

Creating Knowledge Locations

Designing efficient and inspiring knowledge clusters
in Delft

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Colophon

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Preface

This Master thesis has been written in the framework of Urbanism. It comprises my graduation project at the Faculty of Architecture at the Delft University of Technology. The graduation is done with guidance of first mentor Leo van den Burg and second mentor Arie Romein.

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Part I

Introduction

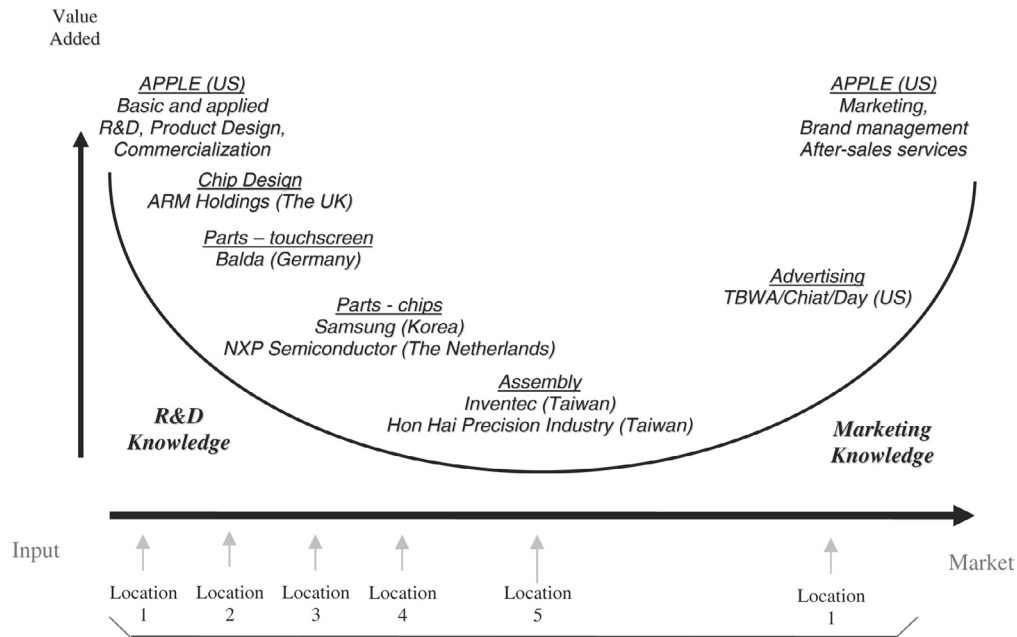


Figure 1. The smile of value creation,
Source: Mudambi, 2008



Figure 2. The world is spiky
Source: Richard Florida, 2008

In this first paragraph the framework for my design project will be explained, together with the relevant literature. The paragraph will give an overview of the economic and societal changes in the western world, new economic and urban concepts.

- **Changing economic context**

At the end of the 20th century the European economy started to change. The post-industrial service economy was gradually replaced by the current knowledge economy (Madanipour, 2011). This knowledge economy refers to the “the greater dependency of economies on knowledge, information and high skill levels, and the increasing need for access to all of these by the business and public sectors” (OECD, 1996).

The shift from the post-industrial to knowledge economy was possible due to new inventions and societal changes. New technologies, especially in the field of telecommunication and information technologies accelerated the process of knowledge creation. In the past it took months to circulate new knowledge but nowadays it only takes seconds to reach millions of people (van Winden, 2012).

The development of the knowledge economy and globalisation is closely related. Globalisation is the process of international integration, arising from the interchange of worldviews, production processes, ideas, and other aspects of culture (Albrow and King, 1990). Global firms have built integrated international

production chains which connect different parts of the world. Figure 1 shows the production process of the iPhone by Apple and its different production locations across the globe. This graph illustrates the shift of Western economies to more knowledge intensive activities. The US and Europe are responsible for R&D, design and marketing of the iPhone, while the countries with low wages, like China and India are responsible for the production of parts and the assembly of it. Technological changes and the growing international division of labour, cause a shift to a relatively higher demand for skilled workers in the knowledge economies, whereas other, less skilled employees become less important (Brinkley, 2006). Nowadays Asia is gradually making this shift from a production economy to a knowledge economy as well. This enlarges the competition for knowledge workers and knowledge locations.

Related to the globalization is the network economy. In current economy it is not possible for one person or company to master all the disciplines, because of the complex developments and the rapid creation of knowledge. Actors have to become specialized and create a strategic network with other specialized actors around them. Networks can respond quicker to the rapid changing markets, and new combinations between actors or nodes can be made (Castells, 2004). The new economy demands a more flexible form of production and an increase of the variety of products (Musterd and Murie, 2010). In consequence, companies become

smaller nodes with a more horizontal organization and they use more project based instead of company based labour (Castells, 2004). Thus, inventions, globalization and the network economy made it possible for the knowledge economy to emerge. A focus on the creation of knowledge is necessary for flourishing economies.

- **Cities and knowledge creation**

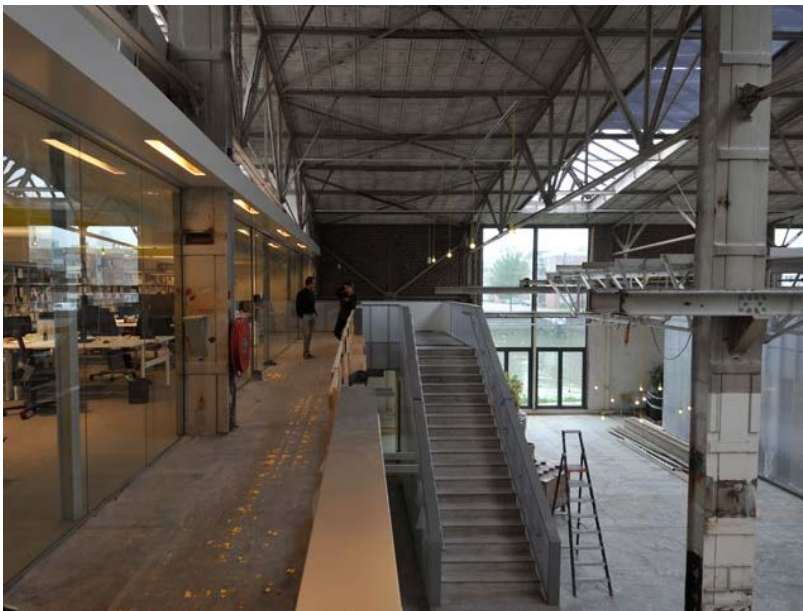
In current society, cities become more and more important. The majority of the people live and work in cities. There are signs that the emerging knowledge economy has reinforced the role of the city. The productivity is higher in cities and have a higher level of human capital and knowledge outcomes. The city is the place where most of the knowledge is produced, processed, exchanged and marketed (van Winden, de Carvalho, van Tuijl, van Haaren, and van den Berg, 2012). Around 1980, researchers predicted that, due to the better connections across the globe and the new transportation and communication technologies, the economy could become footloose. However, the globalisation increased the importance of metropolitan regions, because these are the nodes in the global network (Madanipour, 2011). Locating your companies in the nodes of transportation and information, contributes to the creation of knowledge and competitiveness of the company (Castells, 2004). Saskia Sassen acknowledges this movement and describes cities as ‘major nodes in the interconnected systems of information and money, and wealth’ (1991). As

Richard Florida states; the world is spiky (Figure 2)

The diversity of people, firms and cultures in cities, constitutes a fertile ground for new ideas and innovations (Jacobs, 1961). The diffusion of new knowledge and technology is faster in urban areas, thanks to the density and physical concentration of large numbers of knowledge workers, knowledge-based firms and rich ecologies of face-to-face contacts (Storper & Venables 2004). Big cities have a large and specialized labour market. This makes them attractive for knowledge-based firms which need specialized, skilled staff. In big cities, knowledge workers can find the job they want more easily, and have better career opportunities in the long run. Knowledge workers usually earn a high income and spend more money on luxury goods, and large cities are relatively specialized in this type of goods (van Winden, de Carvalho, van Tuijl, van Haaren, & van den Berg, 2012).

Cities play a major role in the current knowledge economy, because these are places for knowledge transmission, inspiration and innovation (van Winden, et al., 2012). To gain these benefits and to keep up with the knowledge economy, it is necessary to create successful cities with successful knowledge locations.

Work environment



Bohemians

Office buildings



Figure 3. Difference in work environments for nerds and bohemians.

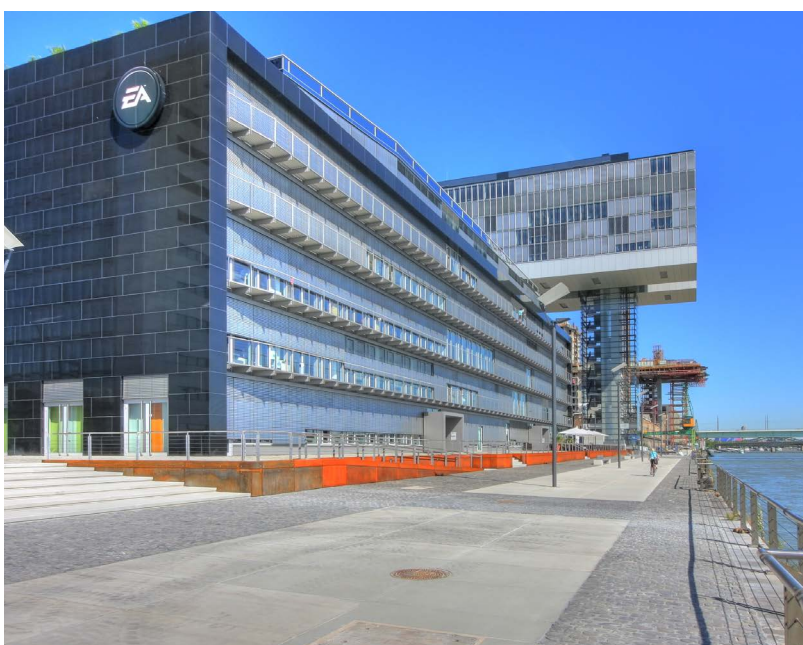
Figure 3.1. Bohemian work environment; Office of IMd, Rotterdam.

Figure 3.2. Bohemian office building; NDSM-werf.

Figure 3.3. Nerd work environment; Room One Shelley Street by Clive Wilkinson Architects

Figure 3.4. Nerd office building; Rheinauhafen Office building in Cologne, Germany

Nerds



The urban knowledge economy thrives on talented people who create new knowledge and ideas. Cities should attract those talented people. They do not simply select a place to work, based on the highest salary, they are typically concerned with a whole series of place-based characteristics (Florida, 2002: 6). Talented people are attracted by places where they can enjoy life (Castells, 1996). There should be attention for both the people aspect and the business aspect of the economy. The requirements for a successful location consists of both hard and soft conditions. Hard conditions are based on the locations theory, and consist of requirements like good infrastructure, the right sort and affordable office space, the right regulations and availability of skilled labour force. The soft conditions concern requirements like sufficient amenities, quality of life, urban atmosphere, housing market situations, level of tolerance, openness and diversity of population (Musterd & Murie, 2010). At the moment, policymakers mostly focus on the hard conditions of knowledge locations, whereas more attention for soft conditions will contribute to a more successful knowledge location.

Besides the lack of focus on the people aspect of knowledge locations, there is a lack of differentiation in knowledge locations as well. This differentiation lacks both in policies and physical appearance. Theoretical recommendations and designs are made for knowledge locations in general, but if you look closely, different kinds of knowledge locations can be found. The main difference can be found in the type of sector; the technological and creative sector. People working in these sectors favour another living and working environment. The people in the technical sector can be called nerds and the people in the creative sector can be called bohemians (Florida, 2002). To make specific knowledge locations more successful, it is necessary to take the differences between the two groups into account and to stimulate the interaction between those groups.

The lack of attention for the soft requirements is a problem for the development of current knowledge locations.

The lack of attention for different working and living preferences between people employed in the technical and creative sector prevent the maximum development of knowledge locations.

This project will give an overview of the spatial requirements that optimize the creation of knowledge and innovation within a knowledge location. This will be applied at the city of Delft, a medium-sized city in South Holland. Delft is a suitable location for this research because it has a university, with both creative and technical studies and comprises technical and creative businesses.

In this project I will explore spatial interventions to optimize the creation of knowledge and innovations within knowledge locations in Delft.

For the optimal creation of knowledge and innovation, there will be a focus on interaction between knowledge workers (nerds and bohemians). The meetings that are needed to stimulate the creation of knowledge and innovation will be explored and the way these meetings should be facilitated is researched. This will result in an overview of the spatial interventions that are needed to stimulate specific kinds of interaction. This will be applied at an interaction environment in Delft.

This project will explore the meetings that are needed to stimulate the creation of knowledge and innovation and the way they need to be facilitated spatially.

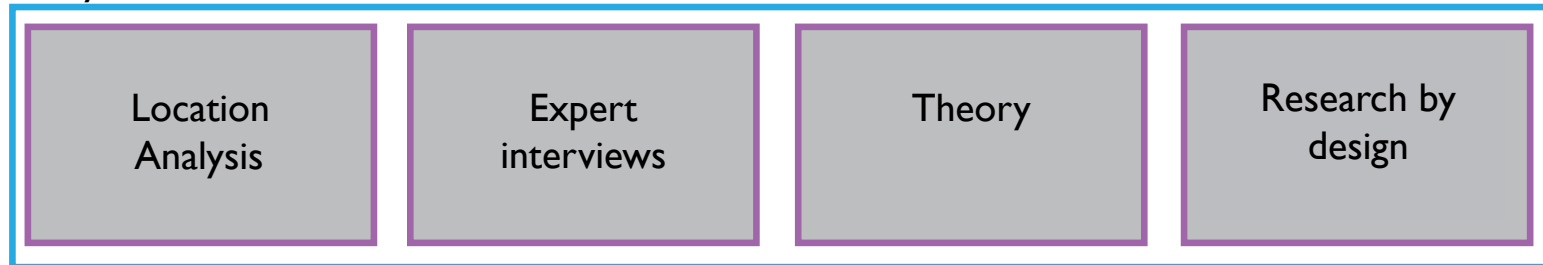
- **Main research question**

What are the optimal spatial requirements that are needed to create successful technical and creative knowledge locations in Delft and what do they look like?

- **Sub research questions**

- What are the optimal spatial requirements needed to create successful technical knowledge locations in Delft and what do they look like?
- What are the optimal spatial requirements needed to create successful creative knowledge locations in Delft and what do they look like?
- What are the interactions that need to be facilitated in the interaction environment in Delft and how should this be done?

Analysis



Design

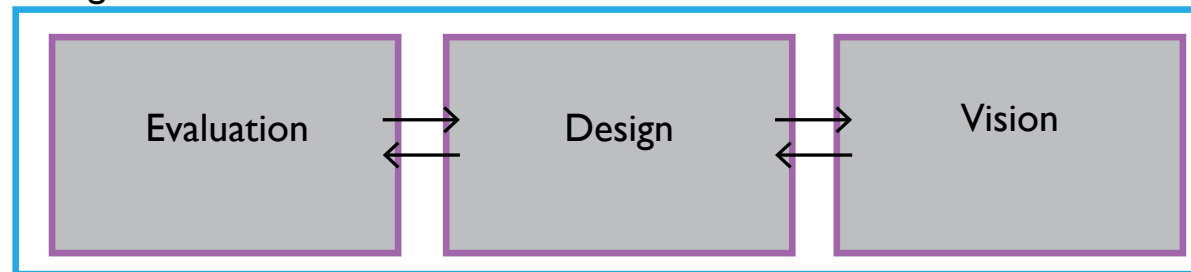


Figure 4. Schematic overview of the methodology

Different methods will be used in different phases to answer the questions stated in the former section. The methods I want to use are the following;

Literature review

With the literature framework it is possible to create a solid base for further analysis. As a result of the literature research a literature review is written.

For the review, different kinds of literature from different disciplines are used. The larger part is based on literature from the field of economic geography. The main literature is Bathelt, Malmberg and Maskell, 2004, Florida, 2002, Marlet, 2009, van Winden, 2012. The end result of the literature review is a review paper. This paper is used as a tool to start the design process. The paper gives an overview of spatial requirements within knowledge locations and requirements for the spaces between knowledge locations, in order to become successful. After the P2 the literature research is continued into more detail and on a lower scale. Literature can be used to answer more generic questions and create a steady framework.

- ## Mapping

To gather more information about Delft, I have made a spatial analysis of these locations. The spatial conditions for successful knowledge locations that are extracted from the literature review, function as the basis for this analysis. The method for the spatial analysis is mapping. The maps are used to analyse, organize and present information. Information for the maps can be found on Google Maps, the website of the municipality and the website of the TU or the Technopolis. By mapping and analysing it is possible to find out which of the conditions are already present and which are lacking.

- ## Interviews

More information about the knowledge locations and its context is obtained by conducting interviews. Since there are many actors that are relevant for the creation of knowledge locations in Delft, semi-structured interviews were held with 'experts'. The experts that I interviewed are; two policymakers of the knowledge locations, one of the Technopolis and one of the TU Delft, the innovation coordinator of the Medical Delta, an organisation that stimulates cooperation between medical businesses to stimulate innovation, and an urban designer who is specialized in economic interaction environments. These interviews gave a practical view on the problems that are relevant in this area and gave me more insight in the current way of practice.

- ## Research by design

Research by design is a research tool in which design is a substantial part of the research process. The design practice can contribute to academic research by investigating the spectrum of options within two extreme poles (Rocco, 2009). 'In research by design, the design process forms a pathway through which new insights, knowledge, practices and products come into being' (Hauberg, 2011, p. 51). In this project, research by design is used to find different solutions for specific design problems. This method is used for developing the vision and the design. For this reason it is used more frequently in the final phase of the project. Research by design helps finding unique and location specific solutions.

SER-voorzitter: te weinig geld voor innovatie

© 21-11-2010, 13:17 AANGEPAST OP 21-11-2010, 13:26 ECONOMIE

SER-voorzitter Rinnooy Kan waarschuwt dat Nederland te weinig geld steekt in de kenniseconomie.

Het kabinet en het bedrijfsleven investeren niet genoeg in het innovatiebeleid en in fundamenteel onderzoek, zei Rinnooy Kan in het tv-programma Buitenhof.

De ambitie om van Nederland een duurzame, toonaangevende kenniseconomie te maken, dreigt volgens hem niet te worden gehaald.



Gepubliceerd: 09 juli 2014 05:59

Laatste update: 09 juli 2014 07:36



Nederland moet zijn kenniseconomie versterken om het opgelopen terreinverlies op exportgebied te compenseren.

Figure 5. Societal relevance to strengthen the knowledge economy, illustrated by newspapers

The project is relevant in different manners.

- **Societal relevance**

This project is of societal relevance because it may stimulate the economy by attempting to make knowledge locations more successful and stimulate the economy by combining knowledge locations, which will give an agglomeration economy. Agglomeration economies are able to compete with other (international) knowledge locations. Thus, this project will stimulate the regional and local economy Delft and its region.

In this project the creation of knowledge and innovations is stimulated. This new knowledge will be beneficial for the society as a whole, because of the creation of innovations. Innovations can solve societal and environmental problems and stimulate economic growth.

- **Scientific relevance**

Usually economic geographers write recommendations to make knowledge locations economically successful, but these recommendations are often not very spatial and difficult to apply. This project will be of scientific relevance because it will try to contribute to the creation of spatial and applicable recommendations to make knowledge locations economically successful.

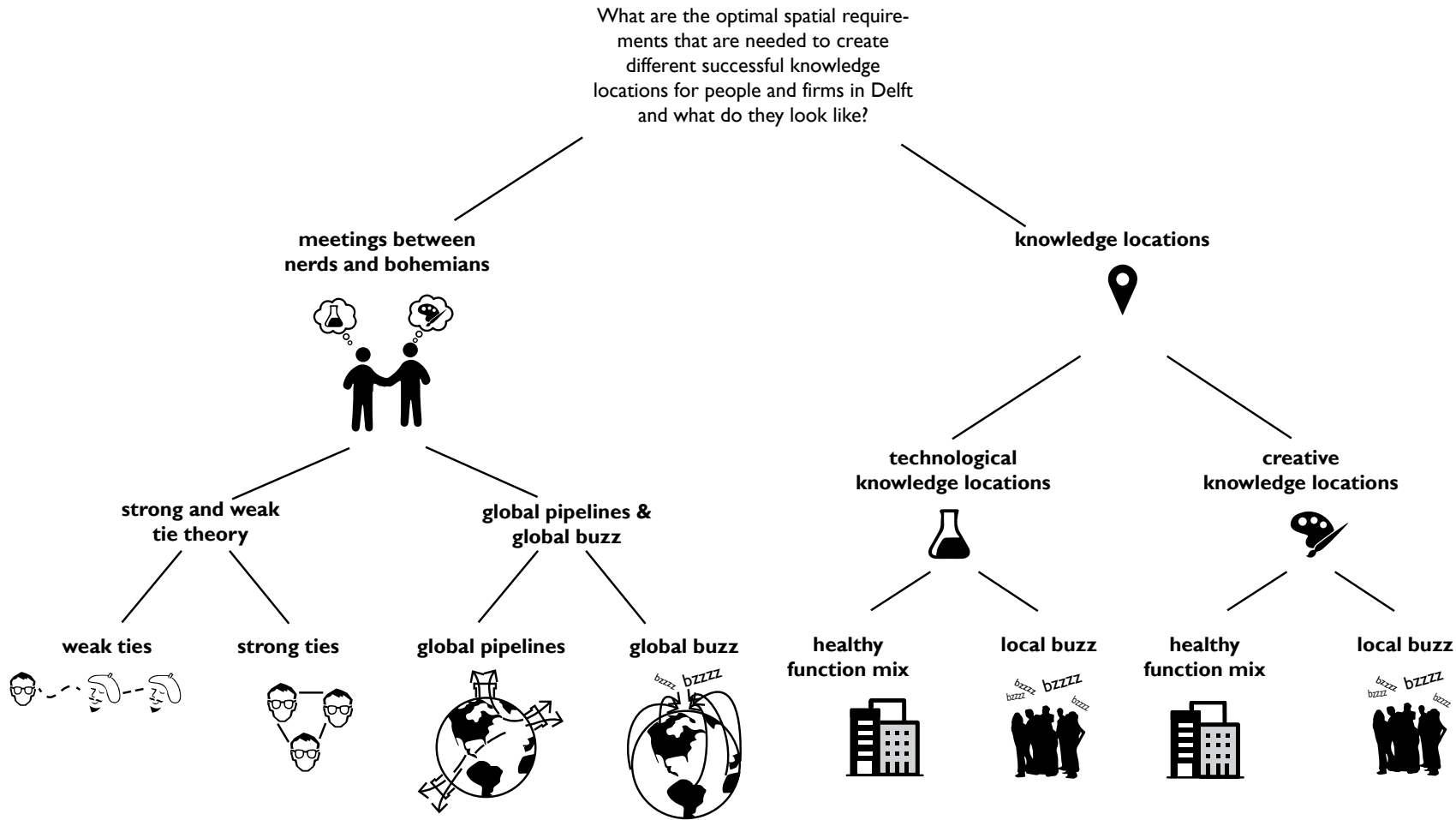
Another new aspect on which will be focussed is the difference in designing for nerds and bohemians. The two types of people have different preferences and needs which will be made explicit in this project.



Part 2

Theoretical framework

Figure 6. Schematic overview of the structure of the theoretical framework.





The theoretical framework is divided into two parts. The first part gives a summary of the spatial theory of knowledge locations. This section describes the business aspects of knowledge locations. The second part is about the meetings that are needed within knowledge locations and the way they should be facilitated. But first the terms cluster, knowledge location and successful knowledge location will be explained.

- **What is a knowledge location?**

There are many different definitions of knowledge locations in literature. These definitions usually describe a specific knowledge location, instead of giving a definition for knowledge locations in general. For example, the 'technopoles' are described by Castells and Hall (1994) as 'various deliberate attempts to plan and promote within one concentrated area, technologically innovative, industrial-related production' (Castells and Hall, 1994: 8). Another example is 'science park' which Queré (2007) defines as an area where knowledge creators and knowledge-based companies are located, as well as supportive services.

Luis Carvalho (2013) gives a definition of knowledge locations in general, which is the following: 'Knowledge locations are planned area-based initiatives aimed at agglomerating knowledge-intensive activities in a designated area or city district. The concept of knowledge location encompasses a number of manifestations such as science parks and quarters, technology hubs, knowledge campuses or creative factories and districts, with a deliberate element of planning and policy aimed at promoting that agglomeration.' (Carvalho, 2013: 19) This definition shows that except from the science and technology based areas, like the science parks, technology hubs and knowledge campuses, knowledge locations comprise creativity based areas as well. These locations can be called creative factories and districts. In practice there are different mixes of creative-based knowledge locations and science-

and technology-based knowledge locations. This review focuses on the high-tech and creative knowledge locations to clarify the main differences between those locations that have their own spatial needs and requirements to become successful. The theoretical framework is divided in different parts which are shown in Figure 6.

- **Spatial requirements in a knowledge location**

Requirements for knowledge locations in the high-tech sector differ from the requirements of successful knowledge locations in the creative sector. Different opinions on knowledge locations are reviewed. By successful knowledge locations, locations that stimulate and facilitate the creation of knowledge and innovation are meant.



Requirements for successful high-tech knowledge locations

High-tech knowledge locations exist in different forms and have different names. Examples of these names are technopoles, science parks, technopolis, science hubs and technology districts. The most widely used and well-known term is science park. Science parks are usually situated at the fringe of the city and built around a university or scientific institute. Most of the science parks are lacking functions as housing or recreation, which make them not very inspiring or vibrant places. Science parks consist of a mixture of businesses, start-ups and research institutes which are managed by public or semi-public companies, with most shares in the hands of the (local) government or the state (van Winde et al., 2012).

This paragraph is divided into two subsections; Local buzz and healthy function mix.

Local buzz

For the creation of new knowledge and innovation, local buzz is needed. Local buzz is 'the learning process that takes place among actors embedded in a community by just being there' (Bathelt, Malmberg and Maskell, 2004: 31). Local buzz was first identified by Marshall (1920); he described industrial atmosphere. This was something 'in the air' which stimulated the economy and was only present in a certain area. Local buzz is something that has to arise by itself and cannot be moved or copied. It is however possible to facilitate local buzz with certain spatial interventions like clustering, the creation of an open urban structure with third places and shared facilities.

One of the major conditions for the existence of local buzz is the clustering of firms. It is hard to create a community or atmosphere if people cannot meet each other easily. A cluster is defined as a 'geographically proximate group of inter-connected companies and associated institutions in a particular field, linked by commonalities and complementarities' (Porter, 2000: 16). This definition is applicable to multiple scales, but due to this not a very practical definition. In this project a cluster will be related to local buzz, which has a spontaneous and fluid character. Therefore clusters have a maximum size of five minutes walking distance. In this project the definition of a cluster is a group of related knowledge intensive businesses with a minimal density of three businesses per square kilometre. A knowledge location can consist of multiple clusters and clusters can either be creative or technical.

The co-location of certain firms creates agglomeration economies, with related benefits. One of the benefits of agglomeration economies is creation of knowledge spill-overs. The other benefits will be discussed in the next subsection; 'healthy function mix'. A knowledge spill-over is defined as the process of creating new ideas through interaction. Marshall describes: 'If one man starts a new idea it is taken up by others and combined with suggestions of their own; and thus it becomes the source of

further new ideas (Marshall, 1920: 225). Co-presence generates opportunities for meetings and communication' (Bathelt et al., 2004: 38). These meetings can be stimulated by spatial interventions like the creation of an open structure with third places and common facilities. These spatial interventions will be explained in the next paragraph.

An open urban structure increases the chance of random collisions with different people. An open urban structure, according to Jacobs, means the presence of wide sidewalks and a wide variety of building typologies and functions (apartments, bars, shops and small factories). These conditions make sure that there are always different kinds of people outside, on different schedules. The street is the place where many different people come together and it is a source for random encounters. By widening the sidewalk it will become a more comfortable place for these encounters (Jacobs, 1961). Although these observations of Jacobs have not taken place in science parks in particular, they are applicable to science parks as well. These above mentioned conditions are currently lacking in science parks and should be facilitated by reconsidering present day science parks.

Within an open structure, places for encounters can be situated. Examples of encounter spaces are third places. A third place is described as 'a place of refuge other than the home or workplace where people can regularly visit and commune with friends, neighbours, co-workers, and even strangers' (Oldenburg, 1989). These are places like pubs, terraces, cultural events, and other places to meet. These places fulfill a major role in the creation of face-to-face contacts. The location can become a hotspot for information exchange ('gossip and buzz'), making it the 'place to be' to pick up new information and trends. In science parks third places like canteens, restaurants or sports facilities can be found. The face-to-face contacts between knowledge workers make the cross-fertilization of ideas and tacit knowledge possible (Storper and Venables, 2004).

Other places for encounters can be shared facilities and services. This does not only increase the chance of encounters with talented people, but it is usually a cheaper option than every firm having their own facilities and services. The facilities can be different in every cluster, depending on the focus of the cluster.

Healthy function mix

For the creation of new knowledge and innovation, knowledge spill-overs are of major importance. Knowledge spill-overs are defined as 'working on similar things and hence benefiting much from each other's research' Griliches (1992, p. 29). There are two theories about how these knowledge spill-overs should be stimulated.

Marshall (1920) argues that the concentration of a specific industry in a region promotes knowledge spill-overs between firms and facilitates innovation in that particular industry within that region. Proximity of related firms favours the intra-industry transmission of knowledge, reduces transport costs of inputs and outputs, and allows firms to benefit from a more efficient labour market (labour market pooling). These intra-industry spill-overs are known as localization (specialization) externalities. (Beaudry and Schiffauerova, 2009)

Jacobs (1969), on the contrary, argues that the most important source of knowledge spillovers is diversity, because "the greater the sheer number of and variety of division of labour, the greater the economy's inherent capacity for adding still more kinds of goods and services" (Jacobs, 1969: 59). Her theory emphasizes that the variety of industries within a geographic region promotes knowledge externalities and ultimately innovative activity and economic growth. A more diverse industrial urban fabric in close proximity, fosters opportunities to imitate, share and recombine ideas across industries. A science base facilitates the exchange and cross-fertilization of existing and new ideas across different but complementary industries (Beaudry and Schiffauerova, 2009).

When all firms are similar, no new combinations can be made, so no new knowledge can be created. The broader and more diverse the knowledge bases, the larger the scope for innovation (Yigitcanlar, Metaxiotis and Carrillo, 2012). Thus Jacobs argues that a diversified local production structure gives rise to urbanization (diversification) externalities.

These two theories appear to be two opposites, but the concept of related variety shows how these theories can be combined. Related variety is defined as sectors that are related in terms of shared or complementary knowledge bases and competences. In other words, there is some degree of cognitive proximity required to ensure that effective communication and interactive learning takes place. Too much cognitive proximity however, can be ineffective because it can cause cognitive lock-in (Nooteboom, 2000). In the concept of related variety, the businesses are both related and diverse. Urbanists can use the concept of related variety to create the most adequate combinations of businesses.

When creating combinations of businesses, path dependency should be taken into account. Path dependency explains how the 'set of decisions for any given circumstance is limited by the decisions one has made in the past, even though past circumstances may no longer be relevant' (Leng, 2009: 285). This means that when a city has history in a certain sector it cannot switch easily to another sector. Every city has its own history and specialism.

In conclusion it can be said that both specialisation and diversification can be helpful to stimulate knowledge spill-overs. A combination of related activities is the most prosperous combination for creativity and innovation. In spatial perspective this means that a good knowledge location has a clear focus to keep the activities related, but can ideally be accompanied by complimentary specialisations.

To create successful knowledge locations, places to live for the knowledge workers are needed. These areas can be part of the knowledge location or can be facilitated in the region of the knowledge location. When housing is part of the knowledge location it will become a more lively area and a healthy function mix is created.

The urban knowledge economy thrives on talented people who create new knowledge and ideas. Talented people do not simply select a place to work, based on the highest salary, they are typically concerned with a whole series of place-based characteristics (Florida, 2002: 6). Talented people are attracted by places where they can enjoy life (Castells, 1996). People who work in the science and technology sector favour another living environment than people who work in the creative sectors.

People who work in the science and technology sector are often called 'nerds' (Florida, 2002; Kotkin, 2001; Marlet, 2009). In this case, nerds are defined as higher educated people working in technology or ICT jobs (Marlet, 2009). Areas where a lot of nerds live, are called 'nerdistans' (Kotkin, 2001). These places used to be mono-functional living places, but are gradually turning into more mixed-functions places with urban amenities and services.

To create a 'nerdistan', a variety of spatial requirements is essential. According to Kotkin, nerds like safety and comfort in and around the house (Kotkin, 2001). Marlet states that most nerds prefer a large house with a garden in a green and safe environment (Marlet, 2009). The fact that nerds like to live in safe neighbourhoods, leads to the fact that they usually live in suburbs or medium sized cities. These suburbs are not only safe places to live, they are comfortable as well. The houses are bigger, they are better accessible by car and there is a lower square meter price than in inner cities.

Nerds appreciate a green environment. Ullman (1954) and Gabriel et al. (2003) mentioned the importance of natural amenities like forests, seas, rivers, city parks and other nature, for the

attractiveness of a city and surrounding region; 'Half of the pay for a view of the bay' (Mills and Hamilton, 1994). However, a condition for the appreciation of these natural amenities is the accessibility, so this should not be forgotten.



Requirements for successful creative knowledge locations

The creative knowledge locations have only recently been accepted as being places where new knowledge is created. Creative knowledge locations are related to sectors like fashion, design, audio-visual and multimedia, and those knowledge locations are usually called creative districts or creative factories. Unlike science parks, creative knowledge locations are often situated in the urban centres or regenerated industrial areas near the city centre. Most of the time, these creative knowledge locations are multi-functional instead of the mono-functional science parks and because of that multi-functionality they have a more urban and lively atmosphere (Carvalho, 2013).

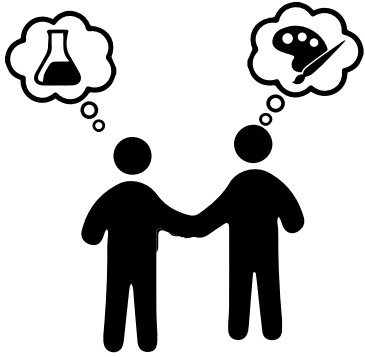
Local buzz

Creative business locations, in contrast with the science parks, have less troubles with creating local buzz. This is because of their multi-functionality. As Jacobs (1961) states, it is very important to have a wide variety of building typologies and functions. Creative knowledge locations usually have a mixture of housing, leisure and work. Beside this function mixture, creative clusters have a wide variety of third places as well. This comprises places like bars, restaurants and coffee shops, but also hairdressers, dry cleaners etc. These different functions make sure that there are always different kinds of people outside, on different times. Thus, in creative clusters there is a lot of opportunity to meet each other and this means that there are lots of opportunities for local buzz to arise.

Healthy function mix

The creative district basically needs specialization and differentiation just like the science parks. Locations with very diverse groups of artists, have been created throughout the years. These locations are very diverse knowledge locations. There are examples of creative knowledge locations with a specific focus, like the Dublin digital hub or the design and art cluster in Helsinki.

The preferences of people working in the creative sector, are different from the preferences of people working in the science and technology sector. People who work in the creative sectors are often called bohemians (Florida, 2002; Marlet, 2009). The people that are part of the bohemians are for example artists, designers, architects and actors (Marlet, 2009). Bohemians appreciate living in vibrant cities with historical city centres and large shares of higher education institutes (Marlet and van Woerkens, 2004). Historical city centres contribute to the aesthetic quality of a city, which is important for a city's attractiveness. This creates a certain pride and identity for residents (Marlet, 2009). The preference of living in historical city centres cause a high square meter price for relatively small houses. The benefits of living in these historical inner cities are the wide range and accessibility of urban amenities and the urban atmosphere. Urban amenities can be subdivided into different categories like natural amenities, sports amenities and cultural amenities, but cultural amenities appear to be one of the most valuable amenities for attracting bohemians (Marlet, 2009).

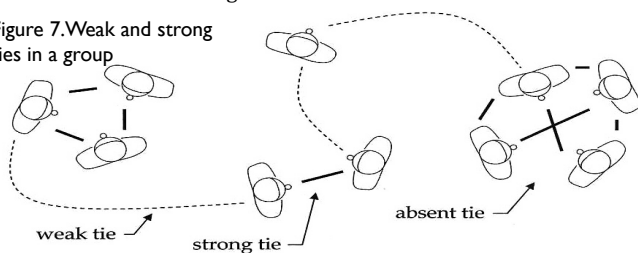


- **Spatial requirements to foster meetings between nerd and bohemian clusters**

Knowledge spill-overs are very important. To create these knowledge spill-overs however, social interaction is needed, because you can work on similar things without being aware of this. This way there will be less benefits from the co-location and less knowledge and innovations will arise. To create knowledge spill-overs, different kinds of interaction is needed. The strong tie/weak tie theory of Granovetter (1973) will be introduced and a further elaboration of the the local buzz/global pipeline/ global buzz theory by Bathelt et al. (2004) will be explained.

Granovetter states that two kinds of interactions should be facilitated. The interaction with similar people, nerds with nerds and bohemians with bohemians, and the interaction with different people, bohemians with nerds. The necessity of those two types of interaction can be explained by the interpersonal ties theory of Granovetter. This theory describes two types of personal interactions, the interaction within a community (strong ties) and the interaction between different communities (weak ties) (Granovetter, 1973). When knowledge is within a community, it is usually approached in the same way. When knowledge is transferred to another community, people can see it from a different perspective (Figure 7), as Marshall already noted. So, interaction between different communities is necessary. The next paragraph explains how weak ties and strong ties can be facilitated.

Figure 7. Weak and strong ties in a group



Strong ties

Designing locations for strong ties is related to designing for communities. To create a community, social cohesion is very important. Kearns and Forrest (2000) distinguish five different dimensions of social cohesion; social networks, common values, place attachment, social order and social solidarity. The first three of these dimensions can be addressed spatially and will be discussed below.

The first dimension is 'social networks'. Social networks refer to the ties between people in the city or neighbourhood and they are likely to emerge when there is a high degree of social interaction within communities and families. When a neighbourhood community is strong, strong ties are created. Urban designers can facilitate this by creating comfortable public spaces and other kinds of interaction environments. The second dimension is 'common values and a civic culture'. This dimension is based on common moral principles and codes of behaviour. Moral principles and behaviour codes tend to converge when people interact more. Frequent interaction can create a group in which people can become ingroup. Stimuli tend to be rated more positive when you are repeatedly exposed to them (Myers, Abell, Kolstad and Sani, 2010). So, this can be stimulated and facilitated by creating interaction environments, the same as in dimension one. The third dimension is 'place attachment and identity'. Place attachment is an intertwining of personal and place identity. People often feel that they belong to a particular place. People are territorial in their behaviour. This territorial functioning is relevant to group cohesiveness and solidarity (Taylor, 1988). The identity of a place can be created with physical features. This is because communities can give symbolic meanings to certain urban characteristics or activities. Urban design can help a place to get an identity, by creating particular street furnishings, designs or naming (Beumer, 2010).

Weak ties

Facilitating a weak tie is more complex, because weak ties are about relationships with acquaintances or new people. Creating new relations between people is a very complex social process which cannot be created, but can only be facilitated. The public space is a place where all different kinds of people meet each other every day, but usually it will not come to interaction. Literature divides three types of interaction that can occur in relation to urban space; active engagement, passive engagement and no engagement (Carmona, 2010).

Passive engagement is about people-watching. Carr describes it as 'the need for an encounter with the setting, albeit without becoming actively involved' (1992: 103). Active engagement is a more direct engagement with a place and the people in it. The people who have no engagement with the public space are the people that are on the move and in a hurry.

These three kinds of engagement can be combined with the field and frame theory of Childs (2004). He states that civic rooms have two milieus: Field and frame, which have different physical requirements and defining characteristics: the Field and Frame. (Childs, 2004) 'Central field' is the portion of the floor that is compositionally centred in a room. It is the place which should be open and easily set and reset with props (p124). 'Frame' is the portion of the floor that surrounds the central field. It is the first place people sit, meet or hang out. A frame can have small fields within it and multiple layers. Within the frame there may be subspace or alcoves that provide a degree of enclosure, but open to the larger place (p26).

When the frame/field theory is combined with the active/passive/no engagement theory of Carmona et al. (2012), similarities can be found. The frame of a public space is perfectly suitable for passive interaction. The field on the other hand is suitable for the facilitation of active engagement and triangulation. The only thing

lacking is that the field/frame theory has no spaces for the people who don't want to have engagement with the public space. This is why flow is added to the theory; the frame/field/flow theory. The flow space is suitable for the movement of people.

The theory can be explained with the example of a street artist (Figure 8). The artist stands in the field, the place where he performs. Around the artists people will gather who listen to the artist, the frame. However, there are also people who do not want to listen or are in a hurry. These people walk in the flow. The artist has an active engagement with the public space, the people who listen have a passive engagement with the environment and the people who walk by have no engagement with the public space.



Figure 8. The street artist

The encounter area should facilitate spaces for passive engagement, active engagement and no engagement. This means a comfortable public space which facilitates fields, frames and flows.

Fields, frames and flow have urban designs for fulfilling their function. A field is a flat empty space, which can have different functions and can differ in height from the flow or the frame. The flow is a space in which people are allowed to move easily. This means that it should not have obstacles and too much distraction. In the frame something to look at and a comfortable place to sit should be facilitated. People can look at fountains, public art or other people. Next to this, people need places to sit like terraces, stairs or benches (Carmona, 2010).

The facilitation of fields, frames and flows is not enough to encourage interaction between different people. Even the most sociable people will not randomly speak to a stranger in public space. Events, however, can stimulate interaction between strangers. So public spaces should create opportunities for different interactive events. Another way to encourage interaction between strangers is 'triangulation'. Triangulation is 'the process by which some external stimulus provides a linkage between people and prompts strangers to talk to other strangers as if they knew each other (Whyte, 1980:94).

Triangulation can be facilitated by placing something interesting or strange in the public space (Project for Public Spaces, 2000). People can use the object to interact with, stand around or talk about it (Figure 9). This way the attention is focused on a third thing instead of each other. This makes interpersonal engagement more comfortable. Both passive and active engagement can stimulate the creation of local buzz in an area.



Figure 9. The role of triangulation

Global pipelines

Besides the previously described local buzz, a network with people and firms outside the cluster should be created. These connections are called global pipelines. Global pipelines are defined by Bathelt, Malmberg and Maskell as 'channels of communication with providers outside the local milieu' (2004: 31). Global pipelines can be facilitated online and offline. Offline global pipeline meetings are planned meetings with people outside the knowledge location. These interactions can be facilitated by creating a comfortable and representative meeting place. The online global pipeline meetings are virtual meetings of the knowledge locations with the world. This can be a global pipeline to another knowledge location or a global pipeline to the public. The global pipeline to another knowledge location can be made by a conference call or a skype meeting, but also with big screens in the public domain which are virtual connected. For the facilitation of this, comfortable and well-equipped meeting rooms should be facilitated or big fields and screens where a large group of people can interact with the rest of the world.

Another type of a global pipeline is the connection of the knowledge location with the public. This is mostly done by reporters. Newsreporters go to the knowledge location to report the news and establish the image of the knowledge location in this way. An urban designer can facilitate this by creating a typical background, urban space, that is representative for the knowledge location.

Global buzz

Next to local buzz and global pipelines, global buzz is needed. 'Global buzz' are the rich information flows that are established at events like trade fairs and conventions. These events function as temporary clusters (Maskell et al., 2004). Events facilitate the face-to-face contacts with people outside the local cluster and create a place to network. 'Face-to-face interaction is widely held to be a necessary condition for establishing trustful relations and communicating

sensitive, not well-established knowledge and information' (Bathelt, Malmberg and Maskell, 2004: 4). Good virtual and long distance connections can only be established as a result of previous face-to-face contacts. In the knowledge economy, temporary activities are growing in importance, with new, mobile ways of working and an increased domination of project work with changing partners. Events create opportunities to meet future partners or establish new projects. Events for the science and technology sector are conferences, conventions and meetings. Events like conventions and conferences can, due to their multidimensional structure, function as a temporary hub that stimulates the process of knowledge creation.

To become a successful knowledge hotspot, events should be facilitated. This can be done in the knowledge location itself or outside the knowledge location, depending on the size of the event. These events can be facilitated with spatial conditions. First, there should be an event space to host conventions or conferences. These places can differ in size and form, depending on the audience. Events can be organized in special event buildings like conference halls and trade fairs or more mix-used places like hotels. Second, the location should be well accessible by car, by public transport and close to an airport in the case of international events.

Besides the location of the event itself, a city should have enough accommodations. Scientists and businessmen usually stay in hotels, so cities or city regions should offer a wide and diverse range of hotel rooms (de Hoog, 2013).

Creative knowledge locations need global buzz just like the science parks do, with the accompanied spatial conditions like event space, accessibility and accommodation. The events itself differ. Creative sectors organise events like trade fairs and biennales to show the contemporary state of the art. 'At these events you can identify the current market frontier, take stock of relative competitive positions and form future plans' (Bathelt, Malmberg and Maskell, 2004: 1). In this sense events can function as an idea generator and can produce new knowledge.

- **Summary and conclusion**

The theoretical framework gives an overview of the relevant spatial theory on knowledge locations. The question: 'What are the optimal spatial requirements that are needed to create successful technical and creative knowledge locations?' is answered. The requirements that are found in literature will be put to the test in my design for Delft.

- Summary**

- To become a successful knowledge location, the creation of knowledge and innovation needs to be stimulated. Local buzz is of major importance in this. It is possible to facilitate local buzz with spatial interventions. Clustering and co-locating firms increase the chance for meetings and for communities to arise. Other spatial requirements are; the presence of an open urban structure, third places and shared facilities. The spatial translation in each knowledge location will be different.

- A mix of firms with different functions or specialisations contributes to a faster and more innovative production of knowledge and it enlarges the chance for new combinations of knowledge. When knowledge locations are too differentiated, it becomes hard to communicate. Knowledge locations need a variety of related activities to enlarge the chances for innovations. In spatial perspective this means that a knowledge location should have a clear target group to keep the activities related. In the case of high-tech knowledge locations you can think of biotech or space clusters. In the case of creative knowledge locations you can think of media or fashion clusters.

- To create these new combinations, interaction should be promoted. Possibilities are strong tie interactions, weak tie interactions, and global pipeline interactions, local buzz interactions and global buzz interactions. Strong tie interactions are interactions within communities, for instance nerd or bohemian communities.

Weak tie interactions are interactions between communities. For creating strong ties, social cohesion is very important. In literature three dimensions of social cohesion that can be spatially addressed are found; social networks, common values and place attachment. Urban designers can facilitate these dimensions by creating comfortable public spaces and different interaction environments. Urban identities can be stimulated by creating particular street furnishings, designs or namings.

Facilitating a weak tie is more complex because this is about creating new relations between people. This process cannot be created, but can only be facilitated. Literature divides three types of meetings that can occur in relation to urban space; passive engagement, no engagement and active engagement. This can be combined with the field and frame theory in which active engagement is related to the field, passive engagement is related to the frame and for the facilitation of no interaction the flow is created. These three parts of the public space can be facilitated in public space; The field is a flat empty space, which can have different functions and can have a different height than the flow or frame. The flow is a space in which people are allowed to move easily. This means that it should not have obstacles and too much distraction. In the frame something to look at and a comfortable place to sit should be facilitated. People can look at fountains, public art or other people. Next to this, people need places to sit like terraces, stairs or benches (Carmona, 2010).

The field/frame/flow theory states that it creates a comfortable public space, but for the stimulation of new meetings, triangulation is needed. Triangulation can be facilitated by placing something interesting or strange in the public space. People can use the object to interact with, stand around it or talk about it.

Next to the previously described local buzz, a successful knowledge location needs global pipeline meetings and global buzz meetings as well. Global pipelines are channels of communication

with people and firms outside the cluster. These global pipeline meetings can be offline or online and can be connections with other knowledge locations or connections with the public. For the offline global pipeline meetings comfortable and representative meeting rooms should be facilitated. For the online global pipeline meetings with other knowledge locations, comfortable and well-equipped meeting rooms should be facilitated or big fields and screens where a large group of people can interact with the rest of the world.

For the online global pipeline meetings with the public (the newsreporter), a typical background, that is representative for the knowledge location should be created. From here the newsreporter can stand and report.

The last type of meeting is the global buzz meeting, Global buzz consists of rich information flows that are established at events like trade fairs and conventions. These events function as temporary clusters (Maskell et al., 2004). Events can, due to their multidimensional structure, function as a temporary hub that stimulates the processes of knowledge creation. Events create opportunities to meet future partners, establish new projects and to create a network. The spatial consequence of this is that cities should be able to facilitate events and have sufficient event spaces, good accessibility by car and public transport and facilitate enough accommodations.

In Figure 10 a table with an overview of the spatial qualities that are needed to create a succesful knowledge location is given.

Conclusion

Urban designers can have influence on the success of knowledge locations by improving, creating and facilitating the qualities or amenities that are showed in Figure 10. However, the role of the urban design in the success of a knowledge location has to be seen in perspective. Knowledge locations can become a success

without meeting all the qualities and requirements. On the other hand knowledge locations can meet all the requirements, but still be unsuccessful. This does not mean that the role of an urban designer is not important. Phenomena like local buzz or communities cannot be created, but can be facilitated. This way, the chance they arise increases.

To create a successful knowledge location, urban design is one aspect out of many others that are of importance. Other qualities that are of relevance can be the management of the knowledge location, the activities that are organised, the willingness of the people to interact or the amount of time that people spend working in the cluster. So, urban designers are important for the success of a knowledge location, but they have a facilitating role.



Spatial requirements in a knowledge location



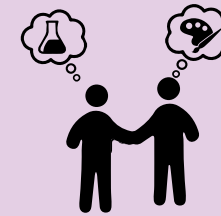
Local buzz

- Clustering and co-locating firms
- Create an open urban structure
- Create sufficient third places
restaurants, coffee, shops
bars, and dry cleaners
- Create shared facilities
workshops, laboratories



Healthy function mix

- Create a combination of related activities with a clear focus, but accompanied by complimentary specialisations
focus on themes like
biotech, space, media,
or fashion clusters
- Create a specialisation and differentiation, which should be complementary to other knowledge locations
- Create large houses with gardens, which are well accessible by car
- Facilitate houses in historical city centres with sufficient amenities



Spatial requirements to foster meetings between nerd and bohemian clusters



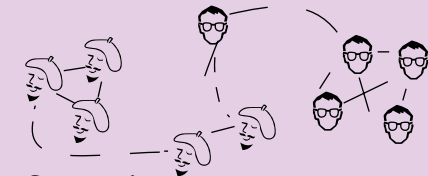
Global buzz

- Create sufficient event spaces
- Facilitate good accessibility by car and public transport
- Facilitate enough accommodations



Global pipelines

- Create comfortable and representative meeting rooms
- Create technical well-equipped meeting rooms
- Create a typical background for reporters



Strong ties

- Creating comfortable public spaces
- Create various interaction environments.
- Creating particular street furnishings, designs or namings.

Weak ties

- Create something to look at
- Create comfortable places to sit
- Place something interesting or strange in the public space

Figure 10. An overview of the spatial qualities that are needed to create a successful knowledge location

Part 3

Application

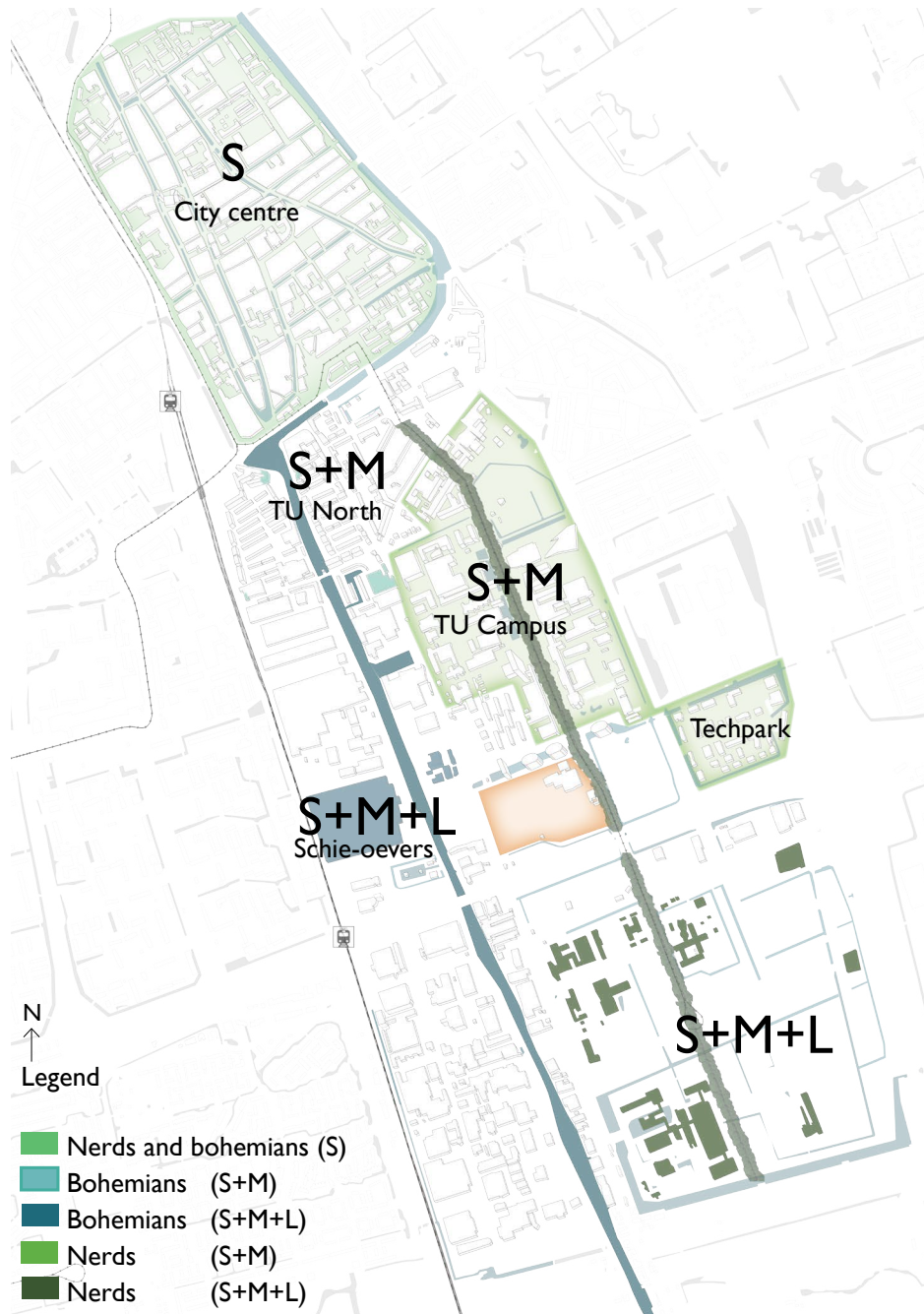


Figure 11. Current places for creative and technical businesses. Authors own, based on a table of Den Heijer (2010)



Figure 12. Differences between nerds and bohemians in urban environment



Figure 13. Atmosphere of the Schieoevers



Figure 14. Current state of the Technopolis



Knowledge location

In this paragraph the requirements for successful knowledge locations will be discussed at the scale of the city. As elaborated before, Delft is the test case for the theory explained in the theoretical framework. The main theories on the city scale are the strong tie/weak tie theory of Granovetter (1973) and the differences in working preferences between nerds and bohemians as explained by Florida (2002), Kotkin (2001) and Marlet (2009). In this paragraph the current situation of Delft and the proposed adjustments are explained. This results in a vision for the most knowledge intensive parts of Delft.

Nerds and bohemians

In Figure 11 the current locations where nerds and bohemians currently work (and sometimes live) in the knowledge intensive locations of Delft are shown. Due to the presence of the TU Delft a big area is reserved as a working environment for nerds, furthermore they can be found in the city centre and in Delft Techpark. The bohemians are currently more present on the Schie-oevers, at the TU North and in the city centre (Den Heijer and Curvelo, 2011).

As shown in Figure 11 there are differences in the maximum size of plots in Delft. In the city centre there is space for small enterprises to settle, but they can settle in the south as well. Medium size enterprises can find work spaces further from the city centre, where the plots get larger. The large enterprises can only settle at places where the plots are big. This is in the very south of Delft, along the Schieoevers and at the Technopolis.

Bohemians and nerds have different preferences for urban atmospheres. In Figure 12 the differences in urban environment is shown. Bohemians appreciate authenticity, roughness and freedom. This results in a demand for flexible spaces with a rough or historical atmosphere. Nerds, however, appreciate comfort, cleanliness and order. This results in a demand for clear and organised spaces which look modern. In consequence of these preferences, new areas for nerds and bohemians to extent can be found. The bohemians have space to extend in both directions of the Schie, because this area still has a rough and authentic character (Figure 13). The nerds have space to extend in the south. In the south there used to be grassland, but the municipality of Delft planned a new technical knowledge location there, which is called Technopolis (Figure 14). More about the Technopolis will be explained later.

In consequence, creative businesses will settle in the city centre and along the Schie-oevers at the places where the plots are suitable for their enterprise. The technological businesses will settle in the city centre and along the Mekelpark. This way two axes emerge and they will become the backbones of the nerd or bohemian area, which are called nerdistan and bohemistan (Figure 15). The Rotterdamseweg is the road that lies between bohemistan and nerdistan.

In conclusion it can be stated that nerds and bohemians with small businesses both work in the city centre of Delft. As the company size and thus the plot size grows, the distance between nerd and bohemian working places grows.

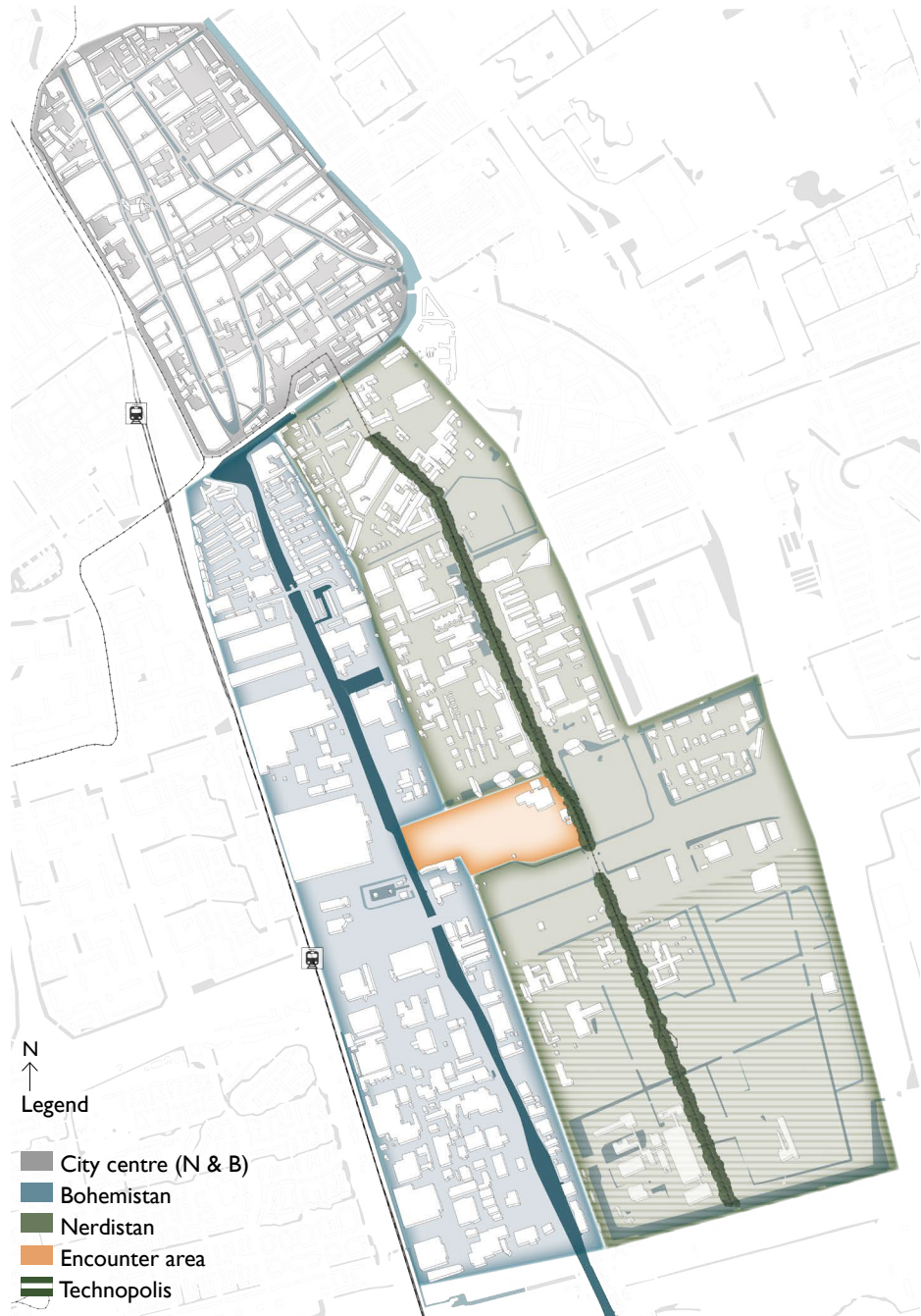


Figure 15. The Schie and the Mekelpark as backbones for the nerd and bohemian area.



Figure 16. Third Places in Delft

Vision



Knowledge
location

Third places

As explained in the theoretical framework, third places are places that are no working or living places. In Figure 16 the third places in Delft are shown. This figure shows that there are a lot of third places in the city centre of Delft. This means that there are enough places for nerds and bohemians to meet, interact and exchange ideas. Further to the south the amount of third places decreases. There are a few small lunch places, but the main third place is the sports and culture centre of the TU Delft. This area contains multiple sports fields, a sports centre and a culture centre. This means that there is chance for nerds and bohemians to interact, but it is not as easy as in the city centre, because of the lack of third places.

It can be said that there is a high proximity between nerds and bohemians in the city centre and that there are a lot of possibilities for interaction between these two groups. As the plot size grows, the proximity between nerds and bohemians decreases, they work in their nerdistan or bohemistan. Next to this, the amount of third places decreases and therefore the possibility for interaction decreases as well. This lack of interaction hampers the chance for innovation and knowledge creation. To improve this situation, the chances for interaction between nerds and bohemians in the south of Delft should be improved. This is done by improving the sports and culture centre of the TU Delft. The S&C centre is the most suitable place to stimulate interaction because of path dependency, as explained in the theoretical framework. Places have a certain focus

which is related to the history of the place. The S&C centre is a place where a lot of people already meet and interact and this could become more extended and more diverse.

Strong and weak ties

As described in the theoretical framework a successful knowledge location needs two types of interpersonal ties; weak ties and strong ties to stimulate innovation and to create knowledge. Strong ties are the ties that are present within a community and weak ties are ties with people outside the community.

For Delft that means that strong ties will be created between people in a cluster. So, interactions between two aerospace nerds or between two art bohemians will be facilitated in the cluster. These meetings can be facilitated in the core of the cluster.

Weak ties are the ties that are created between communities e.g. between the aerospace nerd and the art bohemian. These meetings are usually planned meetings. These interactions take place at different locations, in the city centre nerds and bohemians can already meet easily because of the proximity and the amount of third places. In the south it is harder to meet for nerds and bohemians, because there are separated areas, and the distances between the plots is bigger. Here a specific place to interact should be created for nerds and bohemians. This meeting place will be facilitated at the place of the current sports centre (Figure 17). The sports centre is a place where a lot of encounters already happen and which is focused on both bohemians and nerds. So, this

Figure 17. Weak and strong ties in Delft

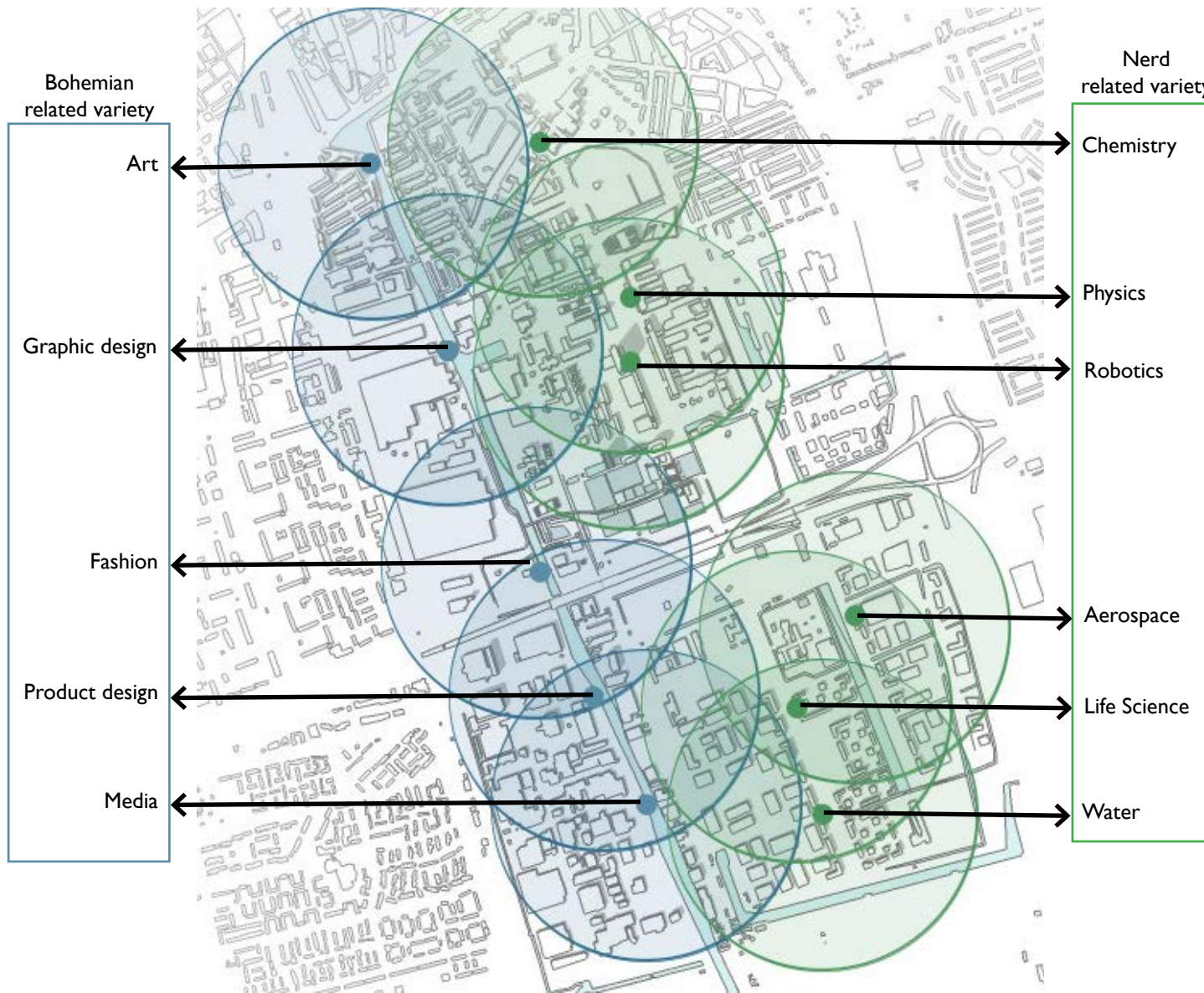


Figure 18. Different clusters in Delft



Figure 19. Impression of the core of a cluster



Knowledge location

place will have to be developed further, to facilitate optimal weak tie interaction. Figure 17 shows the places where weak tie and strong tie interaction takes place.

Local buzz

As explained in the theoretical framework, local buzz is very important for the creation of new ideas. For the facilitation of local buzz clustering is of major importance. Clusters have a maximum size to which they can grow, otherwise they will break-up in different clusters. Because of the spontaneous character of local buzz, the maximum size of a cluster is set on five minutes walking distance, this is equal to a distance of 500 meter. This means that bohemistan and nerdistan in Delft should be divided into different clusters, with each their own shared facilities and community.

The clusters in Delft will be based on differences in specialization. In nerdistan there will be clusters for e.g. aerospace, life sciences and water, while bohemistan will comprise clusters as design, media and art. A proposal for the different clusters in Delft is shown in Figure 18. This map only shows the core of the clusters, with a line of the five minutes walking distance around it. This because clusters and communities are organically growing phenomena, of which the size can differ. Sometimes one cluster is more successful than others and people are more willing to go to that place because that is ‘the place to be’. Clusters do not have a static border. Clusters and communities always have to be either nerd or bohemian,

because nerds and bohemians are different kinds of people and prefer different environments.

The core of the clusters will be situated along the backbones of the area, the Mekelpark and the Schieoevers. The faculties of the technical university can play a major role as the core of clusters. They could facilitate the meeting places or provide shared facilities for the entire cluster, instead of only for their students. An impression of the core of a cluster is given in Figure 19. This figure shows that more doors are opening towards the backbone of nerdistan and bohemistan and terraces, which enhance the liveliness, are situated along this. Cores of clusters do not only function as a meeting place, they can expose the image of the cluster as well. They can portray the image of the cluster and show prototypes or current research that has been done. This way the members of a cluster can identify with the atmosphere of the cluster and other people can get aware of what clusters are doing, talk about this or combine it with their own research. This exposure can be done at the facade of a faculty, with a display window or, in the public domain, with objects or installations.

Healthy function mix

The creation of clusters stimulates the creation of related variety, because all the clusters in bohemistan have bohemian specialisations, and are surrounded by other clusters which have a slightly different, but yet bohemian specialisation. The same goes for the nerd clusters in nerdistan.

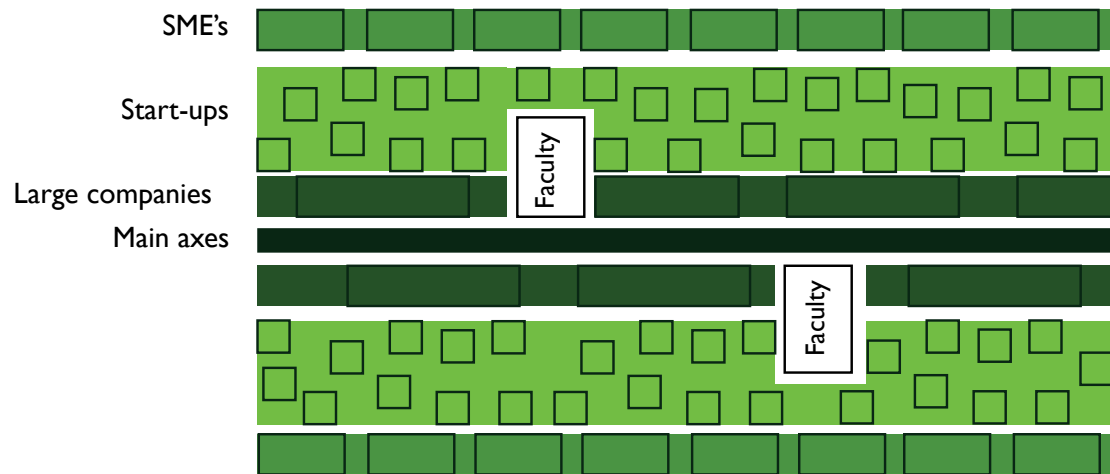


Figure 20. Principles for the Technopolis

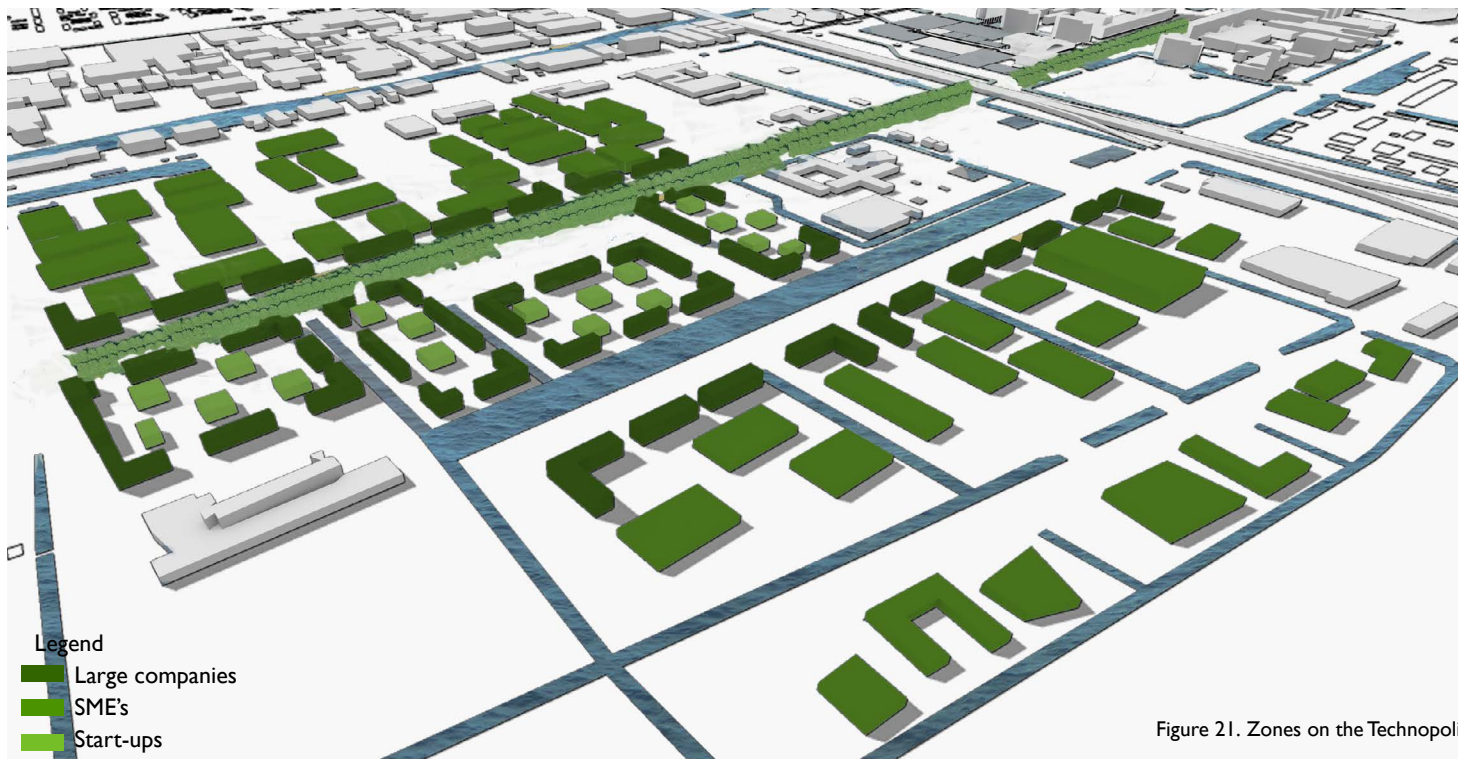


Figure 21. Zones on the Technopolis

Kind of enterprise	Preferences	Place in the Technopolis
Starters	<ul style="list-style-type: none"> - Affordable - Together with other starters - Internal and external interaction 	Small buildings near big companies and amenities
Small/Medium Enterprises	<ul style="list-style-type: none"> - External interaction - Flexible spaces - Affordable 	Together with other SME's and near other enterprises
Large companies	<ul style="list-style-type: none"> - Representative - Space to settle and grow - Accessible 	Along the main axes; Mekelpark and the main road

Figure 22. Location preferences of different sizes of companies

Technopolis

The Technopolis is a new science park south of the TU Delft area. In this area, new businesses should settle in the upcoming decades. Although there are already plans for this area, this project will reconsider the plans for the Technopolis with the current knowledge of the creation of innovation and knowledge.

At the Technopolis a mix of different kinds and sizes of businesses is preferable. So, a mix of incubators, start-ups, medium-small-size-enterprises (SME's) and large companies of different but related sectors. Different sizes of companies have different needs and prefer different kinds of interactions and environment. An overview of the preferences is shown in Figure 25. Based on the spatial criteria that Saris and Modder (2005) composed for the life cycle of creative businesses, the criteria for innovative businesses are composed.

As a result of these preferences a specific place in the Technopolis can be extracted.

Large companies are the kind of enterprises that are the hardest to attract, because they usually have a place where they started from and they have many possibilities to move. Besides that, it is very important to attract these large companies, because they function as a pull factor for other small and large enterprises. Large companies prefer a plot, which still has potential to grow. The plot should be well accessible, both by car and public transport, and the building and surroundings should look representative. In the Technopolis, the most suitable place for large companies would be along the main axes. The two main axes will be the extended Mekelpark and the

main road through the Technopolis.

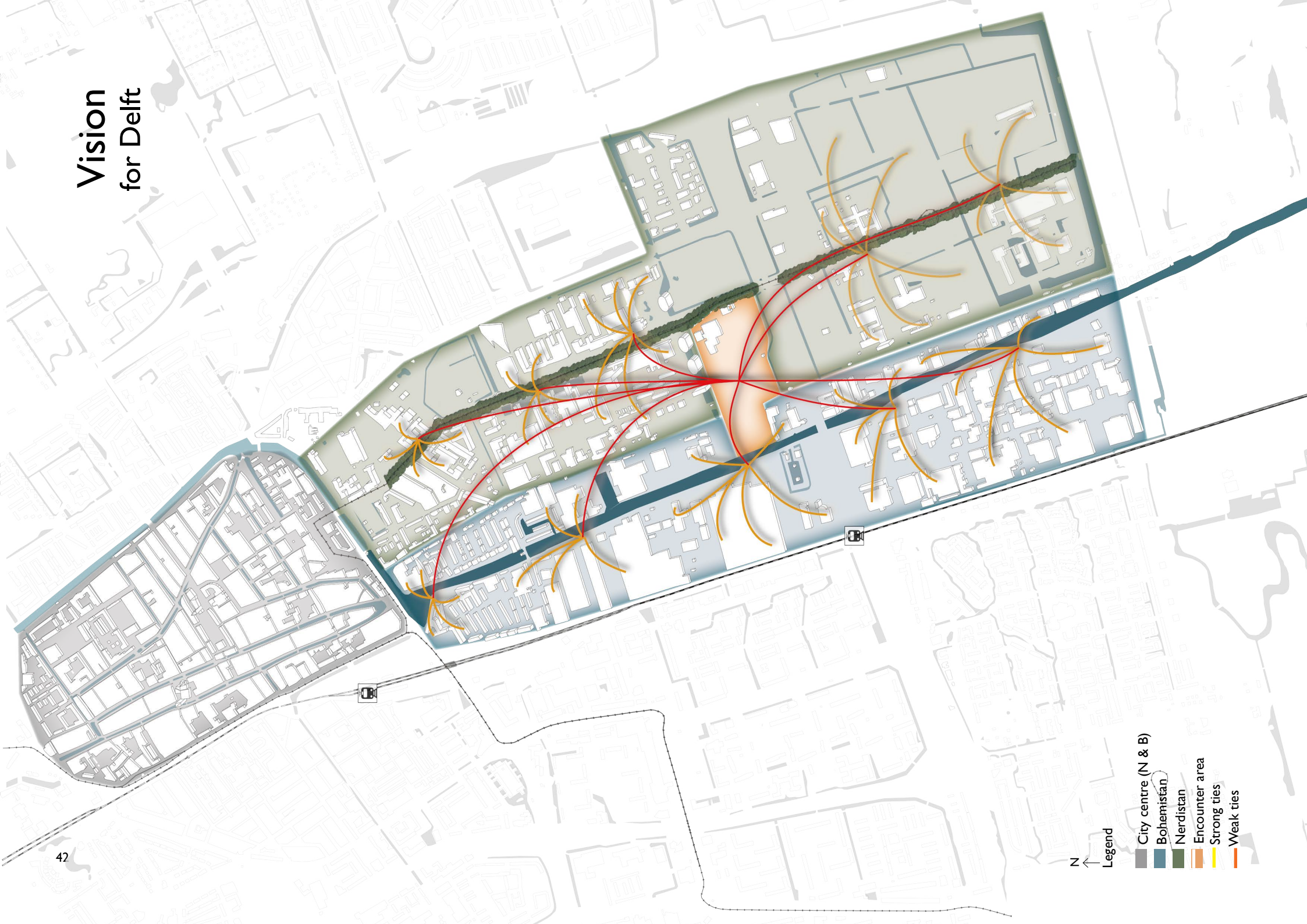
Small and medium sized enterprises (SME's) will account for the largest shared enterprises of the Technopolis. SME's are important for the economic growth and prosperity of cities and regions (EC, 2015). SME's prefer affordable plots which are flexible to organize and leave space for growth. In contrast with the start-ups, SME's only need external interaction. As a result SME's are near other enterprises, but each have their own building. SME's are less interested in interaction and can therefore be placed further away from the centre. SME's will be housed in small buildings near large companies and amenities.

Start-ups are important for the success of the Technopolis as well, because start-up are very innovative and can be the large companies of the future. Start-ups prefer cheap plots where they can settle together in shared business complexes. YES!Delft is a current example of a shared business complex for start-ups. These shared complexes stimulate the internal interaction in the building. Next to the internal interaction start-ups prefer external interaction, interaction with other types of businesses. To stimulate this external interaction, proximity to other enterprises is important. For the position in the Technopolis this means that start-ups should be clustered with other start-ups near other enterprises.

In the rest of the plan, the faculties form the core of the cluster as well. At the edges of the planned area there is the possibility for SME's to build more eccentric buildings. This way they will be noticed from the highway.

Basically, this zoning principal leads to a zoning plan for the Technopolis (Figure 30).

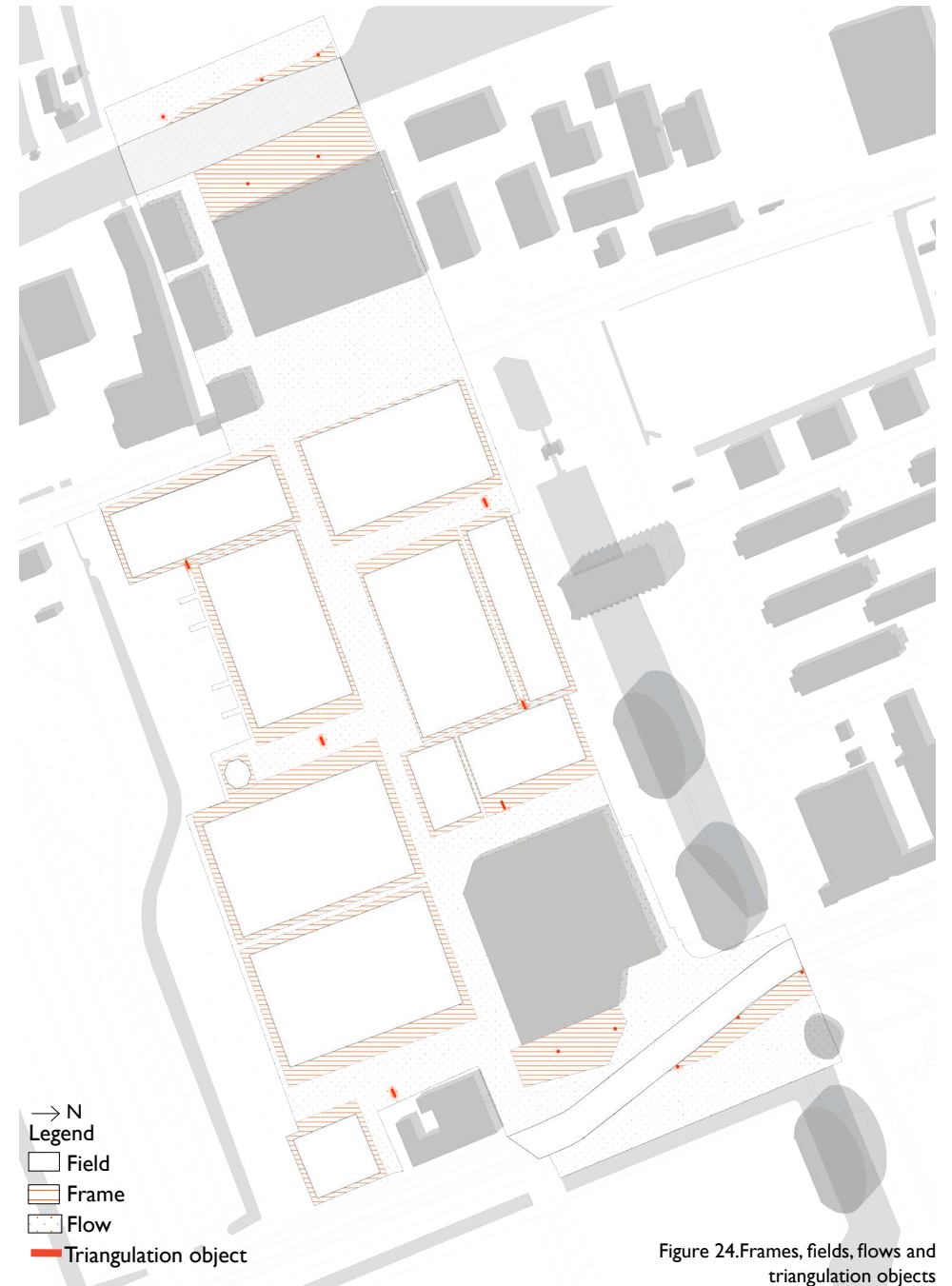
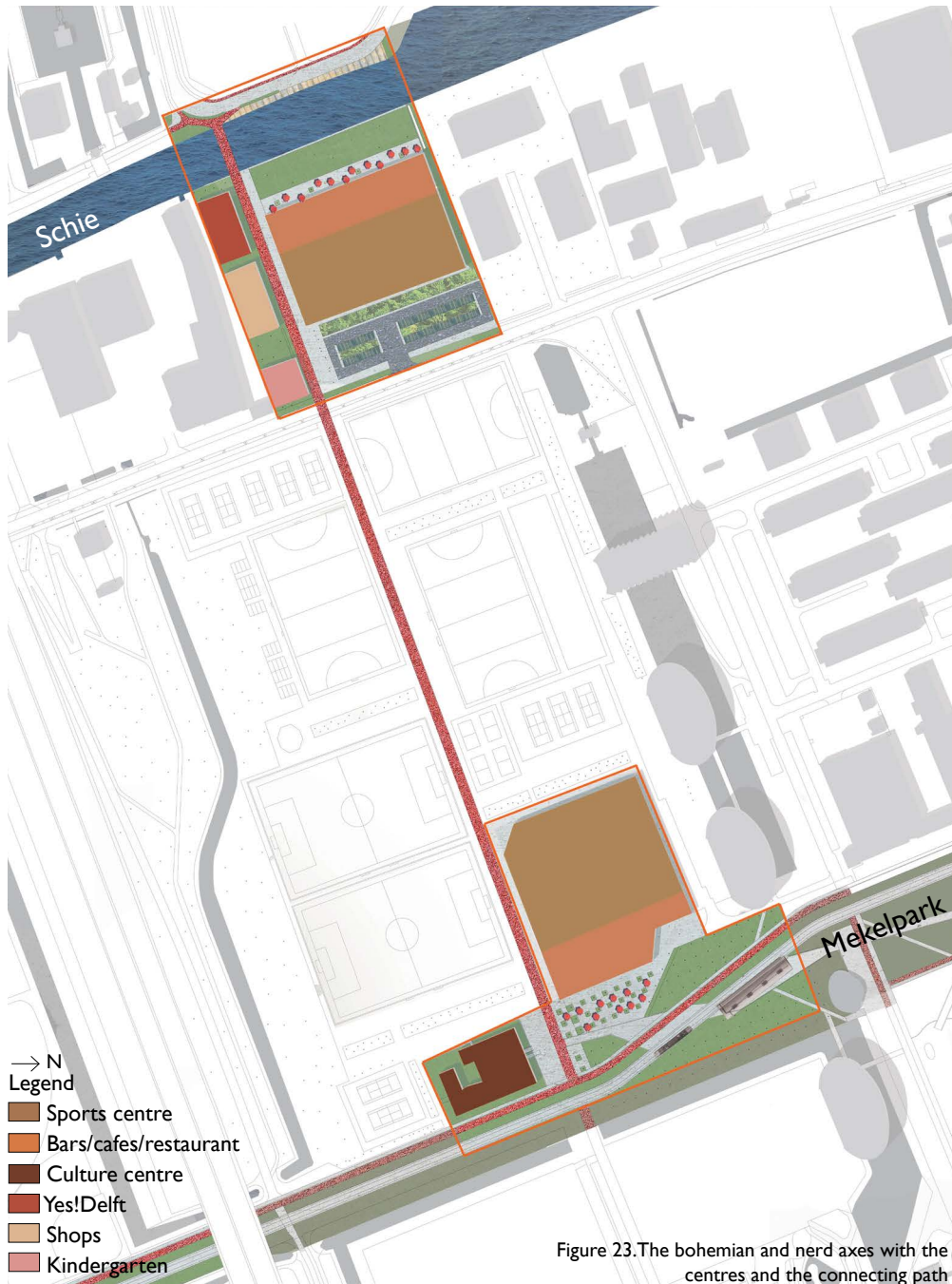
Vision for Delft



N ←

Legend

- City centre (N & B)
- Bohemistan
- Nerdistan
- Encounter area
- Strong ties
- Weak ties



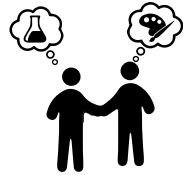


Figure 25. Frames in an old museum

Strong ties and weak ties, as well as local buzz and global pipelines are necessary for a successful knowledge location. Local buzz en global pipeline meetings will both be facilitated at the encounter area. Strong ties are facilitated at the core of the cluster while weak ties are facilitated at the encounter area. The encounter area is thus the place where nerds and bohemians can meet each other by accident or planned, and where global pipeline meetings can take place. These global pipeline meetings can occur between nerds and bohemians or between nerds/nerds or bohemians/bohemians of different clusters. To realise this, different functions and public space are designed at the S&C centre of the TU Delft.

The encounter area consists of different areas; the two centres and the sports fields. Though the entire encounter area functions as a place to meet, the interactions will intensify in the two centres. The centres are located at the intersections of the encounter area with the nerd axes and the bohemian axes (Figure 23). The interaction in the two centres will be intensified as a result of a concentration of functions and comfortable meeting places. The centre at the bohemian side of the encounter area has restaurants, bars and cafes along the Schie, shops, kindergarden and the shared bussines complex Yes!Delft along the main path and some indoor fitness spaces. The centre at the nerd side of the plan has resaurants, bars and cafes at the side of the Mekelpark, indoor sportfields in the sport centre and culture centre. The two centres will be connected with each other by a path. This doesn't only connect the two centres, but it is

also an extra connection between nerdistan and bohemistan. The path will be suitable for cyclists and pedestrians (Figure 29).

Weak ties

Weak ties can be facilitated by implementing the field/frame/flow theory. This theory makes people feel comfortable in a public space. This theory is combined with the triangulation theory, which states that by implementing this theory it will be easier to talk to new people and start new encounters. So, a combination of both theories creates comfortable public spaces that promote new encounters. These theories are applied to the encounter area at the current sports and culture centre.

The sports fields at the sport centre all have their own field and frame which differ because of the differences in sports that are played in the field or the way the frame has been designed. The fields differ in size and relation to each other. Sometimes multiple fields are sharing one frame, the tennis courts for instance.

Frames differ from each other as well. Sometimes there is a high fence between the spectator and the player and sometimes there is no fence at all, such as beachvolleybal fields. Besides this, there are different places for spectators to sit, stand or hang. People in the frame can sit in the dug-out or sit, stand or hang behind the fence. To make it more comfortable for people in the frame to watch the games, grandstands are designed (Figure 30). The grandstands are movable along different paths of the plan and can therefore can be connected

as a big grandstand when a grand finale is played. It can also be seperated in different small grandstands when different games are played.

The space that is left between the fields and frames is the flow. The flow is the residual space defined by the field and the flow. There are different types of flows in the encounter area.

The main flow is the connection between nerdistan and bohemistan. This connection is suitable for pedestrians as well as cyclists. Besides the main flow, other flows are created. These are situated between the sports fields and can have two different designs. They are designed as an alley or as a street.

The alleys are small flows between the fields, with a maximum width of 4 meters and hardly any place for the frame to arise (Figure 31). The streets are designed wider, a maximum width of 12 meters, and have space for trees and grass in the middle of the street and the movable grandstand can be situated in these streets. In the streets there is more space for the frame to arise because it is a comfortable place to sit and hang out (Figure 30).

At the centres, a frame and field are designed too, only a bit different than at the sportsfields. The frames are created along two main axes, the Schieoovers and the Mekelpark. This makes the field and the flow the same space. The people that walk by in a hurry at the Mekelpark are in the flow, but people in the frame are watching the people passing by, that makes them part of the flied. The same thing happens at the Schie. So, at the centres, a differentiation in the field/frame/flow occurs.



Figure 26. The residential area with nerd-, bohemian-, and student housing



Figure 27. Nerd-in-residence tower



Figure 28. Moved bohemian building

Encounter area

The field and the flow have the same space.

The frames are still the same, people can look from the frame at other people walking, cycling or sailing by, at the axes. The frame at the side of the S&C centre has two part. one part is created in front of the cafes and restaurants with terraces. The tram station functions as the other part. This way you can jump out of the tram and directly walk into the centre and the plan area. At the centre of the bohemistan there are also terraces in front of the bars and cafes, but at the other side of the Schie there are places to sit created by using a scaffolding. This way you can moor your boat and visit the centre and the sports facilities. The frame in the centre captures the two axes.

Accidental meetings between nerds and bohemians occur all over the the encounter area, but will happen mostly at the places where triangulation objects are placed. For this triangulation, different kinds of objects are possible. In this project, two types of triangulation objects are designed; triangulation objects for the centre and triangulation objects for the sports area. In the centres, lampposts are designed which switch on and off randomly. The lampposts are designed as lightbulbs that represent the 'eureka'-moment. When you drink coffee on a terrace or walk along the lamppost and it switches on or off, you have something to talk about. The lampposts are shown in Figure 34 and Figure 33. In the sports area, other triangulation objects are designed. These are inspired by the blue boards that were used at stations and showed travel information (Figure 30). Instead of showing the

travel information, these boards will now show information about the current state of innovation in Delft. It can show the amount of start-ups, patents, graduates or inventions. When you walk along or sit near a blue board and it changes with a lot of noise, you know that a new invention has been done. This is a perfect topic to talk about and to show how succesful Delft is.

Global pipelines

Global pipeline meetings are meetings that have to be facilitated in the encounter area as well. There are different kinds of global pipeline meetings. Virtual and real life global pipeline meetings.

The real life global pipelines are the planned encounters between nerds and bohemians and they are facilitated in the two centres. Here meeting spaces like restaurants and cafes are created. These cafes and restaurants have terraces in the public space, so people can sit outside and interact with the public space. These functions and terraces stimulate local buzz to arise. Figure 34 shows what the centre looks like at the nerd side of the plan and Figure 33 shows what the centre looks like at the bohemian side of the plan.

Virtual global pipeline meetings are meetings that happen through virtual connections. Virtual meetings can happen on small scale as conference calls or skype meetings or on the bigger scale as big award ceremonies or election results. For the facilitation of conference calls or skype meetings, well equipt meeting rooms are created. For the facilitation of virtual award

ceremonies or election results, a big field and a screen are created. By connecting two football fields into a combined field with a big screen, people can sit or stand on the field and watch the election or award ceremony (Figure 32). Besides these two forms of virtual global pipeline meetings, a third is possible; The Newsreporter connection. Newsreporter shows the encounter area to the rest of the world when something new happens. This way people create an image of the area and they can distinguish the area as a succesful knowledge location. The position of the newsreporter is shown in Figure 33 and Figure 35.

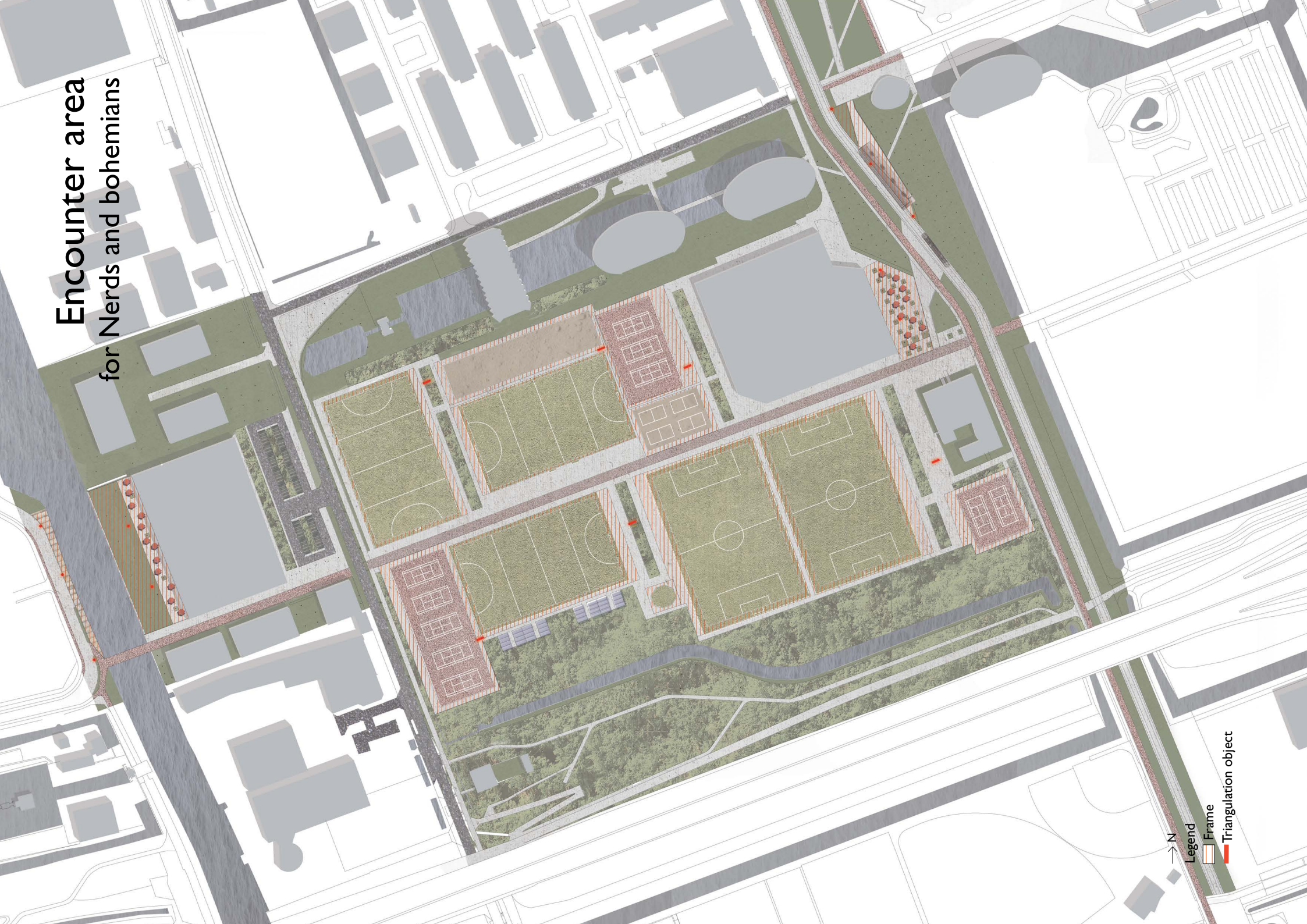
Residential area

Next to the encounter area, a residential area will be created (Figure 26). Nerds and bohemians like living near their working space. In case of bohemians the houses can even be working places. People like to live near facilities and centres. The residential area is near the centre, but is not a part of it though. Residential areas do not contribute to new interactions, they are places where you want to relax and be on your own.

At the nerd side of the encounter area an appartment tower will be situated. In this tower, nerds-in-residence can live (nerds who temporarily live in Delft because they are doing a project). Where the nerd tower is situated and what it could look like is shown in Figure 27. At the nerd side of the encounter area bohemians will find a place to live. It is relatively hard to create new places for bohemians to live, because they do not like 'new' places and they appreciate an atmosphere which is usually lacking in new

buildings. This is why another solution needs to be found. Two possibilities are; the movement of an old building from another place to this area, or the placement of do-it-yourself buildings. A building in the area which could be moved to the residential area is shown in Figure 28.

Encounter area for Nerds and bohemians



N
↑

Legend

Frame

Triangulation object



Figure 29. The main flow with the fields at both sides



Figure 30. A 'street' in the encounter area with an innovation board and moveable grandstands



Figure 31. 'Alley' flow between the sports fields



Figure 32. The combination of two sports fields

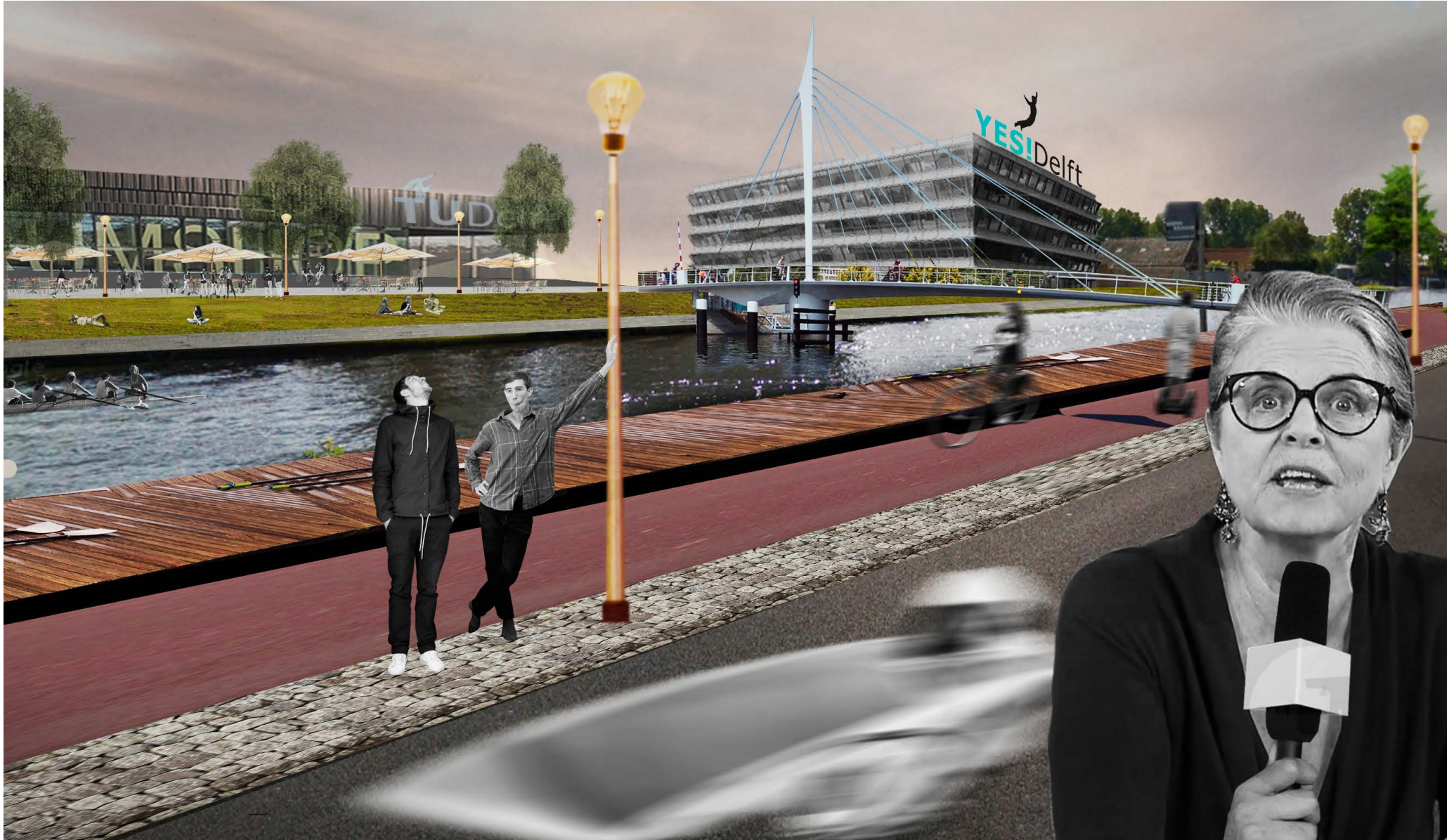


Figure 33. The global pipeline meeting at the Schie with the lampposts and the scaffolding



Figure 34. The centre at the nerd axis with the lampposts and the tramstation



Figure 35. The global pipeline meeting with the EWi building and the terraces as eye-chatters

Part 4

Conclusion

The conclusion of this project is twofold; Conclusions can be made in theoretical perspective and in applied perspective in the case of Delft. This chapter will conclude the theoretical aspect of the project, the conclusion of applied aspects of the project can be found in the design.

The main research question was; *'What are the optimal spatial requirements that are needed to create different successful knowledge locations for people and firms in Delft and what do they look like?'*. This question is answered by looking at the connection between economic geography and urbanism. Urban geographers and urbanists have different perspectives. They both research the city and the way it functions, but do this from a completely different perspective. They thus draw different conclusions on different subjects. This project combines different theories of urban geographers and urbanists and brings them into practice. This is done by implementing it at the case of Delft.

At first economic geographical theory is reviewed to find the spatial aspects in it. The spatial aspects found are translated into spatial applicable and relevant requirements. These requirements are complemented with urbanism literature. The literature resulted in an overview of spatial requirements for knowledge locations and their regions in general (Figure 298). The applicability of the requirements is tested in the case of Delft. The general conclusions and learnings will be explained.

Good people and business environment

In the past the focus of policy makers was usually on requirements, like good infrastructure, the right sort and affordable office spaces, the right regulations and availability of skilled labour force. This can be described as policies to attract businesses. Florida (2002) shows that the focus should be more on attracting people. He states that talented people do not simply select a place to work, based on the highest salary, they are typically concerned with a whole series of place-based characteristics (Florida, 2002: 6).

I concluded that it would be rather one-sided to just look at just one of the aspects to enlarge the change to become a successful knowledge location. So, except from attracting and retaining businesses and firms, cities should attract talented people as well. There should be attention for both the people aspect and the business aspect of the economy. The people aspect can be addressed by creating comfortable places to live and sufficient facilities.

Differences nerds/bohemians

The people that contribute to science and innovation can be roughly divided into nerds and bohemians. The main difference between those two types of people can be found in the type of sector they work in; the technological or creative sector. The people in the technical sector can be called nerds and the people in the creative sector can be called bohemians.

I concluded that nerds and bohemians

need different living and working environments. Nerds appreciate a large house with a garden and the house should be well accessible by car and be situated in a green, comfortable and safe environment. Bohemians prefer living in vibrant cities with historical city centres and large shares of higher education institutes and urban amenities

The difference in working environment is more subtle. At first sight the requirements appear to be the same for nerds and bohemians, but the difference is found by applying the requirements. The design of a nerd working space should have a completely different atmosphere and physical appearance than a bohemian working environment. Bohemians appreciate authenticity, roughness and freedom, this results in flexible working spaces with a rough or historical atmosphere. On the other hand nerds do appreciate comfort, cleanliness and order. This results in clear and organised spaces which look modern.

Healthy function mix

Marshall introduces agglomeration economies (1890) as a benefit for successful businesses. Agglomeration economies are related to the benefits that are created by clustering businesses; agglomeration benefits. The agglomeration benefits are divided into localisation and urbanisation benefits. Localisation benefits are the benefits that are concerned with the specialisation of clusters. Urbanisation benefits are the benefits that are concerned with the diversification of clusters. Although these

concepts appear to be contradictory, they can be combined with the concept of related variety. Related variety is defined as sectors that are related in terms of shared or complementary knowledge bases and competences. So, the businesses are both related and diverse. Urbanists can create specialisation and diversification to stimulate knowledge spill-overs. On the other hand urbanisation benefits can be stimulated by creating comfortable interaction environments which enhances the exchange of ideas and the creation of shared facilities and third places.

Interaction environments

In this project, interaction environments are of major importance for the creation of knowledge and innovation. Knowledge flows via personal contacts and during the way it grows. Different spatial typologies of environments facilitate these networks.

Different places for these encounters are needed. One of these environments is the 'core of the cluster'. In this interaction environment, the interaction is daily and intense and this takes place within a community. Different parties learn from each other, and diversify their activities in mutual specializations.

Another type of an interaction environment is the encounter area. The encounter area is more general and is comfortable for a lot of different people.

It is important that local buzz is facilitated at these interaction environments. More interaction and more knowledge will be created 57



Spatial requirements in a knowledge location



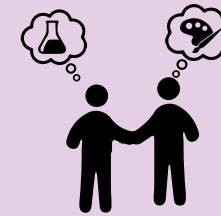
Local buzz

- Clustering and co-locating firms
- Create an open urban structure
- Create sufficient third places
restaurants, coffee, shops
bars, and dry cleaners
- Create shared facilities
workshops, laboratories



Healthy function mix

- Create a combination of related activities with a clear focus, but accompanied by complimentary specialisations
focus on themes like
biotech, space, media,
or fashion clusters
- Create a specialisation and differentiation, which should be complementary to other knowledge locations
- Create large houses with gardens, which are well accessible by car
- Facilitate houses in historical city centres with sufficient amenities



Spatial requirements to foster meetings between nerd and bohemian clusters



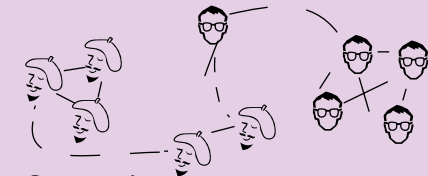
Global buzz

- Create sufficient event spaces
- Facilitate good accessibility by car and public transport
- Facilitate enough accommodations



Global pipelines

- Create comfortable and representative meeting rooms
- Create technical well-equipped meeting rooms
- Create a typical background for reporters



Strong ties

- Creating comfortable public spaces
- Create various interaction environments.
- Creating particular street furnishings, designs or namings.

Weak ties

- Create something to look at
- Create comfortable places to sit
- Place something interesting or strange in the public space

Figure 36. An overview of the spatial qualities that are needed to create a successful knowledge location

Conclusion

as a result of this. Next to this local buzz, global pipelines and global buzz have to be established. Global pipelines are defined by Bathelt, Malmberg and Maskell as 'channels of communication with providers outside the local milieu' (2004: 31). these can be facilitated by creating comfortable and representative meeting places for conference calls, but big fields with screen for large groups of people as well. The newsreporter is important for the global pipeline as well. They choose a background for the report and thereby establish the image of the public of the knowledge locations.

Global buzz consists of rich information flows that are established at events like trade fairs and conventions. These events function as temporary clusters (Maskell et al., 2004). Events create opportunities to meet future partners, establish new projects and to create a network. The spatial consequences of this is that cities should be able to facilitate events and have sufficient event spaces, good accessibility by car and public transport and facilitate enough accommodations.

Field/ frame/ flow

When making a design of an interaction environment, urban designers should make sure that it becomes a comfortable place where everyone feels free to interact with each other. To make interaction environments comfortable for everyone, different levels of engagement with public space should be facilitated, namely active engagement, passive engagement and no

engagement. Different levels of engagement can be facilitated in different parts of the interaction environment. These parts are the field, the frame and the flow zones.

The field is the part where people can have active engagement. This is the place where people can perform whereas others can watch the performances. The frame part is where people can have passive engagement with the interaction environment. This is the part where people sit or hang around and watch other people or objects. The flow part is where people can have no engagement with the interaction environment at all. This is the part where people can move and pass by quickly.

So, these are the three zones that comfortable interaction environments should have, but except from making people comfortable the interaction environment should also stimulate interaction. For making new connections between people, triangulation is needed. Triangulation is 'the process by which some external stimulus provides a linkage between people and prompts strangers to talk to other strangers as if they knew each other (Whyte, 1980:94). When something interesting or strange is placed or happening in the public space, people can use the object or happening to interact with, stand around or talk about it. This way, the attention is focused on a third thing instead of each other. This makes interpersonal engagement more comfortable.

So, an interaction environment should facilitate a field, a frame, a flow and triangulation.



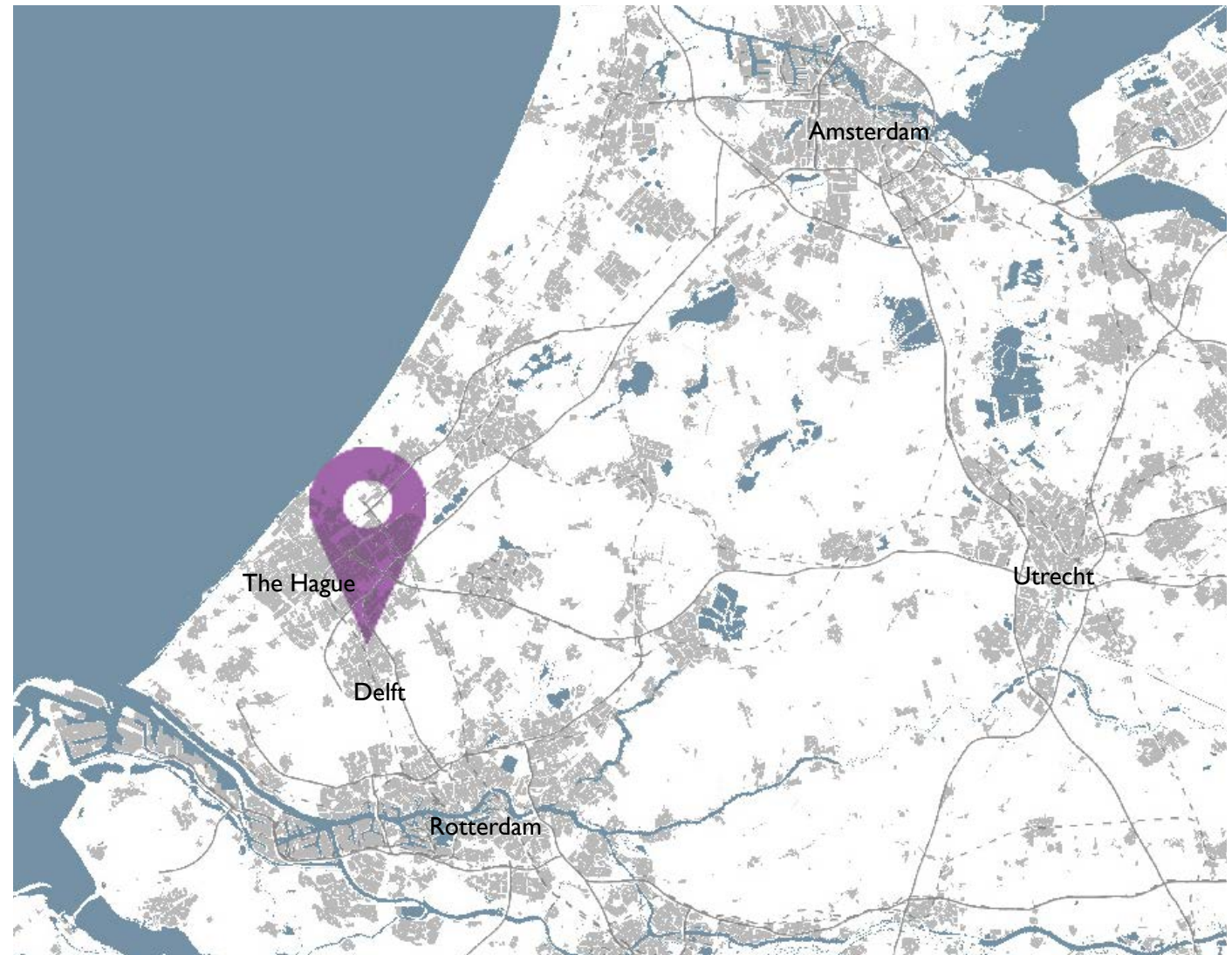
Part 5

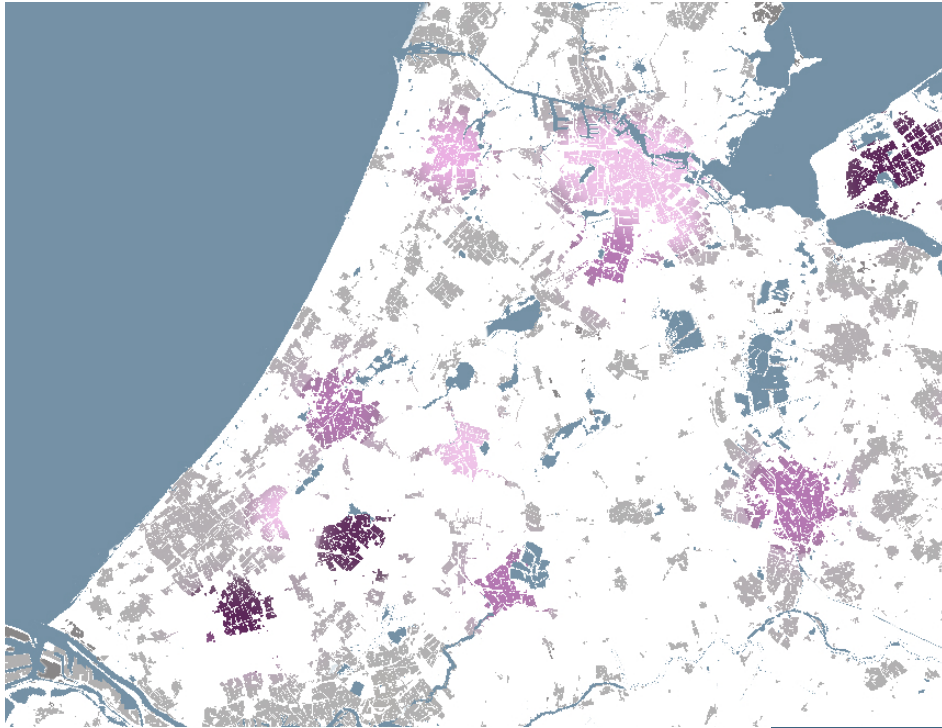
Reflection

In this project the spatial requirements that are needed to create a successful knowledge location are explored and applied to Delft with spatial interventions. Knowledge locations, however cannot facilitate all necessary functions and amenities within their boundaries. In consequence they need the spatial context to provide all functions. The knowledge locations of Delft depend on their spatial context to become successful as well. If these knowledge locations were places in the outback or desert, they will not become a success.

The function of the region is of importance for the success of the cluster. This clarifies why some small cities like Oxford or Delft can become successful knowledge locations as well. This can be explained by the fact that these small cities are situated in a region with other small or big cities. The small cities can borrow size from other cities. Alonso (1973) describes: "in certain European urban patterns, such as those of Germany and the Low Countries, whose cities, quite small by our standards, apparently achieve sufficient scale for the functioning of a modern economy by borrowing size from one another" (Alonso, 1973:200). Smaller urban areas enjoy (or 'borrow') some of size of their larger neighbours. Delft can borrow size from other cities in the region, like The Hague, Rotterdam and even Amsterdam.

Except from the requirements that are needed on the scale of the cluster, there are the requirements for the region of the cluster. These requirements are of importance for the knowledge location and are therefore called conditional requirements.





Legend
 Percentage of nerds
 9-10 %
 8-9 %
 6-8 %
 one hour commuting time

Figure 37. Nerdistans in the region of Delft
 Source: authors own, based on the ranking of nerdistans by Marlet and Woerkens (2005)

Legend
 Percentage of bohemians
 9-10 %
 8-9 %
 6-8 %
 one hour commuting time

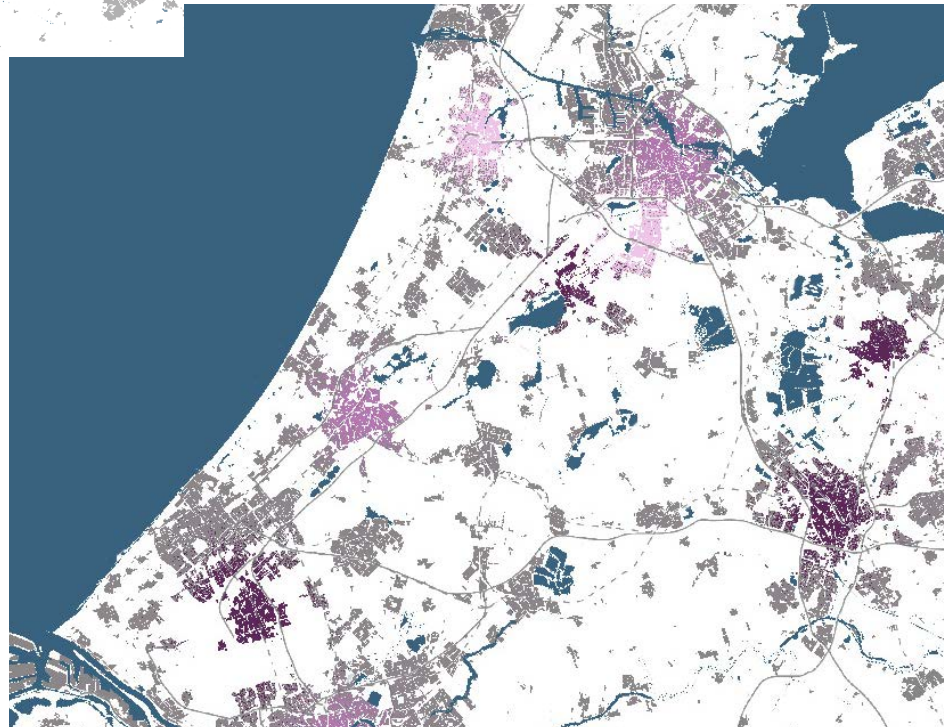
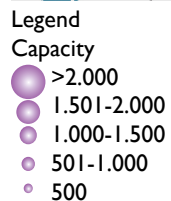
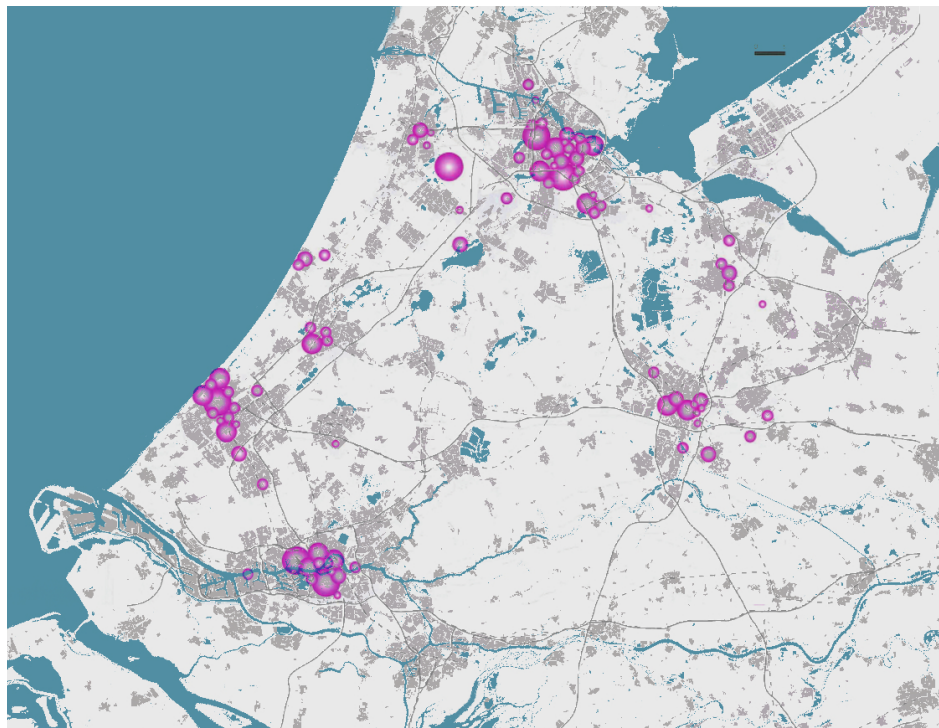


Figure 38. Bohemians in the region of Delft
 Source: authors own, based on the ranking of bohemians by Marlet and Woerkens (2005)

Figure 39. Conference Halls in the region of Delft
 Source: Authors own, based on a map of de Hoog (2013)



• Introduction

The region of Delft is analysed to see which functions are already present and to explore which functions lack or are insufficient. As described above, not all the functions have to be in Delft itself, they should all be within different commuting distances from Delft. The upcoming paragraph will show the present functions and the maximum commuting time that people are willing to travel.

• Region scale

As described in the theoretical framework, nerds and bohemians live on different locations with different urban characteristics. The places of residence for nerds and bohemians in the region of Delft will be discussed. The maximum commuting distance for bohemians and nerds is both one hour (Intermediair, 2004). The light blue line indicates the area that is currently accessible within one hour of travelling.

Nerdistans

Nerds prefer large houses with a garden in a green and safe environment. In the region of Delft, these urban atmospheres can be found in the new towns, like Zoetermeer and Hoofddorp (Figure 37). Next to this, nerds like to live near their work. So, Delft and Eindhoven are popular to live in as well, because these two cities have a technical university which offers a lot of technical jobs.

It can be concluded that there are currently enough nerds living in the region of Delft.

Bohemistans

Bohemians appreciate living in vibrant cities with historical city centres and large shares of higher educational institutes and urban amenities. In the region of Delft, Utrecht and Leiden are very popular cities for bohemians to live in (Figure 38). This is because these are large cities with old city centres and a lot of amenities.

In Delft itself there is already quite a large bohemian population, but if the creative sector grows, more housing for bohemians should be created in Delft itself or in the region of Delft.

Global pipelines

Although global pipelines are lines that reach beyond the region scale, the global pipelines can also be facilitated in the region of Delft. To create these global pipelines, events should be organized to create a network.

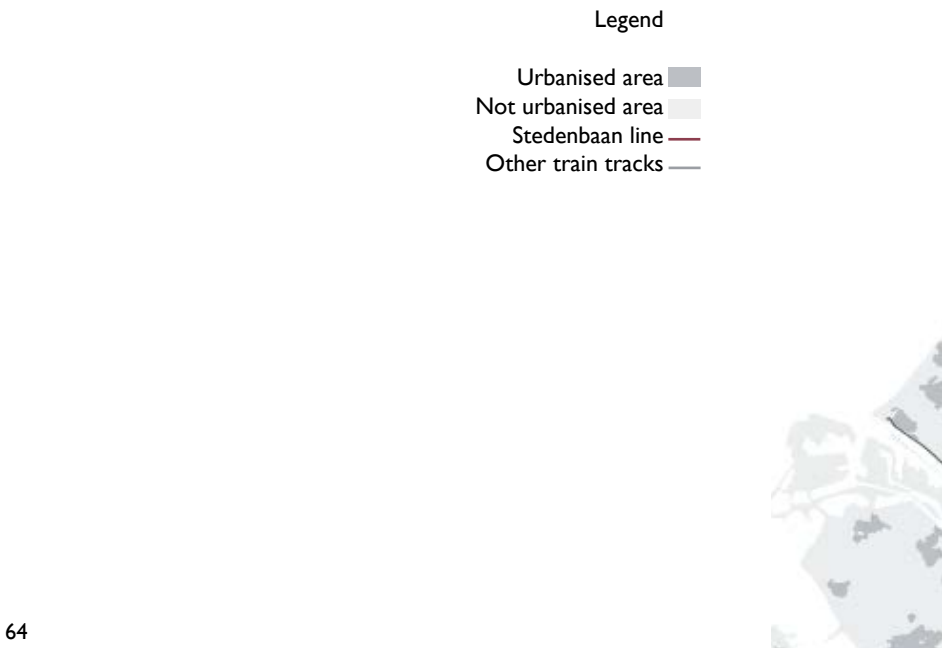
For this, several functions need to be facilitated. First, there should be an event space to host conventions or conferences. In Figure 39 the large event spaces in the region of Delft are shown. The small event spaces can be hosted in local hotels or cafes. In Delft, the Auditorium of the TU Delft is a big event space, with a capacity of 3.700 visitors (Gemeente Delft, 2010). For bigger events, event spaces in Rotterdam, The Hague or Amsterdam are at disposal.



Legend

- High roads
- - Train tracks

Figure 40. The railroads and highways in the region of Delft



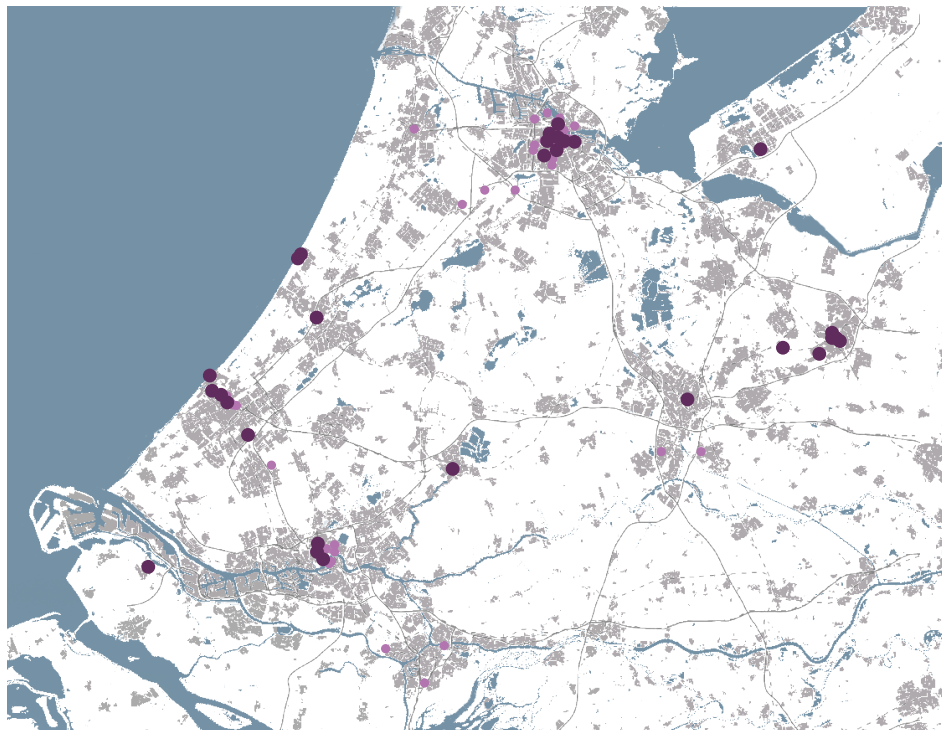
Legend

- Urbanised area
- Not urbanised area
- Stedenbaan line
- Other train tracks

Figure 41. The planned track of the Stedenbaan



Figure 42. Four and five star hotel rooms in the surrounding of Delft



Legend

- five star hotels
- four star hotels

The time people are willing to travel depends on the specialty and size of the conference. This could differ from 1 hour to 1 day travelling. The commuting distance between the event location and the accommodation has a maximum of half an hour travelling.

Second, the location should be well accessible by car and by public transport, especially from and to the airport in the case of international events. In the case of international events it can be more convenient to organise it near an airport or train station. The RAI could be a suitable option. The traffic routes in the surroundings of Delft are shown for public transport and car in Figure 40. Now it takes 50 minutes to get from Schiphol airport to the TU Auditorium and 40 minutes to get from Rotterdam/The Hague airport to the TU Auditorium. The connections of Delft with Rotterdam/The Hague airport should be improved. This can be established by the introduction of the 'Stedenbaan', proposed by atelier Zuidvleugel. The 'Stedenbaan' is a high frequency subway-like transport system, which connects different cities with a great potential. Atelier Zuidvleugel proposes two new stations of which one is Schiedam Kethel. This station is near the airport. From this station, a shuttle bus can be used. The route is shown in Figure 41 (Atelier Zuidvleugel, 2010).

Third, the surroundings of the event space should have enough accommodations. Figure 42 shows the amount of four or five star

hotel rooms. There is a total of 4.200 five star hotel rooms in the region of Delft (Bedrijfschap Horeca & Catering). Five star hotels are found in The Hague and Rotterdam, which is within half an hour commuting distance from the TU Auditorium. The number of four star hotels in Delft itself is sufficient. Bohemians prefer cheaper accommodations, such as B&B's and hotels with less stars. In Delft there are at least 10 three star accommodations and 11 two star accommodations available (Booking.com, 2015).

• Conclusion

We can conclude that there are currently enough nerds and bohemians living in the region of Delft. If, however, the technical and creative sector in Delft grows, more nerds and bohemians have to be attracted to Delft and its region. This line of reasoning works the other way around as well. If there are enough successful nerd and bohemian residential areas, these sectors will become more successful.

The region of Delft currently has enough capacity for the organisation of an event and has enough hotels in the surroundings. However, the accessibility should be improved to become successful. This can be done by the implementation of the Stedenbaan proposal of Atelier Zuidvleugel.



Part 6

Discussion

In the discussion, the gap in the body of knowledge of urbanism is explained, the way urbanism and economic geography are related to each other is elaborated and the remaining work that has to be done and the role that urban design plays are elaborated.

When studying the connection between economic geography and urbanism, the differences became clear. In the upcoming paragraph the mismatch between these disciplines is described and an attempt to solve this is made.

Theory

Economic geographers study abstract concepts about the relation between economy and the city. When doing this research they often do not take the practical consequences or the applicability when implementing these theories into account.

This is partly due to the differences in tools that geographers and urbanists use. Geographers are usually more engaged with statistics and compare current performances but lack the relation with location and its surroundings. Urbanists use design and visions to predict future performances. For this, they research the ways the future could look like (research by design), but lack a focus on the creation of knowledge and innovation.

In my graduation project I explored the gap between these two bodies of knowledge and made an attempt to fill this gap between the requirements of urban economics and the requirements that can be directly applied to locations by urban planners and designers.

Further research

This graduation project is the start of bridging the gap between economics and urban design. To fully understand the implications of urban economics, more research has to be done, for instance on the effect that urban planning and design can have on economic and academic success. I made proposals for the implementation of these theories for one specific location. Consequences for other locations can be completely different and have to be researched again for every single context.

Specific subjects in urban economics can be researched in a more spatial way, like the influence of different urban typologies on innovation, or the influence that proximity and related variety have in innovation as well.

The urban designer

Urban designers have influence on the success of knowledge locations by improving, creating and facilitating the qualities or amenities. However, the role of the urban design in the success of a knowledge location has to be seen in perspective. Knowledge locations can become a success without meeting all the qualities and requirements. On the other hand knowledge locations can meet all the requirements, but still be unsuccessful. This does not mean that the role of an urban designer is not important. Phenomena like local buzz or communities cannot be created, but can be facilitated. This way the chance they will arise increases.

To create a successful knowledge location, urban design is one aspect out of many others that are of importance. Other qualities

that are of relevance can be the management of the knowledge location, the activities that are organised, the willingness of the people to interact or the amount of time that people spend working in the cluster. So, urban designers are important for the success of a knowledge location, but they have a facilitating role.

This example illustrates that urban design is not just a sum of requirements that have to be met. The knowledge location should have a 'good' design as well. A good design can be created by experimenting with options and experience with designing.

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Part 7

Appendix

Appendix

Places for businesses in the garden, the functional and the complex city in the Netherlands

In every part of history, places for businesses were created. They evolved over time because they had to be updated constantly according to the economic changes and the changes of urbanistic views.

Places for trade and business have always been present in the city. Before the industrial revolution people used to have their businesses at home and traded their goods on squares and market halls. But at the end of the 19th century the balance between work and residential areas changed as a result of the industrial revolution. The scale of factories became bigger and they could not be situated within the borders of the city anymore. New solutions for work locations where created.

These solutions were all influenced by different perceptions of the city and changes in the way people do business. In this essay the influence of the garden city, the functional city and the complex city on business places in Dutch cities will be discussed. In the beginning of the 19th century in England urbanists were focusing on the solutions in which urban living had more contact with nature. This was called the garden city. In the rest of Europe other concepts to deal with the effects of the industrial revolution on the city were created (Kostof, 1995: p. 82). One of the new concepts were the CIAM movement and the functional city, with Le Corbusier and Cornelis van Eesteren as main contributors. These concepts separated the different functions of the city in a radical way. Living, working, recreating and transportation should all have their own location in the city. Nowadays there is a wider understanding of the city and its complexity. We can call this concept the complex city approach.

Currently the view on these business places is changing again and we as urbanists should adapt the business locations to the new needs and make them sustainable for the future. My project aims at transforming the Technopolis in Delft into an innovative and inspiring science park.

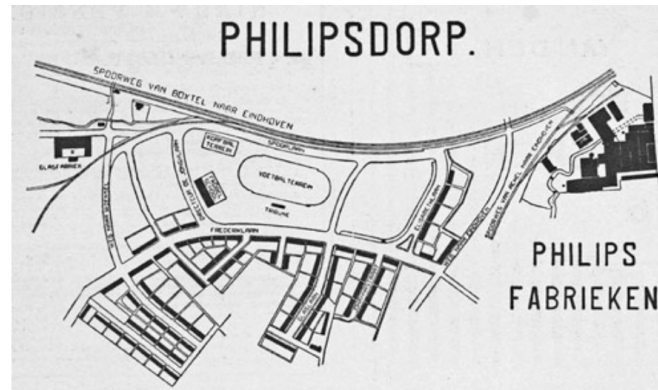


Figure 1. Map of Philipsdorp

- The Garden city

In the Netherlands, the first creation of specific working locations was during the industrial revolution. Typically Dutch companies like Heineken, AKZO-Nobel, Philips and Stork started at that time and created large factory locations. The location was decided in accordance with the municipality, but was mostly based on the spatial criteria of the company. There was a lot of esthetical attention for the appearance of the headquarters of the factories. The appearance represented the image of the company. As a result of this, a lot of these buildings are now assigned as monuments or industrial heritage. In some cases, these locations with large factories were surrounded by residential areas for the employees of the factories. These kind of business locations are called company towns. Well-known Dutch examples of these are the residential complexes built by Phillips in Eindhoven and Stork in Hengelo; called 'Philipsdorp' (Figure 1) and 't Landsink' (Louw et al., 2004). Both of the complexes were meant to create cheap and healthy housing with high quality amenities for the employees of the factories. This would, in their opinion, lead to hard-working, healthy and satisfied employees. The urban design incorporated different amenities for sports, education and shopping (PSV stadium originates from this). The plans were designed to create a sense of solidarity and a work-based community (Klijn and Otten, 1991).

This creation of company towns has clearly been influenced by 'the garden city movement'. Ebenezer Howard was the main supporter of this movement and published the book 'Garden

cities of tomorrow'(1902). The garden cities would have "all the advantages of the most active and energetic town life with all the beauty and delight of the country." It would be the ideal mixture between the town and the country and the solution for the emptying of the country and the polluted, expensive and congested cities. In this concept, new cities were built around the old city (Figure 3). Important was that these towns were economically independent, with their own industries and businesses and separated from the city by a big green belt. The cities would have a clear division of residential, industrial and agricultural areas, as shown in Figure 2. The density of these towns would become low, compared to the old cities, but not too low, because the feeling of a community was a part of his town ideal too (Howard, 1902).

There are many similarities between the company towns in the Netherlands and the garden cities. Both are planned as independent cities with a focus on the creation of a community. Next to this, both of the concepts have a very green character, with parks and sports facilities and a landscape approach. Although the concepts are quite similar, there are some differences as well. Howard saw advantages in not having controlling employers. The garden city would be owned by a foundation, not by private individuals (Wagenaar, 2011).

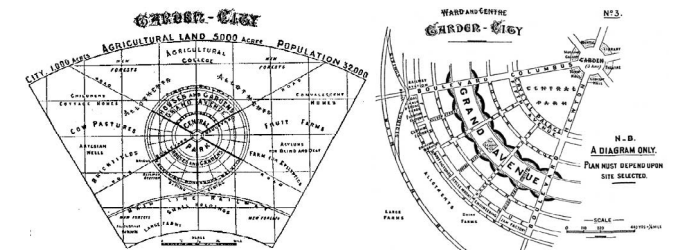


Figure 3. Concept of the garden city Figure 2. Neighbourhood in the garden city

According to Kooijman (1997) the later developed business parks consist of a combination of the company towns and the Anglo-Saxon model of the university campus. Most of these first generation business parks do not exist anymore or have lost their function. Most of them are demolished with the urban renewals of the inner cities in the seventies and eighties and are now being used for housing and some have even become monuments. The towns that surrounded the companies are nowadays often used as residential areas. The city grew around the company town and so it became a neighbourhood in the city.

The functional city

Between 1910 and 1940 the second generation of business parks was created. These working locations were created at the border of the pre-war neighbourhoods, because the industries became bigger and more polluting and nuisance. The biggest difference with the working locations of the first generation is the fact that at these parks multiple companies were settled. These business parks were usually planned along train tracks and harbours because they focused on freight transport by train and boat (Louw et al., 2004).



Figure 4. Lage Weide in Utrecht

After the Second World War, new neighbourhoods were built and the business parks became places in the city, instead of at the border of the city. Nowadays they have lost their functions or there is a high degree of vacancy because of the low car accessibility. The low car accessibility is a consequence of the fact that the areas were planned for ship and train access. A small number of business parks became successful because of urban regeneration. These regenerated business parks became multi-functional and combined living, working and shopping. An example is 'De Laakhaven' in Den Haag.

Between 1950 and 1980 the third generation business parks was developed. After the war, new places for the fast production of goods had to be created. These new business parks were created along exit roads from the city to the new created neighbourhoods (vinox neighbourhoods). This way business parks became suitable for multimodal freight transport, next to the connection to harbours and train tracks. This was possible because

of the large scale introduction of high roads in the Netherlands. The connection to the exit roads increased the accessibility for employees from the city or the vinox neighbourhoods as well. Examples of these business park are Amstel in Amsterdam, Spaanse polder in Rotterdam and Lage Weide in Utrecht (Figure 4), which were created in the fifties and sixties. In the seventies and eighties the borders of the cities were all filled, so new business parks had to be created at locations along high ways in suburban cities. Cities like Purmerend, Nieuwegein, Houten and Zoetermeer are examples of this. Since the eighties, transport by ship and train decreased and the railways are now used for the transport of passengers or have disappeared. Most of the harbours lost their function as well and were filled up to create place for new businesses (Louw et al., 2004).

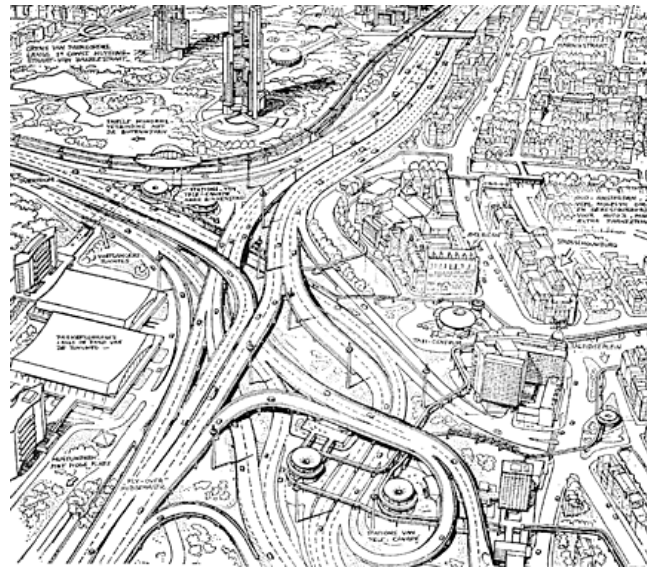


Figure 5. Vision for Amsterdam

The business parks have always been built at the fringe of the city. This is partly due to the fact that industries are very polluting and noisy and the fact that the mobility of employees kept on growing. This tendency is strengthened by the creation of a new urbanism concept, the functional city. The functional city is part of the CIAM movement. Their main idea is the separation of functions. Living, working, traffic and recreation should be spatially separated.

This resulted into mono-functional business parks. The separation would lead to an urban environment in which inhabitants could fully develop themselves. These polluting industries should not be part of such an inspiring place. The explosive growth of car traffic made it possible to extend the distance between these different functions and made it feasible to invest in more highways. Influenced by the CIAM movement, the new focus on mobility made it possible to create large highways which open up the congested historic centres (Somer, 2007). In Amsterdam a ring road was planned along the Jordaan, Nieuwmarkt, Oosterlijke Eilanden, Weesperbuurt and the Pijp to increase the mobility, but this proposal found a lot of protest and was rejected in the end (gemeente Amsterdam, 1968) (Figure 5). Similar things happened in other Dutch cities. The most famous followers of this movement were Le Corbusier in France and Swiss and in the Netherlands Cornelis van Eesteren. Typical examples of this movement are De Westelijke Tuinsteden in Amsterdam and the Deppenbroek neighbourhood, north of the Grolsch complex in Enschede. For the business parks this concept meant that the parks were situated even further out of the constantly growing city (Louw et al., 2004).

• The complex city

The fourth generation of business parks begins roughly around 1980. At this time the borders of the city and the suburban areas were all filled up and a new concept was introduced; the corridor. This meant that new business parks were located between economic centres to become an economic corridor. Another difference with previous business parks is the change in focus from large polluting factories to office buildings. This change is fostered by two economic changes. The first one is the fact that production industries have moved to countries with lower wages, Asia or East Europe for example, and that the Netherlands are trying to attract knowledge industries. The business park that are focussed on knowledge intensive businesses are often called science parks or brain ports. The second change is the deindustrialisation of the Netherlands which was succeeded by the rise of the service sector. This changed the scale of the business parks. The business parks became smaller and so did the buildings (DTZ Zadelhoff Research, 2004).

Although the businesses are not polluting, big and noisy anymore, they are still located on mono-functional, green fields outside the city. This is a.o. based on the old concepts of the functional and the garden city, which are described before.

Mono-functional business parks are a disadvantage in current knowledge economy because they hamper the creation of knowledge and the stimulation of innovation. A healthy mix of specialisations and diversity contributes to a faster and more innovative production of knowledge. Innovation occurs through new combinations of knowledge, skills and resources. There should be an appropriate differentiation in groups, in terms of capacity, specialization and functions to create new combinations. When all firms are similar, no new combinations can be made, so no new knowledge can be created. The broader and more diverse the knowledge bases, the larger the scope for innovation (Yigitcanlar, Metaxiotis and Carrillo, 2012). Business parks can become multi-functional by combining working, shopping, education and living. This could be done on the scale of the business park, but on the scale of the building as well. Although it could still be a problem to mix working with living functions because of safety and noise issues. Mixing working with other functions is usually easier. Offices create a chance to make business parks more dense because they are easier to combine on multiple floors, such was not the fact with heavy industries.

Besides the aim to make business parks more multi-functional, urbanists nowadays focus on more than only the hard requirements of business parks itself. Soft requirements are of growing importance. Hard requirements are based on the location theory, and consist of requirements like good infrastructure, the right sort and affordable office space, the right regulations and availability of skilled labour force. The soft conditions concern requirements like sufficient amenities, quality of life, urban atmosphere, housing market situations, level of tolerance, openness and diversity of population (Musterd & Murie, 2010). Most mono-functional business and science parks do meet the hard conditions as mentioned above, but the soft conditions however are not available on locations like this. Richard Florida focuses on the presence of soft requirements in his book 'The Rise of the Creative Class'. He states that the creative class is evident for the growth of the economy. The creative class is defined as innovative and creative people who draw on complex bodies of knowledge to solve specific problems and to produce commercial products and consumer goods. These talented people do not simply select a place to work based on the highest salary, they are typically concerned with a whole series of place-based characteristics (Florida, 2000: 6). Talented people are attracted by places where they can enjoy life (Castells, 1996).

This wider perspective on business parks can be interpreted as influenced by the new ideas of the complex city. This concept approaches the city as a complex system, a system based on many interacting parts. If adjustments are made in one part, it will influence and change other parts of the system and the system as a whole. Following this concept it can be stated that it is difficult or even impossible to predict the future of the system and therefore the future of the city (Batty, 2005). This explains the appearance of complicated models, simulations and even 'urban gaming' to find

solutions for complex problems. This new method can be applied to the relationships between economy, culture and urban form as well. Both economy and culture are constantly changing phenomena to which the urban area has to be adjusted, but which are complex to predict and to design for. By adopting new complex methods like models and simulations it becomes easier to get a grip on these changing phenomena and to create the urban area according to this.

• Current problems

Urbanists have always been searching for new ways to adapt places for business to the new and ever changing economic circumstances and the opinion of those days. Nowadays our business parks should be adjusted to the knowledge economy. This means that business parks should be transformed to so called science parks and brain ports. In these parks, the focus should be more on the creation of knowledge and innovation. This can be done by creating soft as well as hard requirements and multi-functionality, as described before. Interaction fosters the knowledge creation as well. It is getting more clear that the current business parks should be changed and it slowly becomes clear what qualities are lacking at this moment. This is very important because the knowledge economy has reinforced the role of the city. The diffusion of new knowledge and technology is faster in urban areas, thanks to the density and physical concentration of large numbers of knowledge workers, knowledge-based firms and rich ecologies of face-to-face contacts (Storper & Venables 2004). For the creation of new knowledge and innovation, local buzz is needed. Local buzz is 'the learning process that is taking place among actors embedded in a community by just being there' (Bathelt, Malmberg and Maskell, 2004: 31). Local buzz was first identified by Marshall (1957); he described industrial atmosphere. This was something 'in the air' which stimulated the economy and was only present in a certain area. Local buzz is something that has to arise by itself and cannot be moved or copied. It is however possible to facilitate local buzz with certain spatial interventions. Besides the local buzz there should also be a network with people and firms outside the cluster. These connections are called global pipelines. Global pipelines are defined by Bathelt, Malmberg and Maskell as 'channels of communication with providers outside the local milieu' (2004: 31). To create these global pipelines, events should be organized. These facilitate the face-to-face contacts with people outside the local cluster and create a place to network. 'Face-to-face interaction is widely held to be a necessary condition for establishing trustful relations and communicating sensitive, not well-established knowledge and information' (Bathelt, Malmberg and Maskell, 2004: 4). So, face-to-face contacts are at the base of a good virtual and long-distance connection. In the knowledge economy, temporary activities are growing in importance, with new, mobile ways of working and an increased domination of project work with changing partners.

It is urgent that business parks become up to date,

because otherwise the Netherlands will lose the global economic competition. Urbanists are already aware of the fact that no mono-functional green fields should be built as a place for business, but now they are searching for new concepts to create or regenerate science parks.

In my project I am searching for a way to design an up to date business park which will be an inspiring and innovative science park. I focus on the differences between nerds and bohemians in terms of needs for their work environment and the sort of interaction that is needed between those groups. Therefore I choose to design a new science park at the Technopolis in Delft and an interaction environment as a connection between the nerds and bohemians in order to create a place for meetings. The design could function as a precedent for other science parks, but urban designs should always be adjusted to specific locations and cases.

We can conclude that the business park should become more diverse, more attractive and have more chances for interaction. If we look at history, it can be stated that business parks should go back to the concept of the market place, where all kinds of people meet each other to exchange their skills and knowledge.

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• Figures

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Figure 2. Concept of the garden city

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Figure 3. Neighbourhood in the garden city

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Figure 4. Lage Weide in Utrecht

<http://www.aerophotostock.com/media/44dbd352-d88d-11e3-a151-329e81129ea7-utrecht-nederland-3-mei-2014-bedrijventerrein-lage-weide-op>

Figure 5. Vision for Amsterdam

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