaces of a certain kind in a knowledge city.

In the graduation project, there ought to be many places where people could meet, the so-called ‘third places’. These are the places that are not places for living or working, but the spaces for meeting and interacting, sometimes in unplanned and unexpected ways. Naturally, there should be different kind of places for different kind of people leading different life-styles. In this way, knowledge can be exchanged by many people who are not normally in contact with each other and do not normally exchange different kinds of knowledge. This way, they may acquire knowledge in informal ways.

Besides facilities, there should also be the right infrastructure for personal transport and for digital connectivity.
A Compact and Polycentric City, which protects the countryside, focuses and integrates communities within neighbourhoods and maximises proximity.

There are some similarities between the knowledge city and this compact and polycentric city. The most important aspect is proximity. In the knowledge city, the functions ought to be mixed, because they should be closer to each other. This proximity leads to shorter travel times, which is the base of the compact city, and to more intense face-to-face contacts.

Some researchers, like Abu-Anzeh en Ledraa (2007) describe the knowledge city as a network city, because it is more about flows and streams, than about zones. The nodes between the different flows are important centres. These nodes can be used for knowledge based activities. In this way, a knowledge city can be seen as a polycentric city.

A Diverse City, where a broad range of overlapping activities create animation, inspiration and foster a vital public life.

This last criterion of the sustainable city is again very similar in the knowledge city. Diversity is seen as the base of quality of life, but the last one is much broader. Both themes deal with the amenities and facilities in a city. This diversity of activities makes a city attracting.

In the project, there have to be different amenities and facilities to have a good quality of life. The aim is to let people meet and relax at these locations. Besides these leisure activities, there should also be diversity in living and working areas.

Conclusion

Many similarities can be found in the knowledge city and the sustainable city. The most relevant ones are the easy contact, diversity and creativity. In both cities, these factors are important in the success factor of the city. Besides, there is something of the knowledge city in every criterion of the sustainable city. There are no big contradictions between the two model cities described in this text. Rather, they complement each other. Designing a sustainable, knowledge city is indeed possible.
4.3 Different approaches on knowledge cities

4.3.1 Learning city

The goal of knowledge managements is to generate, distribute and use knowledge, in order to add value to business activity and to provide new opportunities for enterprise. The difference in comparison to other management approaches is that it manages an intangible asset that will be more valuable if it is used more. The main goals of this approach do not differ from other approaches proper to the business world: making profit and grow. (Laszlo & Laszlo, 2007)

Knowledge management and knowledge-based development are international, mainly western, concepts. They are also used by cities and countries, in order to try to be successful in the new knowledge based-economy. These developments should focus mainly on citizens, providing them a good and inspiring environment for creativity and growth. People need to feel free and secure in their environment in order to work efficiently. (Laszlo & Laszlo, 2007)

However, there is a different way of understanding and dealing with freedom and security between Americans and Europeans. Americans see freedom as autonomy, independence and growth of wealth. This gives them security. Europeans feel free if there are many options for living a full and meaningful life. Belonging to communities gives individuals security, as opposed to having security because of one’s material assets. The ‘American dream’ is about economic growth, personal wealth and independence, while the ‘European dream’ is about sustainable development, quality of life and interdependence. (Laszlo & Laszlo, 2007)

The knowledge management approach is more similar to the American way of thinking than to the European one. The ‘American dream’ is very individual and the ‘European dream’ is more generous, which is more similar to knowledge management.

The gross domestic product, GDP, is used to compare the economy of different countries. GDP is generally lower in Europe than in the United States, but this indicator is only about economic growth. Other factors, like quality of life or the quality of the environment, are not taken into account. Looking at this from a sustainability point of view, it is clear that only the economic sustainability is at stake here. Social and environmental sustainability are not measured, although they are very important for freedom and security, especially in Europe. In fact, according to Laszlo and Laszlo (2007), Europe has a better quality of life in comparison to the United States. The better GDP of the US "masks the breakdown of social structure and natural habitat; and worse, it portrays this breakdown as economic gain". (Cobb, Halstead and Rowe, quoted in Laszlo & Laszlo, 2007)
Coming back to the knowledge-based development, there are two recognised purposes. The first one is the “economic growth and the post-industrial development of cities and nations to participate in the knowledge economy”. The second one is “the intention to increase the skills and knowledge of people as a means for individual and social development”. (Laszlo & Laszlo, 2007) These objectives will create an increase of intellectual and human capital, which will bring more creativity, innovation and entrepreneurship. This will stimulate the economic growth. The increase of individual capital will lead to more people who can participate in the knowledge economy, but in the knowledge economy, a lower amount of jobs is needed, because of the technological developments. In times of a growing population, the knowledge economy might not be the right solution. (Laszlo & Laszlo, 2007)

These technological advancements began to play a major role in the middle of last century in the creation of more leisure time, instead of working time. However, people work even more now than before. This is a disturbing paradox. The knowledge-based development (KBD) is not only based on economic growth, but it also demands a sustainable well-being of its community, similar to the goals of the earlier technological advancements. The KBD is going even further than the concept of the knowledge economy. It has more to do with social sustainability.

KBD should have, in comparison to the knowledge economy, a third purpose: “contributing to a socially and environmentally sustainable society as the enabler of an evolutionary future”. (Laszlo & Laszlo, 2007) This means that, besides the economic growth and individual development, the well being of the people is an important goal of this knowledge-based development. Not only are the goals important, but also the process reaching them. This process should be harmless to the people and the environment.

The three purposes of the KBD (economic prosperity, human development and social and environmental sustainability) cover the three types of sustainability.
This different meaning of the knowledge-based developments leads to a need for a change of mind for policy makers and planners operating in the knowledge economy. The people who live in the knowledge economy are not only knowledge workers. Only a small part of the population is able to find a job in the knowledge sector. A better expression for people living under this new development paradigm would be ‘knowledge citizens’. Carrillo describes this group as “a better educated (formally and informally), critical and informed population that is ready to participate in civic life, is politically active, is interested in a better quality of life for itself and the next generation, including concern for healthy lifestyles and less dependence on consumption, is appreciative of artistic expression and cultural activities and is more competent in human relations” (quoted in Laszlo & Laszlo, 2007). Therefore, in a knowledge city, attention should be paid to the whole community and not only to the most established knowledge workers.

Another desirable change in the way we perceive the whole paradigm would be reflected in the substitution of the term ‘knowledge society’ to ‘learning society’. Learning is about gaining and creating knowledge, as in a process, as opposed to knowledge as a product or objective of the learning process. Describing this change of paradigm, Laszlo and Laszlo (2007) describe the knowledge city as the hardware for the learning society. The knowledge city should be the infrastructure for the gaining and creation of knowledge. Without the learning society and knowledge citizens, a knowledge city would have only a selected group with access to the knowledge-based amenities. The universities, high-tech companies and research institutions would be ivory towers for small groups of people. (Laszlo & Laszlo, 2007)

The learning city should not have strict boundaries. The exchange of knowledge should happen through multiple scales, from a local scale to a global one. To make the exchange of knowledge possible, collaboration between regional and national governments, businesses and civil society would be required. (Laszlo & Laszlo, 2007)

Conclusion
For the design project, it means that all three purposes of knowledge management should be adapted in the plans. The amenities in the new Schie canal banks should support economical prosperity, like knowledge-based companies, human development, like educational institutes, and social and environmental sustainability, like recreational facilities and green areas. There should be a good balance between these types of amenities.

This new development should not only focus on the high educated knowledge workers, but on the entire population: the knowledge citizens. There should be learning possibilities for all residents, independent from their education level.

The Schie canal banks should focus on the learning process, instead of having the knowledge. There should be many possibilities for sharing, gaining and creating knowledge, accessible for all knowledge citizens of this learning society.

The connection to different scales are very important for this learning process. There should be many connections between amenities, neighbourhoods, towards other cities and countries.
4.3.2 Smart Cities
The book ‘Slimme steden’ (Dijksterhuis, 2008) is based on the theories of the knowledge city. In the 21st century, cities with a creative and knowledge industry are expected to be successful in attracting residents, tourists and companies, as opposed to old-industrial cities which are losing industries. The cities in this book are called smart cities. They are similar to the knowledge cities.

The book is written like a travel guide. Fifty European cities are described to emphasize the competition between different knowledge cities on the themes of culture, creativity and innovation. These criteria are important, because the knowledge economy needs new ideas and new knowledge. Producing new knowledge is a creative and innovative process. The knowledge workers who produce this new knowledge have high demands for their daily life in the city. The city should be attractive for them for living, working and recreating.

For every city, descriptions are given of the most important projects attracting people and businesses, because of this new economy.
These examples will be used in this graduation project as a source of inspiration for the city of Delft. This chapter will describe some of the relevant projects for the case in Delft.

Competition between cities
The international competition to attract the creative class to a city is very difficult. More people tend to move to other countries more easy. This means that cities have a large target group, but the competition is also growing. Dijksterhuis (2008) describes the global-local paradox. In these times of globalisation, cities need to distinguish themselves by local qualities.
In Europe, the competition is even tougher, because of the European unification. People can easily go from one country to another, from one city to another. The differences between the cities are small. Most important cities already have universities, a research institutes, high-quality shopping facilities, music centers and theaters.

Cities in the ‘Blue Banana’ are becoming more and more similar. The ‘Blue Banana’ is an image to describe the area from Manchester, via southern England, the Netherlands, Belgium, northern France, western and southern Germany, Switzerland, northern Italy, until Milan. This area is known as the economic heart of Europe and has many large and important cities, like London, Amsterdam, Brussels, Frankfurt, Stuttgart and Genève. The competition between cities in this area is enormous. Many cities invest a lot in projects to attract new talent and companies. In the competition between cities, a city needs to have a smart strategy. (ibid)

Sir Peter Hall is quoted from his book ‘Cities in Civilization’: “there are four types of creative, innovative or smart cities: the technological-innovative city, the cultural-intellectual city, the cultural-technological city and the technological-organizational city”. The smart cities should use the type of the city and strengthen it, to attract the talented people in that field of expertise. Richard Florida says that the three T’s are important for smart cities: talent, technology and tolerance. (ibid)
The success of a smart city is unpredictable, but there are some important factors for success, according to Dijksterhuis (2008) and along former findings. The first factor is the human interaction. The city cannot be smart, but its citizens can. People learn from interactions, so in a smart city there should be the so called ‘third places’. Places where people do not live or work, but meet each other in an informal way. The second factor is the diversity in the knowledge and technology. It is important that the residents are willing to share those two elements. The built environment can help by offering a mix of old and new buildings, so every person or company can find a suitable building to settle in. Mixing different people or companies in a coherent way will lead to new ideas and combinations.

An important aspect in the competition between cities is the city branding. However, the people they want to attract would rather listen to friends than to campaigns. They are more attracted by the people of a city, than by their slogans. So actually, the campaigns do not really attract people. (ibid)

Delft
The city of Delft is in the middle of this ‘Blue Banana’, so it has to deal with a large competition. In our understanding, the city should not invest too much in the city branding, because it costs a lot of money and the result is very low.

Delft should invest in its own development as a knowledge city and to be known by people by building or creating new facilities. According to previous research, we have carried out that the focus should be on how to distinguish the city from the other cities in the Netherlands and in Europe. As written earlier, human interactions and diversity are important factors for this new developments.

Examples from other cities are very useful as sources of inspiration, but should not be copied, because many staring points are different and could lead to failures. The example projects should be turned into projects that emphasize the identity of Delft.

Examples from smart cities
The examples from the smart cities can mainly be divided in three groups. The first group is the organisations, the people who start the change into becoming a smart city. The second one is the built environment. New or renovated buildings are used for creative industries. The last one is the event. An event can be a good starting point for a city to put itself on the map. Most of the time, the event is just the start of change in the city. The people and organisations, the buildings and the event together will have a large effect in the change of a city.
Stimulating organisations
Antwerpen, Belgium, started the association COCD (Centre for the development of creative thinking). This organization gives courses, interactive workshop, lectures and publishes articles on creative thinking. They help people and companies to think in a different way, in order to get to other solutions or innovations. There are many different courses and consults from the COCD for different problems. (COCD, n.d.)

In Bregenz, Austria, an organisation was founded for the local furniture makers and carpenters: Werkraum Bregenzerwald. There are many forests surrounding Bregenz, so since a long time, there are many craftsmen working with wood. The craftsmen connected to the organisation have agreed on the basic principle that every product created by them will have a high quality, will be functional and beautiful. Every three years, a competition and exhibition are organised and this will attract many people from different countries. Besides, the organisation invests in an intern program for new craftsmen. (Dijksterhuis, 2008)

Buildings and public space
In Antwerpen, Belgium, the design centre Winkelhaak accommodates multiple creative businesses: web designers, architects and industrial designers. These businesses share a library, secretary, photo studio and rooms for presentations. They even work together on competition. The companies have many advantages of this building, like the shared facilities, the lower costs and the exchange of expertise between the different companies. The surrounding neighbourhood also profits from the extra people who visit the area. (Dijksterhuis, 2008)

In Bratislava, Slovakia, an old car workshop is transformed into the Design Factory. This old industrial building is the only building that is preserved in a large old industrial site. Many buildings were demolished to create space for new offices and housing. In the Design Factory, young designers and architects organise lectures, exhibitions and workshops. By doing these activities, they want to give attention to the need of creative companies in the new master plan for the complete area. (ibid)

The Centre of Life is an important facility in Newcastle, England. In this centre, biotechnology, economy and daily life will be brought together, to make the knowledge better accessible for the people. This happens by giving lectures, creating exhibitions and showing dvds. This way, people will become more familiar with biotechnology and its possibilities. (ibid)

Milan, Italy, is building a large complex of companies, showrooms, housing and a part of the technological university. The public space in this complex will be a ‘library of trees’. The streets and lines in this park will connect the different neighbourhoods with each other. Not only will the important fashion industry be settling here, but also other sectors. The diversity in companies should lead to innovation. (ibid)
Special events
Aveiro, Portugal, has a technological university and has attracted a lot of knowledge-based companies. For graduated students, there are many jobs available. In order to attract more people, the municipality invested in luxurious apartments in the city centre which fit the target group. Aveiro wants to create a high living quality for their inhabitants. The city really became known when the European Championship football was played in Portugal in 2004. In Aveiro, a new football stadium was built. A lot of tourists visited the place and since then, more tourists visit the city every year. (Dijksterhuis, 2008)

The European Capital of Culture in 2005 was Cork, Ireland. In the city, many activities were organised for different types of culture: theatre, music, literature and architecture. This event attracted a lot of visitors during the event. The years after the event, the effects were visible in the city. A gallery was upgraded into a national institute and has more visitors. There are more investors in the museum, so more art work could be bought. Other cities that have used the European Capital of Culture status as a catalyst are Essen, Germany, and Liverpool, England. (ibid)

This year (2009), Vilnius, Lithuania, will be the European Capital of Culture. There is an interesting discussion in this city on the creation of a smart city. On one side are the people who believe in creating and on the other and the people who believe in originating. The first group thinks it’s better to create top down projects, to put the city on the map. The other group suggests it’s better to create space for the individuals and wait for bottom up projects to originate. (ibid)

Both ways offer many possibilities, but they can’t exist on their own. It is important for municipalities to have a good division in creating projects and making space for originating projects.

Conclusion
The main lessons which can be learned from these examples is that a knowledge city needs different types of projects, in order to attract businesses and companies. These projects can be divided into the organisations, the built area and the events. A single project would not lead to success. For the case of Delft, there should be a combination between these types of projects. An organisation should be founded which would stimulate the developments and the communication and exchange of knowledge between different actors in the city. This organisation should be situated in the middle of the knowledge-based developments.

In the design location, there are some monumental buildings, which could be used as inspiring environments. In this building, there could be a public function, to attract residents of Delft to share knowledge. There could also be a function for starting companies, which can share certain facilities. An event can work as a catalyst for the knowledge city. An event can have many spin off projects. For Delft, the event of the European capital of Culture is not really feasible, because it is more a technological-innovative city, instead of a cultural-intellectual city or cultural-technological city.

The design should adapt to the discussion on creating the knowledge city versus making space for originating projects. There should be both top down and bottom up projects.
5. Sustainability

5.1. Environmental maximisation method

**Introduction**
The analysis of the Schie canal banks is partly done with the Environmental maximisation method. This method starts with an inventory of the existing situation. For different themes, a maximisation will be made. This means that for that topic, the best solution is created without looking at other factors. These different maps should be combined to see where they strengthen each other or where they are in conflict. This optimisation map can be used in the urban design. Figure 5.1 shows the scheme of this method.

In this analysis the inventory step is already taken per theme. For some themes an extra step is added. This step explores the plans of the city council of Delft. They already made a vision for the Schie canal banks.

This chapter is only about the maximisation maps. The inventory maps and the plans of the city council can be found in the appendix.

![Environmental maximisation method diagram](image-url)
Land use
The main functions of the Schie canal banks are business and living. There are some furniture stores at Leeuwestijn.

The city council wants to replace some businesses with housing. The harbour (Nieuwe haven) will have a more recreational function. Some businesses will be replaced by stores.

The maximisation map shows a mixed-use programme. There are some key locations assigned where a special function is needed. The Kolk is the entrance to the location from the city centre. It is now surrounded by housing. Many boats stop at the Kolk.

There are two harbours. One harbour is hidden behind housing and the other is used for industrial purposes. These locations could play a large in role in the water recreation.

At the Lijm & Cultuur site there is now a cultural and festival field. This has a flexible use. This should be preserved in the new design.

The Kruihuis, at the other side of the Schie, should also be preserved. It is now hidden behind a lot of trees and bushes. This monument should be more visible.

The last key location is Delft Zuid. This railway station should be more integrated in the surrounding area.
Monumental buildings
The monumental buildings in the area should be preserved and integrated in the urban design. These buildings have each an important history that should remain. Examples of these buildings are the Porceleyne fles and the Kruithuis. The first was the first factory of the Delft blue earth ware. The second was the old storage of gunpowder. Two old factories are also monumental buildings.

Soil
The soil at the right bank of the Schie canal is more polluted than at the left bank. The pollution is less in the surrounding areas, because there were no industries. The highest pollution is still mediocre, so not heavy. It still needs to be cleaned before fragile functions will be placed there.

Housing areas should be placed at sites with less pollution.
Ecology
The existing green areas in the design location are small pieces. The only large strip is at the south side next to the main road.
The municipality wants to add a large ecological connection in the direction of the rail road.
It should be even better to add an extra green connection parallel to the main road. There should be larger areas of green, instead of the scattered pieces in the current situation.

The ecological connection from the Regional Structure Plan is crossing the area, so extra attention should be paid to establish this connection.
Water

The level of the Schie canal is higher than the water in the surrounding waters. These two cannot be easily connected. The water of the Schie canal is more dirty than the clean water surrounding it. From the north west, a dirty stream comes in to the area. The city council wants to add more surface water to the area. This will connect the two harbours.

The maximisation follows the city council partly, but the dirty water will be led out of the area as quickly as possible. The extra surface water will be connected to the water of the surrounding area. This should be in a circuit, so the water can be kept into the area. The water should be used more for recreational functions.
There are not many bicycle paths in the design location. The Kruithuisweg is not really safe at night, so there should be an alternative route. The city council wants an extra bridge and tunnel to accomplish this new route. It is important that there will be good quality cycling paths. People should be stimulated to take the bicycle rather than the car. This can be done by using the scheme of figure 10.26. The arrows are the paths and the circles are amenities. By placing amenities on the route for bicycles, people can use the bicycle to do more things at once. For example, do some shopping on the way to work. There should more separate bicycle paths and they should have priority on cars.
Infrastructure public transport

There are two railway stations in Delft. They both facilitate the design location. Figure 10.29 shows the walking distance and the bicycle distance from the stations. The entire location is covered by the two stations. An extra railway station is not needed.

The same things is done for the buses and trams. (The new tramline to the university is already taken into account.) In figure 10.30, there is a void in the influence of the trams and buses.

In the new design there should be an extra bus- or tramline to facilitate the complete area. Figure 10.32 shows the possible new situation.

The railway station Delft Zuid should be upgraded and connected to other public transport lines. It is now isolated and it can only be used by people who walk or ride their bikes to the station.

The station has a very good location to facilitate new developments on the Schie canal banks.
In the maximisation, the continuous road is blocked in the middle. This way there will be less car traffic through the area. Only visiting cars will enter the area. The speed limit for cars can be lower, so it will be more safe. The cars can still leave the area quickly.
Infrastructure noise
A disadvantage of the main roads and railroad next to the design location is the noise pollution. The figures at the left side show the noise barriers for the trains and cars. The noise of the trains is worse during the day. The buildings block a lot of noise, especially the new housing blocks at the north side of the area. If there were no buildings, the complete area would have noise pollution.

Another disadvantage of the car is the pollution from NO2 (nitrogen dioxide) and PM10 (fine particles). It is not healthy to live close to those roads. Most pollution comes from the roads at the north and south of the location, Zuidwal and Kruithuisweg.

The design should take into account the noise and pollution from the train and cars. There should be a special noise barrier, like the housing blocks at the north side. It is better to build new housing further away from the roads and train.

Fig. 5.13 - Maximisation infrastructure noise and pollution
Infrastructure water transport

The Schie canal is a very busy waterway. Many inland vessels use this route. Besides it is used for recreational transport. There are two rowing clubs, one of them is in the design location. There are two harbours, one for large boats and one for the households surrounding it. Other boats lie at the quays next to the canal.

The city council wants to have more amenities surrounding the main harbours. They assigned several places where boats can lie. In the maximisation there are less places for boats, but they have to be larger. There should also be more amenities surrounding the Nieuwe haven and the Kolk. The industrial facilities for boats should be removed to the southern Schie canal banks. The quays should be more attractive so they can be used for recreational purposes more.
In Delft there is a heat supply from two main sources: the sewage treatment plant in the north and the DSM gist factory. The heat is transported to the Harnaschpolder, the Delflandplein and the cogeneration plant of heat and electricity of the TU Delft. This transport line crosses the design location, so it could be a possibility to use this as a heat source for the area.
Energy sun

The optimal angle towards the sun is between two lines on 20 degrees from the west to east direction. The building blocks should be built in this direction to have the most efficient use of sun energy. The structural elements should be in the direction from north to south.

The buildings in the north of the design location do not have an optimal angle towards the sun. The buildings more to the south do have a better angle. The Schie canal as a structural element does not have an optimal angle.
Fig. 5.18 - Optimisation
Optimisation

Figure 12.58 shows the final conclusions of the maximisation process on a map. All maximisation layers are mapped over each other, in order to find the optimal situation for the environmental point of view.

The main important aspects are the buildings, infrastructure, water and green.

The old and monumental buildings should be preserved. Some of them need to have another function. The old buildings can be important public elements in the new plan.

The car road should not be a straight continuous way. In the middle of the western shore, there should be some kind of construction which forces the drivers to slow down.

The use of public transport or slow traffic should be encouraged. There should be more bus stops in the area. The railway station Delft Zuid should be connected to this network.

The bicycle paths and pathways should be more attractive. These paths could be placed along the Schie canal. There should also be a safe alternative for the Kruithuisweg. An extra connection between Emerald and Voorhof can be combined with this route.

The waterways should be more continuous streams. The water ways of the surrounding neighbourhoods should be continued into the Schie canal banks.

The dirty water in the north should be directly drained into the Schie canal, without crossing the area.

There are three main green connections. These should be integrated in the design. The Schie canal and the Rotterdamse weg should be green axis in the city. This can be done with trees.

The two maps below show the different functions (living, work and recreation) for two types of pollution. The left image is on soil pollution and has no living areas on the eastern shore. The right image is on air pollution and has no living areas next to main infrastructure routes.

The choice for one of these scenarios should be based on other factors, like the knowledge city.
5.2 Health and safety in urban planning

Earlier studies pointed out that a healthy and safe environment is necessary in the sustainable knowledge city. It is important that the well being of people gets a lot of attention. People need to feel safe in their living and working environment, in order to come to new ideas and inventions.

This chapter is about health and safety in urban design and planning. First, the link between health and urban planning will be explained and elaborated. It is followed by four themes of healthy urban planning. This chapter ends with a conclusion.

Health and the link with urban planning

First, we need to look at the term health. Already in 1946, the World Health Organization had a broad view on health: “Health is not only the absence of disease but a state of physical, mental and social well-being. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being, without distinction of race, religion, political belief or economic social condition.” (Barton, 2005a) Duhl (2005) estimates only 10% of health is a result of medical care. The rest is a product of education, housing, transportation, environmental pollution and more. So, health is more about the overall quality of life.

Urban planners can influence the living environment. There is a link between the environmental conditions and health. There are direct physical impacts, like pollution of air or contaminated water, but also indirect social and behavioural impacts, like the exercise of people, the people they meet and inequality to opportunities and facilities, like housing, jobs and health services. (Barton, 2005a)

The figure above shows the neighbourhood as a ecosystem model. The people and their health and well-being are the central point. The people live in a community and have social connections. The community also influences the individuals. Local activities serve and influence the community and the people.

The fourth circle is the places and the built environment. Urban planners and designers can only influence this element. They can only influence the people indirectly. They have a bigger influence on the activities, because they can create place where certain activities can take place.

The natural resources have an influence on the places, because the existing situation limits the design. For example the presence of water leads to special designs and every climate has a different amount of public outdoor spaces. (Barton, 2005b)
There are four main themes how urban planning can have a positive influence on public health. These themes will be attended separately further in this chapter.

- increasing the amount of incidental physical activity
- reducing air and water pollution
- reducing the inequalities in access to facilities
- improving the community cohesion (Barton, 2005a)

These themes can be compared to the twelve WHO healthy urban planning objectives. These objectives can be divided in four groups:

- Individual lifestyles
- Quality of the environmental stock
- Living conditions
- Supportive social networks (ibid)

By increasing the physical activities, the individual lifestyles will be improved. The pollution of the environment should be avoided, in order to have a good quality of the environmental stock. People need to have equal access to facilities, which means that the living conditions of people are similar. And at last, the social cohesion in a community results in a supportive social network.

Physical activity

Overweight and obesity are growing problems in many countries nowadays, which lead to great health risks. One of the main factors causing these illnesses is physical inactivity. People don’t exercise enough and they should be stimulated to physical activity.

Physical activity has many positive effects on a person’s health. The life expectancy is higher, as well as the tolerance to stress. The risk on many diseases is reduced, for example diabetes II, breast cancer and depression. (Racioppi et al., 2005)

Health benefits can already be achieved through moderate physical activity on most days of the week. At least 30 minutes a day is necessary. This can be done in a single activity or spread out over several shorter periods of a minimum of 10 minutes. Climbing stairs, brisk walking or cycling can be part of these activities. (ibid)

Urban planning can influence people into walking or cycling. The Netherlands has already the lowest rate of inactivity of the population. Only 7.5% of the people do not participate in moderate physical activity. For example, in France, Spain and Italy this rate is more than 50%. The main reasons, why people don’t take the bicycle or walk, are that roads are unsafe and that the distance is too long. So, in order to stimulate people into physical activity, the roads should be safe and attractive and facilities should be close. If facilities are far away, a good solution would be to connect public transport to the slow traffic infrastructure. (ibid)
Community

Improving the community cohesion can be done by improving the liveability of streets, making them safe and stimulating the communication between people. (Barton, 2005a) This way, safety becomes a part of a healthy environment.

Social unsafety is the possibility that a crime actually happens. There are three main factors for a crime to take place: the offender, the target and the environment as a barrier or opportunity. These three factors lead to a safe or unsafe feeling.

From the point of view from the built environment, the scale and size of buildings influence the presence of offenders. Large apartment blocks and large scale public spaces with little public facilities attract offenders, so they should be prevented.

The target has two main criteria: attractiveness and physical vulnerability. If an object is made of a weak material, it will sooner be demolished. So the public area should have firm and solid objects. Objects that are already broken are even more attractive to offenders.

Pollution

Urban planners have influence on several themes, concerning pollution and the environment. The energy use of buildings can be lowered by placing buildings in an optimal angle towards the sun, so they could use a lot of sun energy. By using more sustainable energy sources, the effect of the polluting fossil fuels can be reduced.

The choice for materials can also influence the pollution. Some materials need a lot of energy to be produced. Other materials have a negative influence on the local environment, because in contact with water, they discharge harmful particles, like zinc. (Barton, 2005b)

Equal access

All people should have a right on good housing. If only expensive housing have good facilities and supplies, then social exclusion of people lead to health inequalities. If people are socially excluded, it has a very negative influence on their well being. This should be prevented. This can be done by creating facilities for all people and some investments to help the vulnerable groups. (Barton, 2005a)

A diverse population has diverse demands. Each age group requires something different and each culture has different priorities. People need common spaces, where they can interact. The different demands for these common spaces should be taken into account, because all people should profit from the possibility to meet other people. (Duhl, 2005)
There are five themes in the environment which influence the safety.

- The presence of 'social eyes' is the presence of people or the visual relation from buildings. The more 'social eyes', the safer the place is.
- Visibility and overview make people feel safer, because if they have control on the situation. For example, in case of danger, people should immediately know where other people are or where to run. Involvement and responsibility are factors that make a neighbourhood safer.
- If people feel responsible for their surroundings, they want to prevent crimes and pay more attention. People feel connected to a neighbourhood if they like it.
- An attractive and a well taken care of public space can have a positive influence on the safety. A high quality design and maintenance are very important.
- Accessibility and escape paths make spaces safer. People should be able to escape fast and easily. However, a low entrance barrier attracts more offenders. So, there should be a good balance.

**Conclusion**

Summarised, a higher density, mixed-use, pedestrian friendly environment with accessible local facilities and social diversity will lead to a better public health. However, there is a huge danger of wishful thinking. The assumption of a direct, simple cause and effect is not always right. For example, creating good facilities for pedestrians will not influence all people to take a walk. Most people, who will walk, already have a healthier way of living. (Barton, 2005a)

So, attention should be paid to create a healthy environment, but the real effect should be kept in mind. It is not harmful to design healthier environment, but the effects can differ from the objective.
6. Delft

6.1 Regional context: South wing of Randstad

National, regional and local governments already made plans for the South wing, Delft and the Schie canal banks. These plans will be described in this chapter and in the next chapter.

South wing
Delft is one of the cities of the ‘Zuidvleugel’, South wing, of the Randstad. Other cities are Rotterdam, The Hague, Dordrecht, Zoetermeer, Leiden and Gouda. These cities are combined in a governmental platform, the South wing. This can also be seen as a network city.

This platform wants to stimulate economical progress by intensify the core qualities of the region. The three core qualities are:
- (inter)national centre of justice and government
- the high-quality knowledge centres
- main maritime and logistics cluster.

The first quality is seated in The Hague and the third in the area west of Rotterdam. Delft is one of the cities with a high-quality knowledge centre. The South wing wants to distinguish on a European and mondial scale with this set of core qualities.

Improvements are assigned for different themes, like green, water, living, infrastructure and labour. The last two themes have most influence on Delft as a knowledge city. (Bestuurlijk Platform Zuidvleugel, 2003)
Figure 6.1 shows the existing infrastructure in the area. The public transport lines and the highways should function as backbones for new developments as businesses and housing. Accessibility is one of the main goals of this network city. Delft is in the middle of this network and has short travel times to the largest cities. The trip to Rotterdam or The Hague is by train 12 minutes. By car, it is just a few minutes longer. All cities can be reached within half an hour.

The connection to the global level is via two airports, Schiphol and Rotterdam airport. Both airports can be reached in 45 minutes. By car, the trip takes less time. For Rotterdam airport, it is just 15 minutes, but not many airplanes land here. Schiphol is much bigger and can be reached within 36 minutes.
As mentioned earlier, there are three main themes for the economy, government and justice, knowledge and maritime and logistics. Figure 6.2 shows the knowledge economy on the map.

There are four assigned knowledge centres:
- Node Leiden-West
- Binckhorst, Trekvliettracé
- Knowledge boulevard A13
- Shipping Valley

These knowledge centres have different themes and have different qualities for the knowledge economy. There are two large supporting areas, the sea harbour and the green housing area in Westland. These areas have specified knowledge.

There are three universities in the South wing:
- University of Leiden (Life sciences)
- Delft University of Technology
- Erasmus University (business)

These universities complement each other and attract different students. There are some integrated studies. Next to the universities there are several colleges.

Delft has an assigned knowledge centre, a university and a college. It is the centre for technology in the South wing. This should be one of the key factors in the strategy for Delft. Links can be made with the other cities in the South wing.

Fig. 6.2 - Knowledge economy
Kennisalliantie (knowledge alliance)
The knowledge alliance of Zuid-Holland is founded in 2003. It is a network of innovation and entrepreneurship to connect the four groups of actors (education, research institutes, entrepreneurs and authorities). Their main goal is to stimulate the innovative industries. Main themes are observing and connecting.

The strategy of the alliance exists out of three core activities: network organisation, implementation organisation and knowledge organisation. The first activity observes the developments in the province and connects different actors; in order to let the knowledge economy will develop in a more efficient way. The second activity is about starting up projects that will contribute to the innovation and the entrepreneurship in the province. The last activity deals with creating knowledge and expertise.

Besides the city council of Delft, main actors are the province of Zuid-Holland, the city council of Rotterdam and Den Haag, three universities, three higher education institutes, other city councils, the Chamber of Commerce and companies, like Shell, Siemens, TNO etc.
The alliance is settled in the centre of Delft. (Kennisalliantie Z-H, n.d.)

This knowledge alliance will support the development of knowledge businesses in Delft. The first activity is the most important one, creating a network of knowledge-based businesses and people. It is important for the knowledge city that there will be networks to share knowledge. However, there should be attention to the lower levels of knowledge sharing.
6.2 Governmental context: Policies of the city council of Delft

Foundation Delft Kennisstad
In order to become a knowledge city, the city council of Delft started the foundation Delft Kennisstad. Their goal is to attract knowledge-based businesses. These businesses, together with the university, will serve as the engine of the economy of Delft and they will bring it to a higher level. In this collaboration of the foundation, there are four groups of actors: education, research institutes, entrepreneurs and authorities. Main actors are the university, the two higher education institutes, the city council, the Chamber of Commerce and knowledge-based businesses. The foundation is cooperating with the Kennisalliantie Zuid-Holland (knowledge alliance). (Stichting Delft Kennisstad, n.d.)

The attention of the city council is focused on the higher level of education and similar businesses. They forget that knowledge is not only for universities, but for everybody. There should be more attention paid to these lower levels of knowledge sharing.

Marketing the city
In order to attract businesses, citizens and tourists to Delft, the city council made a marketing campaign. There are four main themes: technology, history, creativity and innovation. The goal of this marketing campaign is to create a livable and wealthy city.

The city of Delft has set up four main arguments, based on the main themes, to attract businesses and people. The first one is the cultural history of the city. Main attractions for tourists are the delftware, the old churches, the Prinsenhof and the city centre. The second argument is the university. It attracts students and knowledge-based and international businesses. This way, there are many nationalities together, which creates a very diverse society. The last argument is the creative city. Historical figures of Delft were creative inventors, like Anthony van Leeuwenhoek and Johannes Vermeer. Nowadays, Delft is the second creative city in the Netherlands. The last argument is the free minded and informal atmosphere in the city, created by the diverse population of students, international employees and tourists. (Vier unieke troefkaarten, n.d.)

The city council of Delft has four main themes, which fit partially in the knowledge city. Technology, creativity and innovation are important themes for this concept. History can fit in, if it is used in an educational way. The marketing campaign needs a good slogan and not only four main themes.
In its vision for housing, the city council of Delft formulated three main themes: Knowledge, Quality and Changes.

In order to become a knowledge city, special target groups are mentioned who needs extra attention. These are the students, the knowledge workers and starting companies. Another starting point is the creation of the living-learning-working-ladder.

More higher education institutes are settling in Delft and more national and international students come to the university. This means more students will come to Delft and want to live there. Housing for students will be mainly realised on the campus. Temporarily students can live in buildings in redevelopment areas.

After finishing the study, many people leave Delft. In a knowledge city, it is important to keep starters, because only with these young knowledge workers the city can develop. For this target group, compact, urban living environments should be created. Combined housing and working should be possible in these areas. Besides, there should be enough recreational amenities. The city council of Delft sees the TU area and the northern Schie canal banks as good areas to create these environments.

For older knowledge workers, the city council wants to create city-centre-like urban living environments close to infrastructural nodes and green urban living environments. The first environment can be created around the railway stations. The other environment needs more space and can be situated at the borders of the city. Delft almost reached its borders, so other cities need to cooperate with Delft.

Delft tries to connect the knowledge institutes with the so called living-learning-working-ladder. Delft wants to stimulate knowledge sharing by mixing functions on different scales. Business should enter the living environments and housing blocks should be combined with offices or education institutes. Internships and courses should be available for all inhabitants. (Gemeente Delft, 2008b)

The Schie canal banks can play a large role in this vision. Housing for students, starters and other knowledge workers can be created here, because the features of the area have many possibilities for creating an urban living environment. Mixing functions will be important to create this living-learning-working-ladder.
Climate plan and ecological plan
The city council wants to decrease the CO2-emissions. However, there are many large developments, which lead to higher CO2-emissions. Delft made a climate plan for lowering the total CO2-emissions of the existing buildings and the new developments. They use the ‘trias energetica’: diminish the demand for energy, use sustainable energy sources and use energy efficient.

Delft uses the knowledge city concept also for the climate plan. Innovative solutions for a different use of energy should come from the knowledge-based companies. New developments can be example projects and can be inspiring for its citizens, which is also a important in a knowledge city. (Gemeente Delft, 2003)

Another environmental policy is the ecological plan. The two main strategies are to create a high-quality ecological structure and to keep a good balance between nature and the built up area.

A good ecological structure has a positive effect on the social, physical and economical environment of the city. The people can enjoy the green areas and recreate in it. The quality of the air and the water will improve. This leads to a better health and more safe environment, which is attractive to people and companies. (Gemeente Delft, 2004)
6.3 Local context: Existing amenities and building plans

**Schie canal banks**
The city council of Delft sees the Schie canal banks as a business area. They admit that the area is a mess nowadays, but they also see the potential qualities of it, like the proximity to the canal, the railway station and the highways A4 and A13. New plans are made to make the Schie canal banks a lively and attractive business area.

The Schie canal banks became a business area, because the Schie canal was an important route for ships. During the Industrial revolution, the area was used intensively. Factories, like the Glue and gelatin factory, were settling on the banks. The transformation of this area was started by the transformation of the Glue and gelatin factory into an event and culture area.

The Schie canal banks are actually two areas, divided by the Kruithuisweg. The southern area will be improved by a better accessibility and by reshaping the public space.

The northern area (the area of this graduation project) will change heavily. The city council wants to create space for small-scale businesses. In the Schiehal, there will be studios for graduated students from the university, so they can start up their own business. The existing businesses should be moved to the Harnaschpolder.

An important node in the area will be the railway station Delft Zuid. This will be upgraded, because it will be part of the ‘Stedenbaan’. This new railway concept has more trains in a higher frequency. The new station will be surrounded by housing and offices. (Schioeovers, n.d.)

The alderman, Anne Koning, describes the main goals as:
- attract more (water bounded) businesses to the area;
- connect the neighbourhoods Voorhof and Tanthof with the university and Technopolis;
- connect the city to the rural landscapes;
- create ecological zones next to roads and water;
- only housing in the north side.

The Schie canal banks should be a durable social-economic working environment. (Gemeente Delft, 2008)
Fig. 6.3 - Vision of city council for Schie canal banks
The northern Schie canal banks are the most important location for the graduation project. The city council wants to create a new business area, but not for knowledge-based businesses. In the graduation project, there will be, because this location is closer to the university and the existing knowledge-based businesses.

There should not be only businesses in this area, but a mixed programme is more suitable. So next to businesses, there should be more housing and recreation amenities.

The main goals are actually fitting well into the concept of graduation project, except for the last one. A mixed programme should have more housing than only in the north.

The vision of the city council is for this site is shown at the left side. There are four structural principles for the area:

- Etalage (show window)
- Stemvork (tuning fork)
- Ladder (ladder)
- Kruisverband (cross connection)

The first three are in the area of the graduation project.

The Etalage is the area around the railway station Delft Zuid. This is where the area can present itself, because it is visible from the train and the cars. There should be a grand entrance and a high quality public space. The functions will be offices, hotels and conference centre.

To the north, there will be a better supplying infrastructure. An extra road should cause a better use of the site. It also creates two front sites. There should be a more attractive view towards the railway.

At the other side of the Schie Canal, there will not change that much. Some buildings will be removed to improve the view on the water from the Rotterdamse weg. The ladder will be the variation in buildings and empty areas. The empty areas can be used for parking and storage, to relieve the Rotterdamse weg. (Gemeente Delft, 2006)
Glue and gelatine area
The former lime and gelatin factory is situated in the middle of the Schie canal banks. The city council wants to turn this factory into the centre of the art and knowledge city. This new centre Lijm & Cultuur (Glue and culture) will be a place where cultural creativity and innovation will inspire the people of Delft.

There are spaces for presentations, plays, rehearsal and storage. There will be room for people from different disciplines, like theatre, musical or art. (Gelatineterrein, n.d. & Lijm en cultuur, n.d.)

This centre suits very well into the knowledge city concept. It brings people together and inspires them. Art and culture is a important factor in the quality of life. The diversity of things that can happen at Lijm & Cultuur attracts many different people.

Porceleyne Fles
Delft is famous for its delft-ware, its blue porcelain. Nowadays, tourists visit the Porceleyne Fles, the old factory of the ceramics. The city council wants to expand this museum into a Museum-factory. There will be an exhibition of the collection of the delft-ware, combined with a working factory. It should be an attraction, together as a source of knowledge on the history of Delft and its delft-ware. Tourists can visit this attraction, but it should also have an educational role. (Gemeente Delft, 2008) Especially the last goal is very important in a Knowledge city, so the amenity is very important in the project. Together with the cultural function, it fits well into the concept.

Schie-factory
Many of the graduated students leave Delft after their study. In order to prevent this, in the Schie hall, new rooms will be created for small starting businesses. Graduated students can hire studios. There is a lot of space and flexibility. This should be possible somewhere in the middle of 2009.
The studios are for the pioneers. Later on, there will be living and working buildings in this Schie-factory. Besides, there will be a big, multifunctional hall, for festivals, events and markets. A factor that will influence the success is the connection with the university area. A new bridge for bicycles and pedestrians is necessary. This will be connected to a new railway station for Delft Zuid. (Gemeente Delft, 2008)

The function of the Schie-factory is very important in the knowledge economy. In a building like this, there is a lot of sharing of knowledge. At the other hand, it is sustainable to use an existing building and re-use it in another way, because you don’t have to demolish and build a new building. The old industrial looks of the hall give the place a special atmosphere. The building is very large, so the question has to be raised if this is really the right solution.

Technopolis
The city council of Delft wants to develop Technopolis Innovation Park into one of the most important knowledge areas of Europe. This business area is focusing on the research and development companies.

The location of Technopolis is close to the university of technology, so there should be a collaboration between the university and the businesses. The business area will be developed in the next 20 years. At the end, it will be around 86 hectares. The first company is already settles, the Dutch Measurements Institutes (NMI). (Technopolis, n.d.)
The location of Technopolis is also close to the exit of the highway A13. However, there is a big barrier in between Technopolis and the university, so the advantage of proximity is limited. The Schie canal banks are closer to the university and there is no barrier. It is further from the highway exit, but it is closer to the railway station. This location is more suitable for knowledge-based businesses. At Technopolis. There should be large buildings and businesses, because there is a lot of space.
**Volksuniversiteit Delft (University of the people)**

In Delft, there is an organisation called the Volksuniversiteit. They organise courses on different topics, like languages, culture, history etc. Professional teachers give lessons to small groups. The courses are now at the Stanislas school at the Westplantsoen, at the west side of the city centre. (Volksuniversiteit, n.d.)

This kind of amenities is very important for my location, because it is about sharing knowledge with all kinds of people. This amenity is especially good for knowledge sharing on low levels. The diversity of the courses attracts many different people, not only the higher educated people.

**International water centre**

The Netherlands is famous for its knowledge on water management. In the Netherlands, Delft has a lot of this knowledge on this topic, because of the University of Technology, UNESCO-IHE (the Institute for water education) and some companies, like Deltares. The city council of Delft wants to strengthen their image by creating an International water centre. This should be a showroom of everything Delft has to offer in the field of delta technologies.

The centre should be a place where entrepreneurs, scientist and authorities can come together. Besides, everyone who is interested in water or water management should be able to visit the centre. An important topic in the centre will be the technologies on protection against the water. Examples of projects will be displayed. For example, big projects like the Maeslant Storm Surge Barrier in the Nieuwe Waterweg, but also smaller local projects.

However, the main function of the centre will be a location for business to settle and develop. In this building, the different business can discuss, exchange knowledge and do business together.

The first location of this centre will be the old GGD building, which is situated in the northern area of the Schie canal banks. In the future, the city council of Delft wants to build an innovative and recognisable building at the Technopolis Innovation Park, close to Deltares. (Internationaal centrum, n.d.)

This International water centre will be a suitable amenity in my project, because it fits into the concept of the knowledge city. In this centre, a lot of knowledge will be exchanged, but it is also some kind of exhibition of the knowledge. All people who are interested can visit it, so it creates a link between the knowledge institutes and the population of Delft.
Developments around the Schie canal banks

On the map on this page, all new developments around the Schie canal banks are assigned. In the text above, most of the projects are already described, accept for the Railway tunnel, Poptahof, the Mekelpark and Delft Zuid.

The railway that is now crossing the city on a viaduct. This will be transformed into a railway tunnel. This tunnel already starts in the design location, so it has a big influence on the northern side of the area. On top of the tunnel, there will be a park, surrounded by new buildings.

At the west side of the location, the neighbourhood is redeveloped. This area had a bad social quality, it was unsafe and neglected. Now, it is physically upgraded, so the living environment is improved. The ecological connection is visible in the park in the middle of the area. However, this connection is blocked by the design area.

On the other side, there is the Mekelpark, the area of the university. The road in the middle of the buildings is replaced by a park. This leads to more traffic on the Rotterdamse weg. At this road, new colleges and new student housing are build facing the Porceleyne flies. At the opposite of the Glue and gelatine area, a adventurous playground will be developed. Here, children can play in a rural area and build sheds and huts with wood.

Delft Zuid will be a new office area. These offices are placed at the other side of the Kruithuisweg than the design location. A new railway station is planned over this road. This should be an eye catcher.
6.4 Socio-demographic research: Population of Delft

This chapter is about the population of Delft. The 7 neighbourhoods of Delft are compared with each other. The information comes from the Buurtmonitor Delft (Gemeente Delft, 2009). All data is transformed into maps, so the differences between the neighbourhoods is better visible.

The seven neighbourhoods are Binnenstad (city centre), Hof van Delft, Vrijenban, Voorhof, Buitenhof, Tanthof and Wippolder. The design location of this graduation project is in Wippolder.

The most important maps can be found in this chapter. The rest is placed in the appendix.

At the end of this chapter, a map shows the conclusions. This gives starting points for the design for the Schie canal banks.

Population and density

Delft has more than 95,000 inhabitants. The neighbourhood Hof van Delft has the highest number of inhabitants: almost a quarter of the people of Delft lives here. The neighbourhood is rather big.

Voorhof has the most residents per square kilometre, because there are many high apartment blocks. The city centre has also a high density of people, because many students live together in old canal houses. Wippolder and Vrijenban have a low density, because there are many large amenities without housing in the area. In Vrijenban, there is the Delftse Hout, a recreational area at the other side of the highway. In Wippolder, the university possesses a lot of space.

The design location is in Wippolder, so it has a low density. Most of the people live in the northern part of the neighbourhood, close to the centre. The contrast between the location and the neighbourhood Voorhof at the other side of the railway is large. By creating a higher density in the design location, there can be more coherence in between the neighbourhood. There should be more facilities for the extra people.

Fig. 6.11 - Population and density
Age diagrams
The age diagrams show the composition of the population in groups of age. The first diagram shows the comparison between the population of Delft and the Netherlands. In Delft, there are a lot of young people, because there are many students at the university. There are less children in Delft, compared to the Dutch average. People who studied in Delft probably move out when they want to have children.
There are also less older people. The aging problem in the Netherlands is not present in the Delft in the same degree.
All groups are described in percentages, so the large group of students causes a lower percentage at the other categories.

The diagram below show the differences between the population of Delft in 2008 and in 2020.
There are even less children in 2020. However, the group of potential parents, 25-34, is growing. This also means that more students will stay in Delft after there studies. The group of students, 15-24, stays the same.
The aging problem also comes to Delft, because the group of elderly is growing.

For my design location, a good strategy would be to create housing for the group of 25-34, because these new knowledge workers should live in Delft to preserve the knowledge in the city.
For the elderly, there should be more facilities to recreate during the day. This can be connected to the knowledge city concept, because older people has collected a lot of knowledge over the years and should share it with other people. New facilities should make this possible.
**Changes in population**

This map shows the numbers of people being born, die, move in and move out. The colour of the neighbour represents the overall change in population. In the northern neighbourhoods, the population is still growing, while in the south of Delft, the population is shrinking.

The numbers of settling and leaving are representative for the attractiveness of a neighbourhood. Because if more people leave the area, than are moving in, the area is not that popular. This way, Buitenhof has a very negative result. A lot of people are moving out of the area. The same accounts for Tanthof and Voorhof. Hof van Delft is very popular.

In Binnenstad, there are many people moving. This is caused by the students, because they tend to move a lot and do not live for a long period in the same house.

In Delft, more people are settling than leaving. There are also more births than deaths, so the population is rising. This should be taken into account in the design process.

The design location is situated in a moderate popular area. By making an attractive neighbourhood, more people would move to this area.

Fig. 6.14 - Changes in population
Ethnicity

The ethnic part of the population in Delft is higher than the average in the Netherlands, 20-30%. This is not compared to the large cities, where the percentage of ethnic people is higher.

Inside of Delft, the highest percentage of immigrants is in Voorhof. Tanthof has the least immigrants.

The circular diagrams represent the difference between the western and non-western immigrants. There are overall more non-western immigrants in Delft. A large part of the western immigrants are knowledge workers, so they are the minority. Only in Binnenstad, there are more western immigrants. In Buitenhoef and Voorhof, the non-western immigrants are the largest groups.

The design location is at the edge of the neighbourhoods with the lowest and highest amount of non-western immigrants. Attracting international knowledge workers leads to a larger part of western immigrants. Attention should be paid to this big difference between Voorhof and the design location.
Income
The average income of Delft is lower than the average income in the Netherlands. Many students have a low income, so that is a possible reason for the low average. Only Tanthof has a higher average income. Voorhof and Vrijenban have the lowest average income.

Besides, Voorhof has the highest percentage of minimum incomes. Tanthof has the highest percentage of high incomes.

The design location is close to Voorhof, so maybe there should be a possibility to improve the changes for the people of Voorhof along the Schie Canal.

Unemployment
The percentage of unemployment is the highest in Voorhof and Buitenhof. Hof van Delft and Binnenstad have the lowest rate of unemployment.

Most of the unemployed people have had a low education. In Binnenstad, there are the most high educated unemployed people.

The design location is next to the neighbourhood with the highest rate of unemployment. In the plan, there should be jobs for low educated people also.
**Knowledge-based companies**

The circles in the map represent the size and number of the companies. The yellow dots are the small companies, the green the average companies and the blue the large companies.

Most companies are situated in Binnenstad. The share of small companies is the largest. In Wippolder, there are many large shops, because here is space to accommodate large companies.

The knowledge-based companies are all concentrated in Wippolder, around the university. The share of the knowledge-based companies in this area is almost twice as high as in the other neighbourhoods.

The design company is in the middle of the knowledge-based concentration. So the knowledge city project can be realised here.
Social quality and contentment

Every neighbourhood is graded for its social quality. The neighbourhood Wippolder has had the highest mark, while Buitenhof and Voorhof don't score well.

The design location is in the middle of the highest and lowest graded areas. The project should pay attention to the social quality and try to improve the surrounding neighbourhoods by making good links.

In Wippolder, all problems are dealt sufficiently. It has the highest contentment in Delft. Most problems are with dog shit, graffiti and youth annoyance. Voorhof is again the opposite of Wippolder, because all factors are negative.

In the design location, extra attention should be paid to upgrade also other surrounding neighbourhoods.

Green areas and amenities

Every neighbourhood is questioned for its appreciation of the green areas. Binnenstad has the least green areas, because it is a very urban area. In Wippolder, there is a lot of space, but the appreciation of the green areas is not high.

In Tanthof and Buitenhof, the green areas are well appreciated.

The amenities are also reviewed on appreciation of supermarkets, public transport, sport facilities and medical facilities. In Delft, all amenities are appreciated well.

Except for the supermarkets, every function is valued positive. In Wippolder and Vrijenban, there is a lack of supermarkets.

In the design area, there should be a supermarket, to facilitate the people in Wippolder. There should also be more green space in the neighbourhood.
Appreciation
Every neighbourhood has got a mark for its amenities, social quality and living environment. Binnenstad and Tanthof have the highest mark and are most popular to live.
Voorhof has the lowest mark, but it is not negative.

The diagram show the part of the population which is planning to move. This represents the appreciation of the neighbourhood. In Voorhof, this part is very large, while in Tanthof, not many people are planning to move.

The design location is at the edge of the highest and lowest graded neighbourhood. Maybe it is possible to redesign the edges of Voorhof to improve the quality of the neighbourhood.

Fig. 6.21 - Appreciation
Fig. 6.22 - Conclusion study population

- More housing for young people and knowledge workers
- 25-34
- More green spaces
- Add supermarket
- More amenities
- More low educated jobs
- Improve surrounding neighbourhoods
- Higher density
Conclusion
The final conclusions of the study of the population of Delft is shown in the map alongside. The demands are described from top to bottom.

In the surrounding neighbourhoods Binnenstad and Voorhof, many shops are concentrated. It is not necessary to create many shops on the Schie canal banks if there are good connections to the surrounding shopping centres.

There is a lot of space nowadays on the Schie canal banks. However, there is a lack of good quality green spaces. In order to have a better living environment, there should be more green spaces.

Delft wants to have a grow in population, so there should be more housing, especially for young people and knowledge workers. The young people, who are recently graduated at the university, often move to other cities. It is better to connect them to Delft.

In Wippolder, there is now only one small supermarket at the eastern side. There are many in the city centre or in Voorhof, but it is better to have it close to the neighbourhood. The daily shopping should be more close to home than the other shops.

There are not many recreation facilities in the design location. In order to make the design location more attractive, there should be more amenities.

The neighbourhood Voorhof, immediately next to the design location, is in many ways the worst neighbourhood in Delft. The design project should also focus on how to improve the situation of that neighbourhood and its population. One way is to create low educated jobs, because the unemployment is very high in Voorhof.

There are many functions to be add in the location, so there should be a higher density to place it all.
PART III

Design criteria
7. Requirements of the knowledge city

Case of Delft

Chapter 4 describes the general requirements of a knowledge city. These requirements are divided in two groups:

Formal spatial requirements
- Scale
- City structure
- Infrastructure
- Urban appearance

Functional spatial requirements
- Knowledge-based activities
- Quality of life
- Urban diversity
- Meeting points

In this chapter, the general requirements will be projected on the case in Delft. Every requirement has a different scale. Three scales are used in the case of Delft:
- South wing of the Randstad
- Delft
- Schie canal banks
103

7.1 Formal spatial requirements

Scale
Delft is in itself not large enough to be a knowledge city. The supply of knowledge-based jobs is very similar. Most of the jobs are based on technology.
A proper knowledge city should have a wider range of types of jobs. This is why the South wing of the Randstad can function as a knowledge city together.
Delft is the city for technology. It already has the university of technology and many companies connected to technology. One of the main themes is water.
Rotterdam has also a university and it focuses on business and economy. Besides the university, the harbour also attracts a lot of companies.
The Hague is the city with the International Court of Justice. It already attracts many foreign knowledge workers. In The Hague, many embassies are seated, as well as the national government of the Netherlands with many ministries.
Leiden has a very old university. Here, medical studies are very important. There are many related studies, the life sciences.

The cities together offer a wide range of knowledge themes for different knowledge workers. Together, the cities are more attractive.
The cities have to cooperate to create enough jobs, housing and recreational facilities.
City structure
The knowledge city should have a mixed structure in cities. Housing, working and leisure should be combined. This is possible, because of the polluting industries leave the city. People can live closer to working areas.

In Delft, the area around the university is monofunctional. Other functions should be added in this area, like housing, recreational facilities and shopping facilities.

The knowledge-based amenities should also spread out over the entire city. Every neighbourhood should at least have one centre where people can meet and organise courses.
The structure on the Schie canal banks should be a mixed programme. Housing, working and recreation should be combined in this area. The different parts do have a main function out of the three themes. That does not mean that this part will be monofunctional. In this part there are buildings which have a different function.

This way the housing areas will be lively and vibrant. Many people will visit the area for different purposes, so it will be crowded on different times.
**Infrastructure**

The cities in the South wing need to cooperate, so the connections between the cities are essential.

Figure 7.4 shows the times to reach each city from Delft by car or train. The connections are already good, but there are two main interventions needed.

The highway A4 should be continued from Delft to Rotterdam. Nowadays, the A13 is the only fast connection between the cities, but it has also many traffic jams. The A4 can partly solve this problem and has a better connection to the south of Rotterdam.

The travel time to Rotterdam airport is short for cars, but very long by public transport. There should be a better connection to the airport from Delft.

On the scale of the city, the mobility nodes to the higher network are very important. In Delft, the stations and the highway exist are the major nodes. It is important to connect these nodes with each other and the rest of the city. The connection from the main railway station and the highway exist should be improved. This also leads to a better connection from the northern part of the design location to the highway by car.

The connections to the mobility nodes should be improved on the scale of the Schie canal banks. The route to the exit Delft Zuid of the A13 is very long. There is a long detour and this should be improved. There can be a direct connection from the Kruithuisweg to the Rotterdamse weg.

The slow traffic connections to the railway stations are very important. This slow traffic network should also connect other parts of Delft to the Schie canal banks.
Urban appearance

In the knowledge city, old and monumental buildings can create an inspiring environment. These buildings connect the past, present and future.

On the Schie canal banks, there are several building which could function like that. The Porcelain Flies, the former factory for Delft ware, is already transformed into a museum and the old lime factory is now a cultural institute. The other buildings should be transformed, so they will function in the knowledge city.

Fig. 7.7 - Urban appearance, Schie canal banks

Fig. 7.8 - Knowledge based activities, Delft
Knowledge-based activities

The core of the knowledge city are the knowledge-based activities. Nowadays, these activities are only in the south eastern area of Delft. The schools are in the other areas.

The new knowledge-based developments in Technopolis should be moved to the Schie canal banks, because this way, the city can profit more from it. There should still be a cluster of knowledge-based activities, but there should also be some extensions in other neighbourhoods.

In the mixed programme of the Schie canal banks, the knowledge-based activities should be at the major infrastructure nodes. The developments should be highly visible, so the neighbourhood will have a image of knowledge.
Quality of life
In Delft, most of the recreational functions are in the city centre. For example, more than 70% of the restaurants are in the Binnenstad. Besides, the theatres and clubs are in this area.

The connection from the Schie canal banks towards the city centre needs to be good. This way, the new population could profit from the facilities of the centre.

There are not many parks in Delft. The Delftse Hout is the only large green area in the city. On the Schie canal banks, there should be a park, also for the surrounding neighbourhoods. The other parks are not close to the Schie canal banks, so the surrounding population should be able to profit from this park.

The green and urban facilities should be in balance. These facilities should be connected by slow traffic routes, to facilitate the neighbourhood.

Facilities that should be added are restaurants, bars, terraces, a supermarket, a park, playgrounds etc. For large recreational facilities, there should be good connections to the city centre.
Fig. 7.11 - Quality of life, Schie canal banks
Urban diversity

In the Schie canal banks, many different people should feel at home. A mixed group leads to tolerance in the area. This is important, because people should be able to express themselves, without being commented by others.

These different people will be the students, (foreign) knowledge workers, artists etc. These people do not like the same facilities, so there should be a wide range of facilities.

Fig. 7.12 - Urban diversity, Schie canal banks
Meeting points

In a knowledge city, it is important that these different people meet each other. This way, knowledge can be exchanged and people can produce new knowledge.

These meeting points should be at nodes of different routes. Different people will visit the area for different reasons, housing working or leisure. People will use different routes, so the meeting point will be at nodes, in order to connect the people.
8. Case study: Schie canal banks

8.1 Existing situation

Important locations
For the design of the Schie canal banks, some starting points are determined. They are based on valuable buildings, existing structures for water and traffic. These important locations represent the many opportunities for this location. To these points, extra attention should be paid. The choice of the locations is instinctively based on the existing situation and does not come from a knowledge city or sustainability point of view.

In the map alongside, the starting points are divided into four themes:
- Buildings
- Water
- Infrastructure
- Views

Buildings
The buildings that have to be preserved are the old and monumental buildings in the area: warehouse ‘De Liefde’, Porceleyne fles, Nederlandse kabelfabriek, Lijm en Gelatine fabriek and Kruithuis. For some of these buildings, a new function needs to be determined.
Fig. 8.6 - Important locations
Water
The most important water in the design location is of course the Schie canal. This canal is still used for navigation transport. It connects Delft with Rotterdam over water.
There are three ports connected to the Schie canal:
- De Kolk
- De Nieuwe haven (aanleghaven)
- Living area port

Especially the first two ports can be used for recreation purposes. The shores are not really attractive. They can better be used in their relation with the water. That is why the dotted line is placed along the ports.

The third port is in the middle of a housing block. It is not really visible from outside. The surrounding houses profit from it, but it has no meaning for the rest of the location. This should be upgraded, so more people can make use of the port.

Infrastructure
In order to make a fitting design, it is important to adapt to the connections with the neighbourhoods. There are now three main entrances for cars, one from the Zuidwal in the north, one from the Kruithuisweg in the south and the Rotterdamse weg at the east.
The west side is blocked by the railway. The northern part of it will be developed, as mentioned earlier. In the south, the railway station will also be redeveloped. This will have a large influence on the location.

For pedestrians and cyclist, there are many entrances, assigned on the map on the former page. These routes are not very nice to ride for recreational purposes now. There are many possibilities to make better routes for slow traffic.
Views
Some regional routes have there entrances to Delft on the Schie canal banks. It is important that Delft should make a good first impressions.
The first route is the railway from Rotterdam to Delft. Nowadays, the train rides along large depots, factories and large stores. It is not a very attractive view.
The second route is the Schie canal. Nowadays, it is lovely to live or recreate alongside the water. However, there are not many functions using the water along side the Schie canal. The water can be used much more than it is in the current situation.
The last route is the Rotterdamse weg. Some buildings are old and monumental, while others are too modern and large. It is out of balance.
Other important views are from the roads on the north and south side of the location.

The most famous, historical point in the location is where Johannes Vermeer painted ‘Zicht op Delft’. There is in the current situation a monument at the place. However, it is a boring space and more a transport route, than a place to stay. There are many possibilities to improve the situation on this location.
Fig. 8.17 - Public space
Public space
In the knowledge city, public space are very important, because people meet and exchange knowledge in these spaces. The map shows the public space that are now at the Schie canal banks. There are just a few public space, but they are not really attractive. There is a lack of high quality public space, where people could recreate. There should be a good balance between green and urban areas. The pictures show some of the public spaces, which are not functioning well.
The different maps with starting points led to the design criteria. The most important elements from the different maps are combined in the concept.

So the conclusions from the knowledge city requirements, the optimisation, important spaces, public spaces, population and existing plans are put together.

It is very important that the concept will be flexible. The knowledge city is very unpredictable. Besides, it is more on creating possibilities for developments to evolve, than planning every square meter. There should be a good balance between the top down and bottom up projects.

Fig. 8.27 - Former design criteria
Fig. 8.28 - Design criteria
PART IV  Design
9. Redesigned Schie canal banks

9.1 Design concept

The existing situation has many north-south lines through the area. See image 9.1.

The main line is the Schie canal, because it structures the area and the surroundings. The railway is the edge of the design location on the west side. This line is changing, because of the tunnel, that will be built in the coming years. At the east embankment, the Rotterdamseweg is the main north-south connection.

Some of these lines form barriers, like the Schie canal, because there is only one bridge in the area. Other bridges force people to take a detour. The railway is in the new situation, with the tunnel, mainly a barrier in the southern area of the location.

There are a few connections with the surrounding neighbourhoods. Besides of the north and south borders, there is only one east-west connection crossing the area.

The Schie canal banks will be better integrated in the surrounding area (image 9.2). This is important, because the adjacent university campus is momentarily not really accessible for all people. By making better connections through the Schie canal banks, more people can visit the new Mekelpark and use the tramline.

In the Knowledge City will create spin off, like new knowledge-based businesses and also recreation and shopping facilities for the new residents.

In order to integrate the Schie canal banks in the surrounding area, more east-west lines are crucial (image 9.3). This can be new connections, but also view lines, in order to make a visual connection.

These new east-west lines are connected to monumental buildings and historical locations: Zicht op Delft, Porceleyn Flies, Nederlandse Kabelfabriek, Lijm en Gelatine fabriek and Kruithuis (image 9.4). The monumental buildings give the redeveloped area a historical connections. Besides, the monumental buildings are better accessible for more people.

The design for the Schie canal banks has some key projects. These leading amenities
The final design concept is shown in image 9.5. The five east-west lines are all connected to a monumental building or historical place.

These five axes are designed to fit into the Knowledge City concept. They all have a different character, because diversity is important in the Knowledge City in order to attract more different people to the area and have them exchange their knowledge.

The five main themes for designing the Knowledge City are knowledge, recreation, culture, architecture and green. The themes are related to the activities people will do in the Knowledge City. People need to work (knowledge) and live, but also leisure time is important (culture, green and recreation). The functional spatial requirements are summarised into the themes mentioned above.

The formal spatial requirements are represented by the urban appearance (architecture). The other requirements are implemented in another way. The good infrastructural connections secure the cooperation of a larger Knowledge City in the South Wing of the Randstad. The different city structure is implemented in the diversity in working, living and recreational spaces.

These themes are all incorporated in the design. All axes have elements of all themes, but the main character of an axis is connected to one specific theme.

The most northern axis, the ‘Zicht op Delft’-axis has many cultural facilities. From a historical point of view, (Vermeer painted its famous painting there) it is the best location for culture, art and expositions.

The second axis is connected to the ecological network, so the main character is green. Here, people can enjoy a quiet and relaxing walk.

The view line of the Harbour-axis is leading towards the university and the new college buildings. The central axis has the character of knowledge. Here, many knowledge-based developments can settle.

Axis number four is connected to the old Glue and gelatin factory. There is already a new development in the old factory: the ‘Lijm & Cultuur’ area. In the old industrial buildings, there are cultural activities, parties, expositions and festivals. By connecting this east embankment with a bridge towards the west, more residents of Delft can visit this area. This new connection also provides a safer route at night than the existing Kruithuisweg.

The last axis is a visual connection. The beautiful Kruithuis should be exposed more. The new railway station is placed at the axis of symmetry of the monumental building. This way, the axis has a grand and prominent character. It also functions as an entrance towards the entire location.
Fig. 9.5 - Design concept
Phasing

The area is very large. The length is more than 1.5 km. This means that the project will be developed in different phases.

The first phase, see image 9.6, is the southern part and the east embankment. Most important are the knowledge-based developments and education, because they form the core of the Knowledge City. That is why the area directly next to the university should be developed first. It is always better to join existing amenities. The upgrading of the railway station Delft Zuid also has priority. The Schie canal banks are too small to be a Knowledge City on itself. (Sustainable) Connections to other cities and areas are vital. This also puts high priority on the new connection from Emerald to Voorhof, connected to the ‘Lijm en Cultuur’-area. A new bridge is constructed over the Schie canal. The connection towards the city centre is improved.

A stimulating organisation will be settled in the first phase to coordinate the Knowledge City activities. Meeting places are developed to stimulate communication between different people. These developments also offer lower-educated jobs, so the people in surrounding neighbourhoods can profit from it.

Phase 2 focuses on the area in the middle. Main activities will be building suitable housing and expanding of the knowledge base. A conference centre will be built, in order to stimulate meetings and communication with other Knowledge Cities all over the world. A green connection offers a natural recreation facility, which is a good contrast to the urban recreation facilities.

The last phase is connected to the building process of the railway tunnel. A museum is built as an entrance to the location. It is close to the city centre and is easily accessible. At the end, there will be a special ‘Year of Knowledge’, to promote the finished knowledge-based developments at the Schie canal banks.
The overall design focuses mainly on the structure and infrastructure. The area is not completely designed, because there should be enough room for bottom-up developments. By offering a sustainable network and structure, many possibilities lead to a successful area.

The programme in the area is very diverse. Living, working and recreation areas are alternated. In this chapter, housing facilities are not mentioned separately, because they are integrated into all axis on a nonspecific location.

The five axis are described separately in paragraph 9.3, because these elements are designed further.

In this paragraph, the overall design will be described by four themes.
- Monumental buildings
- Water
- Infrastructure
- Green connections

Monumental buildings (9.10)
The existing monumental building in the location are preserved. This gives the area an historical background in between all new developments. This can inspire and stimulate the creativity of the people.

The Porceleyne Fles will keep its function as the museum for ‘Delfts Blauw’, the famous Delft-ware. Museums are important elements in the general education of the population.

The old building of the factory for ropes and lines (Nederlandse Kabelfabriek) is transformed into a conference centre. The old front side of the building is combined with a new building, in order to create enough space for conferences.

The function of the glue and gelatin factory as a recreational facility is preserved. It is important to interconnect the existing facility, so not only the Schie canal banks will profit from it, but the entire city of Delft.

The Kruithuis at the south was enclosed in a green area. By removing this green area at the west side, the building is better integrated in the area. The Kruithuis is a recreational facility with bars, restaurants and terraces.
Fig. 9.11 - Overall design - water

Fig. 9.12 - Overall design - infrastructure
**Water (9.11)**
Concluding from the environmental maximisation method, more surface water is needed, because of the growing need of catching the rainwater and having a large storage capacity for heavy rainfalls. The new waterways are connected to the existing structure in the surrounding neighbourhoods, in order to create a larger water network. Every axis is structured by a waterway. Special attention is paid to the shape of the water, in order to prevent dead ends. The water always has loops or is very wide at the end, so it can constantly flow. The shape of the water also emphasises the character of each axis.

**Infrastructure (9.12)**
The biggest change in infrastructure is the new railway tunnel. This creates a better connection with the other side of the track. The old roads are used for the new roads, because it is more sustainable to use the existing facilities, instead of building new ones. There is no road connects the north and south side in a direct line, in order to prevent speeding cars. The network of bicycle paths is expanded. New routes run trough the green areas and next to the Schie canal. These new and attractive path ways should stimulate people to take the bicycle. The railway stations are better integrated in the slow traffic network. The new bus line trough the area is also connected to the railway station Delft Zuid. This way, the station has a larger accessibility by public transport.

**Green connections (9.13)**
The main green east-west axis fits in the plans for larger ecological network. It runs from the green canal next to the Jaffalaan on the university campus towards the redesigned area of Poptahof. This connection crosses the green line of the railway. Next to the railway, the green area functions as a buffer area. There is a new park on the railway tunnel. This runs trough all new developments at the north side of the area. At the south, green also acts like a buffer around the noisy Kruithuisweg. This green line continues to the west and the east. A network of informal space runs inside the large building blocks between the axes. These semi-private areas offer the residents quiet public spaces where they can meet. These informal space will be designed in collaboration with the residents and companies surrounding it. This way, there is space for bottom-up developments, which give the Knowledge City a unique character. In the design of the axis, they’re represented by open spaces in the surrounding building blocks.
9.3 Design of the Axes

‘Zicht op Delft’-axis

The northern axis is the axis of ‘Zicht op Delft’ (View on Delft). Vermeer painted this famous painting on the embankment on the east side of the axis. Nowadays, there is still a beautiful view on the city centre from this point of view.

The axis has two main cultural facilities: a museum and an art gallery. In the Knowledge City, it is important that people have many possibilities for spending their leisure time. Culture is a very important element of these possibilities. Besides, the museum and art gallery give visitors the possibility to enlarge their knowledge.

The axis is an entrance to the location from the city centre and the central railway station.

Fig. 9.14 - Vermeer - Zicht op Delft

Fig. 9.15 - Design ‘Zicht op Delft’-axis
The city council of Delft wants to build a museum about water and many related themes. Delft has a lot of knowledge on water since many years, so it is the perfect city for an interactive museum on water: Aquaralis.

The museum is a landmark for the Knowledge City at the entrance of the area. The architecture is expressive and unique. On the plan of the axis (image 9.15), the museum is at the west side of the axis.

People can enter the museum via a bridge over the water. People will notice that they enter a different area. The museum is situated as an individual building in its surroundings. It can be seen from all sides: the city centre, the Westlandseweg, the Schie canal banks and the new park on the new railway tunnel. The museum is pushed into the park, so it is highly visible.

At the side of the park, the museum has an accent on the top of the building, similar to the fire station at the other side of the crossing between the road and the park.
Fig. 9.20 - Section A

Fig. 9.21 - Section B
Section A (image 9.20) shows the museum and the water in front of the building. Trees accompany the road, giving it the importance of being an entrance route.

People enter the area over the bridge. The bridge continues in the other direction in a pathway. This path connects the museum with the other cultural facility in the area: the art gallery. The path is made of a recognisable material, like wood. People notice that the two facilities are connected. On one side, the pathway is a bridge over water and on the other side over stones.

The path ends at a circular square in front of the gallery. This is at the location where Vermeer painted its ‘Zicht op Delft’.
The square is an extension of the art gallery. Public art is placed on the square, so people can visit it at any time of the day. Information columns give extra information about the artist. These outdoor expositions can change regularly.

The building of the art gallery is facing the city centre of Delft. This way, more attention is paid to the importance of this historical location, where Vermeer painted the city. The roof is coming out of the ground towards the city centre. The roof is made of grass and is built as a slope. This way, the existing housing blocks don’t have a disturbing change of view.
Fig. 9.25 - Visualisation of gallery and exposition square

Fig. 9.26 - References roof gallery
'Porcelain Fles'-axis

The second axis is the line that crosses the old factory for the famous delft-ware. Nowadays, it is a museum about the ceramics.

The axis fits into the ecological plans of the city council. The ecological connection is continued in the Schie canal banks.

In the Knowledge City, it is important to have a good balance between the urban recreation and natural recreation. In green areas, people can enjoy a quiet moment.

The axis can be visited by business people during breaks, but also by residents who do not have their own backyard.

Fig. 9.27 - Visitors green axis

Fig. 9.28 - Design 'Porcelain Fles'-axis
The axis is led by a cycling path. This is an important route from west to east. The new railway tunnel makes it possible to create an easier connection for cyclists to the west side of the track. The cycling path is now a straight road, instead of running through an unpleasant tunnel.

Besides cycling paths, there are many smaller walking paths. People can choose if they want to walk alongside the water or through the green area. Along the walking paths, there are several facilities, like a playground or terrace.

Fig. 9.29 - References park activities
Fig. 9.30 - Section C

Fig. 9.31 - Section D
The water in this axis has a more natural shape. The sloping banks offer space for storage capacity in cases of heavy rainfall. The trees and shrubs have a great diversity in sort and type.

On the west shore, there is more space than on the east shore. On the last one, valuable existing buildings narrow the green area. Trees and shrubs are used as a buffer to the existing buildings.
Harbour-axis

The knowledge-based developments are essential for the Knowledge City. If businesses and companies are located close to each other, the employees can easily meet each other. Only when people meet, knowledge can be exchanged. This is why in the Harbour-axis, the focus is on the knowledge-based developments.

One of the main facilities is the conference centre. This exists out of the former offices of the ‘Kabelfabriek’ extended with a new building part. Here, exchange of knowledge is the basic activity. Besides, Delft needs a large conference centre.
On the west embankment, an area is enclosed by the water canals. On this kind of island, small buildings offer space for starting up businesses. They can share facilities and so it is easier to set up a new business.

At the end of the island, a restaurant with a view on the water square is situated. On this water square, new water techniques can be presented. Expositions should learn people all new knowledge on water and related themes. It gives knowledge workers the possibility to share their knowledge. They can meet on the square and discuss about it.

A combination can be made with water techniques and art, like the fountain next to Centre Pompidou in Paris.

This square will be the central meeting point for the knowledge workers. It will also be the public space in front of the conference centre.

Fig. 9.37 - References water square
Fig. 9.38 - Section E

Fig. 9.39 - Section F
The knowledge-based companies surrounding the island have a representative entrance and facade. The buildings are similar to the buildings at the other side of the Schie canal, in order to create unity.

At the east embankment, a restaurant is located on the corner of the building block. From the building and its terrace, there is a good view on the Schie canal and the water square at the other side.

The harbour offers a space for boats to anchor. It is a good location for tourists boats, because it is close to large amenities, like the Porcelain Fles and Lijm & Cultuur.
‘Lijm& Cultuur’-axis

Meeting places are indispensable in the Knowledge City. Not only the knowledge workers should meet, but all citizens should have the possibility to meet each other. This axis plays a big role in this concept.

There are many amenities on the axis: shops, supermarkets, bars, restaurants, cinemas, hairdressers, beauty salons etc.

This diverse programme attracts a diversity of people. In the public spaces, they can meet each other. The main hotspot is the Lijm& Cultuur area. This old factory provides space for festivals, concert, expositions and other cultural activities.
Fig. 9.45 - References quays and terraces

Most activities happen on the west embankment. On the south side, there are terraces on a wooden quay. Bars and restaurants are located in small pavilions next to the water. The shops and other recreational facilities are situated in the surrounding buildings.

On the north side, the quay is closer to the water and it offers calm seating places.
On the small island in the water, there is a water playground. Here, children can play all kinds of water games.

A new bridge connects both sides of the Schie canal. This bridge only offers a passage way for cyclists and pedestrians.

On the other side of the canal, the Lijm & Cultuur area attracts many people. Behind it, there is a natural playground for children.
‘Kruithuis’-axis

The last axis of the bunch is the one connected to the old powder storage, the Kruithuis. This complex laid the base for the design of the axis.

Connectivity and infrastructure were important. The Schie canal banks are too small to be a Knowledge City independently. Connections with other cities and parts of the city are essential.

The Kruithuis axis is the entrance area for people coming from the south. The railway station Delft Zuid is therefore a gate to the area.

Fig. 9.53 - Design ‘Kruithuis’-axis
The railway station is replaced on the symmetrical axis of the Kruithuis. By doing this, the axis gets a grand and elegant appearance.

The railway station is the entrance to the location for travellers. On top of the railway station, there are offices. The architecture of the building is prominent and grand. It is a recognisable landmark for visitors of the Knowledge City.

A square is located in front of the station. At the end of the square, a new bus station offers travellers to extend their journey.
When people enter the area from the station, they can oversee the square towards the Kruithuis. The green shrubs in front of the building are removed, in order to open up the Kruithuis. This beautiful monument should be visible for all people.

At the other side of the Schie canal, the new building of the Faculty of Architecture arises. It functions as a landmark and entrance for the Knowledge City and university.
The square is surrounded by water. On the water edges, parking spaces for the bicycles are created. This area is separated from the square by some stairs, trees and shrubbery.

On the square itself, there are many possibilities to sit down and wait for a moment. The street furniture and lighting give the square an attractive character.

In small architectural pavilions, amenities are located, like a newspaper stand or coffee bar.
Fig. 9.62 - Visualisation stations square
In chapter 2, the main goal of the project is described as: a new, socially sustainable strategy for the city of Delft, based on knowledge, but in a way that all citizens of Delft can benefit from it. Delft should be attractive and the physical, social and cultural gap between the city and the knowledge-based developments should be closed.

The research on the Knowledge City presented eight spatial requirements. These requirements are compared to the sustainable city and the conclusion was that the sustainable Knowledge City was in fact possible.

The research is expanded by studies on the, smart cities and learning cities, health and safety, current situation in Delft etc. All conclusions are visualised in a map and all maps combined led to the design criteria.

The design is mainly based on the criteria of the Knowledge City, but the other studies are also taken into account.

The five main themes in the design of the Schie canal banks are knowledge, recreation, culture, green and architecture. These themes together fulfil the requirements for the Knowledge City.

Knowledge workers want to work, live and recreate in the Knowledge City. This is possible in the design for the Schie canal banks. There are many possibilities for exchange of knowledge and education.

There is a good balance between natural and urban areas. A big diversity in types of recreation attracts many different people. Not only knowledge workers will profit from the developments, but also the other citizens of Delft. By creating more amenities, jobs are created for lower educated people.

The new design for the Schie canal banks offers many possibilities for the Knowledge City to be successful. The axes cause a better integration of the location in the city. This way, the city and its citizens can profit from this new design.

The Schie canal banks are no longer a barrier in the area, but it is an attractive location for all citizens, which will help the city of Delft to grow as a Knowledge City.
Jongeren dromen over de toekomst

‘De hele stad moet bloeien’

Jongeren verschillen in hun wensen voor de toekomst niet zo heel veel van volwassenen. Dat bleek in elk geval tijdens het stadvisiedebat op 11 november. Hoog op het verlanglijstje van de jonge Delftaren en daarbij aanwezig waren staat een goede plek om te wonen. Ook willen zij genoeg groen in en rond de stad, passend werk en ruimte om uit te gaan en hun creativiteit kwijt te kunnen.

Silicon Valley

"Iedere student die in Delft afstudeert zou in Delft moeten blijven", bepleitte een deelnemer. “Nu trekken veel mensen naar steden als Amsterdam, omdat daar de beste mogelijkheden zouden zijn om je te ontwikkelen. Ik zou willen dat men dat van Delft gaat vinden. Dat het hier een soort Silicon Valley wordt. Om dat te bereiken is een andere instelling nodig in de stad, meer ondernemerszin. De hele stad moet hiervoor gaan werken.”

Delft: huiskamer in de Randstad

Delft in 2030? Dat is een stad die investeert in onderwijs en internationaal gezicht. De kennis-economie bloeit dan, mede door de uitwisseling met studenten, wetenschappers en ondernemers.

Fig. 10.1 - Articles from local newspapers about the debates on the vision for Delft 2030

Fig. 10.2 - Plan Schie canal banks


Appendix
A. Environmental maximisation method

Inventory maps and plans of the city council

Fig. A.1 - Inventory land use

Fig. A.2 - Delft land use
Fig. A.3 - Inventory soil

Fig. A.4 - Inventory ecology

Fig. A.5 - Delft ecology
Fig. A.6 - Inventory water

Fig. A.7 - Delft water
Fig. A.8 - Inventory infrastructure slow traffic

Fig. A.9 - Delft infrastructure slow traffic
Fig. A.14 - Inventory infrastructure car traffic

Fig. A.15 - Delft infrastructure car traffic
Fig. A.20 - Noise from train and cars

Fig. A.21 - Inventory infrastructure pollution NO2

Fig. A.22 - Inventory infrastructure pollution PM10
Fig. A.23 - Inventory infrastructure water transport

Fig. A.24 - Delft infrastructure water transport
Fig. A.25 - Inventory energy heat supply

Fig. A.26 - Inventory energy sun
**B. Socio-demographic research: Population of Delft**

**Conclusion maps**

**Age and gender**
The average age of the population in Delft is 38. Binnenstad has the lowest average age, because of all the students that live in the city centre. Vrijenban and Voorhof have the oldest population. The design location is in the middle of the youngest and the oldest part of Delft. In the neighbourhood itself, the population has a similar average age as the total population of Delft.

In the Netherlands, there are more men than women, but in Delft, it is the other way around. The university of technology attracts many young men. Almost 80% of the students are male. In every neighbourhood, except Buitenhof, the men are in the majority. The biggest differences are in Binnenstad and in Wippolder. In these areas, most students live.

![Fig. B.1 - Age and gender](image)
Households
The number of households is similar to the number of people. The two main differences are Binnenstad and Tanthof. In the first neighbourhood, there are relatively many households and fewer people, because there are many students who have a single household. In Tanthof, it is the other way around. There are relatively more people and less households. The average number per household will be bigger in this area.

Compared to the Netherlands, Delft has more single households. Again, the students are responsible. There are relatively few people who are married in Delft. The neighbourhood Tanthof is very similar to the Dutch average. In Binnenstad, there is the largest amount of single (student) households.

In the neighbourhood of the design location, there are also many single households and not many children. Knowledge workers do have families, so in order to attract them, there should be suitable housing for them. This can be realised in the design location.

Shops
Obviously, most shops are in the city centre, Binnenstad. There is also a concentration of shops in Voorhof in the shopping centre De Hoven.

The average size of shops is the smallest in Binnenstad, Hof van Delft and Buitenhof. The largest shops are in Wippolder and Vrijenban. In the last neighbourhood, Ikea is the largest shop and influences the average surfaces a lot.

In Wippolder, there is space enough for large shops also.

In the design project, there should not be many small shops, because there are many shops in the neighbourhoods next to the location. There should be good connections to the surrounding neighbourhoods.
Companies

Most companies in Delft are in the commercial services. The second largest group is the non-commercial sector. In Wippolder, there is the largest amount of companies in industry and construction.

The density of employees per inhabitant is the highest in Wippolder. It means that in Wippolder, there are relatively many companies compared to the inhabitants. In Tanthof, the density is the lowest. In this neighbourhood, living is the main function.

In order to balance the companies over the inhabitants, there should be more housing in Wippolder.
Single family housing and stock
The percentages represent the share of the single family houses. In Tanthof, more than 50% of the houses are family houses, because in this neighbourhood there is enough space for living. In Voorhof, the percentage is very low, because here there are many apartment blocks.

In Binnenstad, there are not many single family houses, but the average value of a house is the highest in this area, mainly because the location. The average value is the lowest in Voorhof, because there are many apartments.

The diagrams show the years of origin for the housing stock in each neighbourhood. Most houses in Delft are built after 1945, like many houses in the Netherlands. In Binnenstad, most of the housing stock are built before 1906. Voorhof, Buitenhof and Tanthof are built completely after 1945. In Wippolder, there is an equal share of housing from different times after 1906. There is a balance mix of buildings from different time periods. This can lead into a mixed programme in the design location.

Housing density and ownership
The density of housing is the highest in Voorhof and Binnenstad. In Voorhof, there are many high apartment blocks, which cause this high density. In the old city centre, many houses were built close to each other, because the housing should be inside of the former city walls. In Wippolder, the density is low, because there are many other functions in this neighbourhood.

Delft has a very big share of rent housing. Even in Tanthof, less than half of the housing stock is privately owned.

The design location should offer more housing, to balance the functions in...
Cars

The percentages represent the lack of parking spaces in the neighbourhood. In Binnenstad, there are few parkings spaces, because the housing density is very high. There was not enough space left cars and parking spaces.

In Voorhof and Buitenhof, there are many parking spaces. These neighbourhoods are built later, when the car already influenced daily life.

Tanthof is also built during this period, but the lack of parking spaces is higher. In this neighbourhood, most people have one car and it has the highest share of people with two cars.

The design location is situated in a neighbourhood with a lack of parking spaces, but it is not possible to solve this problem, because people like to park their cars in front of their buildings.
Crime
Every dot represents 1 or 10 acts per 10,000 inhabitants. They are divided in burglaries, theft from cars, demolitions, murders and drug deals. Binnenstad has the highest amount of burglaries, because the high amount of shops and tourists. It has also the highest amount of murders and drug deals. In Voorhof, Vrijenban and Wippolder, there are many thefts from cars. Tanthof has the lowest crime rates. The map also shows the feelings of unsafety of the population. Tanthof has the lowest crime rates, but has an average feeling for unsafety. In Voorhof, most people feel unsafe, especially at night. The design location has a low percentage of unsafety, but it is close to the most unsafe neighbourhood in Delft. It is important to pay extra attention to the safety in this location.

Participation
An important aspect of the knowledge city is the participation in the society. The neighbourhood Vrijenban has the highest rate of participation of Delft. Binnenstad and Wippolder also have a high rate. The west side of the city has lower rates of participation. The participation in Delft is highest in autograph actions, followed by concertations, public protests, contact with local politicians and is lowest at contact with local media.