CHALMERS
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Property Developers' Engagement in Adapting Urban Waterfronts to the Changing Climate

In Gothenburg and Dordrecht

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CAROLINE LINNEA MARGARETHA NILSSON

In collaboration with Stadsbyggnadskontoret Göteborg
and Delft University of Technology

Tutor and examiner Chalmers: Ulrika Palme
Tutors TU Delft: Tom Daamen and Frans van de Ven

Mentor Stadsbyggnadskontoret: Ulf Moback

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Department of Energy and Environment
Chalmers University of Technology
SE-414 54 Gothenburg
Sweden
+46 7 62 69 66 06

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ABSTRACT

The climate is changing and the rising temperatures are causing the polar ice to melt, combined with more and intense rain low-lying waterfronts are becoming vulnerable for flooding. Two urban waterfronts have been selected for the study: Frihamnen in Gothenburg and Stadswerven in Dordrecht. The two waterfronts have to be adapted to be able to cope with the risk of flooding. This research **investigates how property developers are engaged in the adaptation of the waterfronts and what features influences their behavior**.

The engagement of the property developers depends on several features, which can be divided into internal and external features. The internal features influencing the behavior of the property developers are their **business model** and the **partnership agreement** they have with the urban planners from the municipality. The external features consist of five conditions:

- The conditions set by the **urban planners,** through the master and zoning plan, the building permits and as an owner of the land they can influence the property developers' behavior.
- The **economic conditions** in a city and country, influences the housing demand and prices, which have an impact on the development decisions of the property developers.
- The housing demand and prices are also influenced by the public flood risk awareness. which are the **social conditions**.
- The laws, regulations and interest of the national and regional government are steering and controlling the actions of the urban planners and therefore indirectly influencing the behavior of the property developers, which are the **institutional conditions**.
- Finally are the **physical conditions** influencing the adaptations and the nature of the adaptations that are needed.

From the case studies three main features that influences the property developers in Gothenburg and Dordrecht to adapt the developments were identified: the **business model**, long term property developers have more incentives to adapt the developments to avoid damages. The **partnership agreement** the property developers have with the urban planners from the municipality, if they are given too much freedom, they will use this to make the most profit. Which does not always lead to the development of adapted buildings. The **economic conditions**: the housing demand and prices are influencing the adaptation investments property developers can afford and are willing to take. An understanding of the features and how they influence the behavior of the property developers, will contribute in the development of resilient waterfronts.

Urban waterfronts, flood risk, adaptation, property developers & comparative case study

This thesis is the graduation report for my master Management in the Built Environment, at the Faculty of Architecture at Delft University of Technology and the graduation report for my exchange at the Department of Energy and Environment at Chalmers University of Technology.

The previous year has been an incredible journey, which has brought me in contact with various actors from the private and public sector both in Sweden and the Netherlands, challenged me in understanding and applying lessons learned and given me the opportunity to study the impacts of the changing climate and the urbanization of two European waterfronts.

A special thank you to Ulf Moback, from the City Planning Office at Gothenburg, who has been a enormous support and the expert throughout my study. Ulrika Palme from Chalmers, the University of Technology in Gothenburg, thank you for your weekly guidance and positive feedback. Furthermore I would like to thank Tom Daamen and Frans van de Ven from Delft, University of Technology, for challenging me in improving and taking this research one step further.

Finally I would like to thank my parents and sister, for being supporting and loving during my studies and this research and given me the strength I sometimes needed to carry on.

I hope you will enjoy the report as much as I have enjoyed creating it.

Caroline Nilsson

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LIST OF DEFINITIONS

Adaptation	The aim of adaptation is to cope with the negative impacts of the changing climate (Andersson-Sköld et al, 2015).
Consortiums	A group made up of two or more individuals, companies or governments that work together toward achieving a chosen objective.
Engagement	Refers to the commitment of individuals in a process /project.
Economic conditions	Refers to insurances, market demand, lending and litigation (Shearer et al. 2013).
Institutional conditions	Refers to regulation, policies and industry structure of the national, regional and local governments (Shearer et al. 2013).
Mitigation	The aim of mitigation is to reduce climate changes (Andersson-Sköld et al, 2015)
Resilience	*'Resilience means the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of the hazard in a timely and efficient manner'* (UNISDR, 2012, p. 92).
Physical conditions	Refers to the geographical location and the biophysical process. For example the soil, flood risk and precipitation for a specific location.
Planning institution	By planning institution are meant the public actors, who are responsible for making the master and zoning plan and ground exploitation.
Property developers	The property developers refers to the private actors that are developing the buildings in the waterfronts. Two different kind of developers can be identified: developers and end-owners or developers who sells the building after realization.
Social conditions	The social conditions refers to the citizens demand and preferences regarding housing.
Urban waterfront	*By urban waterfront is meant the water's edge in cities and towns of all sizes. The water may be a river, lake, ocean, bay, creek or canal' (Sairinen, 2006, p. 121).*

ENGLISH | SWEDISH | DUTCH TERMS

English	Swedish	Dutch
Master plan	Översiktsplan	Master plan
Zoning plan	Detalj plan	Bestemmingsplan
Developer	Byggherre	Ontwikkelaar
Building permit	Bygglov	Bouwvergunning
Spatial planning	Fysisk planering	Ruimtelijke ordening
Planning institutions	Planerings institutioner	Planning instellingen
älvstranden development	älvstranden utveckling	-
City planning office	Stadsbyggnadskontoret	-
Real estate office	Fastighetskontoret	-
Traffic office	Trafikkontoret	-
Water and Sanitation	Kretslopp och Vatten	-
County Administration Board	Länsstyrelsen	-
Sewage tariff	VA-taxan	-
Development combination the Werven	-	OCW: Ontwikkelingscombinatie de Werven
Waterboards	-	Waterschappen
Waterboard tax	-	Waterschap belasting
Rijkswaterstaat	-	Rijkswaterstaat
Provincial government	-	Provinciale overheid

(Image: Wchuckster, 2012)

1. INTRODUCTION

We are living in a globalized and dynamic world where the population is growing rapidly, developments in cities are increasing and the climate changes can no longer be ignored. This research project investigates the adaptation of two European waterfronts: Gothenburg and Dordrecht to the changing climate. This research project was conducted at the City Planning Office in Gothenburg, as a student from the Technical Universities Delft and Chalmers.

1.1 Background

1.1.1 Urbanization

Fifty years ago 2.5 billion people lived on earth, nowadays the population has reached 7 billion and in 2100 it is expected to reach 10.8 billion (United Nations, 2012). The growth of the population is a fact and the impacts of this growth are becoming more and more visible. Cities are growing as well as the number of cities, which is a so-called double urbanization (Nijkamp & Kourtit, 2013). Urbanization is stimulated by the benefits cities have of being the drivers of an accelerated economic growth (World Bank, 2009). Due to the economies of agglomeration, the productivity level in cities is high and this is important for the position of cities in a globalized world. Therefore cities can be seen as a cradle of new and innovative industries, which makes them an attractive place to live (Kourtit et al.,2013).

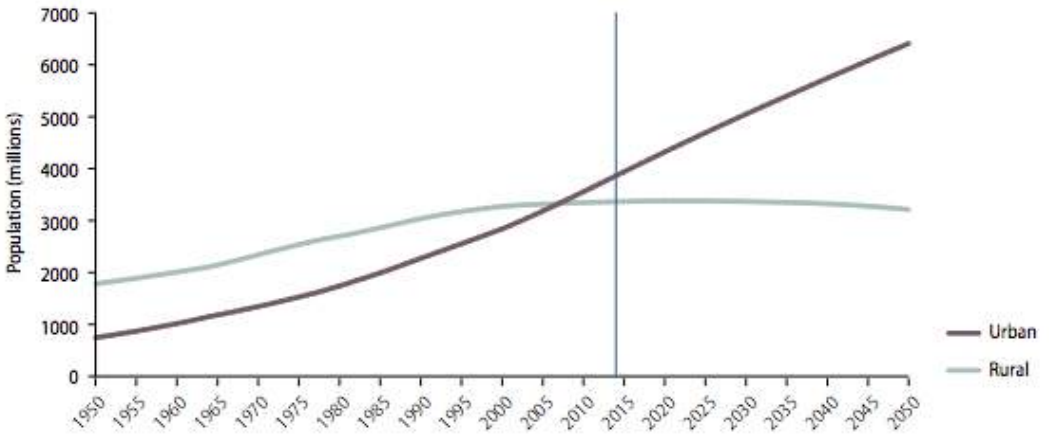

Figure 1: Urban and rural population of the world, 1950–2050 (United Nations, 2014).

According to the United Nations, 20 percent of worlds population lived in cities in 1900, in 2010 this was 50 percent and in 2050 this will be 70 percent (United Nations, 2012). In figure 1 the growth of the urban and rural populations is illustrated. The growth of the urban population will mainly occur in coastal areas and in 2025 74 percent of the urban population will live in coastal areas compared to 65 percent in 2000 (Habitat, 2011).

1.1.2 Climate change

An increased amount of CO2 and other greenhouse gases in the atmosphere is changing the climate. According to United Nations the temperature will rise with 2,7 degrees Celsius until 2100 (United Nations, 2015). In figure 2, the changes in global surface temperatures are shown from 1880 to 2014. These rising temperatures are causing the polar ice to melt, which is accelerating the sea-level rise (Habitat, 2011). The sea level rise is caused by two factors related to global warming: the added water from melting land ice and the expansion of sea water as it warms (NASA, 2015). According to IPCC fifth assessment report, the global sea level is expected to rise with 0.6 meter by 2100 (IPCC, 2014a). There are estimations, that in extreme cases the sea level could rise with 2.0 meters by 2100, dependent on the amount of Glacier ice that melts (Pfeffer, 2008). The sea-level rise is threatening low-lying coastal cities, with inundation and flooding as well as pollution of drinking water supplies due to saltwater intrusion and a reduction of livable land areas. Compounded with more and intense storms such as hurricanes, cyclones and rainstorms, low-lying coastal areas are becoming vulnerable for flooding (Habitat, 2011). When more than a quarter of mankind is living in these low-lying coastal areas new challenges for the development of these urban waterfronts will emerge (Rahman & Rahman, 2014).

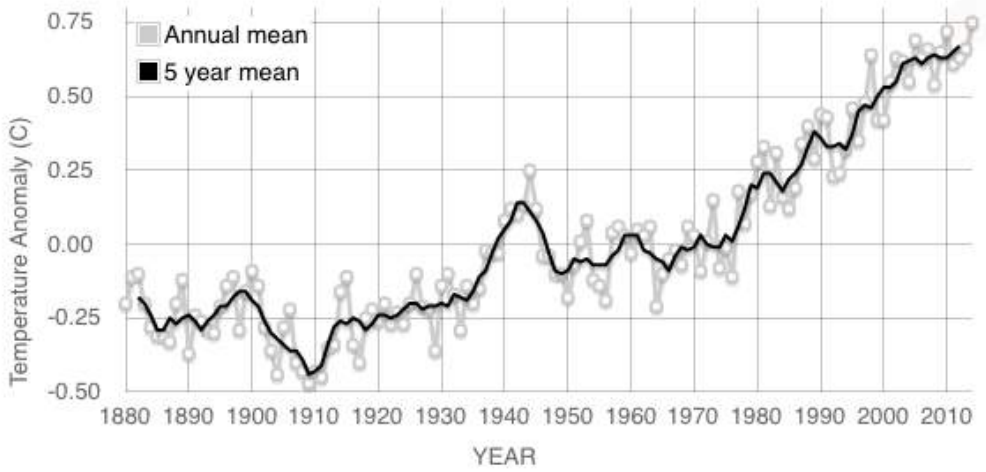

Figure 2: The change in global surface temperature from 1880 to 2014 (NASA's Goddard Institute for Space Studies (GISS), 2014)

1.1.3 Transformation of urban waterfronts

The desire to live near water can be traced back to mankind's earliest settlements, which gradually developed into fishing villages and then into the port of a city. Nowadays, the urban waterfronts are being transformed into public spaces with multiple uses: commercial activities, housing, tourism and recreation (Huang & Kao, 2014). According to Frantzeskaki et al. (2014), the transformation of urban waterfronts, to expand port- and/or coastal cities is encouraged by the desire of people to live near the water and the demand for space to house the growing population. The transformation of old harbors entails opportunities and challenges, due to the cultural (historic and symbolic), ecological and economic values these areas posses. These complexities leads to multiple ends and means for the transformation of waterfronts. *'Waterfront transformations have to deal with institutional complexity such as conflicting regulations, non- existing planning laws, required planning and land-use policy changes, environmental restoration complexities and conflicting visions of the restored area between local authorities, citizen and businesses'* (Frantzeskaki, et al., 2014, p. 406).

Therefore the transformation of urban waterfronts is a complex process and with the changing climate, these areas are becoming more vulnerable to flooding, which makes the process and the development of the urban waterfronts even more complex. To reduce the climate related risks, cities and especially urban waterfronts are forced to mitigate and adapt. In figure 3 the effects of the urbanization and the climate changes on waterfronts is illustrated. As the figure shows, two contrasting forces are effecting the transformation of waterfronts.

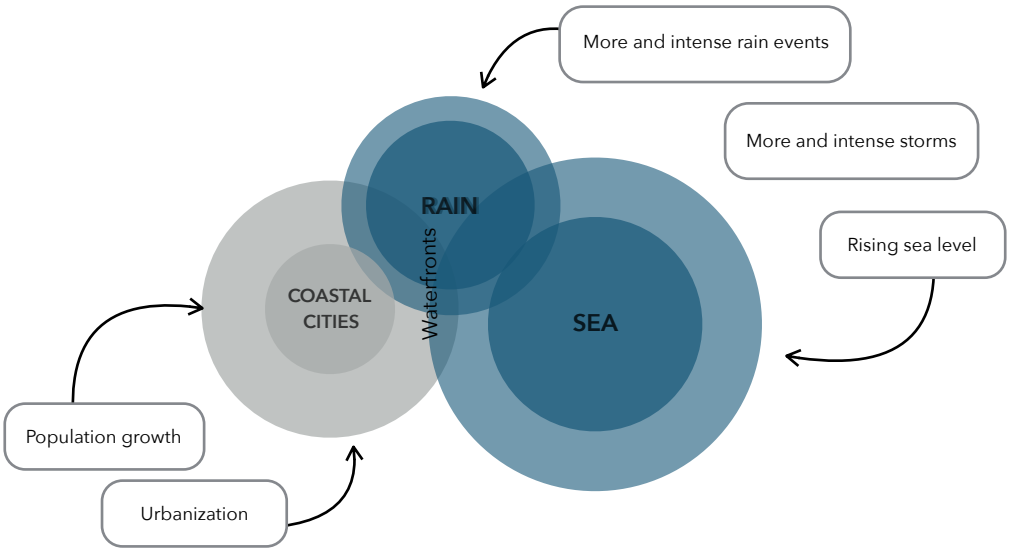

Figure 3: Global trends and climate changes (own ill.).

1.1.4 Mitigation and adaptation

Mitigation strategies have already been implemented on international, national, regional and local levels, which includes technical and infrastructural investments, renewable energy and improved energy efficiency. However it is difficult to predict and avoided the negative impacts of the changing climate through mitigation (Laukkonen, et al., 2009). Therefore adaptation strategies are needed and the aim of adaptation is to reduce the vulnerability of an area by minimizing direct and indirect impacts of the climate (O'Brien, 2012). Adaptations are long-term strategies, which are implemented on a local level, they focusses on managing and coping with the rising sea levels and increased precipitation in waterfronts. While mitigation is more visible on a global or national level, with the implementation of regulations by authorities such as the global GHG emissions regulations (Laukkonen, et al., 2009).

Mitigation and adaptation activities are central to urban resilience strategies. *'Resilience means the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of the hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions'* (UNISDR, 2012, p. 92). Resilient cities are cities that can withstand a variety of shocks and stresses (Leichenko, 2011). Resilient buildings are in average less costly and time-consuming to restore (Lamond & Proverbs, 2009).

According to Rojas et al. (2013) private and public actors invest more in mitigation than in adaptation, and it differs by a ratio of 20:1. However if no investments in adaptations strategies are made, the cost caused by flood events in Europe are expected to increase to € 98 billion per year by the end of the 21st century, compared to € 52 billion in losses between 1998 and 2009 (Rojas, et al., 2013). Thus where extreme weather events become more intense and/or more frequent, the economic and social costs of those events will increase (IPCC, 2014a)

1.2 Problem definition

The trends of urbanization, climate change and transformation of urban waterfronts are globally visible. There are many coastal cities that face challenges with the developments of urban waterfronts and which can be studied, however my interest in this topic arose when I was in Gothenburg and did a small research project on how stakeholders are affected by the rising sea level and extreme rain. During this project I observed that the threats of flooding in Gothenburg is a relatively new topic and a challenge for Gothenburg as well as for Sweden. Therefore the transformation of the urban waterfronts in Gothenburg were my starting point. These developments are compared to a waterfront in the Netherlands.

1.2.1 Sweden

According to Granberg and Elander (2007, p. 538), is *'Sweden a pioneer in environmental governance'.* In 2007 Sweden published a report: Climate Change and Vulnerability Commission, which stimulated the development of adaptation policies and where the risks of the changing climate were identified. The responsibilities for the implementation of the national climate policy targets, lies at the municipalities, as part of the physical planning. This gives the municipality a lot of responsibility to manage the negative impacts of the changing climate, which is often a financial and organizational challenge for the municipalities.

Gothenburg on the west coast of Sweden is being confronted with extreme weather events, like increasing precipitation and rising sea levels. In 2011, Gothenburg flooded due to a high sea level and the large amount of rain: the water level was 146 cm above mean sea level and 52 mm of rain fell in 48 hours (Sörensen & Rana, 2013). Like many European cities, the urban population is increasing. To house this growing population in Gothenburg, areas along the river, Götaälv, are transformed into public spaces with multiple uses. Between 1990 and 2012 two areas: Eriksberg and Lindholmen were transformed into areas with commercial activities, housing and a campus for the university of Chalmers.

Frihamnen is the next area that will be transformed, it will house 1000 dwellings in 2021 and 15000 dwellings in 2040 (Göteborgs Stad Stadsbyggnadskontoret, 2014). Meanwhile the sea level is expected to rise 0,74 meter in 2100 and in extreme cases it could rise to 2,36 meter due to intense westerly or southwesterly winds in the coastal area of Gothenburg (Rullander, 2014). This is making Frihamnen very vulnerable to flooding, as it is located between 1.1 meter and 2.6 meter above the normal sea level (Sepehr, 2010). To enable Frihamnen to withstand the rising sea level and increased precipitation, mitigation and adaptation strategies will be implemented. As already mentioned, mitigation strategies are more visible on an international and national level and the aim is to avoid the negative impacts of a changing climate. In Frihamnen the impacts can not longer be avoided and therefore the focus will be on adapting the area to the changing climate. The municipality of Gothenburg is developing adaptation strategies for Frihamnen and herein the property developers have an important role, as they are the ones shaping the area through the design and construction of the buildings.

1.2.2 Public and private engagement in adaptation strategies

Adaptation strategies are regulated by central and local governments, through land use regulations, building inspections, critical infrastructure protections and emergency planning (Vogel & Henstra, 2015). According to Agrawala et al. (2011), the success of an adaptation depends heavily on the decisions made in the private sector. The private sector, consist of multiple stakeholders: property

developers, investors, builders, urban designers, architects, estate agents and end-users (Franzen et al., 2011). However the involvement of private actors in climate adaptation strategies is not always that obvious, if they are not directly affected by the changing climate they will not feel the responsibility to adapt (Becker et al., 2014). According to research by Klein and Juhola (2014), adaptation is not the first priority of Swedish stakeholders. On flood prone areas, developments were allowed, because it would improve the local economy. Furthermore little research has focused on the involvement of the private sector and how they adapt the buildings to the rising sea levels in Sweden. This is a problem, because property owners and developers have the responsibility to secure their buildings to the rising sea level (André, 2013).

1.2.3 The Netherlands

The Netherlands is often referred to as the specialist in water management. With 60 % of the country lying below sea level and 70 % of the gross national product being earned in these flood-prone area. Flooding has been a threat to the Netherlands for centuries and has resulted in an old Dutch water management tradition where waterways, earthworks and water barriers have been constructed to protect the Netherlands from water disasters. Some examples are: polders, canals, dikes, dams, locks, windmills and sluices (Stead & Taşan-Kok, 2013). The waterboards are responsible for the flood risk management and freshwater supplies in the Netherlands and this has lead to few private actors (and other public actors) being aware of the problems caused by rising sea levels and increased precipitation (Lu & Stead, 2013).

The waterfront developments in Dordrecht are selected* for the case study in the Netherlands. The urban waterfront: Stadswerven is transformed into residential, commercial, cultural and public functions. Due to its location outside the dikes it is vulnerable to flooding (Van Herk et al., 2011). Because it is not protected by the dikes, the waterfront transformation will provide the municipality and the private property developers with new challenges on how to deal with the rising sea level in the development.

1.2.4 Problem statement

In IPCC fifth assessment report (2014a, p. 877) is stated that there is '*little academic literature that provides information on the implementation of adaptation plans, in contrast with the large accumulation of literature that discusses concepts, strategies, and plans of adaptation*'.

In Gothenburg and Dordrecht the municipalities are developing adaptation strategies for the urban waterfronts, however in how far and why the property developers are involved in the adaptation process and implementation is unclear.

*See appendix A for selection.

1.3 Research goal

1.3.1 Engagement of property developers

In Gothenburg and Dordrecht, the municipalities are developing adaptation strategies to manage the changing climate. The selected property developers for the transformation of Frihamnen and Stadswerven are involved in the adaptation process, through a development consortium. In the consortiums the adaptation measures are discussed and defined. Therefore the property developers are in theory involved in the adaptation of the urban waterfronts, but property developers are mainly driven by profit-making objectives (Haque & Asami, 2014), they buy land, which they develop and then sell to a purchaser. (Congreve, 2012) This makes them short term oriented, while adaptation strategies are long term oriented, with the aim of managing an increasing occurring problem: floods. **Hence, the aim is to investigate the level of engagement of the property developers in the adaptation of the urban waterfronts and what influences their engagement.**

1.3.2 Resilient waterfronts

Urban waterfronts have to adapt to the changing climate and property developers have a key role in implementing the selected adaptation measures and are therefore important in the development of resilient urban waterfronts. Sweden as a pioneer in environmental governance and the Netherlands as a specialist in water management have been selected for the comparison. The similarities and differences can provide both countries with new insights on waterfront developments and the role of property developers in the adaptation of flood-prone urban waterfronts.

1.3.3 Readers guide

This report is structured as follows: the background and the reasons for the research project have been presented in this chapter. In chapter 2, the theoretical background is presented and the key concepts are combined into a theoretical framework. Next the research design and methodology are presented in chapter 3, followed by the two case studies including the findings, Frihamnen in Gothenburg and Stadswerven in Dordrecht, in chapter 4 and 5. The comparison of the two waterfronts is presented in chapter 6. In chapter 7, the theory and findings are reflected upon and discussed. Conclusion and recommendations for Gothenburg and Dordrecht are given, in chapter 8. Finally a personal reflection on the process is given in the last chapter.

(Image: own photo, September 2014)

2. ADAPTING WATERFRONT DEVELOPMENTS

There is an abundance of literature on urban waterfront developments, urban planning, climate related adaptation strategies and the implementation of adaptations. In this chapter the key findings related to the adaptation of waterfronts are presented. The findings are used to create a theoretical framework, which forms the bases for the case studies. The used research engines are: sciencedirect.com and scholar.google.com.

2.1 Growth of cities

2.1.1 Cities

The economic benefits in cities, encourages business and people to move to cities and to be able to house this growth old harbors and industry areas are transformed into urban waterfronts with multiple uses; commercial activities, housing, tourism and recreation (Huang & Kao, 2014). Through the urbanization the amount of intact ecologically land is reduced, as well as changed (IPCC, 2014a). According to Matthews et al., (2015) around 67% of the land in cities is made of hard surfaces and only 16% are green areas. While the green surfaces have multiple benefits for the residents health and wellbeing, as well as it holds solutions for the climate changes: more green space can reduce the storm water run-off in cities.

According to Wamsler & Brink (2013) the physical features of a city can be regarded as the 'urban fabric,' which is connected to four features. The first feature is the urban ecosystem in a city which is characterized by precipitation, wind, temperature, air quality, humidity, radiation, soil, water bodies, flora and fauna. The second feature is the urban society and culture, which refers to the social cohesion, social inequality, public participation, values and the diversity of people in a city. The third feature is the urban economy, which relates to agriculture vs. non-agricultural incomes, subsistence vs. money economy, urban livelihood practices and resource availability in a city. The fourth feature is the urban governance, which is characterized by public expectations, the public reliance on institutions and social security systems in a city. In figure 4 the four features are illustrated.

According to Wamsler & Brink (2013) the physical features, the 'urban fabric', has to be linked to the risk factors. The physical features of a city influences the characteristics and the occurrence of hazards and has an impact on the urban climate in cities. As well as the physical features can create new hazards, like landslides and high emissions, which leads to rising sea levels and increased precipitation. To be able to house the growing population in cities, the 'urban fabric' is expanding onto hazard prone areas, which can be more vulnerable to flooding. Secondly the vulnerability is location specific, which can be enhanced and reduced by the physical features in cities. Inhabitants, buildings, services, infrastructure, economic and political centers are concentrated in a city, making cities more vulnerable for the impacts of a hazard, than rural areas. The physical features in cities can also destroy an existing natural hazard protection, like a flood wall or floodplains. Thirdly and fourthly the urban fabric can also have a negative impact on the response and recovery mechanisms of a city, due to the many people in a city, lack space to shelter the affected people and difficulties to access and transport the affected people in a densely built environment. The vulnerability of a city is therefore related to the physical features in a city, which is shaped by the cities urban planners and developers.

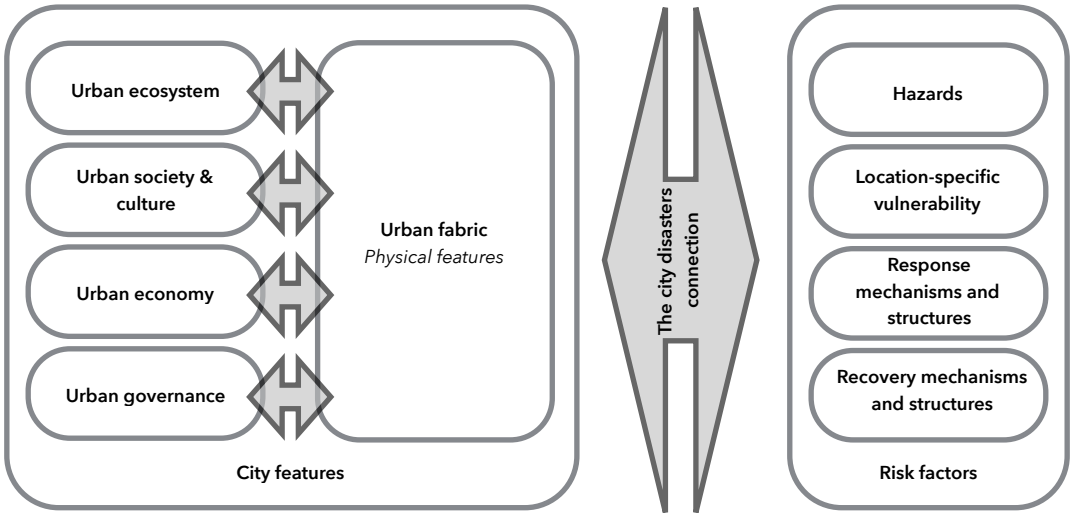

Figure 4: Connection between the urban fabric and risk factors (Wamsler & Brink, 2013).

2.1.2 Waterfronts

The first civilization settled near the water, due to the benefits the locations have for transportation, drinking and cleaning water. (Jiang et al., 2001). Now these old economic centers near the water are growing due to several economic reasons. First companies can benefit from clustering their production and business, due to the efficiency in the production process. Second, economic developed areas have high employment opportunities which attracts households. Third, coastal zones provide households with environmental facilities, which they value; like the view of the sea and the activities in, on and near the water. Thus the economic benefits of coastal cities are promoting the development of flood-prone areas. According to Filatova et al., (2011) inhabitants who are not aware of the risks of flooding are encouraging the growth of flood-prone areas. The expansion of coastal cities onto flood-prone waterfronts faces challenges with the changing climate, in the next chapter the negative impacts of the changing climate are presented.

2.2 Climate changes

2.2.1 Effects of climate changes

The changing climate entail positive and negative outcomes. Some negative impacts of the rising temperatures and increased precipitation are the risks of flooding and landslides. Related to the rising temperatures, an increased risk for droughts, the spreading of diseases and the deterioration of water quality arises. Some positive outcomes of the changing climate in Sweden are: a growth of the forest, a potential increase of hydropower, a possible 30 precent reduction of energy for heating and an increased growing season (Holgersson, 2007). However in this research project, the focus is on the transformation of two European urban waterfronts and therefore the negative impacts of the changing climate related to these locations are further presented.

2.2.2 Floods

Some negative impacts of the changing climate in urban waterfronts are the rising sea levels, more and intense storms and an increased amount of precipitation which can lead to coastal and river floods. This affects the population, properties, vegetation and the ecosystem in low-lying waterfronts. According to the IPCC fifth assessment report, different types of floods can occur depending on the geographic location (IPCC. 2014a):

- Coastal floods: caused by a low air pressure which pushes the ocean water onto the land and by sea waves for example tsunami's, which can be created by earthquakes or volcanoes in the ocean. The water level in oceans is dropping and rising with the tide, which cause a coastal flooding, when there is a high tide.
- River floods: flooding along a river occurs when the season changes. In spring the winter snow is melting causing the rivers to overflow, due to the quick fill of river basins and a slower run-off.
- Flash floods: in areas with steep slopes, the collected rain water flows 'too quickly' downhill, causing the water level in river beds to raise.
- Urban floods: in cities where most of the ground is paved, rainfall can not be absorbed into the ground resulting in a water run-off on the streets. According to Irannezhad (2009) a main reason for urban floods is a lack of drainage systems in cities, which effects many people and properties due to the high building density in cities. Urbanization increases the amount of unpaved areas in cities, and the sewage systems are becoming overloaded. A solution could be an open water system, where the rain water can be absorbed and slowed down before it reaches the sewage system. More solutions for urban floods are presented in the next chapter.

2.2.3 Effects of flooding

According to Nelson (2007) the effects of flooding can be primary, secondary and tertiary:

- Primary hazards are directly connected to a flood event: humans can die, large objects (rocks, cars, houses) can be damaged or moved, the water can affect the eroded amount of soil, which destabilizes bridges and building foundations, human built structures like furnitures can be damaged by the water, crops, livestocks, pets can be damaged or die and floods can carry garbages, debris and toxic pollutions, which can cause secondary effects.
- Secondary effects are occurring due to the primary effects: the drinking water can get polluted which can cause diseases and health hazards, power plants and gas stations can be damaged and the transportation system can be disrupted.
- Tertiary effects, are long term effects: rivers can be changed, new canals can be developed, agriculture productivity can be affected, jobs can be lost as well as some jobs can be created, insurance rates can be increased and wildlife and habitats can be destroyed.

2.2.4 Risks of climate changes

According to Shearer et al. (2013) the changing climate provides property developers with challenges and opportunities. These challenges and opportunities can arise directly from the physical changes in the climate or indirectly through regulations and social responses to climate change. The property development sector is a very heterogeneous and complex market. Therefore the risks and opportunities of the changing climate will vary from location, the nature of the development, finance and insurance arrangements and the specific characteristics of the company undertaking the development.

Four risks the property developers can be exposed to, due to the changing climate were identified in a research by Shearer et al., (2013): These risks are also illustrated in figure 5.

- Physical risks: Risks related to floods, storms and cyclones.
- Economic risks: Risks related to insurances, market demand, lending and litigation.
- Institutional risks: Risks related to regulations, policies and the industry structure. The institutional risks were identified as the most challenging for private property developers, due to the impact a changed approval time of the plans, government charges and regulatory frameworks would have on the developments of the property developers.
- Social risks: Risks related to marketing, green demand and their reputation.

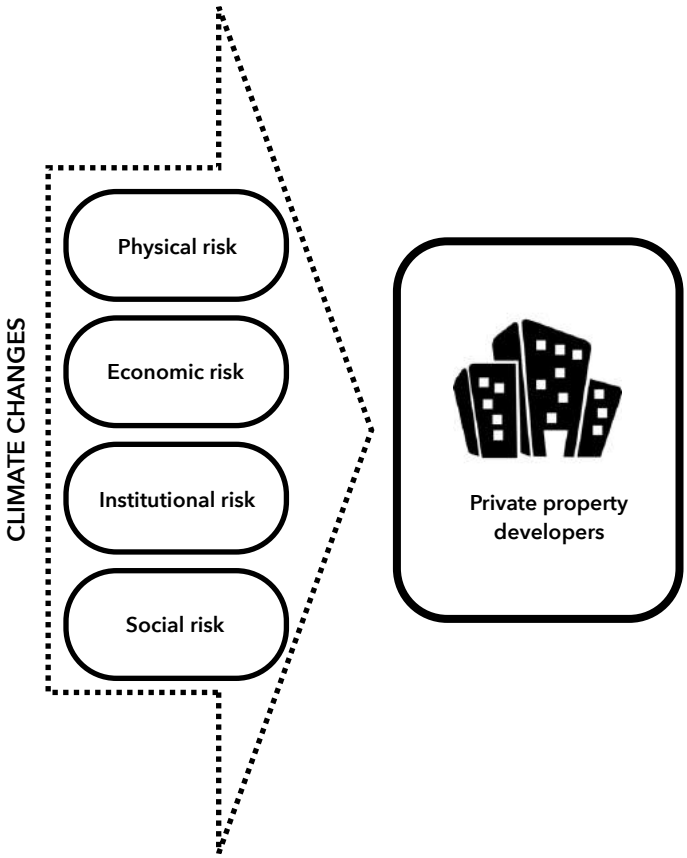

Figure 5: Risks for private property developers related to the changing climate (Shearer et al., 2013).

2.3 Resilience

2.3.1 Resilience

The more resilient a system, the larger the stress it can absorb without shifting into an alternate system or collapsing (Weichselgartner & Kelman, 2014). Mitigation and adaptation activities are central to urban resilience strategies. According to Flood and Schechtman (2014) resilience of a community to bounce back after a coastal storm can be strengthen by hard infrastructure defenses, like dikes, but this hard infrastructures can also have a negative impact on the ecological resilience, because it disrupts nature.

A resilient harbor, is according to Becker et al. (2014), a public good, because a public good is non-excludable and non-rivalrous, which means that one individual cannot be effectively excluded from the benefits of a resilient harbor or reduce the benefits for someone else. In chapter 2.5 the adaptation of public and private good will be further discussed.

2.3.2 Grey, green and blue measures

Resilience to extreme weather events like floods can be improved by implementing grey adaptation measures or green and blue adaptation measures. Grey measures are mono-functional interventions like underground drainpipes and pumping stations. These interventions are effective, but their capacity is limited. According to Voskamp and Van de Ven (2015) the urban resilience can be improved by green and blue adaptation measures. These measures make use of natural processes, are self-adaptive and can produce co-benefits. The green and blue infrastructures are dependent of each other as the green infrastructure depends on the availability of water from the the blue infrastructure.

The implementation of blue-green measures is difficult when the location is heterogeneous and owned by multiple actors, which is often the case in cities. According to Voskamp and Van de Ven (2015) private actors are less willing to implement blue-green measures, because they would bear the costs for the development and implementation of measurements, while the municipalities would receive the benefits there from. The high density in cities is also making the implementation of blue-green measures difficult, because available land for those measurements are limited and of high value.

2.3.3 Mitigation vs adaptation

As already mentioned mitigation and adaptation activities are central in resilience strategies. In urban areas much focus has been on mitigation rather than on adaptation. Several mitigation strategies in cities can be recognized whereof one is the promotion of short distances between living, working and recreation within cities, which contributes to the reduction of CO2 emissions in cities. The benefits of mitigation are mainly visible on a global level and according to the IPCC fifth assessment report (2014a) the essence of mitigation for a sustainable development is generally known. As it reduces the magnitude of climate change though a reduction of GHG emissions.

However mitigation can have some negative impacts on the implementation of adaptation measures. For example, the concentration of buildings to reduce the distances and therefore reducing the GHG-gasses, is beneficial for mitigation but not for adaptation, when the high buildings density in cities makes it difficult to implement green and bleu infrastructures. According to Jabareen (2013) the many landowners and capital-intensive high rise buildings in cities can also make it difficult to implement adaptation plans, due to the different interests and opinions of the involved actors. In figure 6 the negative impacts of mitigation on adaptation are shown.

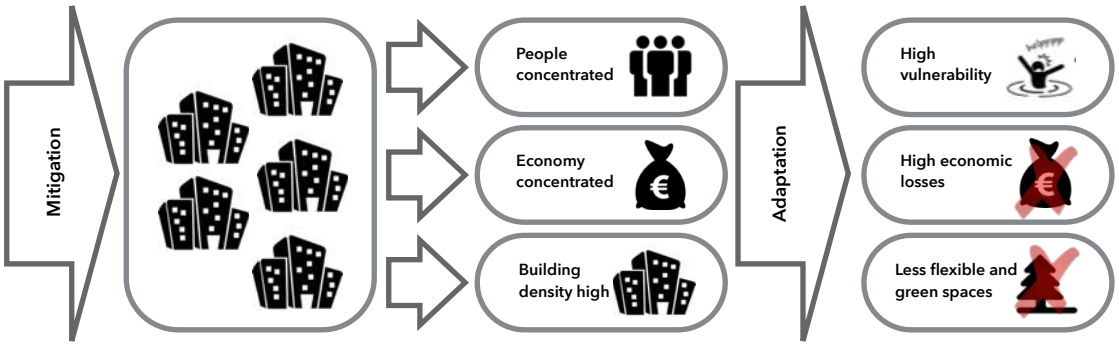

Figure 6: Negative impacts of mitigation on adaptation (own ill.)

2.3.4 Public and private partnerships

According to Harman et al. (2015), the collaboration between public, private and civil society actors has become more popular in the last decades. Partnerships have the ability to solve issues of funding large scale projects, sharing the risk of a development and provide the resources and skills that are needed for a project. On a regional level, partnerships have been formed to increase awareness, build capacity, coordinate policy and promote learning for urban responses to climate adaptation. However a challenge exists when translating the learned lessons and success of an adaptation and observe the cause and effect relation.

Vogel & Henstra, (2015) have developed several frameworks to observe the cause and effects of a partnership. These frameworks compare the:

- policy process: compares how a problem is conceptualized and brought to the attention of decisions-makers and how public authorities formulate, select and implement policy solutions.
- policy content: compares the actions and the means by which these are implemented
- policy quality: involves scoring and ranking policies based evaluative criteria, such as coherence and durability.
- policy change: compares new or amended policies to an earlier baseline. An evolution of policy goals and means over time.
- policy outcomes: focusses on the consequences of policy decisions to identify ineffective actions as well as promising strategies that might be replicated elsewhere.

For this project the last framework is the most applicable, for the comparison of the influences on the engagement of the property developers in Gothenburg and Dordrecht.

2.3.5 Partnership agreements

Three partnership agreements are mentioned by Franzen et al. (2011):

- The building right model: the private parties buy the land and build on the plots they get assigned by the municipality. Here the risk of developing the land is born entirely by the municipality.
- The joint venture model: the municipality and the market players are joined in a land development company, which develops the land. Here the land development risk is shared between the municipality and the market players.
- The concession model: the municipality gives the private parties the exclusive right to develop the land in a specific location. The role of the municipality is limited and they are only involved in drawing up the development requirements.

2.4 Urban planning

2.4.1 Urban and spatial planning

According to Hurlimann et al., (2014) urban planning can play an important role in reducing extreme flood events. By including adaptation plans in the urban planning, cities can be created that continues to exist with the changing climate and are able to withstand extreme weather events without jeopardizing the safety of its inhabitants.

According to Djordjeivc et al., (2011) the changing climate will influence the future spatial patterns, the growth and the developments taking place in cities. Therefore the changing climate has to be taken into account when making the spatial plans (Wamsler et al., 2013). According to Biesbroeck et al., (2009) this is difficult, because of the multiple challenges spatial planners are facing, like context-dependent environmental and socio-economic challenges, which requires scientific and political attention. Especially in developing countries where poverty, hunger and the availability of drink water resources has a priority. However, the extreme weather events, caused by the changing climate needs attention, and requires the creation of new and innovative frameworks. According to Biesbroek et al. (2009) spatial planning could provide this framework, to ensure that mitigation and especially adaptation measures are implemented at a local and regional level. However each region is unique and characterized by a combination of socio-economic and bio-geophysical processes, making it impossible to develop one spatial plan which can be used in all areas.

2.4.2 Trade-offs between mitigation and adaptation

According to Biesbroek et al., (2009) urban policy makers are realizing that a mix of short-term actions are needed to support the long-term mitigation and adaptation strategies. These strategies have to be mainstreamed into existing policies, to ensure a more efficient and effective use of financial and human resources, instead of formulating these strategies as separate climate policies. The increased mass media attention for the changing climate has influenced the perception of the society and ensured that mitigation and adaptation is placed higher on the political agenda.

Mitigation strategies can be easier monitored than adaptation strategies. Due to the fact that the GHG emission reduction in a country can be measured and compared to the targets of the Kyoto Protocol, to determine the effectiveness of the policies. With adaptations it is more complex to measure the success rate of an adaptation measure, because there are no predefined targets or quantified objectives. A second difference between mitigation and adaptation strategies are the different policy approaches. Mitigation strategies are top-down approaches and are assumed to be easier to implement, than the bottom-up approaches of adaptation strategies, due to the fact that bottom-up approaches involves multiple stakeholders with conflicting interests and opinions on the implementation of adaptive strategies.

2.4.3 Urban property development

The development of the land is often carried out by property developers, who buys land, carries out most or all of the construction work and then sells the building(s) to a purchaser. The development of properties is vulnerable to economic cycles of growth and recession, due to the fact that private capital is needed to make the investment (Congreve, 2012).

The development process, consists of four main phases, which are illustrated in figure 7. The first phase is the selection of a location and the purchase of land. The choice of a certain piece of land will be influenced by the zoning plan and the context of that area. The second phase includes the initial

design and formal approvals from the zoning planning and building regulations. When the approval for the design has been gained, the third phase, the construction phase starts. After this the fourth phase starts and the building is sold to a purchaser, who takes over the responsibility of the building (Congreve, 2012).

The fact that the property developers may not be the end owners of the buildings and that they are driven by profit-making objectives, can make them less interested in investing in measures that lowers maintenance costs and adaptation measures. According to Haque and Asami (2014) it would be more interesting for developers to invest in solutions that reduces the maintenance costs and adaptation measures if they would receive a higher price for a building that costs less to maintain and is adapted to the changing climate. However the housing prices are related to the demand and the demand is related to the awareness of the public. More on the flood risk awareness can be found in chapter 2.6.

Figure 7: Development phases of developers (own ill.).

2.5 Adaptations

2.5.1 Adaptations

Adaptations are long-term processes, which according to IPCC fifth assessment report (2014a), involves learning and adjusting to the changing climate in a continuos and flexible process. In low-lying waterfronts, the adaptations are aimed at reducing the vulnerability of present and future inhabitant by minimizing direct and indirect impacts of flooding. According to the Darwinian view, *'groups which does not have adequate methods of coping with environmental stress will not be able to compete for scarce resources and will fail to continue'* (Smit & Wandel, 2006 p. 283)

According to Birkmann et al. (2010) it is of great importance to adapt cities to the changing climate, because of the high concentration of population and infrastructure in cities, which have an important role in economic, political and social processes. In the Commission on Climate Change and Development report by Christoplos et al. (2009) is concluded that cities and city residents have received too little attention in the discussion of the changing climate and adaptation. Most of the adaptation actions have been in rural areas, while the urban areas have a growing share of the world's population.

Birkmann et al., (2010) identifies several specific characteristics of urban areas compared to rural areas, which have be taken into account when urban adaptation strategies are developed:

- Urban areas have a different scale in population size, density and area of built environment than rural areas. The spatial concentration of population, infrastructure and other assets in cities makes them more vulnerable for the negative effects of the changing climate. The high concentration is also entailing opportunities for the efficiency and implementation of certain adaptation measures, like dyke systems.
- Cities are interlinked with multiple processes and flows, which play an important role in large-scale economic and social systems. In case of a climate related disaster, the damages would go beyond the boundaries of a city.
- Diseases can spread easier within and between cities, and thereby affecting a large part of the population.
- The built environment in cities, is characterized by a high persistence, which ensures a longer period for the buildings and infrastructure to be changed and this is connected to higher costs.

2.5.2 Adaptive capacity

The adaptive capacity is the ability to adapt which according to Moser and Ekstrom (2010) does not necessarily imply that an adaptation is implemented. The adaptive capacity is context-specific and will vary from country to country, from community to community, among social groups and individuals and over time (Smit & Wandel, 2006). According to Ford and King (2015) conditions that influence the adaptive capacity are economic resources, technology, information, skills, infrastructure, institutions and equity. A distinction can be made between the short term ability to survive, which is called the coping ability and the long term and more sustainable adjustments, which is called the adaptive capacity. According to Smit and Wandel (2006) a growth in the economic conditions and improvement of technology and institutions can lead to an increased adaptive capacity.

According to Carter et al (2015) the adaptive capacity is determined by the ability and willingness of the city's key stakeholders to cope with the negative impacts of changing climate and depends on the awareness, capacity and willingness of the stakeholders. In the transformation of waterfronts the involved stakeholders are the government, the private sector and civil sector.

Uncertainties with the changing climate and the nature of the problem can cause adaptations to be postponed, avoided or prevented from being implemented. According to Ford and King (2013) this indicates a limited adaptation readiness. The adaptive readiness refers to the ability of a country's private and public sectors to absorb investment resources and apply them effectively towards adaptation.

2.5.3 Adaptation measures

Including adaptation (and mitigation) measures in the built environment is crucial, when infrastructures and buildings can last at least 50 -150 years. Despite the challenges to include adaptation strategies in the urban development, it can also generate opportunities for cities to create a more attractive built landscapes, which takes the natural areas into account and creates quality spaces with a high value, where people and business want to spend time. According to Laukkonen et al. (2009), high upfront costs have to be made to realize these environments, but large net benefits can be gained over the long-term. According to Ford and King (2013) the lack of multi year funding plans for adaptation strategies, is limiting the ability to implement climate adaptation measures. Due to the short-term budgets, long-term processes like adaptation strategies are difficult to implement.

2.5.4 Planned and autonomous adaptation

A distinction can be made between public and joint adaptations, which are so called planned adaptations, and the private and individual adaptations which are so called autonomous adaptations. According to Filatova (2014) a planned adaptation is applicable for the management of a public good and for ensuring the safety of inhabitants of a flood prone waterfront. An autonomous adaptation occurs when an individual acts within the given rules to make its dwelling or area more climate-resilient. The planned adaptation measures are based on publicly-funded flood defenses and the implementation of the planned adaptation measures faces several challenges: the adaptation costs are increasing, there is a growing land scarcity and inefficient use of space, individuals have a low risk awareness and the management of the adaptation measures needs flexible investments.

Nicholls (2015) describes three categories of adaptations measures, which are illustrated in figure 8:

- 'Retreat' means that all natural effects are allowed to occur and the impacts on humans and assets are minimized by moving developments away from the coast line. This can be realized through the land use plan, development control and planned mitigation.
- 'Accommodate' means that all natural effects are allowed to occur, but the impacts on humans and assets is minimized by adjusting the use, through for example changing the land use, flood resilience measures, warning systems and insurances.
- 'Protection' means that the natural effects are controlled by soft or hard boundaries.

According to Nicholls (2015) retreat is supposed to be the best response to sea-level rise, however the benefit-cost models that compare protection with retreat suggest that it is worth investing in protection as the the population and economic value in coastal areas is high. A benefit-cost approach implies a proactive attitude to protection, but historical experiences have shown that most protection is a reaction to actual or near disasters. When one or more of the adaptation measures have been implemented, it is essential that the measures are monitored and evaluated, due to the large uncertainties with sea-level rise and the performances of an adaptation measures.

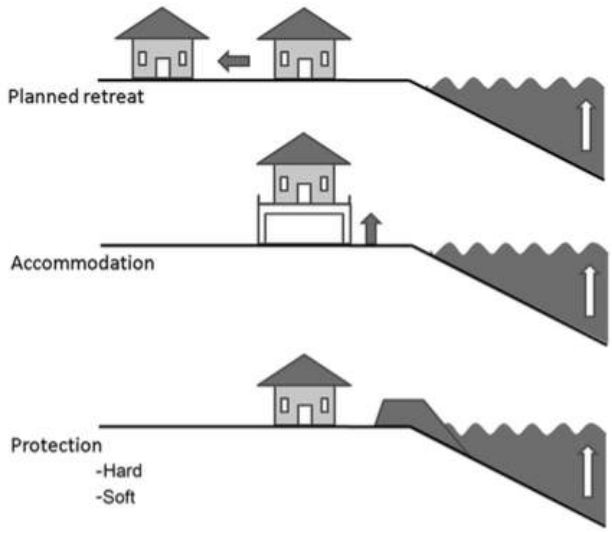

Figure 8: Adaptation measures: protect, accommodate and retreat (Nicholls, 2015)

2.5.5 Private and public goods

A distinction can be made between private and public goods. Private goods are goods where the benefits of the good is for a private actor. Public goods are goods where the benefits are for the public. Private actors can invest in an adaptation measure where the benefits are directly for the adaptor. Examples of these kind of adaptations are insulating homes, buying sandbags or moving out from a flood prone area. Private actors can also invest in public goods, where the benefits of an adaptation is not for an individual or private actor, but for the public. These benefits are non-excludable, which means that anyone living in or near the area where an adaptation has been implemented can benefit from the adaptation (Tompkins and Eakin (2012).

In flood-prone areas there is a need for private actors to invest in public goods. In rural areas there are some examples of private actors investing in adaptation measures for the public; private farmers and other landowners are encouraged to enhance the capacity of flood storage on their private lands to reduce the public expenses of flood disasters. According to Tompkins and Eakin (2012) the private adaptation investments in public goods are not always an obvious choice. Three reasons for this has been identified. First, the benefits of a public good may be visible on different spatial scales and at temporal moments making it difficult to distribute the rights, ownerships, costs and benefits. Second, for some private actors there may not be an immediate need for adapting a public good. It can be beneficial to wait for other private actors to implement the adaptations. Third, the private interests do not always corresponding to the public interest.

According to Geaves & Penning-Rowsell (2016) spatial plans that includes flood risk management measures are a public good. Because the public is protected through the measures that are included in the spatial plan. This raises the question, how involved and willing are the private actors to invest in the public flood measures.

2.6 Adaptation process

2.6.1 Adaptation process

According to Moser and Ekstorm (2010), the adaptation process consists of three stages; understanding, planning and managing an adaptation. In each stage, different subprocesses can be identified. The first stage, understanding, consists of: defining the problem, gathering and using the information and (re)defining the problem. The second stage, planning, consists of developing options, assessing an option and selecting an option. The final stage, managing, consists of implementing an option, monitoring an option and evaluating. The three stages are illustrated in figure 9.

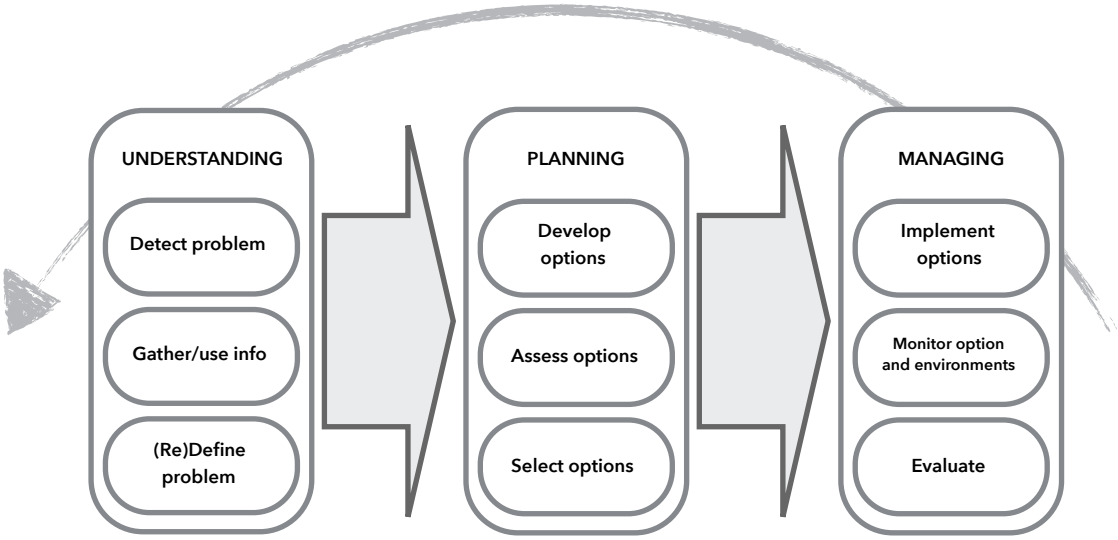

Figure 9: Adaptation process (Moser & Ekstrom, 2010).

In the adaptation process multiple barriers can emerge, which can delay or prevent the implementation of an adaptation measure. Adger et al. (2005) classified six types of barriers in the climate adaptation process: the first one are the ecological and physical limits, the second one are the technological barriers, the third one are the financial barriers, the fourth one are the informational and cognitive barriers and the fifth one are the social and cultural barriers. With proactive adaptation planning the barriers can be identified and addressed. A final barrier is time, the adaptation measures are need for the long term, while the developments are taking place at this moment, causing uncertainties in which adaptation measures that should be implemented.

Moser and Ekstrom (2010) have also identified multiple barriers that can occur in the adaptation process, but they have divided them into the earlier mentioned three stages. In the first stage, the understanding phase: barriers can occur in detecting the problem, gathering and using the information and for defining the problem. In the second stage, the planning phase barriers can occur in developing options and when assessing and selecting options. In the third stage, the managing phase barriers can occur in implementing an option, monitoring outcomes in the environment and when evaluating the effectiveness of an option.

2.6.2 Receptivity theory

Receptivity in the context of innovation and technology transfer can be defined as the extent to which there exists not only a willingness (or disposition) but also an ability (or capability) in different constituencies (individuals, communities, organizations, agencies, etc.) to absorb, accept and utilize innovation options (Jeffrey and Seaton, 2004 p. 281).

According to Jeffrey and Seaton (2004) the concept of receptivity can be broken down into four components:

- Awareness, which refers to the capability to search and scan for knowledge which is directly or indirectly related to a problem or issue.
- Association, which refers to the recognition of potential benefit of the knowledge by associating it with needs and capabilities. The ability of the public to interpret the implications of problems or an issue and associate it with policy responses can be very limited.
- Acquisition, which refers to the ability to acquire technologies or learn new models of behavior with supports exploitation of knowledge.
- Application, which refers to the ability to actually apply knowledge to achieve a benefit. This depends on the ability to integrate the innovation into the routines and procedures of the recipients given the context which they find themselves in.

The receptivity theory is used to study the willingness and ability of actors to absorb, accept and utilize innovation options. In this project the receptivity theory is used to study the willingness and ability of property developers to absorb, accept and utilize adaptation strategies in the waterfront developments. The four components related to climate changes and adaptation strategies are shown in the table below.

Awarness	Knowledge of the impacts of the changing climate. Knowledge of the adaptation strategies.
Association	Knowledge of the impacts of the rising sea level and increased precipitation on their developments. Knowledge of the impacts of the adaptation strategies on their developments.
Acquistion	Knowledge on purchasing or obtaining information on the adaptation strategies and measures
Application	Knowledge on implementing the adaptation strategies in their developments.

Table 2: Four components of receptivity theory.

According to Jeffeye and Seaton (2004) a principle of the receptivity theory is that it is not possible to properly understand the response and behavior of people to a situation or policy instrument without also understanding their perceptions, attitudes and the agendas for change that are relevant to them.

2.6.3 Institutional influences on adaptation

Kettle and Dow (2014) believes adaptation strategies should be mainstreamed into the planning processes, which is in the comprehensive plans, in land use and management plans, and into hazard mitigation plans in order to integrate climate policy into ongoing activities.

In the IPCC fifth assessment report (2014a) three main measures for institutions to stimulate adaptation and improve the safety in hazard-prone areas were defined: first through the use of economic instruments such as taxes, subsides and insurance arrangements. Secondly by means of

laws, regulations and planning measures, by protecting hazard prone areas, building codes and re-zoning climate vulnerable areas. Finally government policies and programs can be developed to stimulate adaptation. The three institutional measures to stimulate an adaptation are shown in figure 10.

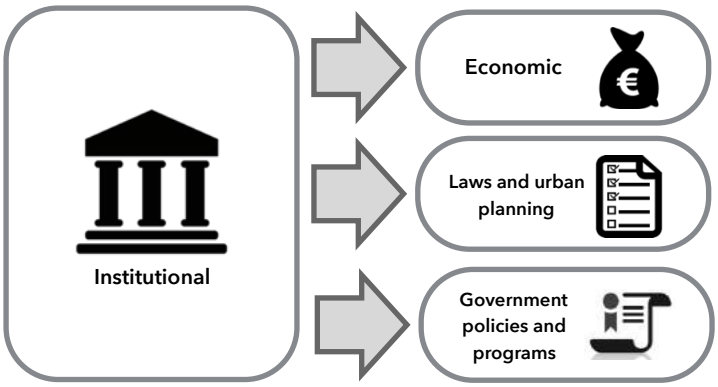

Figure 10: Institutional measures to stimulate adaptation (own ill.)

However the city governments can be enabled, bounded and constrained by national, subnational or supranational laws, policies and fundings for their implementation of adaptation measures (IPCC, 2014a). According to Fünfgeld (2010) city governments look at the national governments to set the adaptation agenda, to clarify legal liability, and to avoid commitment and resources to managing risks that can be addressed more efficiently at provincial or national level.

2.6.4 Adaptations in new developments

In new developments, planners can provide the developers with frameworks that encourages them to incorporate adaptations. According to Carter et al. (2015) the sensitivity to hazards can be reduced through spatial planning, for example the spatial plan can include roads that can be accessed during a flood event and facilitate movement away from a location that is exposed to a hazard. Therefore the urban planners play an important role in reducing vulnerability and supporting urban adaptation.

> *'Developers determine the size, density, timing and spatial distribution of developments. Thus they are the most important agent in the development process, involved in financing, planning, building and shaping the urban environment'* (Maruani & Amit-Cohen, 2011, p. 887).

Planning institutions have the power to develop, approve or disapprove plans, but as stated above, the developers are the ones shaping the urban environments. This ensures that developers have an important role in implementing adaptation actions in the built environment. According to Shearer et al., (2013) the willingness of developers to address sustainability issues is strongly linked to economic conditions: the better the economic conditions are, the more willing are the developers to engage in efforts to incorporate green and sustainable principles.

2.6.5 Adaptation government

On an European level, the development of national adaptation strategies is promoted. Since the last IPCC report, the European Union started with adaptation planning, through information sharing, the Climate-ADAPT platform and legislations (IPCC, 2014a).

Governments at all levels play an important role in improving adaptations and in enhancing the adaptive capacity and resilience of diverse stakeholder groups (IPCC, 2014a). Because national governments decide the funding priorities, develop regulations, promote institutional structures and provide policy direction for the state and local governments, national governments have the possibility to directly influence the adaptive capacity and reduce the risk and vulnerability of areas and populations. Through the development of regulations, related to zoning, storm water management and building codes, the national government can steer the development and stimulate the inclusion of adaptation strategies in the development (IPCC, 2014a).

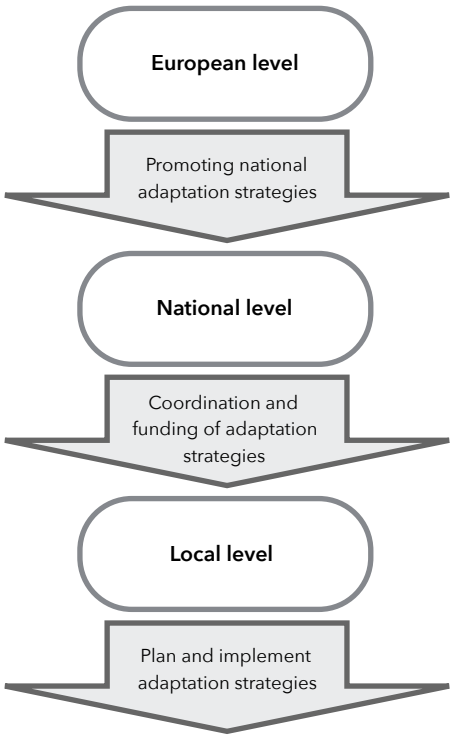

Figure 11: Adaptation government levels

Also according to Laukkonen (2009) the national governments have an important role in integrating adaptations into climate policies across government scales and to steer the long-term horizons of adaptations. But these long-term horizons of adaptation is not always a popular choice for governments, who prefer short-term goals and quick fixes. To avoid trade-offs, Ford and King (2015), state that it is essential to coordinate the adaptation strategies between the different departments and involved stakeholders. Local adaptations are increasingly coupled with global policy and connected with other institutions and actors in different scales.

On a local level, the local governments have an important role in translating the goals, policies, actions and investments set by the national and international governments. As well as taking the incentives of local communities, civil societies and non-government organizations (NGO's) into account. According to Carter et al. (2015) the vulnerability is related to the context and will differ at the different locations, ensuring that an adaptation is context dependent. Therefore the local governments are essential in addressing the challenges of adaptation strategies and the implementation of the adaptation strategies. Difficulties in the development of the adaptation plans, are the uncertainties about the future climate changes and impacts thereof, which the local governments have to take into. While they are constrained by limited funding, technical expertise, institutional mechanisms and a lack of information and leadership. Through mainstreaming the adaptation plans into the urban planning, land use management and regulatory frameworks, local governments could be more successful in implementing adaptation measures in flood prone areas (IPCC, 2014a). In figure 11 the three levels of governments for adaptation strategies are illustrated.

2.6.6 From government to governance

According to Biebroek et al. (2009) There has been a shift from government to governance, which implies an involvement of multiple public and private stakeholders discussing and defining their ambitions. According to Biesbroek et al. (2009) and Van Herk (2014) this shift is making the development process and integration of climate policy at a local level more complex. For the urban climate risk governance integration of scientific knowledge into the decision making is important and therefore an exchange of information between scientists, policymakers and those at risk has to be stimulated.

At a local level there are conflicting values which creates challenges for the development and realization of acceptable adaptation options. To overcome these challenges Hurlimann et al. (2014) suggest that coordination and collaboration between the communities and levels of government is needed. According to Van Herk (2014) a framework that can support collaborative planning, development planning and decision making is the Learning & Action Alliance (LAA) model. The aim of the LAA, is that a group of individuals or organizations who have a shared interest in innovation and want to learn from each other will integrate the action in the process. In flooding vulnerable areas, the action refers to the integration of flood risk management in the urban development planning. In the Netherlands two examples of integration of the flood risk management in the urban planning are present: the programs are 'living with water' and 'room for the river'.

2.7 Economics of adaptations

2.7.1 Investments in adaptation

According to the IPCC fifth assessment report (2014a) the private sector investments in adaptation will remain limited, without a transformative change in the urban development. Before the private sector will make investments in urban adaptation strategies, they will have to see the financial justifications and benefits of adapting the urban environments. Therefore the citizens demand has to change to stimulate the private sector to investments in adaptation, as well as being part of these investments.

Fliatova et al (2011) identifies four ways to increase the flood risk awareness of individuals/citizens:

- Personal experience of disaster: individuals who have experienced a flooding themselves, are more likely to have a higher flood risk awareness. When individuals have an increased flood risk awareness, this can influence and change the spatial patterns and land prices in flooding vulnerable areas.
- Risk communication: the European water management aims at proactive measures, which can only be achieved if individuals are aware of the risk. As already mentioned the awareness of a risk can change the use of land, as well as it can make people more willing to accept proactive actions of the government. When there is an increased risk awareness among individuals, developers are more likely to integrate the risk of flooding in their choice of a location.
- Insurance against flooding: the purposes of flood insurances is to guarantee premiums proportional to the risk of individuals in flooding vulnerable areas. Insurances can serve as a measure to communicate the risk, when the prices for the insurances in flooding vulnerable areas is related to the risks, individuals would notes the risks of flooding in the price they pay for the insurances.
- Building on higher elevation levels: by construction new developments on higher grounds, the direct damages in case of flooding decreases and it serves as a flood communication tool, that remains people of the possibilities of flooding.

According to Ford and King (2015) the public awareness is important for stimulating the adaptation readiness. The behavior of an individual can change in the form of spatial adaptation: Individuals may move to areas where they are safe from flooding, resulting in fewer and cheaper developments in high flood risk areas.

2.7.2 Economics of adaptation

According to the IPCC fifth assessment report (2014a) there are different kinds of adaptation measures, some measures include physical interventions: which are investments in the maintenance and implementation of adaptation measures. Before an adaptation investment is made, a cost-benefit analyses is conducted, herein the timing of an action is of importance, and sometimes it can be beneficial to delay a decision until there is more information available. Some adaptations can also involve a change in behavior and lifestyle.

Parry (2007) describes adaptation costs as the costs of planning, preparing for, facilitating and implementing adaptation measures. However this description is difficult to operationalize, because a development alone is also costing money and it is difficult to separated the costs for the adaptation from the total cost of the development. Upfront in a project the threats of the changing climate will be unsure, making it difficult to define the type and amount of adaptation that is needed. According to Narain et al. (2011) a country can choose to fully adapt and therefore being able to cope with the

climate change, do nothing and suffer from the impacts of the climate change or adapt to a level that the benefits of an adaptation are equal to the costs.

2.7.3 Adoption vs adaptation

Adoption is by Zilberman et al. (2012) defined as a change in practice or the technology that is used whereas adaptation is defined as the response of economic agents and societies to major environment changes and\or political and economic shocks. According to Zilberman et al. (2012) individuals are making an adoption decision based on economic decision-making rules, heterogeneity of potential adopters and dynamic process, which all three change over time. Adaptation on a micro level can include the selection among discrete strategies, like adoption of technologies. Adaptation on a macro level can be measured through commonly behavior, caused by a change of policy at local, regional, national or international level. Zilberman defines adaptation as changes in public and private decision making and resource allocation in expecting or responding to the prospect or reality of large- scale and long-lasting changes.

The benefits of an adaptation are calculated as the differences between the immediate effects of external changes and the long-run effects after the economy reaches the new equilibrium. Because the impacts of the changing climate are uncertain, actors implementing proactive adaptations are facing uncertainties, missing information and lack of experience. Economists observe two responses to climate risk: mitigation efforts to reduce the risk and insurances that manage the risks. So financial instruments can be used for adaptations, however there are several challenges for the implementation: first it is difficult to quantify the risk. Second insurance and adaptation activities are independent, the ability to insurance can reduce the engagement in adaptation activities. Third insurance can encourage risk-taking behavior. Fourth, financial effective tools in spreading the risk, are not necessarily reducing the direct impacts of an event (Zilberman et al., 2012).

2.7.4 Loans and insurances

According to the IPCC fifth assessment report (2014a) insurance companies and banks are facing problems with an accurate pricing of risks and the loss of capital after an extreme weather event, which is affecting the markets within and outside Europe. Banks can be affected by the physical impacts of the changing climate, and changed demands regarding sustainability.

From a study by Shearer et al., (2013) none of the banks reported that climate change was an important criterion when assessing loans. The short time frame of most developments loans meant that banks had a relatively low exposure to climate risk. If the risks of flooding would exist in an area, the banks assumed that the risks for flooding had been dealt with during the plan approval stage. Lenders were also recognized to be extremely risk averse, they based their lending decisions on the proposed development product, and were more willing to lend money to a developer who had already developed a similar development in the same geographical area. This tends to discourage most of the developers from innovation.

Insurances distributes the risk across the time and space for climate vulnerable locations, which otherwise would be to risky to develop. If risks are correctly priced, the premiums reflects the risks in hazard-prone areas and those who are ready to bear the risk, pay for this without increasing the burden on all taxpayers (Filatova, 2013,). According to the IPCC fifth assessment report (2014a), increasing the prices of insurances is a first step in risk reduction measures, but will not automatically imply that an adaptation action will be taken.

According to Filatova (2013) flood insurances could be a perfect risk-communication device, because people have difficulties understanding the risks and threats of flooding if it may occur once in the 500 years, while a monthly insurance payment would give the people a clearer message about the risk of flooding. Insures and governments could work together in increasing the individual flood risk awareness. If the flood insurances rate would adapt to the increasing risks of fooding in an area, individuals would feel an increased responsibility for the location and make their dwellings flood-proof.

A problem with insurances is the adverse selection, insurers can choose to only cover areas which are considered to be safe from flooding, while only customers in flood risky areas choose to insure their properties (Crichton, 2008). When only customers with a high risk for flooding choose to insure their properties, the costs for the insurer can be tremendous. Aerst and Botzen (2011), propose a public-private three layered flood insurance system. The first layer of small losses is paid by the households/ victims themselves in order to provide loss-reduction incentives and prevent moral hazard. The second layer of large losses is covered by private insurance companies, using risk-based premiums. The third layer of very large losses is covered by the government, to prevent problems with the insurability of highly correlated risks. The three layered flood insurances can stimulate homeowners to undertake loss-reducing measures (Botzen & van den Bergh, 2008).

In England 500 000 homes have difficulties in receiving a flood insurance, because the houses are located in areas with a high risk of flooding, which may lead to an decrease in value of the house (Association of British insurance, 2015).

2.8 Challenges with adaptations

2.8.1 Adaptation endeavor

Not all adaptations will be implemented, a conceptual way of locking at this is through an endeavor, this is illustrated in figure 12. The first circle represents the adaptations that are needed, these adaptation actions would be required to avoid any negative effects from the changing climate. The second circle illustrates the adaptation actions that are possible with the available technical and physical limits. This circle can be expanded through research and developments. The third circle represents the adaptation actions that are desirable considered limited resources and competing priorities, some adaptation actions are technical possible but they are too expensive. This circle can be expanded through economic growth, which can increase the resources that can be used for adaptation. The final circle represents the adaptation actions that will be taken, this is influenced by market failures and political or institutional constraints (IPCC, 2014a).

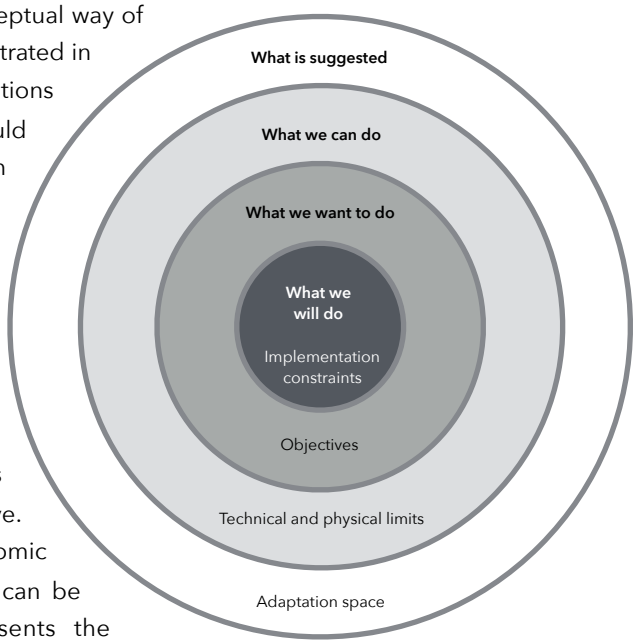

Figure 12: Adaptation endeavor (IPCC, 2014a).

2.8.2 Institutional barriers in adaptation

According to Carter (2011) a lack on the uptake of adaptation strategies and plans in cities and countries can be caused by institutional barriers. Policies can have limited overarching policy frameworks that supports adaptation on a local level and some policies may encourage developments in flood risk zones and focus on short-term goals, and therefore constraining the development of long-term adaptation strategies.

Unclear roles and responsibilities between actors at different levels and fields can slow down or even prevent climate adaptations. According to the IPCC fifth assessment report (2014a) few national requirements or guidelines are helping the local governments with their adaptation approach. Through regulations and policies the local governments could receive some support for the implementation of local adaptations actions. However some authors believe that to much emphasis on national guidance, could constrain local initiatives and create a local dependency of the national government, which would slow down the development of adaptation actions. Therefore a top-down approach should be combined with a bottom-up approach, where national actors set a proactive agenda regarding the climate adaptation strategies and support the local implementation of adaptation plans.

2.8.3 Short term oriented

The exposure of developers to the risks of the changing climate can be limited, if they are only shortly involved in the projects. Some developers are only involved in the development process for several months to at most a couple of decades, while the lifetime of a development and the impacts of the changing climate are more long term. According to Shearer et al. (2013) developers consider the risk of flooding as not severe, because of the minimal risk for the exposure of flooding during the

development phase. If a flooding would occur during the development process, many developers are insured. Coiacetto (2015) states that the way developers respond to risks, will differ for each developer, making it difficult to develop climate related policies and regulations which works for all developers. Depending on the developer, one may choose land which is already zoned while other with more power and time may search for land which is not zoned. Large scale developments, with a time span of 25 years are more likely to consider flooding as a serious risk, because of a higher likelihood of exposure to flooding and a reputation that may be at stake if a flooding would affect the community living there (Shearer et al., 2013).

Many developers rely on external resources for the finance of their developments. When property developers intend to develop land which is located in hazardous areas, for example flood or cyclone prone areas, they have to provide all the necessary information to demonstrate that the proposed developments are not likely to be negatively impacted by flood or cyclones. But according to Shearer et al. (2013) coastal areas which are vulnerable to floods and cyclones, are also very appealing locations on the market and are therefore promising the investors, with a good return. In this case, the financing institution will use a number of factors to asses the level of risk. One of these factors is the duration of the loan, which is often not that long, and is therefore making it unlikely that a flooding will occur during the period of a loan and therefore the developers are able to receive a loan, even when they develop a flood-prone area.

2.9 Theoretical framework

Before the theoretical framework is presented the key findings from the literature review are summarized.

Cities around the world are growing and expanding onto old harbors and industries. These locations are often located near the water and will therefore face challenges with the changing climate. To be able to cope with the negative impacts of the changing climate, cities have to become resilient. As described earlier on page 12, resilient cities can be created through adaptation and mitigation strategies. However even with the most ambitious efforts to reduce greenhouse gas emission, some degree of climate change is inevitable and therefore adaptation strategies are becoming very important.

According to Vogel and Henstra (2015) the central goal of adaptation is to reduce the vulnerability of cities to the negative climate-related impacts and to increase the adaptive capacity, which refers to the ability to adjust to climate change in order to moderate damages or cope with the consequences of the changing climate. The negative impacts of the changing climate are local and context specific, and therefore are the adaptation strategies and measures also local and context specific.

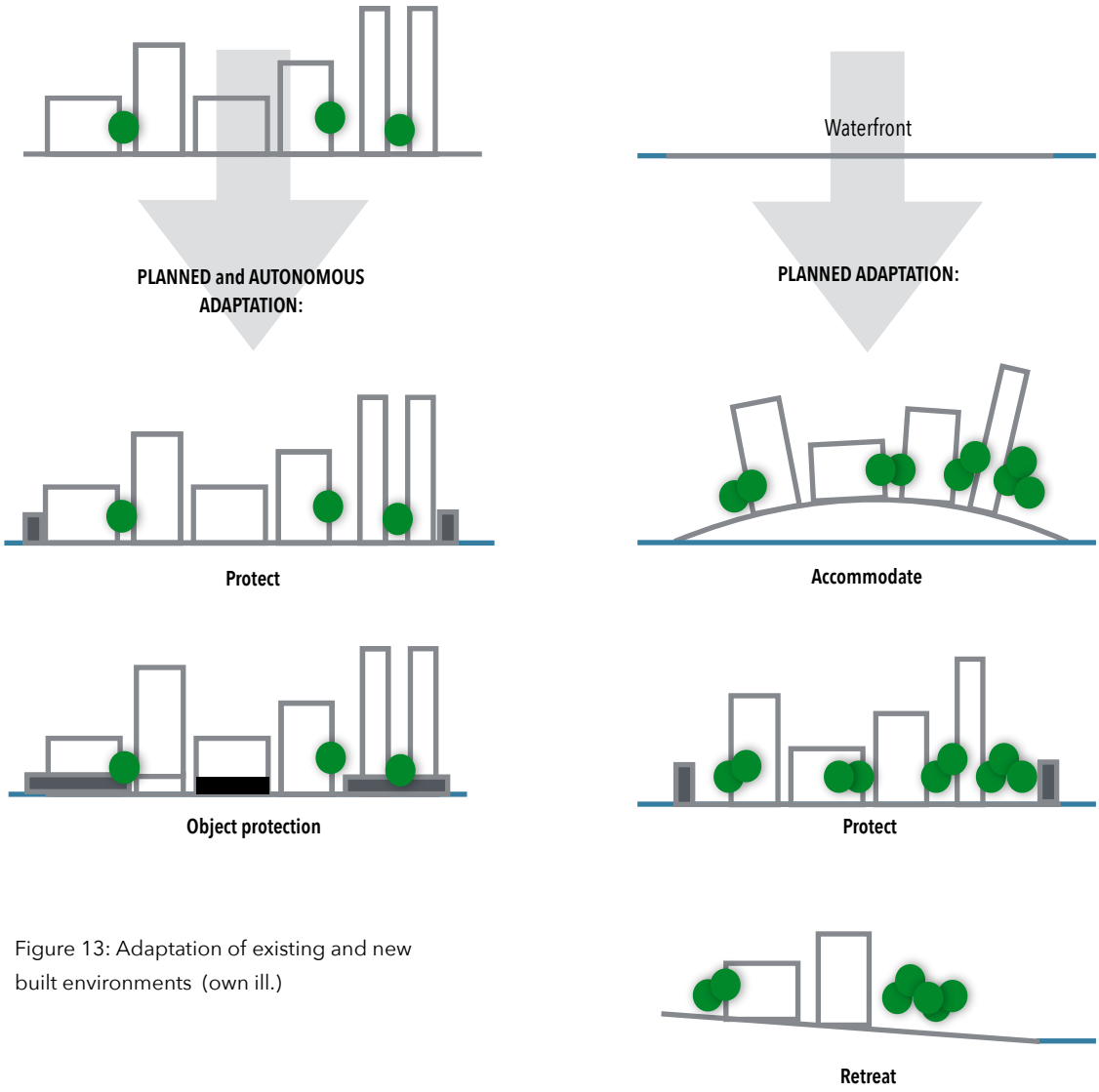

Figure 13: Adaptation of existing and new built environments (own ill.)

A distinction can be made between the adaptation of existing and new built environments, the distinction is shown in figure 13. In cities, the existing infrastructures and buildings demands other adaptation measures than in a new development or waterfront transformations. The growth of coastal cities onto urban waterfronts, is a global trend and therefore the adaptation of these waterfronts to the changing climate is essential.

Two waterfront developments have been selected: Frihamnen in Gothenburg and Stadswerven in Dordrecht. Because the areas are and will be transformed from old harbors into residential areas, the urban planners have the possibility to include the adaptation strategies in the spatial plans. The adaptation strategies are context specific and therefore implemented with a bottom-up approach. Where multiple stakeholders are involved, with different interests and opinions on the implementation of adaptation strategies and according to Jabareen (2013) this is making it difficult to implement adaptation plans.

The property developers are important actors in the development and adaptation of an area. As they are the ones shaping the urban environments through the design and construction of buildings (Maruani and Amit-Cohen, 2011). The planning institutions have the power to develop, approve or disapprove plans, but they are also dependent on the property developers to invest and develop the urban environments. According to Geaves & Penning-Rowsell (2014) a spatial plan that includes flood adaptation measures is an example of a public good and according to Tompkins and Eakin (2012) it is not an obvious choice for private actors to invest in adaptations that benefits the public, because of their profit-driven objectives.

Due to this reason, the role and the engagement of the property developers in the adaptation of urban waterfronts is unclear. The engagement of the property developers is studied through the receptivity theory. The receptivity theory by Jeffrey and Seaton (2004) enables the researcher to study the willingness and the ability of the property developers to absorb, accept and utilize adaptation strategies in the waterfront developments. The receptivity theory can be broken down into four components: awareness, association, acquisition and application, shown in figure 14.

The behavior and the engagement of the property developers to adapt the urban waterfronts is influenced by several internal and external features. An internal feature influencing the engagement of the property developers is their profit-driven objective. The external features influencing the behavior of the property developers can be direct or indirect. A direct influence on the developments of the property developers are the master and zoning plan and building permits developed and given by **planning institutions**. The urban planners can include the adaptation strategies in the spatial planning process and thereby engage the property developers in the adaptation of the waterfronts.

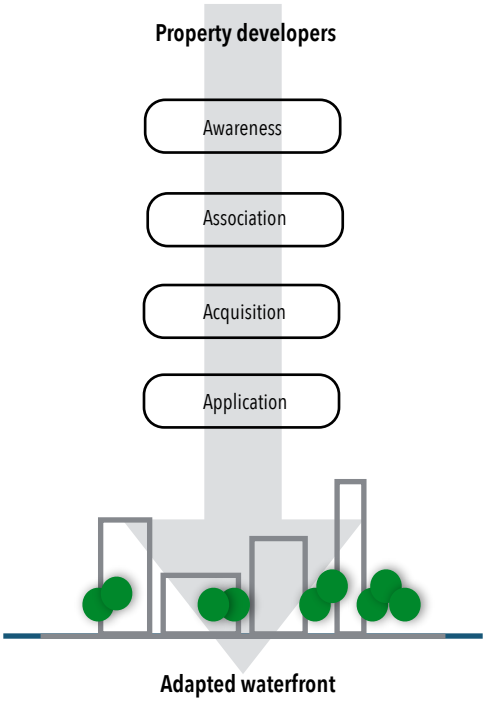

Figure 14: Four components of receptivity (own ill.).

According to Shearer et al., (2013) the willingness of developers to address sustainability issues is linked to a cities and countries economic conditions: the better the **economic conditions** are, the more willing are the developers to engage in efforts to incorporate green and sustainable principles. Therefore are the economic conditions a factor that can indirectly influence the behavior of the property developers. Secondly the international, national and regional governments can enable, bound and constrain the implementation of adaptation measures, through so called the **institutional conditions** of a country and city (IPCC, 2014a). Thirdly, the citizens demand can stimulate the private sector to investments in adaptations, as well as being part of these investments. According to Ford and King (2015) the behavior of an individual moving to areas where they are safe from flooding, can result in fewer and cheaper development projects in high flood risk areas. These conditions are the **social conditions** which are indirectly influencing the behavior and actions of the property developers. Finally the **physical conditions**, the physical features of a location, have an indirect influence on the adaptation measures that are needed and can be taken (Birkmann et al., 2010).

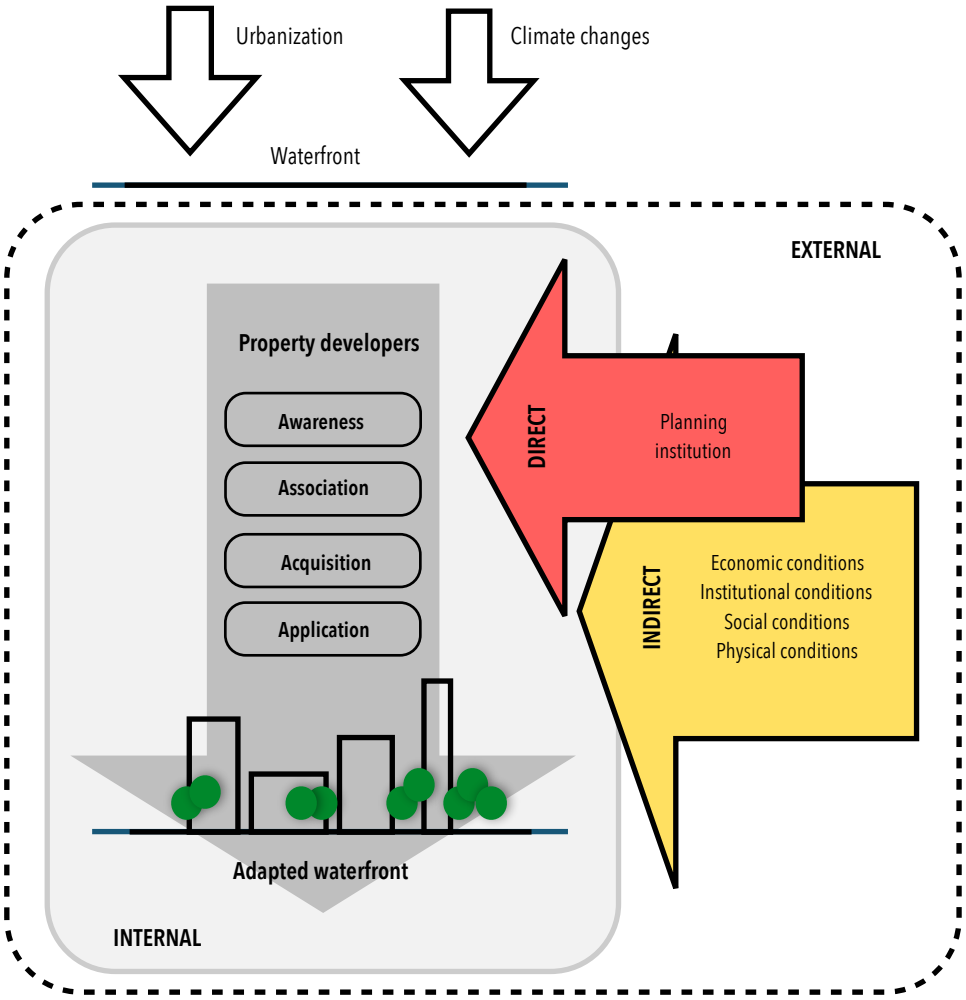

Figure 15: Theoretical framework (own ill.).

In figure 15 the theoretical framework is presented. The willingness and ability of the property developers to be engaged in the adaptation of the urban waterfronts is shown with a dark grey arrow. This includes the four components of the receptivity theory: awareness, association, acquisition and

application. The external features are the red and yellow arrow, the red arrow represents the direct influences the planning institutions have on the property developers. The yellow arrow represents the indirect conditions: the economic, the institutional, the social and the physical, which influences the behavior of the property developers and decisions of the planning institutions. In how far these assumptions in the theoretical framework are accurate will be studied through an empirical research of two case studies. In the discussion, the theoretical framework will be reflected upon and modified to the findings from the case studies.

(Image: own photo, September 2014, Gothenburg)

3. RESEARCH DESIGN AND METHODOLOGY

The research design and methodology is shaped and re-shaped through the literature review and the theoretical framework. This chapter starts with the research aim and objective. Followed by the research questions, the research design and strategy, the research method and processing, the case studies, the research planning and finally the transparency and credibility of the research.

3.1 Research Aim and Objectives

The aim of the research is to investigate what influences the property developers to be engaged in the adaptation of the urban waterfronts in Gothenburg and Dordrecht. To be able to understand what is influencing the engagement of the property developers, the engagement of the property developers had to be studied. These two parts of the research: the engagement and the influences on the engagement of the property developers to adapt Frihamnen and Stadswerven are presented below. The research objectives are Frihamnen and Stadswerven and the empirical objectives are the property developers in Gothenburg and Dordrecht, who adapt the urban waterfronts.

3.1.1 Engagement of property developers

The engagement of the property developers to adapt the urban waterfronts is studied with the receptivity theory. The receptivity theory consists of four components (Jeffrey & Seaton, 2004):

- The awareness of the risks of the changing climate and the planned adaptation strategies in Frihamnen and Stadswerven.
- The association of the adaptation strategies and measures with their waterfront developments.
- The acquisition of the adaptation strategies and measures in their waterfront developments.
- The application of the adaptation strategies and measures in their waterfront developments.

The behavior of the property developers is influenced by internal and external features, which is the second part of the research. Important to bear in mind is that the two aspects cannot be studied as two separate aspects because the behavior of the property developers is direct and indirectly dependent on several features.

3.1.2 Influences on engagement of property developers

The internal influences on the engagement of the property developers are features that effects the behavior and actions of the property developers. According to Haque and Asami (2014) property developers are profit-driven and often short term oriented which can have an influences on their engagement to adapt the developments in the urban waterfronts, which makes their business model influencing their behavior.

The external influence on the engagement of the property developers is directly and indirectly influenced by several actors, actions and processes. These features are based on the literature review, which is presented in the previous chapter. Directly it is connected to the planning institutions, due to the role planning institutions have in the development of an area: owner of the land (not always), developer of master and zoning plans, preparation of the land, approver or disapprover of buildings permits and some municipalities are also acting as a public developer, by making use of the private law to purchase its own land for development, which is an active land policy (Franzen et al., 2011).

As several authors state (Wamsler et al., 2013, Hurlimann et al., 2014, Djordjeivc et al., 2011 & Carter et al., 2015) the spatial planning is a key mechanism for the implementation of adaptations. This makes the planning institutions crucial in the adaptation of urban waterfronts. However the planning institutions are dependent on the property developers to shape the built environment, as well as the property developers are dependent on the planning institutions to develop the master and zoning plans and give them the building permits. Therefore the planning institutions are directly influencing the behavior of the property developers.

Indirectly the behavior of the property developers is influenced by economic, institutional, social and physical conditions in a city. These features are also interconnected with one another, for example the housing demand is connected to the economic conditions and social conditions of a city. How these features are interconnected is presented in the analytical framework in the case studies chapters.

By studying the internal and external features influencing the engagement of the property developers, insights and lessons for Gothenburg and Dordrecht on the adaptation of the urban waterfronts can be gained. Which can contribute in the development of resilient waterfronts in Gothenburg and Dordrecht.

3.2 Research Questions

3.2.1 Research questions

The research questions narrows the topic area to a meaningful and manageable size, as well as it gives the research a focus (Edmondson & McManus, 2007). The main research question is:

What influences the engagement of property developers in adapting urban waterfronts to the changing climate in Sweden and the Netherlands?

Sub-questions:

1. What features influences the behavior of property developers in adapting urban waterfronts to the changing climate?
2. To what extent are the property developers engaged in the adaptation of Frihamnen, Gothenburg and Stadswerven, Dordrecht?
3. What external features are dominant in influencing the property developer's engagement in adapting the urban waterfronts in Gothenburg and Dordrecht?
4. Are the property developers differently engaged in the adaption of the waterfronts in Gothenburg and Dordrecht and what are the reasons here for?

3.2.2 Research comparison

The aim of the research was to find out what is influencing the property developers to be engaged in the adaptation of urban waterfronts. By comparing two waterfront developments in Gothenburg and Dordrecht, the internal and external features influencing the engagement of the property developers was found. The comparison contributes in theory and practice, in theory the study contributes in mapping out what is influencing the property developers in adapting their developments and in practice the study provides the cities with insights and lessons for the development of adapted waterfronts.

3.2.3 Research approach

In figure 16, the research approach is illustrated, which gives an overview of the taken steps and connections of these steps. The research started with my interest in the topic and a preliminary literature review, which eventually led to a problem and the aim of the study. After some further literature studies on the practical and scientific relevance of the research, the research questions, design, methodology and case selection were formulated. This led to the eventual data collection of the two case studies: Gothenburg and Dordrecht. Through the case studies answers for the research question were found. Which led to a comparison of the findings, which provided Gothenburg and Dordrecht with interesting insights and lessons on the development of flood adapted waterfronts and the engagement of the property developers herein.

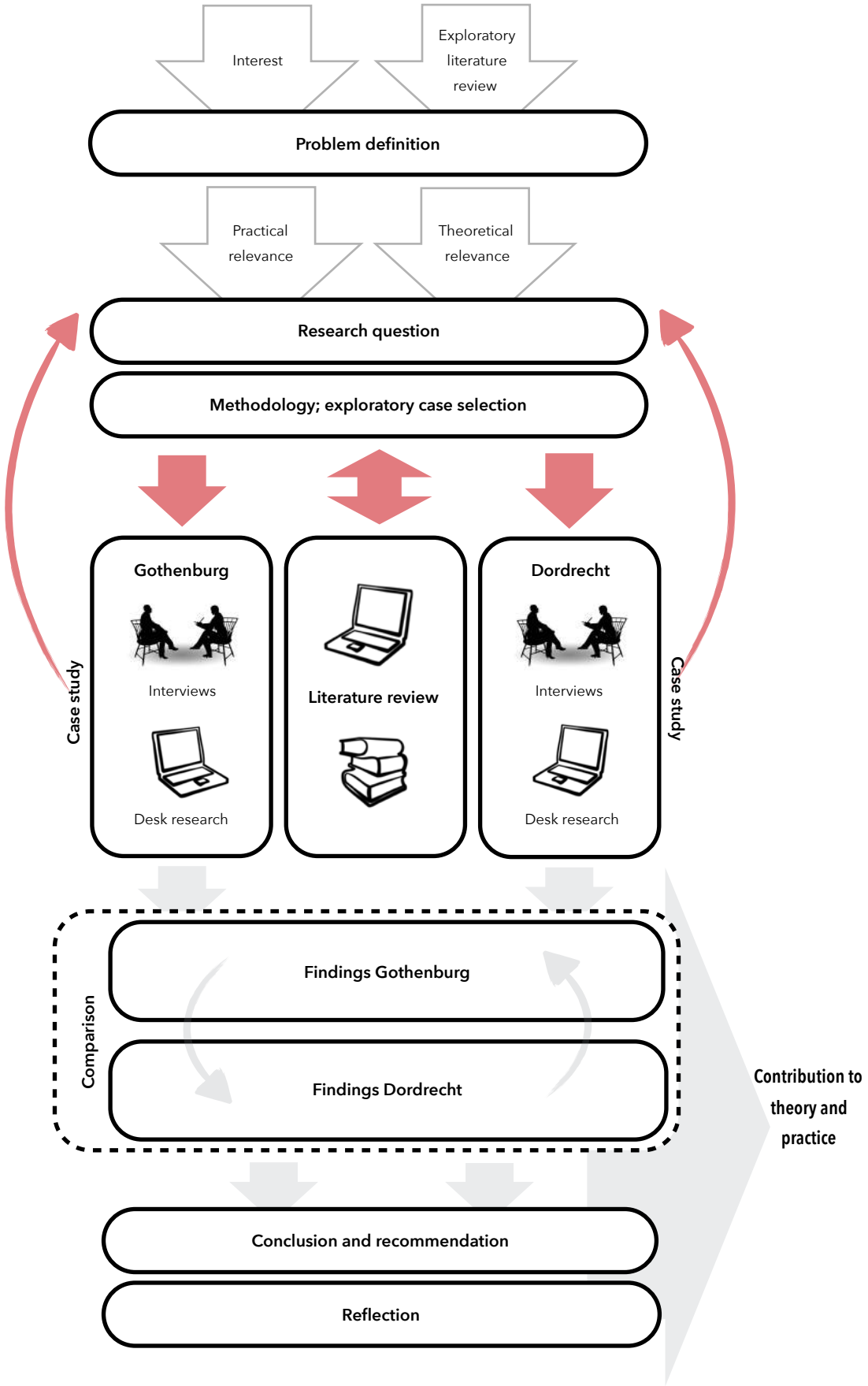

Figure 16: Research approach

3.3 Research Strategy and Design

3.3.1 Research strategy

The research strategy is qualitative, to enable the researcher to understand the complexity in the engagement of the property developers in the adaptation of flooding vulnerable waterfronts in Gothenburg and Dordrecht. This asks for their perceptions and attitude towards the risks of flooding and adaptation of the waterfronts, which can only be found with a qualitative research.
The behavior of the property developers is dependent on several actors, actions and processes, which is studied in order to perceive an in-depth understanding of the features influencing the property developers to be engaged in the adaptation of the waterfronts in Gothenburg and Dordrecht.

3.3.2 Research design

The research design provides the framework for the collection and analysis of the data. To get an in-depth understanding of the behavior of the property developers in Gothenburg and Dordrecht, a case study approach is selected. A case study enables the researcher to study a case in depth and to understand the actions and processes of the involved individuals in a specific context (Creswell, 2002). In this case the specific context, the research objective, is the low-lying waterfronts in Gothenburg and Dordrecht: Frihamnen and Stadswerven. The involved actors, the empirical objectives, are the property developers, who's behavior is studied. Their behavior is influenced by internal and external features which were studied as well.

In this research a combination of two single-case studies and a multiple-case study is used. The single-case study refers to the in depth studies in Gothenburg and Dordrecht, which explains the commitment of the property developers for the adaptation of the urban waterfronts and the directly and indirectly influences on their behavior (Baxter & Jack, 2008).

The multiple-case study, allows a cross-case comparison of the single-case studies in Gothenburg and Dordrecht. Because a comparison is made, it is important that the cases are carefully chosen, so similarities or contrasting results can be based on theory (Baxter & Jack, 2008).
To be able to compare the engagement of the property developers, the comparison has to focus on the differences in outcome and what is causing this differences or similarities (Vogel & Henstra, 2015).

3.4 Research Method and Processing

3.4.1 Research method

The research method is the technique for the collection of data. The data is collected through a literature review, explorative interviews, document analysis, semi-structured interviews and a questionnaire. These techniques were used to understand the behavior of the property developers as well as the influences on their behavior. The literature review presented in the previous chapter provided the study with the theoretical framework. The document analysis includes national and local government policies, programs, laws and regulations from Gothenburg and Dordrecht.

The explorative interviews were conducted at the beginning of the research and were used to get a general understanding of the situation and shape the research. The exploratory interviews can be found in appendix B.

The semi-structured interviews includes several actors: the property developers themselves. Actors who influences them directly: the urban planners form the planning institutions. Actors who influences them indirectly: from the regional and local governments, insurance companies and banks. Semi-structured interviews enables the interviewer to respond to the answers of the interviewee and gain more insight in the behavior and decisions of the property developers. (Bryman, 2012) The interviews were preferable conducted in English, because of the international character of the research, however the aim of the interviews were to get an in-depth understanding of the behavior of the property developers and therefore the interviews were conducted in the language the interviewee could express him/her self the best in, which in some cases were Swedish or Dutch. The interview schedules for the property developers, planning institutions, banks and insurances are documented in appendix C. The aim of the research is not to point out what some actors are doing right or wrong, and to respect the privacy of the interviewees, the interviewees are presented anonymous.

The questionnaire was used to gain an understanding of the citizens demand and how they influences or not influences the property developers to adapt urban waterfronts. The questionnaires were conducted in the native language of the residents: Swedish and Dutch. To avoid language barriers in the self-completion. The questionnaires were distributed personally in the waterfronts, to increase the willingness of the respondents to answer and to not intrude on their privacy. The questionnaires are documented in appendix D.

3.4.2 Research processing

The collected data from the document analysis, semi-structured interviews and questionnaires had to be analyzed, which is an important step in a qualitative research. Each interview is recorded and transcribed, ensuring that all data is documented and correct documented. Coding is a transitional process between the data collection and a more extensive data analysis. It also enables the researcher to organize and group similar coded data into categories because they share some characteristics (Saldana, 2009).

> *'A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data' (Saldana, 2009, p. 3).*

For the analysis was chosen to divide the findings into two categories: findings related to the engagement of the property developers and the findings related to the features influencing the behavior of the property developers. These two categories have been dividid into several sub categories, which have a deductive character, because they are based on the theory: of receptivity and risks developers are exposed to, due to the changing climate, based on a previous research by Shearer et al. (2013). In table 2 an overview of the categories and sub-categories are shown.

Category	**Sub-category**
Engagement of property developers	Awareness
	Association
	Acquisition
	Application
Category	**Sub-category**
Influences on behavior	Planning institutions
	Economic conditions
	Institutional conditions
	Social conditions
	Physical conditions

Table 2: Categories for data analyzing

All the transcribed interviews were analyzed through quoting the parts that refers to the sub-categories. Some interviews provided more information on the behavior of the property developers, while other interviews: from the planing institutions, banks and insurances provided more information on the influences on the behavior of the property developers. Due to the fact that the interviews were conducted in three languages: English, Swedish and Dutch the quoted findings are translated to English and collected in an excel sheet. From this excel sheet the research questions were answered and some key findings were quoted to support the findings and the answers. In appendix E and F the excel sheets with the findings from the semi-structured interviews are documented.

The self-completion questionnaires were also analyzed through excel. The findings from the questionnaires are summarized in one excel sheet, which shows how many of the respondents gave a certain answer, an overview of the excel sheet can be found in appendix G. The key findings are presented in the findings chapter, due to the aim of the research: the behavior of the property developers, the questionnaires were only used as an additional source of information, to understand the behavior of the property developers. To be able to draw valid and general conclusions from the questionnaires from the citizens, more responses are needed. But as already explained this was not the aim of the questionnaire and therefore the findings are only used to get an idea of the public awareness of the changing climate and related risks.

3.5 Case studies | Case selection

The two case studies: Frihamnen and Stadswerven are already briefly presented in the first chapter. In this paragraph the selection of grey literature, the interviewees and the respondents for the questionnaires are presented.

3.5.1 Gothenburg | Frihamnen

In Gothenburg the selected case study area was Frihamnen. More information on Sweden, Gothenburg and Frihamnen is available in the next chapter. Frihamnen was selected due to the presences of the following features:

- Urban waterfront, in a growing European city. Gothenburg, was the starting point of the research and to be able to compare the developments in Gothenburg, a city with similar planning institutions and welfare is preferred. Otherwise the comparison of the engagement of the property developers can be very difficult. More on the European situation can be found in appendix H.
- The area is vulnerable to the negative impacts of the changing climate: rising sea level, increased precipitation. Otherwise any flood adaptation strategies and measures wouldn't be needed.
- The planning institutions have developed adaptation strategies for the area. Otherwise their wouldn't be any engagement of the property developers in the adaptation strategies.
- The property developers have been selected for the transformation of the waterfront, making it possible to study their engagement.

The actors for the semi-structured interviews were selected because of their direct or indirect involvement in the development and adaptation of Frihamnen. In table 3 these actors are shown. For the grey literature, policy documents, regulations, laws and programs from Gothenburg city and from the county administration board were analyzed. The social conditions in Gothenburg were partly studied through a self-completion questionnaire. Because Frihamnen is not yet developed, the demand of the inhabitants was studied through the inhabitants of the surrounding neighborhoods: Eriksberg and Lindholmen.

Semi-structured interviewees:	Grey literature:	Questionnaires to:
Property developers in Frihamnen	Göteborgs Stad Stadsbyggnadskontoret	Inhabitants Eriksberg
City planning office Gothenburg	Klimatanpassning i fysisk planering	Inhabitats Lindholmen
älvstranden development	Vatten så klart	
Water and sanitation Gothenburg	Extremt väder återrapport	
County administration board	älvkantskydd 2014	
Insurance company	Yttre portar 2014	
Bank	Skyfallsmodellering 2014	
	Hyrdomodell Göteborg 2014	

Table 3: Selected actors and documents

The bold marked actors and actions have been interviewed, studied and questioned. As the table shows, an interview with a Swedish bank was not possible. The role of the actors that have been interviewed can be found in appendix I.

3.5.2 Dordrecht | Stadswerven

To enable a comparison between the waterfront developments in Gothenburg, a waterfront with similar features as Frihamnen had to be selected. Therefore Stadswerven an unambanked area in the Netherlands was selected. The fact that Stadswerven is an unambanked area was crucial for the comparison, because developments in embanked areas are protected by dykes, which are built and maintained by the national government and the Waterboards, and these water management structures are not present in Gothenburg, Frihamnen.

The actors in Stadswerven were also selected because of their direct or indirect involvement in the development and adaptation of Stadswerven. An overview of the actors are shown in table 4. The grey literature exists of policy documents, regulations, laws and programs from Dordrecht city, the Rijkswaterstaat and the Waterboards. The first buildings were realized in 2015, therefore the inhabitants could directly be questioned through the self-completion questionnaires.

Semi-structured interviewees:	**Grey literature:**	**Questionnaires to:**
Property developers in Stadswerven (OCW)	**Nieuwe stedelijkheid voor Dordrecht**	**Inhabitants Stadswerven**
City planning office Dordrecht	**Urban Flood Management Dordrecht.**	
Urban flood management Dordrecht	**Deltaprogramma. Nieuwbouw en Herstructurering en Veiligheid.**	
Waterboards	**Concept Gebiedsrapportage Eiland van Dordrecht. Deltaprogramma Rijnmond-Drechtsteden.**	
Rijkswaterstaat	**Deltaprogramma 2015. Deltacommissaris.**	
Insurance company		
Bank		

Table 4: Selected actors and documents

The bold marked actors and actions have been interviewed, studied and questioned. As the table shows, an interview with the Rijkswaterstaat and an insurance company was not possible. The role of the actors that have been interviewed can be found in appendix I.

3.6 Research Planning

The research is conducted between February 2015 and January 2016. However the research started already in 2014, with a course at Chalmers University of Technology that presented the challenges Gothenburg are facing with the rising sea levels and increased precipitation. The first part of the research from January until July, entailed a proposal of the research where the focus was on defining the research questions, method, design and selection of the case studies. In the second part from August to January the proposed research was conducted through interviews and questionnaires. The gained findings provided new insights which shaped and re-shaped the research approaches and theoretical framework. The theory and findings were reflected upon in the discussion and an answer to the main research question is given in the conclusion. When al the data and theory was collected, the report was finalized and a presentation was made. Due to the contribution the research has on the waterfront developments in Gothenburg and Dordrecht the report will be distributed to the involved actors in both Sweden and the Netherlands. In figure 17 and 18 the research planning is shown.

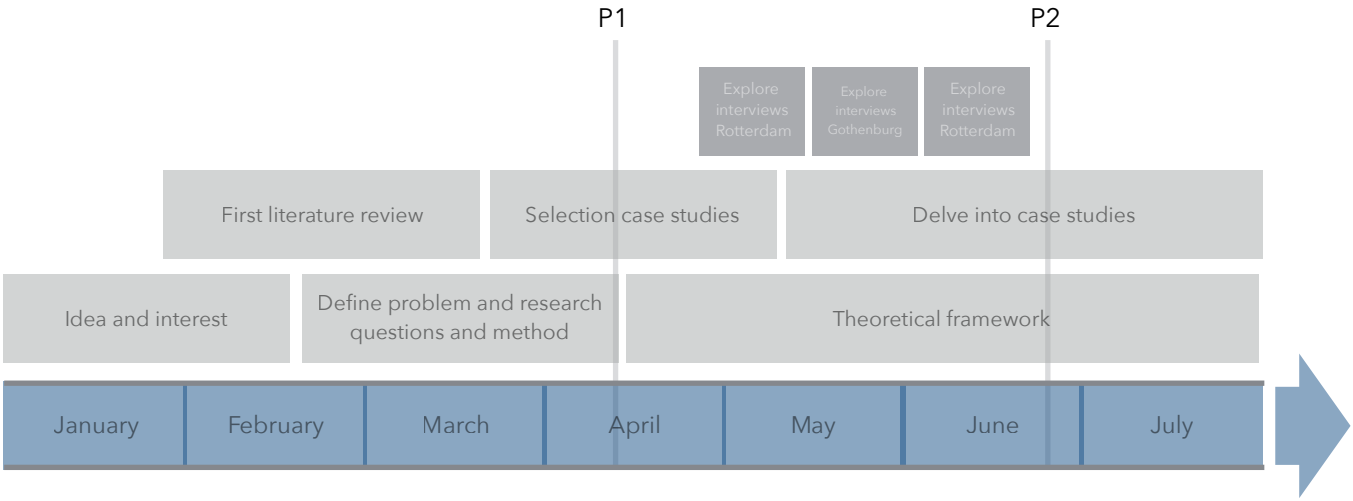

Figure 17: First part: the research proposal (own ill.).

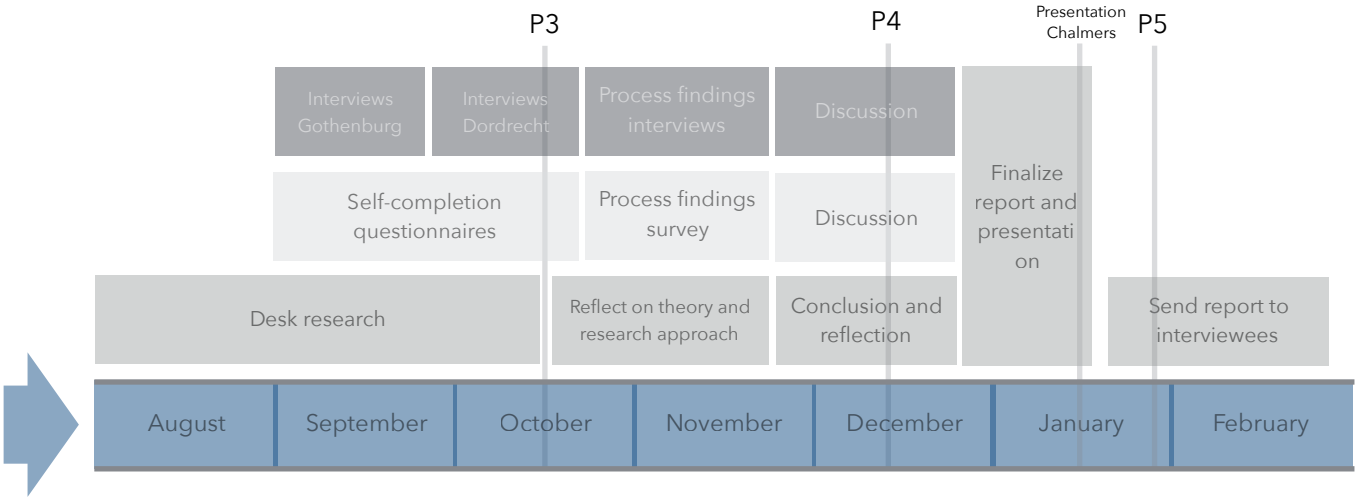

Figure 18: Second part: the data collection and processing (own ill.).

3.7 Transparency and credibility of research

The collection and analysis of data is vulnerable to biases and inaccuracies, which influences the transparency and credibility of the research. Biases and limitations of the research are presented in this chapter.

3.7.1 Biases

The collection of data through semi-structured interviews is vulnerable to biases. Preferably all the interviews were conducted in English to ensure a comparability of the findings in Sweden and the Netherlands, due to the international character of the research. However the language had to be adjusted to the preferences of the interviewees and therefore the interview were conducted in Swedish and Dutch. A challenging aspect of the semi-structured interviews with private property developers, were their willingness to share information, because they are driven by profit-making objectives. This had to be taken into account when comparing the property developers answers. One may have been more honest than another. When analyzing the collected data uncertainties regarding the data may occurred, therefore the interviews were recorded to avoid uncertainties and confirm the answers, to ensure the transparency and credibility of the research.

To avoid language barriers in the self-completion questionnaires, the questions were asked in the native language: Swedish and Dutch. The absence of the interviewer to help the respondent if they had difficulties with a question, lead to some unfinished questionnaires, which had to be taken into account when analyzing the questionnaires. The absence of the interviewer also made it impossible to ask a follow-up question which could provide the research with further insights. Other disadvantages of self-completion questionnaires were the risks of a low response rate, missing relevant data and difficulties for certain respondents to answer. These risks have been taken into account when analyzing the data from the self-completion questionnaires (Bryman, 2012).

3.7.2 Limitations

The first limitation of the research is the fact that the developments in Frihamnen are in the planning phase, which made it difficult to study the four components of the receptivity theory. The engagement of the property developers is currently based on their intended acquisition and application of the adaptation strategies, however this can differ from their actual behavior and therefore influencing the actual engagement of the property developers in the adaptation of Frihamnen.

The second limitation of the research is the fact that the research is conducted at the municipality of Gothenburg. In Gothenburg it was easier to get excess to relevant document and interview involved actors, compared to Dordrecht. In Gothenburg 13 actors were interviewed, compared to 7 in Dordrecht. Therefore a more in-depth understanding of the situation in Gothenburg was gained. However the starting point of the research was the influences on the engagement of the property developers in the adaptation of the urban waterfronts in Gothenburg and Dordrecht, and therefore some information on the situation in Gothenburg is left out and placed in the appendix, to ensure that the aim of the research is pursued.

(Image: own photo, September 2014, Gothenburg)

4. FRIHAMNEN

This chapter presents the first case study: Frihamnen. Before the situation in Frihamnen is discussed, the Swedish context and the conditions in Gothenburg are presented. Through the document analysis, the interviews and questionnaires the sub-questions are answered. *To what extent are the property developers engaged in the adaptation of Frihamnen, Gothenburg?* and *What external features are dominant in influencing the property developer's engagement in adapting the urban waterfronts in Gothenburg?*

4.1 Context

4.1.1 Sweden

The temperatures in Sweden are expected to increase more than the global average. By 2080 the Swedish average temperature will have risen by 3 to 5 degrees Celsius. The precipitation will increase as well, especially during autumn, winter and spring, causing high water flows and possible floods. In southern Sweden the sea level can rise up to 0.8 meters, while the northern parts of Sweden will not be that affected by the sea level rise due to the land elevation. According to Johansson and Mobjörk (2009) especially the western and south-western parts of Sweden will face more daily floods, due to the changing climate.

The central government acts as a source of information, funding and provider of the regulatory framework. They are not often involved in the implementation of adaptation strategies and there is no spatial planning policy that sets the framework for the municipal and regional level. However, the state can influence the spatial planning through national targets and by pointing out national interests. They can also influence the regional and local decisions through legislations, for example through the Planning and Building Act (Law 2010:900). On the request of the state Boverket, a national authority for housing, construction, urban development and urban planning, developed a vision for Sweden in 2025. The vision included four mega trends: the changing climate, a globalized, urbanized and digitalized world (Boverket, 2012).
Boverket is working on the development of a sustainable society, where climate adaptation strategies are linked to the spatial planning. They recommend that the masterplan includes and takes the impacts of the changing climate into account, and that new developments on flood-prone areas are avoided (Boverket, 2012).

On a regional level, the county administrative boards are responsible for the promotion and the coordination of the states interests in the building process, as well as the coordination of climate adaptation actions. Gothenburg is located in Västra Götaland, and the responsible county administrative board is Västra Götalands county. The county administrative board is controlling the spatial planning, which is governed under the Planning and Building Act. They have an inspection and judicial review of the plans where they should ensure that the municipal and state interests are guarded. Floods often affects a whole catchment area, which makes a collaboration between county administrative boards necessary (Klimatanpassningsportalen, 2015).
Several county administrative boards are giving the local authorities recommendations on how the risk of flooding should be included in the physical planning. One of the recommendation is that no buildings should be located below the 100-year flood level, with the exception of simple buildings such as garages and outhouses. However not all local authorities are incorporating these recommendations.

In 2011 the Västra Götalands county developed a handbook for spatial planning in flood prone areas. Herein 5 steps were identified to provide guidance and advice the municipalities, developers and property managers on how to plan and develop in flood-prone areas (Ivarsson et al., 2011).

1. Risk assessment; map the flood risk
2. Land use; come up with suitable land for new developments
3. Probability reduction; define measures that reduces the likelihood of a flood
4. Impact mitigation; minimize the consequences when a flood occurs
5. Evaluation; analysis and asses the effects of the proposed plan

In 2012 Västra Götalands county developed a regional action plan for climate adaptation. The goal of the report was to create a society that is robust to the changing climate. The action plan consists of measures that different actors have to take to adapt Västra Götalands county to the changing climate (Länsstyrelserna, 2012). According to Johansson & Mobjörk (2009) the most active authorities are the ones that have been affected by flooding and erosion.

There are 290 local authorities in Sweden and they each have the responsibility to implement the national climate policy targets, through the physical planning. They are also responsible for reducing the vulnerability in cases of extreme weather events (Johansson & Mobjörk, 2009). Local authorities have several regulatory instruments for the development of land, for more information on the regulations see appendix J.

4.1.2 Gothenburg

Gothenburg, is the seconds largest city in Sweden, with 530.000 inhabitants. It is located on the west-coast along the North Sea and at the mouth of Göta älv and is an example of a coastal city that is expanding on flood-prone areas to accommodate the growing population. In figure 19 an overview of Gothenburg and the neighborhoods are shown. The low-lying areas along Göta älv, are expected to house 24.000 households in 2035. Meanwhile, the North sea is expected to rise 0,74 meter in 2100 and in extreme cases it could even rise to 2,36 meter due to intense westerly or southwesterly winds (Rullander, 2014). Therefore the municipality is facing challenges with the transformation of the flood-prone areas.

Gothenburg is 450 km2 large and has a population density of 1.200 persons per km2 (Sörensen & Rana, 2013). Gothenburg is relatively low-lying and has a high proportion of clay soil. The river, Göta älv runs through Gothenburg, and is connected to Sweden's largest lake, Lake Vänern, which flows into the North Sea (Keskitalo, 2010). The land rise in Sweden can prevent some of the effects of the rising sea level. In the northern of Sweden, the land is rising with 7 to 8 mm per year and in the south the land is sinking between -0.1 to - 0.2 mm per year. In Gothenburg the land is rising 3 mm per year, but this is not enough to outpace the rising sea level of an average of 1.8 - 5.9 mm per year (Bui, 2011).

The Swedish export and import, goes through Gothenburg and makes it the largest and best equipped port in Scandinavia. Some well known industries like SKF, VOLVO and Hasselblad and companies like Saab, Ericsson, Astra Zeneca, Skanska, NCC and Nobel Biocare are located in Gothenburg. The population in the Gothenburg's region is expected to reach 1.5 million inhabitants by 2020, and to be able to accommodate this growth 120.000 homes and 80.000 jobs are needed. If Gothenburg is not able to react to the growing demand of housing in the city, it may loss its' citizens and economic position (Business region Göteborg, 2009).

Figure 19: Overview Gothenburg and neighborhoods (Göteborg Stad Stadsbyggnadskontoret, 2014).

The municipality of Gothenburg is responsible for the development of the masterplan and zoning plan. In the masterplan the municipality addresses how urban areas and land should be developed; where buildings can and should be placed, where new roads and bicycle roads are needed and which areas should be protected and saved for recreation. The masterplan is not binding, only indicative. With the zoning plan the municipality is able to regulate how land and water should be used and how the buildings should be designed. The zoning plan regulates the rights and obligations between the landowners and the community. The plan is binding when considering building permits (Boverket, 2012).

The zoning plan can be disapproved by the county administrative board if they believe that the zoning plan does not correspond with the safety and health of humans, national interests, environmental qualities and coastal protection. The county administrative board can therefore review the municipalities' decisions to adopt, amend or repeal a zoning plan. This was the case for the development plan for Älvstaden in 2014, where the count administrative board took in the detail plan, because of question regarding the resilience of the plan to future sea levels. A special group was composed to release the repealed plans (Göteborgs Stad kommunfullmäktige, 2015). More information on this group can be found in the next paragraph.

The municipality of Gothenburg owns 50% of the land in Gothenburg, which is compared to other cities, quite a lot. In Gothenburg projects can be initiated in several ways (Moback, 2015):

- The city, through the Real Estate office can initiate a project and the municipality is the owner of the land. In this case there is an allocation competition and several builders present their ideas for a certain area based on the requirements. The best project (based on several criteria's) is chosen and a zoning plan for that area is developed.

- By a builder / developer a project can be initiated and the municipality is the owner of the land. In this case the builder / developer presents the Real Estate office with a proposed development for a certain area, if the Real Estate office finds it interesting a zoning plan can be developed in consultation with City Planning office.

- In älvstaden a special model for the development of the area is develop. In this case Älvstrand company owns the land, which is part of the municipality of Gothenburg. In the program phase several builders / developers were invited to be part of the discussion. The builders do not know which area they will develop, therefore it is for their own interest to prepare the whole area as good as possible. Älvstranden company and the developers are involved throughout the planning phase and at the end of the planning phase the developers are assigned to a plot. More about the development of Frihamnen can be found in the next paragraph.

- When the land is owned by a private actor and the owner wants to develop a certain area on its land, the actor contacts the Real Estate office or City Planning office with his ideas, if it is consistent with the municipality's intentions and masterplan, the development of the zoning plan starts. If the area already has a zoning plan, it is checked with the zoning plan and then decided if it will receive a building permit.

On the website of Gothenburg a 3D model is available which shows the effects of the changing climate in Gothenburg city center. Four different scenarios are available; the situation with a normal sea level, shown in figure 20. The situation in 2008 with an extreme tide of +1,8 meter, is shown in figure 21. In 2100 the sea level is expected to rise with one meter, which could lead to a sea level of +2,8 meter in extreme cases, due to uncertainties with the sea level rise a situation with +3.8 meter is also taken into account. These two scenarios are representatively shown in figure 22 and 23 (Göteborg Stad, 2015). As the figures shows, a large amount of the land in Gothenburg city center can in the future be flooded. Especially the land in Frihamnen is vulnerable for flooding.

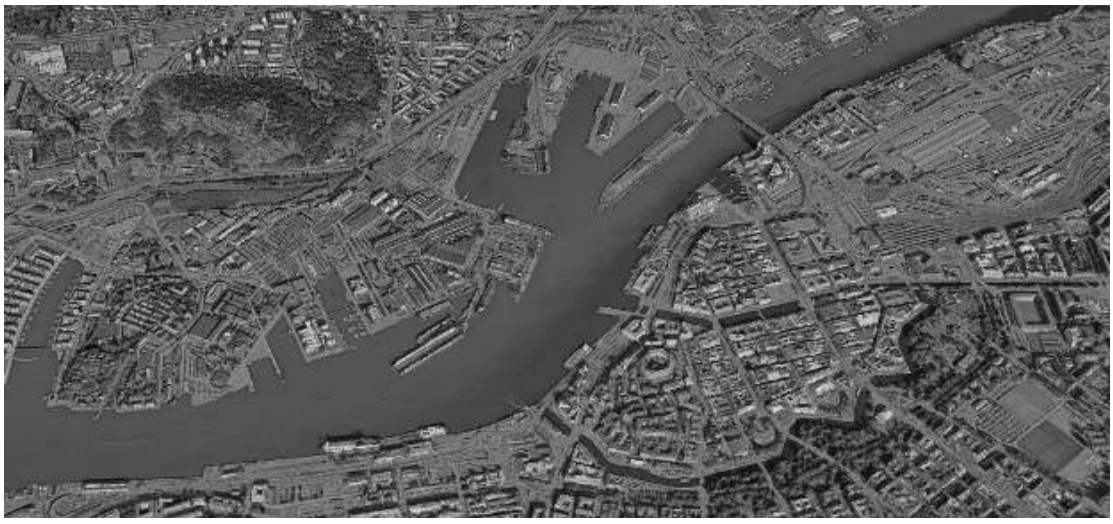

Figure 20: Current situation in 2008 (Göteborg Stad, 2015).

Figure 21: Current situation with extreme tide in 2008 (Göteborg Stad, 2015).

Figure 22: Situation with 1 meter sea level rise and extreme tide (Göteborg Stad, 2015).

Figure 23: Situation with 2 meter sea level rise and extreme tide (Göteborg Stad, 2015).

Two alternatives to protect Gothenburg from these scenarios have been developed by Ramböll, a consult firm who was assigned to make a report for the City Planning Office of Gothenburg:

- River protection: Dikes and ports could be built along Göta älv to protect central Gothenburg against flooding. The protection will prevent the low-lying areas along Göta älv for flooding and ports would be built on the outsides of Vallgraven, Northern Hamnkanalen, Gullbergsån, Kvillebäcken (Frihamnen) and Sannegårdshamnen.
- Storm surge barrier: Two outer barriers could be built to prevent the high tide in Kattegat, to flood the city center of Gothenburg. One barrier would be built at the height of Jordfallsbron south of Kungälv and the other at Älvsborgsbron (Ramböll, 2014). In appendix K the two solutions are illustrated.

From a cost-benefit analysis these two measures were studied. The research showed that both solutions would generate a negative net present value of -2717 million Swedish crowns for the älv protection and -567 million Swedish crowns for the outer barriers. However with the river protection there would be a damage reduction of 3450 million Swedish crown and with the outer barrier the damage reduction would be 1760 million Swedish crowns (Ramböll, 2014). In this research the value of the new developments in Frihamnen have not been taken into account when calculating the damages costs. According to Ramböll (2014) the damages cost would increase significantly after the realization of the developments in Frihamnen. Ramböll concluded that even with the outer storm surge barriers, some parts of central Gothenburg would still be vulnerable for flooding. Therefore the river protection will protect more areas from flooding then the storm surge barriers. A challenge with the river protection is the space that is needed to build the protection and due to the river protection a new urban landscape is created, which could form a barrier for residence and urban planners (Ramböll, 2014). Which of the two solutions that will be selected hasn't been decided yet, however the choice will have an impact on the developments in Frihamnen and other areas that are located along Göta älv.

4.1.3 Frihamnen

In Frihamnen the developments have been divided into several phases. The first phase includes 3000 houses and 2000 workplaces. This phase has been divided into a first land allocation, that consists of 1000 houses and 1000 workplaces. The selected developers for the first land allocation are shown in the table below.

Älvstranden utveckling AB	*Municipal company*
Hauschild + Siegel Architecture	*Developer of urban villas*
Botrygg Göteborg AB	*Developer of rentals and condominiums.*
Magnolia Bostad AB	*Focus on sustainability, developer of rentals, hotel and public services*
Framtiden och Göteborgs lokaler	*Developer of rentals and focus on the integration issues*
Rikshem AB	*Developer of rentals and condominiums. Responsibility regarding construction costs and rents*
JR Kvartersfastigheter	*Focus on commercial functions at the street level*
NCC AB	*Focus on offices*
P-bolaget	*Parking (will not be interviewed)*

Table 5: Selected developers for the first land allocation

The ground level in Frihamnen is between +2,0 to +2,5 meter and due to the low ground levels, the area is vulnerable for flooding from the rising tide and heavy rain falls. Also the surrounding neighborhoods; Kvillebäcken, RIngö area and Lundbyleden are located low, and are therefore vulnerable for flooding. The traffic intersection in the northern part of Frihamnen is the lowest point and is below sea level.

According to the fifth assessment report of IPCC (2014a), the sea level will rise between 0,3 m and 1,0 m in 2100. To be able to examine the negative impacts of the rising sea level, the municipality has developed a Hydromodel. In the Hydromodel three different sea levels and different precipitations can be modeled. The different sea level are: +2,0 m, +2,31 m, +2,65 m. The sea levels are based on studies of SMHI (Swedish Meteorological and Hydrological Institute) and representing the sea levels in 2014, 2070 and 2100, the representatively flood risk is shown in figure 24, 25 and 26. As the figures shows, large parts of Frihamnen can get flooded with the current land levels. Therefore the municipality of Gothenburg is developing adaptation strategies to be able to cope with the current and future sea levels. The adaptation strategies are presented in the next chapter.

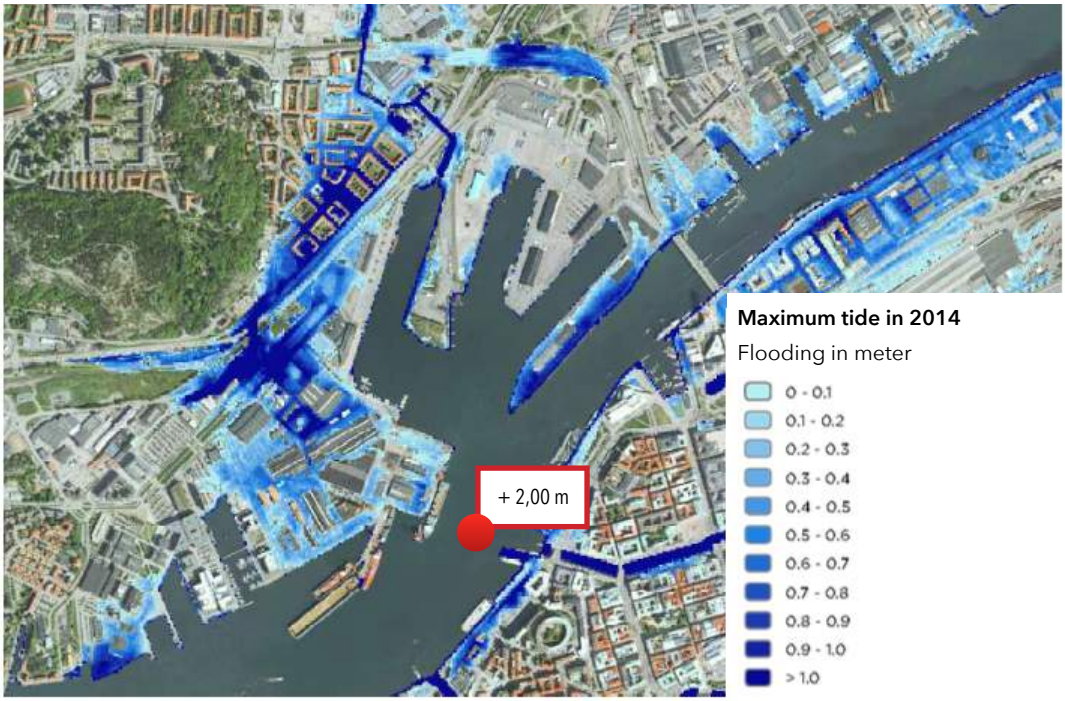

Figure 24: Sea level in 2014 with maximum tide (Blomqvist, 2015)

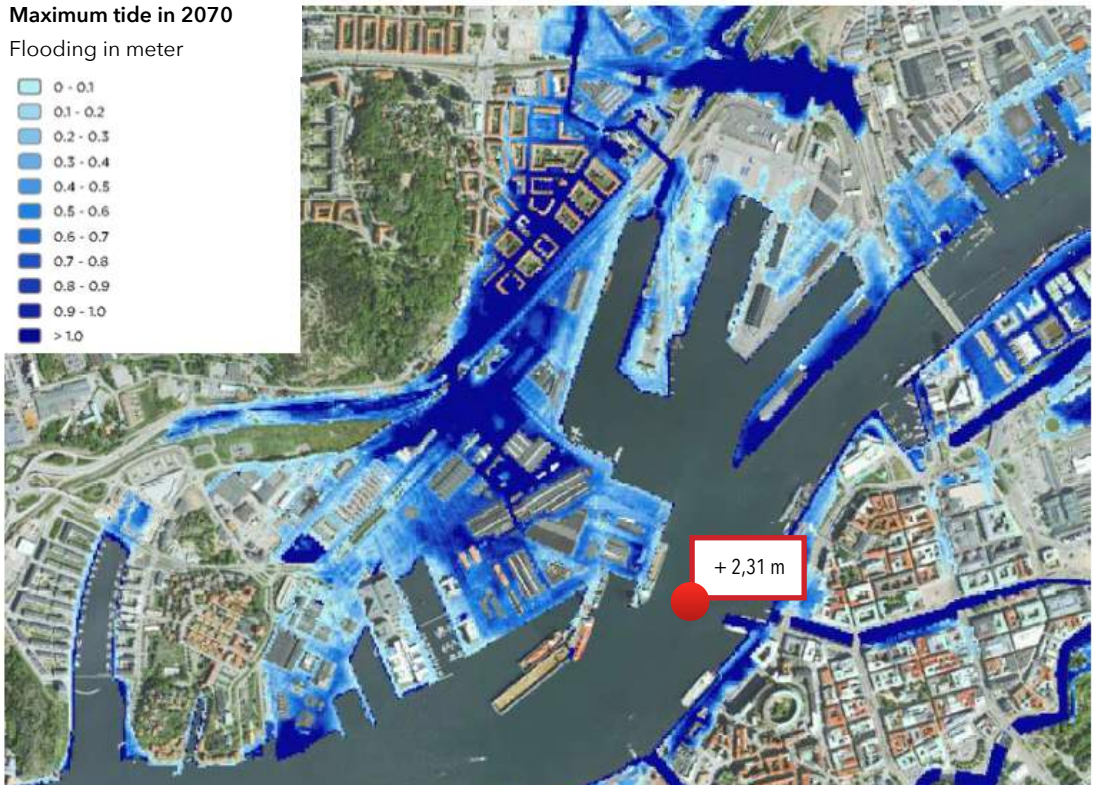

Figure 25: Sea level in 2070 with maximum tide (Blomqvist, 2015)

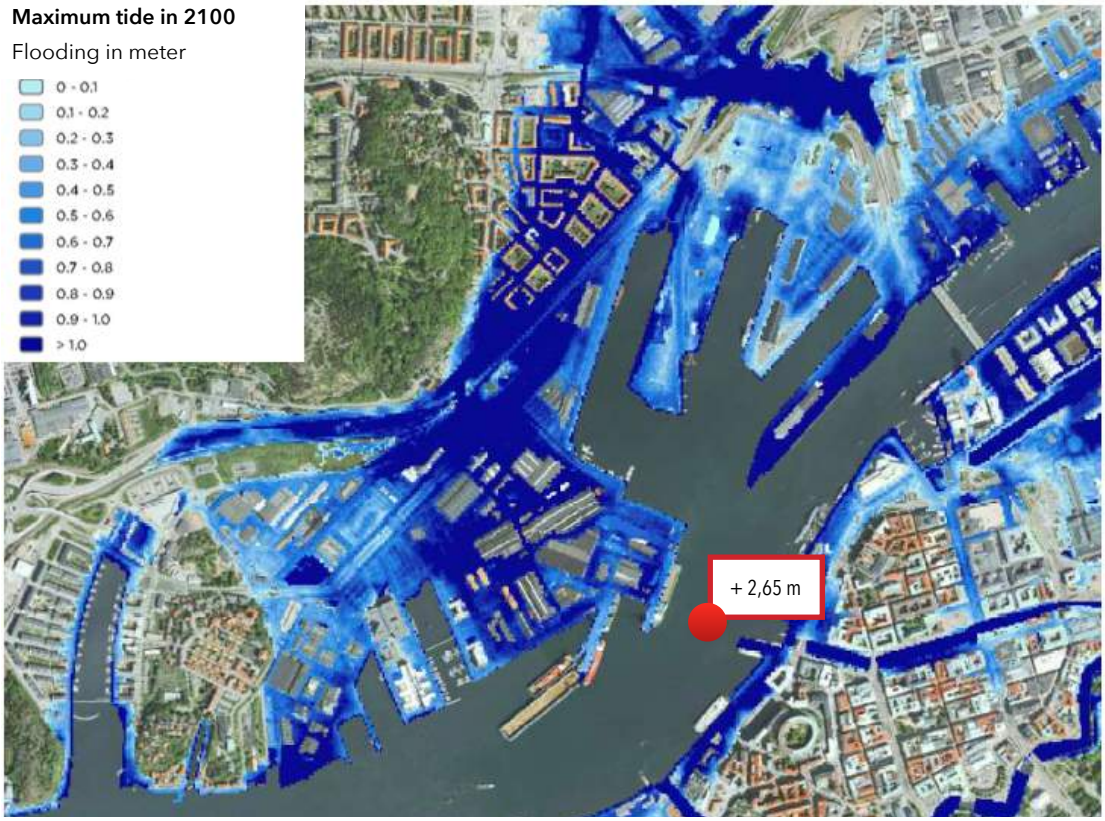

Figure 26: Sea level in 2100 with maximum tide (Blomqvist, 2015

4.2 Adaptations in Sweden and Frihamnen

To be able to cope with the climate changes: rising sea levels and increased precipitation, Älvstranden developments and the City Planning Office in Gothenburg are developing an adaptation strategy for Frihamnen in collaboration with the property developers.

4.2.1 Adaptation in Sweden

Nordic countries are putting adaptation high on their political agenda. In 2007 Sweden published the final report of the Climate Change an Vulnerability Commission, which stimulated the development of an adaptation policy. This policy is based on stakeholder engagement, consensus and negotiation and it includes the risks of climate change and the vulnerability of nature, people and socio-economic activities in Sweden (Klein & Juhola, 2014).

A research on two Swedish municipalities revealed a gap between the ones with information on adaptation and the ones implementing the adaptations. According to Klein and Juhola (2014) there was a misunderstanding between the national authorities and the local planners on the worst-case scenarios. As well as some of the municipalities were lacking in planning documents for the rising sea level and two-third of the municipalities did not discuss the expected sea level rise for 2100 (Von Oelreich et al., 2013).

According to Klein & Juhola (2014), several bottlenecks can be identified which caused a gap between the adaptation policies and the actions. One of the bottlenecks is the fact that adaptations are not the only priority of many stakeholders and that adaptations have to compete with other concerns. In some developments the economic and aesthetic value could conflict with the need for adaptation. For example the investments in flood-prone areas were allowed to improve the economic development of an area, despite the risk for flooding.

If there are any adaptation measures in Sweden they are mainly oriented at physical measures, which aims at reducing the hazard and vulnerability of flood-prone areas. Examples of physical measures for the protection of cities from the rising sea levels are building dams, walls, embankments and other permanent structures which interrupts with the water flows and can safeguard the coastline. According to Wamsler and Brink (2014) the establishment of a minimum height above sea level for the development of new buildings, could reduce the vulnerability as well as prepare the buildings to potential flooding.

Environmental measures aims at managing the runoff of water by directly reducing it where it falls or by delaying the water flow. Examples of environmental measures are green roofs, rain gardens and the use of open and local stormwater systems. Another measurement to protect cities from floods and the rising sea levels, is to give the water space and allow certain areas to be temporarily flooded to protect the city (Wamsler & Brink, 2014). A third adaptation

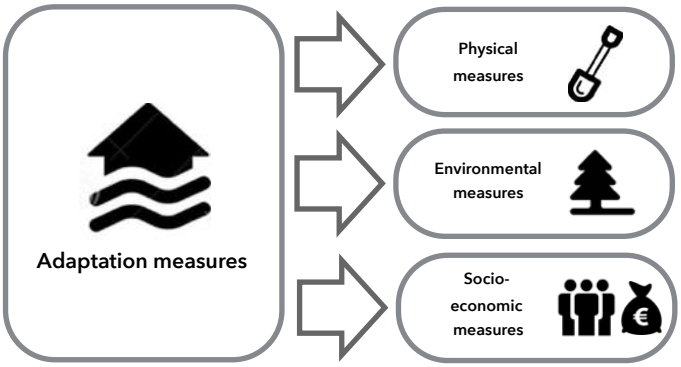

Figure 27: Adaptation measures (Wamsler & Brink, 2014).

alternative is the socio-economic oriented measures, which aims at preparing the inhabitants of a possible flood, by providing the public with information and raising their awareness. A problem identified by Wamsler & Brink (2014), is the fact that flood information can scare the homeowners and insurance companies and make houses in flooding vulnerable areas unsellable and with out an flood insurance. To avoid this some municipalities provide the inhabitants with a false sense of security and the risks of flooding is often build away. The three adaptation measures: physical, environmental and socioeconomic are shown in figure 27.

According to André (2013), there is little research which is focussing on the private sector and on how they are involved in adapting their buildings to the rising sea level. More research has been done on the public sector and on how Swedish municipalities are working on climate adaptation. This is a problem, when the private property owners have the responsibility to secure their own buildings to the rising sea level.

As already mentioned the municipalities are responsible for the adaptations on a local level. According to Wamsler & Brink (2014) the lack in top-down guidance for adaptation strategies, has made municipalities turn to private consultants for information. Water flows through multiple municipalities is making the municipalities dependent on each other. Currently their cooperation is optional but they recognize the need for a cooperation which is organized and institutionalized at a regional level. Meanwhile, several municipalities are waiting for other municipalities to take actions, and are thereby avoiding to take own responsibilities. This is complicating and delaying the implementation of adaptation strategies.

4.2.2 Adaptations Frihamnen

In Frihamnen the municipality and Älvstranden developments are taking actions to be able to deal with the rising sea levels and increased precipitation, through two interconnected adaptation strategies. To cope with the sea level and seal level rise, the streets in the middle of the piers are raised to +2.8 meter and vital social functions have an entrance at +3.8 meter and housing have an entrance at +2.8 meter. Towards the river the land is lower: in the park it is +2.0 meter and on the dockside it is +2.5 meter. To cope with the precipitation and increased precipitation lower parts will be created, which quickly can lead the rain water to the river (Klimatanpassningsstrategi, 2015). In figure 28, a sketch of the adaptation strategy is shown.

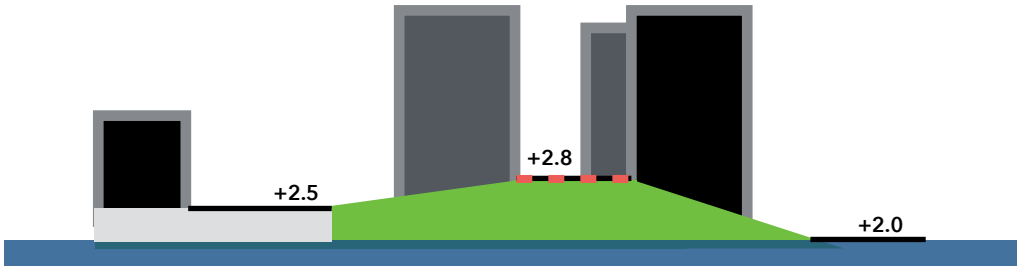

Figure 28: Adaptation strategy in Frihamnen (Klimatanpassningsstrategi, 2015)

In the development of these adaptation strategies the property developers are engaged through the consortium. Several workshops have been held to involve the property developers in the adaptation process and create awareness of the changing climate and needed adaptations.

On the request of the municipality of Gothenburg, Ramböll developed several solutions to cope with an increased precipitation in Frihamnen (Ramböll, 2015):

- Canals: By leading the canals far into the area the streets do not need to have slopes to transport the water. The canals can be small, and therefore take up less space than other solutions. But they are often high and paved quays which is preventing a relation with the water.
- Stream or channel with one park side: the park side gives the water the opportunity to expand into this area when there is a heavy rainfall.
- Stream or channel with park sides: the park sides gives the water the opportunity to expand into the area when there is a heavy rainfall. Along the stream bicycle and walk roads can be created.
- Multifunctional parks and plaza squares: along the water street parks and plaza can be created which can expand and collect rain water.
- Streets with storm water delay: the side of the roads can delay the water flows, through green structures.

Frihamnen will be a newly developed area and therefore it has good conditions to include climate adaptation strategies from the beginning. However the raising of the ground will only be able to cope with the sea level rise until around 2070, after this point the land levels do not meet the zoning plan requirements, where in is stated that the entrance of buildings needs to be 0.5 meter above the maximum tide. When in 2070 the maximum tide is 2.31 meter, the difference is less than 0.5 meter. Then one or both of the two earlier mentioned adaptation strategies: river protection and storm surge barrier are needed. Concerning the implementation and finance of these adaptation strategies many questions arises. To ensure that Frihamnen will be able to implement one or both of these adaptation strategies, room for the river protection is needed and is therefore saved along the outer embankment in Frihamnen (Klimatanpassningsstrategi, 2015).

In 2014 the detail plan for älvstaden was disapproved by the county administration board, because of question regarding the resilience of the plan to future sea levels. The county administration board demanded a tangible implementation strategy to manage the rising sea level. Therefore a special group consisting of; Älvstranden development, the traffic office, the city planning office (leading party), park and nature office, the real estate office and the water and sanitation company formed a group in 2014, to work on a proposal for the responsibilities regarding the implementation of the älv protection (Göteborgs Stad kommunfullmäktige, 2015). How this will be organized is still in process, and especially the financing part is unclear.

4.3 Findings

The findings from the interviews and questionnaires are presented in this chapter. An overview of the findings can be found in appendix E.

4.3.1 Engagement property developers

In this part the findings on the engagement and the behavior of the property developers in adapting the developments in Frihamnen are presented. This part is mainly based on the interviews with the property developers.

Awareness

The awareness of the property developers is divided in two sub categories, their awareness of the changing climate and on the flood risks in Frihamnen and secondly on their awareness of the planned adaptation strategies.

Overall the property developers were aware of the changing climate, some had hired consultants for the research, others had been involved in previous adaptation strategies and a study trip to Hamburg has been made, to study the property developments in the harbor and how they tackle the problems of the rising sea level. Thereby they were aware of the flood risk, however with the ground that will be raised the flood risk is limited.

> *'The risk of flooding in Frihamnen, I think is pretty small right now, due to the land that will be raised' (Long term property developer 5).*

Notable is that one property developer was not aware of the risks of flooding in Frihamnen and saw it more as an issue for the municipality of Gothenburg:

> *'We do not believe there is any risk. It is the assessment that has been made'*
> *'We wouldn't build in a place where there is a risk of flooding. Then we would build in another place' (Short term property developer 2).*

Through the workshops and the consortium the property developers (except one) were aware of the adaptation strategies for Frihamnen. Where the strategy aims at coping with the rising sea levels and (extreme) rain fall. To cope with the rising sea level, parts in Frihamnen will be raised and for the (extreme) rain fall, lower parts will be created and channels will be dug to collect and transport the water away.

> *'We have been involved in workshops, where the city's thoughts about walls and future dams are presented' (Long term property developer 4).*

> *'We participates in Frihamnens general works to raise the ground level. The city is also planning further actions, for example the outer barriers' (Long term property developer 3).*

Depending on the developments of the property developer, specific adaptation strategies have to be elaborated on. But there is an overall awareness of the planned adaptation strategies that have been developed by the municipality / Älvstranden development in collaboration with the property developers.

'We have discussed where to put electrical and technical installations, if there is a rising sea level. Because we are located on the ground floor, and will not be able put the installations one floor above' (Long term property developer 1).

Association

The association refers to the understanding the property developers have of the adaptation strategies and the (positive) relation the adaptation measures have on their developments. So how do they associate the benefits of the adaptation strategies with benefits of their developments.

The property developers saw the need of an overall adaptation strategy to cope with the rising sea levels.

'It is the area that has to be adapted not profitable to do this per building'
'It is much easier to raise the soil in general than to build the houses to low down and then adapt them' (Long term property developer 4).

We are on a general level in the consortium to find a model for the rising sea level and increased precipitation and we check the heights. We deal with sea level rise by raising the ground' (Long term property developer 5).

However the specific adaptation measures for the buildings have not yet been discussed. But the fact that some measures are needed on a building level several of the developers were aware of.

'On a building level the adaptation strategies / measures have not yet been discussed' (Long term property developer 1).
'The construction of the buildings will be waterproof' (Long term property developer 3).

Except for one developer, who didn't see the need to take any actions, besides complying with the standards and rules of Gothenburg city.

'We take no actions. But we ensure that the things we do are compliant to the standards and rules of Gothenburg city' (Short term property developer 2).

Acquisition

The acquisition refers to the ability and the willingness of the property developers to acquire the needed technology and skills to implement the adaptation strategies and measures. The ability and willingness will heavily be influenced by the business model of the property developers.

The developers who are long term property developers aims at avoiding problems and damages to their properties, and therefore they were more willing to adapt the buildings:

'We will own the buildings for a long time and we want to avoid problems. We are a developer and investor' (Long term property developer 3).
'We will own, manage and deliver quality housing to people in Gothenburg' (Long term property developer 5).

The long term property developers were aware of the changing climate and the risks of flooding, as well as they showed an interest in the adaptation strategies.

The technology and skills to adapt the building exists, however the developers emphasized the need to adapt the whole area, instead of adapting the buildings separately.

> *'The technology exists, if we would build on a waterfront which can be flooded. Installations could be higher, etc. But that is not the intention in this project' (Long term property developer 4).*

The developer who did not see any risks and wasn't planning on taking any actions was a short term property developer, who builds and then sells. Although they stated that they are very aware of the changing climate, they saw the municipality of Gothenburg as the responsible actor for the adaptations.

> *'This are issues that the City of Gothenburg are working with' (Short term property developer 2).*
> *'We develop properties and then we sell them. We believe in the idea that some are good in building, and others are good in owning' (Short term property developer 2).*
> *'If the municipality does not believe that we have to raise the ground for the coming changes then you don't do that' (Short term property developer 2).*

If the different perspective of the short term property developer only depends on their business model may not be the case and other aspects can cause the difference. For example the fact that where the headquarter of company is located (Gothenburg, Stockholm), involvement and knowledge of the person being interviewed and the medium of the interview (Face-to-face, telephone or email).

Application

The application refers to the ability of the property developer to apply the adaptation measures. If a property developer implements an adaptation measures depends on the previous steps, but also on the allocation of responsibilities.

The financial aspects of an adaptation are important for the implementation here of. The costs for the adaptation of Frihamnen will be included in the land price, depending on how much you have to raise the ground. If adaptation on the buildings are needed, these costs will be reflected in the selling price.

> *'It will be integrated in the price of the plot. So if you buy a plot which is very low and you have to fill it up to get the 2,8 meter, you will have a lower price, because you have to make the investment' (Long term property developer 1).*
> *'The city sells the land: yet not clear how it will be sold. The land can become cheaper if you need to make action to raise the ground' (Long term property developer 5).*

> *'Normal financing, with 1 to 2% higher costs. The sales prices justify the costs' (Long term property developer 3).*
> *'If we have to adapt the building and add a higher floor, then it will be more expensive' (Long term property developer 4).*

According to one developer the housing prices and rents are already very high, investing in adaptation measures would only increase the costs and the housing prices.

'We will never build homes in places which will expose their accommodation for any sort of risk. Because this would only increase the costs of buildings, and it would mean that rents go up' (Short term property developer 2).

One property developer discussed the needed interventions for extreme rain fall, and believed that the stormwater collection in canals will not be that much more expensive than the traditional way, while it can also add a value to the neighborhood.

The property developers believed the municipality of Gothenburg has the most responsibility in the adaptation of Frihamnen. The municipality is for 10 years accountable for the damages that can be caused by a zoning plan or building permits. In the zoning plan the adaptation measure on a scale of Gothenburg should be included. If the developers separately would adapt the buildings, the adaptation would be fragmentized, time consuming (if each developer to had to do a climate change forecast) and difficult to coordinate because it would involve several developers.

'The municipality makes the zoning plan, and that is where you set the conditions' (Long term property developer 4).
'Many of the solutions are on the scale of Gothenburg, so there has to be an contribution from the city in order to secure the city from the water' (Long term property developer 1).
'It must be the public authorities who set the rules. If the municipality does not believe that we have to raise the ground for the coming changes then we don't do that. Because it is the municipality that is responsible under the law for this' (Short term property developer 2).
'The municipality needs to take the responsibility, because these areas are extensive and involves several developers' (Long term property developer 3).

A developer can choose to develop in an area which the municipality has stated in the master or zoning plan is vulnerable for flooding, however then the developers have the responsibility to deal with the flood risk.

The municipality needs to take the responsibility that the conditions are correct, and they may say you are allowed to build on that level, but every 5 years this will flood and then it is the responsibility of me the developer to handle it in any way (Long term property developer 5).

4.3.2 Influences on behavior property developers

In this part the findings from the planning institutions, municipality of Gothenburg, insurance and questionnaires of the inhabitant of Eriksberg and Lindholmen are presented. These findings focusses on the external influences on the behavior of the property developers.

Planning institution

The planning institutions in Gothenburg and Frihamen are the city planning office and Älvstranden developments. The vision for Frihamnen and the climate adaptation strategies are developed by the consortium, which consist of Älvstranden developments and the selected property developers for the first land allocation.

The climate adaptation strategies for Frihamnen consists of two parts:

- A short and medium long adaptation strategy: *'local protection of Frihamnen: modeling the soil: high points for buildings and low points, to take care of heavy rain' (Älvstranden developments A).*

- A long term adaptation strategy: *after 2070 Frihamnen and the other areas in Älvstranden will be dependent on the city making a bigger strategy, which can be a huge barrier out side the city or a shelter along the river (Älvstranden developments B).*

The strategy is based on the fact that Frihamnen is a newly developed area, and therefore the ground can be raised.

> *In Frihamnen, where there is nothing we will raise the ground level. But in Lindholm, a neighborhood area, we have to build some kind of river shelter (City planning office C).*

The land in Frihamnen will be developed in a way, that each area protects itself. This is because the area is very large and it would be very costly and inflexible to build a big barrier and then build the houses on the inside. Added to this is the fact that Frihamnen does not only have to deal with the rising sea level, but also with heavy rainfall:

> *'If you build a wall around the area; the water is collected on the inside and then it will be flooded from within' (Älvstranden developments A).*

The buildings that will be developed are also part of the flood adaptation strategy as it will be part of the flood protection.

> *'The buildings are higher at the street and can be wet on the waterfront side. There will be a need to put temporally protection between the buildings, someone has to be responsible for this' (Älvstranden developments A).*

An ambition of the municipality of Gothenburg is to develop rentals with four different rent levels:
- A level is 1000 SEK / m2 year. *'Is really cheap for new construction' (Long term property developer 5).*
- A level is 1400 SEK / m2 year.
- A level is 1850 SEK / m2 year. *'Which is perhaps the normal rent in new construction' (Long term property developer 5).*
- And a fourth level that is not defined.

To be able to develop the package deal of the four rents, the developers have to find new business models and exploit in new ways.

Älvstranden developments owns the land and sells the land, therefore Älvstranden developments can make agreements with the property developers. Through the traffic office and park and nature office the higher and lower parts are created. The traffic office is responsible for the streets and canals, and the park and nature office is responsible for the parks.

> *'We sell the land to them and then we can fund the expansion and climate protection. We (Älvstranden) build nothing, everything is built by external developers'*
> *'So the roads and climate protection is build by the traffic office, who receives the money from Älvstranden, who receives from selling the ground' (Älvstranden developments A).*

The municipality has the monopoly on planning, through the building permits, master plans and zoning plans. If a developer is not meeting these conditions they can't develop. Therefore the

municipality has an important role in adapting Frihamnen to the changing climate, because in the zoning plan for Frihamnen the impacts of the rising sea level has to be taken into account. The level of the buildings are included in the zoning plan: Hospitals and other society important functions have to be located at 3.8 meters, local streets at 2.6 meters and finished floor of residential accommodations at 2.8 meters.

'It lies at the municipality to develop a zoning plan that manages risks' (Long term property developer 4).
'The municipality has a plan monopoly' (Long term property developer 5).

'The City Planning office and Water and sanitation office are responsible for making the climate adaptation strategy. Then Älvstranden developments and the developers in the consortium are responsible for executing / implementing the strategies' (Älvstranden developments B).

However within the municipality there are uncertainties on who should be responsible for the finance and implementation of the long term strategies, the big barriers and the collection of the heavy rain fall in existing neighborhoods:

'When it is everybody's responsibility without coordination it doesn't work very well' (City planning office C).

'The City Planning office is responsible for planning the new building in a way that they can withstand the heavy rain, but there is no clear responsibility who should build / finance those measures, and especially if you're talking about existing environments' (Water and sanitation office D).

Through the development model that is used in Älvstranden, the property developers are involved early on in the process. An unique aspect of the model is the fact that the developers don't know which plot in Frihamnen they will develop, therefore it is in everybody's interest to come up with a plan that is climate adapted and attractive. By including the developers early on the process, an understanding for the plan and the adaptation strategies can be gained and the incentives for the property developers to leave the developments in Frihamnen can be reduced.

'The developers have an understanding how to design and develop and they are calculating the costs of these measures to ensure it is feasible. Therefore it is important to include them in the process' (Älvstranden developments B).

'The development model in Älvstranden invites the developers early in the process, and together we have created a manifest: a sort of treaty which is related to the zoning plan and where the joined ambitions are included' (Älvstranden developments A).

The housing shortages and the competition for space in Sweden and Gothenburg is causing the municipality of Gothenburg to increase the pace of housing developments, which is leading to a plan in Frihamnen with a very high building density.

Institutional conditions

The institutional conditions refers to the national government in Sweden, the regional government: the county administration board of Västra Götalands län and the local government, including the departments within the municipality of Gothenburg.

The interest of the national government are represented in the masterplan. One aspect of interest for the national government, is the national security. A part of this national security are secured national roads. Here for is the municipality the responsible actor, and some actors at the municipality and Älvstranden developments are wondering when the national and regional governments will take a responsibility here for.

> *'A outer storm barrier would protect the national road to Karlstad and Oslo, the railroad and the surrounding municipalities' (City planning office C)*

The county administration board approves or disapproves the master and zoning plan.

> *'Therefore they are also very important in the process in Frihamnen. If they agree on the detail plan for the first phase, the developments in Frihamnen can start' (Älvstranden developments B).*

When the county administration board chose to take in two zoning plans in 2014, because they had some uncertainties on how the municipality dealt with climate adaptation in the plan, the delay costed more than 70 million Swedish crowns.

Within the municipality there are several departments responsible for the implementation of the adaptation measures, which can delay and complicate the adaptation of Frihamnen.

> *'Many different units within the municipality: Park and Nature office, Traffic office and City Planning office. Not clear who is responsible. Disagreements within the municipalities takes time and that can affect the consortium' (Long term property developer 1).*

> *'But right now the City Planning office are the most important, because we have the mission from our politicians to coordinate the climate adaptation in the city' (City planning office C).*

At the water and sanitation office in Gothenburg a sewage tariff has to be paid to be connected to the sewage system. The sewage tariff consists of two parts:

- Construction charges: you pay it one time when connecting your property: the property owner pay the charge.
- Operating Fee: you pay for the water you consume: water (drinking water), waste water (douche, toilet and laundry) and surface water (rain).

> *'The operating fee will be changed because not everybody has a system where the surface water is connected onto' (Water and sanitation office D).*

The water and sanitation office is limited in what they can fund with the sewage tariff. For example a heavy rain fall, of 100 years or more is not a sewage tariff issue, but an issue for the City Planning office. Because in the law is regulated that the sewage tariff can not be used for heavy rain.

'The City Planning office responsibility; Planning rain management. When it rains so much, the pipes are already full, so it has to be dealt with through elevation and green areas' (Water and sanitation office D).

The sewage tariff can be used to guide the developers. There is a proposal where the sewage tariff will depend on the pipeline the property developers order from the water and sanitation office. Through this tariff incentives can be created for the property developers to delay or/and decrease the amount of rain water that will be collected in the pipeline.

'It is clear that if there is a very large plot and only hard surfaces you will need a giant pipeline' (Water and sanitation office D).

One way of reducing the rain water in the sewage system is to set rules for the developers to delay the rainwater and lead it out on the garden or have your own water magazine, as in Germany. A property developer who is only involved in the building phase, will be less interested in the maintenance costs and sewage tariffs.

'But the developers are just building a house and then selling it to the next' (Water and sanitation office D).

On an international level: the European level, new standards are set on how often a house may be flooded. Before it was not more then once a ten years, now this has changed to not more then once a thirty years. This is influences the dimension of the pipelines and therefore many pipelines have to changed, which will be time and cost consuming. The pipes are replaced every 200 years, but the water and sanitation office will now change this to every 100 years.

Economic conditions

The economic conditions refers to the housing and financial market in Sweden and Gothenburg. This includes the finance of the adaptation strategies in Frihamnen, the banks and the insurance companies.

Financing the adaptations in Frihamnen will be done through the land sales. A pre- assumption herein is that all the land will be sold. So far the municipality and property developers experience a housing shortage in Gothenburg, which is stimulating the propriety developers to develop in Frihamnen.

'The land is sold for the market price and the price will cover the costs of the local road network '(Älvstranden developments A).
'The financing of Frihamnen is a bit easier because a lot will be developed and the adaptations can be included herein '(Älvstranden developments A).

For the finance of the outer barriers or river shelter protection a lot of money is needed. For the outer storm surge barriers around 150 million Swedish crowns is needed yearly for the maintenance and management hereof. How this will be financed it not clear yet.

'I think that money must be marked for the purpose, because the general taxes can go to everything if the politicians say that' (City planning office C).

Banks provide the property developers with a loan to develop or to own the properties. If the risks are high, the bank can relate this to a high interest rate.

> *'And if the price for money goes up, due to the risks, it can be difficult to develop in a flooding vulnerable area' (Financial department Gothenburg city F).*

However the role of the banks in managing and translating the risk of flooding into the interest rate is not that common and obvious yet:

> *'I do not think that banks are looking at the risks. We exploit the ground and the risk must be eliminated in the plan. It lies with the municipality to develop a zoning plan which manages the risks' (Long term property developer 4).*

In Sweden, every insurance company has an insurance that includes flooding. This is a condition which the insurance companies want to keep, but it can become impossible or very expensive if floods occur more frequent.

> *'A pre-condition to insure is that it is sudden and accidental, but if it is not that, we have to put another price which is the same price to repair it. The insurance will not be able to insure the house for flooding if the flooding is not longer sudden and accidental' (Insurance company E) .*

The costs and claims for flooding in Sweden in 2011 to 2013 were between 200 - 300 million Swedish crowns and around 4000 - 7000 claims. In 2014 the costs were nearly 1 billion Swedish crowns and around 24000 claims. So far in 2015 there haven't been so much costs and claims from flooding.

If a property developer wouldn't be able to receive an insurance for its development, they would rethink the developments. Because an insurance is crucial for the risk management of a property developer.

> *'If you can't get an insurance, you wouldn't build' (Long term property developer 5).*
> *'An insurance is critical. If you don't have the ability to insure the project, you need a much stronger economy' (Long term property developer 1).*

The conditions for an insurance can also change, if the insurance companies notice that floods occur to frequent, this could lead to higher premiums for the property developers and homeowners or no insurance anymore.

> *'The premiums will go up if you do not adapt the buildings. So adaptation is needed to get an insurance' (Long term property developer 1).*

An insurance company has a reinsurance, to be able to bear the responsibilities and cover the possible damages of an insured property.

> *'If you have a large company, you can insurer more by our self. But if it a small company or if it is a really large accident, you have to reinsure the cost that your company can't take' (Insurance company E).*

The responsibility to adapt flooding vulnerable areas is transferred to the municipalities, who has the responsibility to develop the master and zoning plan, where the risks of flooding should be included.

> *'Insurances goes after the zoning plan, and would there be flaws in the zoning plan, the municipality is responsible for those shortcomings. And then, the insurance can take up compensation of the municipality' (Long term property developer 4).*

Also the national government have a role in the adaptation, but a problem with them is their focus on mitigation instead of adaptation.

> *'The state have the responsibility to adapt and we have to work together. But that is not working out so well, we are trying to talk to them and to have a collaboration with them, but they previous and current government is more into mitigation (CO2 reduction) than adaptation' (Insurance company E).*

If flooding vulnerable areas are not adapted to the changing climate, the insurance companies may not be able to insure the houses in this location anymore and then the value of the houses can drop a lot.

> *'In a couple of years, we may not be able to insure anymore and then the owners/ users and banks will have a problem' (Insurance company E).*

Social conditions

The findings from the social conditions are based on the interviews with the property developers, planning institutions, and the insurance company, as well as on the questionnaire that were filled in by the residents of Eriksberg and Lindholmen.

There is a high demand for housing in Gothenburg, Sweden and the current housing shortage is around the 11.000 -14.000. One developer believes that the public have the feeling that they are paying a large part of their income on housing.

> *'People feel they have to pay a large part of their income to housing' (Short term property developer 2).*

Citizens can be involved in the development of a zoning plan. Because the zoning plan is a democratic process, where they have the opportunity to appeal the plan, which is a reason the planning process takes from 3 years to an indefinite period.

> *'This makes the process very long: 5 to 7 years before a zoning plan becomes legal' (Long term property developer 5).*

The areas that will be develop close to the water, is something many people find interesting and therefore there is a demand for houses in Frihamnen.

> *'Somehow it is more exclusive to have a view over water than a field' (Long term property developer 5).*

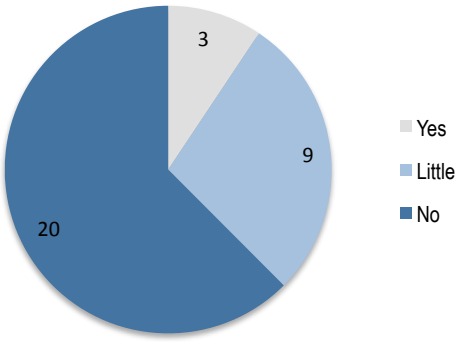

Figure 29:
Q: Do you ever feel threatened by water?

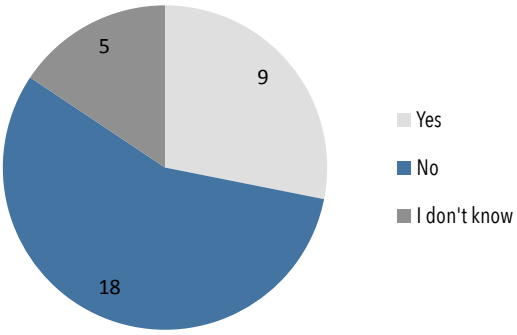

Figure 30:
Q: Do you think your home would get flooded it the sea level rises and the rain increases?

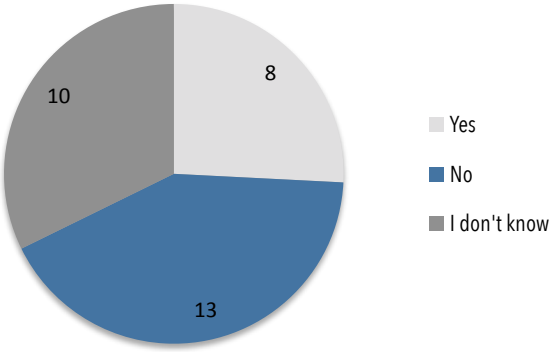

Figure 31:
Q: Do you know if you have an insurance that cover damages from flooding?

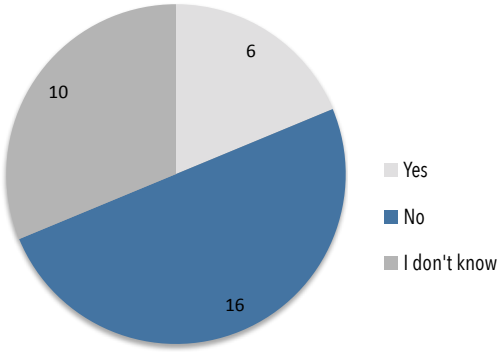

Figure 32:
Q: Is your home/neighborhood adapted to the changing climate?

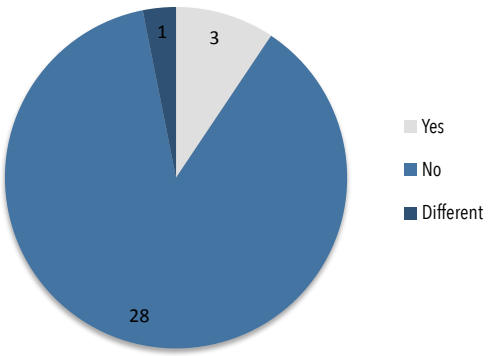

Figure 33:
Q: Did you bear the risks of flooding in mind when you bought/rented your home?

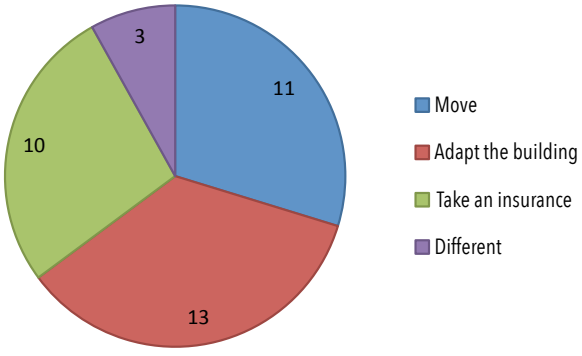

Figure 34:
Q: How would you deal with potential risks for flooding in your neighborhood?

From the questionnaires were found that, the majority of the inhabitants of the waterfronts in Gothenburg are aware of the changing climate and all the respondents believe the sea level will rise. However only 3 out of the 32 respondents felt threatened by the water, and 20 did not feel threatened by the water: figure 29. The risks that their house would get flooded wasn't seen as a big risk: figure 30. If they have an insurance that covers flooding, the respondents gave scattered answers, 8 said they did and 13 thought they did not: figure 31. Most of the respondents, 16 did not think their neighborhood is adapted to the changing climate: figure 32. Only 3 respondents thought about the risks of flooding when they bought / rented the building: figure 33. If there would be a potential risk of flooding in the neighborhood of the respondents, 11 would move, 13 would adapt the building and 10 would take an insurance: figure 34. When it comes to the responsibilities of a flooding in the neighborhood of the respondents the municipality was seen as the most important actor: figure 35. When it comes to the safety and responsibility of the building the owner and the municipality are the biggest group: figure 36.

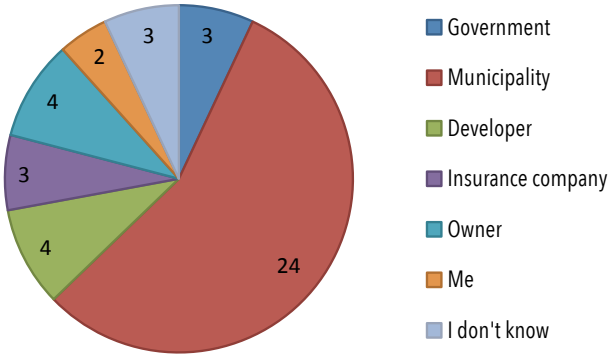

Figure 35:
Q: Who is responsible for the safety of your neighborhood regarding flooding?

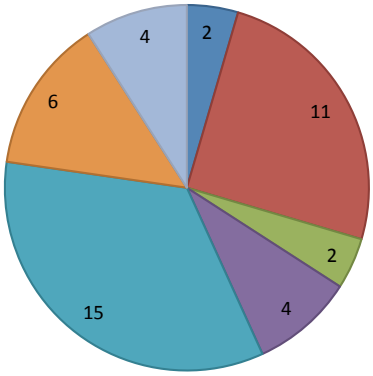

Figure 36:
Q: Who is responsible for the safety of your house regarding flooding?

An overview of the findings from the questionnaires can be found in appendix G.

Physical conditions

The physical conditions refers to the climate, the changing climate and the land in Frihamnen.

Many developments have been made on higher located areas, and now these areas are exploited therefore the developments are now taking place on lower located areas.

> *'The higher levels have already been exploited. The lower areas, haven't been build for a reason' (Property developer 1).*

The soil in Frihamnen consist of 100 meters of clay, which is making it very difficult and expensive to raise the ground.

'Adapt to the rising sea levels in combination with the really bad GEO technical conditions is a challenge. Because it is over 100 meter of clay, before you reach firm rock will be a challenge' (City planning office C).
If you want to build up more than 0.5 to 1 meter you need to piling all the land, and it will be very costly (Älvstranden developments A).

Future sea level rise is something which is uncertain but which can have a large impact on the developments along the river.

'How much will the sea level rise in the future, no one knows' (City planning office C).
'After 2070 the city as a whole will have a problem with the rising sea level' (Älvstranden developments B).

In the next chapter the findings are summarized and related to the research questions.

4.4 Conclusion

This part answers the sub-questions and gives a short reflection on the findings and the theory. The answers are divided in two parts: the engagement of the property developers and the influences on the engagement of the property developers.

4.4.1 Engagement of property developers

In general the property developers in Frihamnen were **aware** of the impacts of the changing climate and the planned adaptation strategies, however the strategy entails the raising of the ground and therefore the property developers didn't experience the rising sea level as a threat to their developments. One developer was even convinced that the risks of flooding was nihil in Frihamnen and that the location wouldn't be developed if a risk of flooding would exist. Where this developer based its assumptions on is unclear, because the other developers were aware of the planned adaptation strategies for Frihamnen and the need to adapt the area to the risk of flooding.

According to Moser and Ekstrom (2010), the first step in the adaptation process is understanding the problem: which in this case is understanding the risk of flooding, due to the sea level rise, rain and extreme rainfall. If there isn't an awareness or understanding of the risks the next steps: planning and managing an adaptation will not be taken, and the adaptations in Frihamnen can be delayed or prevented. In Frihamnen a majority of the property developers had an understanding of the risks and the planned adaptation strategies for Frihamne, which is positive for the adaptation.

The awareness among the property developers has been raised through the consortium and the workshops, which emphasizes an inclusion of all the involved stakeholders. Through including the property developers early on in the process they became aware of the problems and the adaptation strategies. According to Jamal & Stronza (2009) including key individuals and groups early on the process can be an effective way to get stakeholders engaged. In Frihamnen a mutual understanding of the risks of flooding and the needed adaptations will make the property developers more willing and able to be engaged,

The property developer **associate** the adaptation of Frihamnen with their developments: without raising the ground and the creation of the lower parts for the rain it wouldn't be possible to develop in Frihamnen. Because adapting the house separately would be very expensive. Therefore the developers agreed that an overall planned adaptation strategy for Frihamnen is the best solution, instead of adapting the buildings separately. The overall planned adaptation strategy can include measures to the dwellings as well, but these conditions haven't been identified yet, but examples of adaptation measures that can be done on the buildings are: green roofs, more green surfaces, which can absorb the water and slow down the water run-off and waterproof basements.

The ability of the property developers to **acquire** the skills and technology to implement the adaptation strategy in Frihamnen is something all property developers have, either within the company or they hire the skills. However if a property developer acquire the skills and technologies is based on the previous steps: the awareness and association, as well as on their core business: are they involved for the long or short term. Because a property developer who is shortly involved in the development, is limited exposed to the risks of the changing climate and the risk of flooding, therefore they are less willing to invest in adaptation measures which are needed in the long term (Shearer et al., 2013). The property developer who was not aware of the flood risks in Frihamnen is a short term developer. While the other developers, who are the developers and the end owners of the

properties, were more engaged in the adaptation measures to prevent flood damages to their properties. Therefore a connection between the property developers engagement and their business model is found

If the property developers **apply** any of adaptation measures in their developments, depends on several aspects. First of all the developed adaptation strategies will be included in the zoning plan, making the property developers obligated to pursue the requirements in the zoning plan. The adaptation measures are part of the land preparation and will therefore be done by the traffic and park & nature office. However the property developers have to pay for this, when they buy the land. Because the property developers are driven by profit-making objectives the extra costs for the adaptation will be included in the selling price or rents. Including the adaptations in the zoning plan, is the responsibility of the municipality, therefore the municipality has a big responsibility in ensuring that the master and zoning plan are adapted to the changing climate. The adaptations for the buildings have not yet been identified, and therefore it is difficult to determine how engaged the property developers will be in the adaptation of the buildings.

4.4.2 Influences on engagement of the property developers

The **planning institutions** in Gothenburg consists of the City Planning office and Älvstranden developments, who are developing the adaptation strategies for Frihamnen. The adaptation plan aims at accommodate the risk of flooding in Frihamene, through creating higher parts in the middle and lower parts which leads to the canal, illustrated in figure 37. By including the adaptation strategies in the master and zoning plan, the risk of flooding can be reduced, and according to Carter et al. (2015) this makes the spatial planning a key mechanism in adapting the built environment.

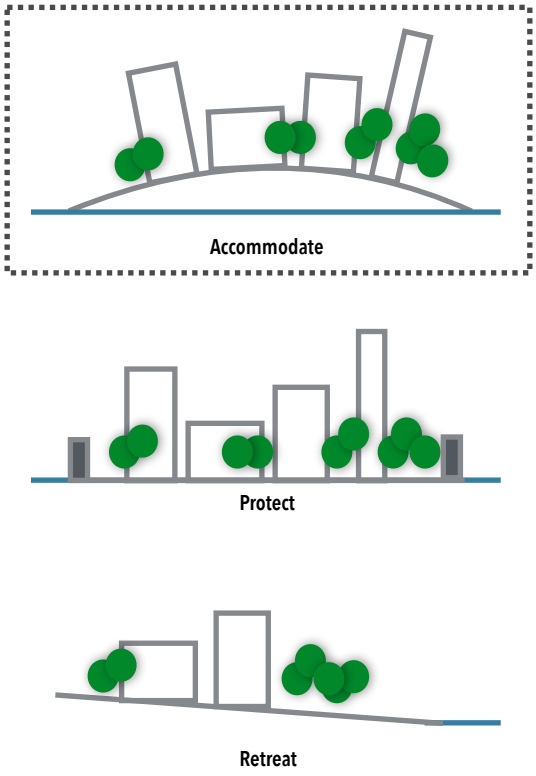

Figure 37: Adaptation strategy in Frihamnen

This strategy will ensure that Frihamnen is able to cope with the risk of flooding on the short and medium long term, depending on how much the climate is changing. These measures are financed through the land exploitation. Hence, the role of the planning institution in the adaptation of an area, is essential, through the master and zoning plan.

On the long term the adaptations strategies in Frihamnen will not be enough, due to the rising sea levels. Two alternative solutions are developed: outer storm barriers or/and river protection. Where the aim of the hard adaptation measures are to protect the low-lying areas. How these interventions will be financed is not identified, because it is difficult to distribute the rights and ownerships, costs and benefits. Secondly the need of these interventions are for some private actors not immediate and thirdly the interest of the private actors may not correspond to the interests of the public, these

difficulties of implementing long term adaptation strategies corresponds to the findings from Tompkins & Eakin, (2012).

Sweden is a welfare state, where the role of the **institutions** / government is strong and steering, which is influencing the developments in Frihamnen. The national government is not so involved in the climate adaptation strategies, their focus is on mitigation and the current refuge situation, which is pushing the municipalities to increase there housing developments. In Frihamnen this is visible through the high number of accommodations that will be developed, first it was 9000 now 15000.

The regional government: the county administration board is controlling the master and zonings plans and ensuring that they are taking the changing climate: the sea level rises and increased precipitation into account. Due to their disapproval of a zoning plan in 2014, due to uncertainties regarding the plan and future sea level rise, the delay costed 70 million Swedish crowns. After a plan has been approved, the local government: the municipality of Gothenburg is responsible for the development and implementation of the adaptation strategies. Which is a challenge for Gothenburg because they are constrained by limited funding, institutional mechanisms and a lack of leadership, which were also mentioned in the fifth assessment report (2014a) as challenges for local governments when developing and implementing adaptation plans.

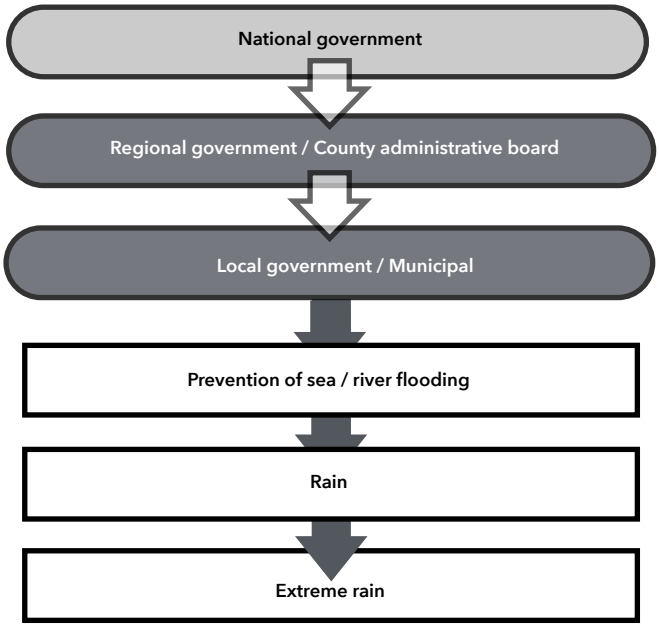

Figure 38: The connections between the governments (own ill.).

In Frihamnen the adaptation strategies are developed by the municipality and Älvstranden developments, who are controlled by the county administration board. The national government is only involved on a general level, with their interests in for example a secured road infrastructure. The connections between the governments is illustrated in figure 38. The white arrow indicates that the governments have an influence on the municipality. The grey arrow indicates that the municipality is responsible for the sea/river flooding, rain and extreme rain.

According to Shearer et al., (2013) the willingness of developers to address sustainability issues is strongly linked to **economic conditions**: the better the economic conditions are, the more willing are

developers to be engaged in efforts to incorporate green and sustainable principles. This is visible in the developments in Frihamnen. In Sweden, Gothenburg, the economic conditions are very promising and the housing shortages are causing the housing prices to go up, therefore the developers have a positive attitude towards the adaptation of the area an the buildings.

A second phenomena which is influencing the engagement of the property developers to the flood risks, are the insurances. The developers in Frihamnen wouldn't build anything if they wouldn't be able to get an insurance for their developments. Many of the developer in Frihamnen are also the end owners of the buildings and therefore they have a long term perspective and want to avoid damages, and an insurance is a tool to manage the risk of flooding. So the insurance companies can play an important role in influencing the developers to adapt the buildings.

The Gothenburg citizens are important for the developers, because they from the **social conditions** which influences the housing demand, if there wouldn't be any demand for housing the developers wouldn't build. In Gothenburg there is a high housing demand, making it attractive for developers to develop in Frihamnen.
Sweden is a democratic country, which implies that the planning process also is democratic, where the citizens have the possibility to appeal a plan. Through elections the citizens can affect the national, regional and local government, who sets the policies and documents regarding the urban development of areas.
The awareness of the changing climate is present, however an awareness of the flood risks is limited, which may be caused by that fact that a severe flooding has not occurred and therefore the inhabitants haven't experienced any tremendous damages of flooding themselves, according to Fliatova et al. (2011) the flood risk awareness is related to your own experience with flooding, and here in Gothenburg any extreme floods haven't taken place.

The **physical conditions** in Frihamnen consists of 100 meter clay in the soil, which is complicating the raising of the ground. Therefore is chosen to only raise the middle of the docks. The location of Frihamnen at Göta älv, which is connected to the North sea, is vulnerable for sea level rise, when there is a low air pressure, that pushes the sea level up. When there is a high air pressure, the possibility of rain is high. Making Frihamnen vulnerable for flooding from the sea and rainfall at various times.
The intended adaptation strategies in Frihamnen will be able to manage the sea level rises until around 2070, after this point the changing climate will lead to a sea-level rise, where the current building heights in Frihamnen are not high enough. However that will also be the case for other areas in Gothenburg and therefore a solution for the whole of Gothenburg is needed.

Thus, the planning institutions have a large influence on the engagement of the property developers in adapting Frihamnen, through the master and zoning plan, where the adaptation measures are included and the building permits. The national and regional government is influencing the decisions of the local government through policy documents and regulations. These documents are steering for the development of the master and zoning plan and therefore the national and regional governments are indirectly influencing the engagement of the property developers. The strong economic conditions in Sweden are stimulating the property developers to develop in Frihamnen, and has a positive impact on the adaptation of the developments. When the citizens have the financial prospect to buy expensive houses, the developers have the possibility to develop more expensive houses that are adapted to the changing climate. The physical conditions are complicating the raising of the ground, however with new solutions and technologies these conditions can be

managed. The location also determines the price of the properties. The more attractive and requested an area is, the higher can the housing prices be.

4.4.3 Analytical framework

In figure 39 the connections between the external features and the property developers are shown in an analytical framework. The connection between the planning institutions and the property developers is illustrated with a red arrow. The planning institutions have a direct influences on the behavior of the property developers through the master and zoning plan and because they are the owners of the land in Frihamnen. The property developers are also influencing the planning institutions, through the consortium. The planning institutions are also influenced and steered by the national and regional government, who set the regulatory framework and controls the master and zoning plan. This influences is shown with the bold arrow from the institutional conditions to the planning institutions. The social conditions: the citizens demand has an impact on the developments of the property developer, without a demand, they wouldn't build. The extreme high housing demand in Gothenburg is also influencing the planning institutions to increase the building density in Frihamnen, these influences are shown with the black arrows from the social conditions to the planning institutions and the property developers. The citizens demand is influenced by the economic conditions in a city, which in Gothenburg is a high housing demand and high housing prices. The high housing prices are also influencing the property developers to develop, as they are driven by profit-making objectives, and will conduct a cost-benefit analysis to determine their investments. The influences of the economic conditions is illustrated with two arrows to the social conditions and to the property developers. The adaptation of Frihamnen is mainly driven by the planning institutions which is illustrated with a big grew arrow towards an adapted Frihamnen. However the property developers are also involved and engaged in the adaptation of Frihamnen, and therefore this is illustrated with a smaller and lighter grey arrow.

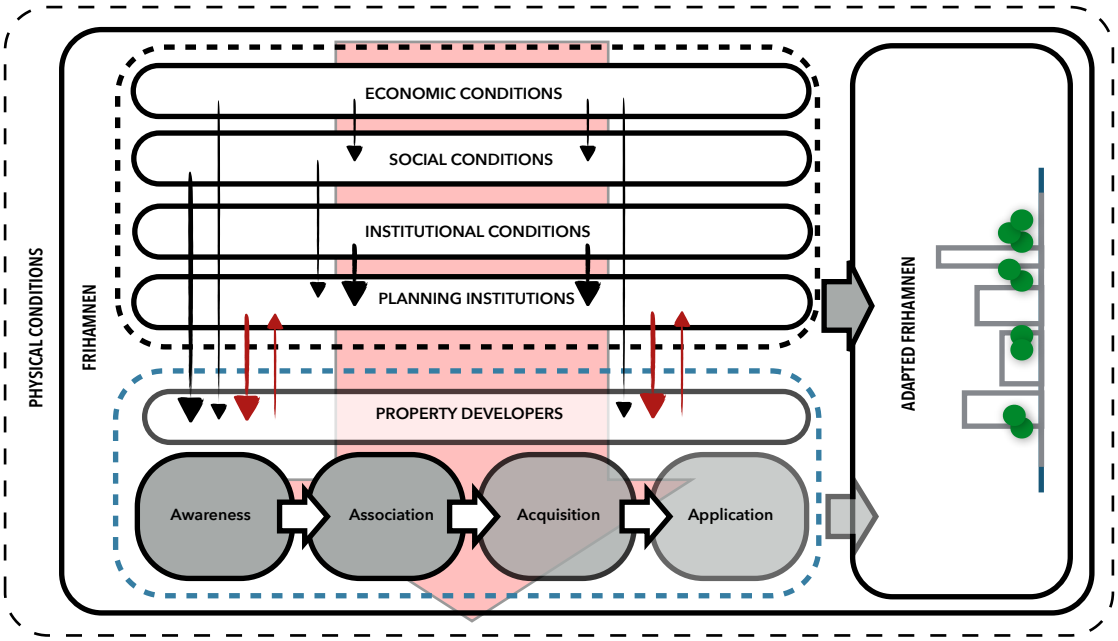

Figure 39: Analytical framework

(Image: own photo, October 2015, Stadswerven)

5. STADSWERVEN

This chapter presents the second case study: Stadswerven in Dordrecht. Before going into depth on the findings in Stadswerven the context in the Netherlands and Dordrecht are discussed. Through the document analysis, the interviews and the questionnaires answers to the sub- question are given: *To what extent are the property developers engaged in the adaptation of Stadswerven, Dordrecht?* and *What external features are dominant in influencing the property developer's engagement in adapting the urban waterfronts in Dordrecht?*

5.1 Context

5.1.1 The Netherlands

The Netherlands is a low-lying country which has faced challenges from the sea for centuries. According to KNMI (The Royal Netherlands Meteorological Institute) and the Delta Commission, the sea level is expected to rise between 0.20 and 0.40 meter by 2050 and to 1.30 m by 2100. Combined with longer periods of increased precipitation, low-lying urban areas will face an increased risk for flooding. With 60 percent of the the Netherlands lying below the sea level, the changing climate is an important policy issue in the Netherlands (Stead & Tasan-Kok, 2013).

'Activities to minimize and prevent flooding have been part of the planning agenda since planning began' (Stead & Tasan-Kok, 2013, p. 214). The Dutch water and land management is very old and for centuries the Dutch have constructed waterways, earthworks and barriers to protect themselves against the water. However there have been some events, where the systems could not withstand the water, for example the flood disaster in 1953, where the dikes in the south-western of the Netherlands were unable to protect the country against a combination of a high spring tide and a north-westerly storm. This led to the foundation of the Delta Commission, who became responsible for reducing the threats from sea. In 1993 and 1995 high water levels in the Maas and Rhine rivers located in the southern and central part of the Netherlands, which forced thousands of people to evacuate (Stead & Tasan-Kok, 2013).

The Dutch urban planning is controlled by the government. Through integrated instruments, national spatial policies are distributed top-down to the municipalities. However in recent years the control of the government has been reduced, which left the developments more to the market conditions. The government changed its role and is not longer the developer and financier of a project, but provides the normative framework of planning and building regulations. According to Verbeek et al. the lack of central direction has hampered the adaptation of climate resilient policies (Verbeek et al., 2010).

The Rijkswaterstaat is the executive agency of the Ministerie of Infrastructure and Environment (a ministry of the national government in the Netherlands) and they are working on a safe, livable and accessible Netherlands. Together with waterboards, provinces and municipalities, the Rijkswaterstaat is protecting the Netherlands from flooding. The Rijkswaterstaat is responsible for the main water systems, the primary flood defenses and the standards for the water safety. The waterboards are responsible for the regional water management, management of flood defenses and wastewater treatment in a certain area. Nowadays there are 24 waterboards compared to 3500 in 1850, which are united in the Association of Waterboards (Kuijken, 2015). The municipalities are responsible for disposal of sewage and stormwater through the drains and the groundwater in the urban areas.

Several programs have been developed to secure the Netherlands from floods: the Delta Program, Room for the River and The National Water Plan, these programs will be explained below.

The Delta Program is a national program, where the national government, provinces, municipalities and waterboards are working together in protecting the current and future generations from flooding. The Delta Program 2015, consists of national delta decisions and preferred strategies for subareas, which provides the national government, province, municipalities and waterboards with a compass for the implementation of interventions until 2050 (Kuijken, 2015). The Delta Program is controlled by the Delta Commissioner.

The five Delta decisions are (Kuijken, 2015):

- Water safety: a new approach for protecting people and the economy from floods
- Freshwater: a new approach for limiting water scarcity and optimize the use of freshwater for the economy and utility functions
- Spatial adaptation: a new and more focused approach on the water robust and climate proof (re) development of urban areas.
- Rijn-Maasdelta: structured decisions on the water safety in Rijn-Maasdelta
- Ijsselmeergebied: structured decisions on the water safety in Ijsselmeergebied.

Room for the River (RR) is a new policy, where the focus of the strategy is on 'living with water'. It aims at creating space for the rivers. The policy is developed by the Rijkswaterstaat, waterboards, provinces and municipalities. The RR aims at an integration between water and land and is moving away from the hard boundaries. Several areas along the Rhine, Waal, Meuse, Ijssel and Lek are contributing to the flood safety by increasing river flow and discharge capacity and enhancing the spatial quality and stimulating regional economic developments (Roth & Winnubst, 2014, p. 234).

The Room for the River plan in a spatial water solution, the shift from infrastructural to spatial flood risk management have some impacts on the risk and protections of citizens, property values, the daily life and economic activities. According to Roth and Winnubst (2014) the spatial solutions requires new forms of negotiation and cooperation between stakeholders.

The National Water Plan provides guidelines, principles and direction for the national water policy in the period 2016-2021, with a preview to 2050. The ambition of this document is to make authorities, companies and citizen more aware of the risks and threats of the surrounding water (Waterstaat, 2008). In the National Water plan a multi-layer safety approach is introduced. The first layer aims at preventing flooding, the second layer aims at reducing the consequences of flooding by adapting the spatial layout and the third layer aims at enhancing the emergency responses in case of a flooding. According to Van Herk (2014) preventing

Figure 40: The three layers of safety (Van Herk, 2014).

has been the main priority in the Netherlands, but the risk of a flooding can not be excluded and therefore the second and third layer have been developed. In figure 40, the three layers of safety is illustrated.

In the Netherlands a distinction is made between embanked areas and unembanked areas. The embanked areas are protected by the Rijkswaterstaat and Waterboards, who govern the safety of the residents against flooding. In the unembanked areas there are no legal standards for the protection against water and the Rijkswaterstaat and Waterboards are not responsible for the safety of these residents. These areas are primarily intended for the dispose and storage of water. In unembanked areas along the coast and rivers the government have formulated guidelines, which the municipalities and provinces have to take into account for the development and design of the areas. However the owners and users of unembanked areas are responsible for the risks and the damages by the water and the implementation of measures to reduce the risk of flooding from the water. Because the residents and users of unembanked areas bears these responsibilities it is important that they are aware of the risks. (Waterstaat, 2008).

5.1.2 Dordrecht

The population of Dordrecht consists of around 120.000 inhabitants. It is located in the south west of the Netherlands, below Rotterdam, figure 41. Dordrecht has an old historical inner city, which is characterized by multiple functions and the most important center of the region. It owns its identity to the connection the city has with the surrounding water and has therefore been dealing with high water levels for centuries. Stadswerven is located closely to the inner center of Dordrecht and is well connected to the main infrastructure of the city, therefore it has a potential to give the inner center a new urban impulse (Masterplan Stadswerven, 2009).

Figure 41: Location Dordrecht (sourcs)

Dordrecht is located on an island and has a surface of 90 km2. It is surrounded by the old Merwede river and the Old Maas in the north, the new Merwede in the south and the Dordtsche Kil in the west. The polder is protected by a 37 km long primary dike-ring, in the areas outside the dike there is a tidal differences of 80 cm (Kelder et al., 2013 & Gersonius et al., 2011).

The municipalities in the Netherlands have three specific responsibilities concerning water (Jong & Hobma, 2012, p. 5).:

- Collection and transport of wastewater
- Rainwater run-off; Section 3.5 of the Water Act, regulates the municipal duty to care for the efficient collection and processing of rainwater run-off.
- Groundwater; Section 3.6 of the Water Act, regulates the municipal duty to care for groundwater.

In section 3.1 of Spatial planning act it is stated that *the Municipal Council shall adopt one or more local land use plans for the entire territory of the municipality, in which, the interests of proper spatial planning, the use of the land included in the plan shall be designated and rules laid down with a view to such use* (Jong & Hobma, 2012, p. 7).

According to the Spatial planning act the following aspects are relevant for the spatial plan (Jong & Hobma, 2012):

- Water storage areas (in for example parks).
- Forms of roofs, density of buildings in the area (for example in the form of more green and water functions).
- A multifunctional rain water storages.

5.1.3 Stadswerven

Stadswerven is a former shipyard on the edge of the historical city center in Dordrecht. Stadswerven will be transformed into a residential area with 750 buildings and a range of commercial, cultural and public facilities. The area that will be developed is 0.3 km2 big and is surrounded by water; river the Merwede, a smaller river the Wantij and a very small river the Vlij. Stadswerven is located outside the dikes and has an average ground height of +3.0 meter NAP (Van Herk et al., 2011).

The development process started in 2001, when the municipality started to acquire the land and developed the urban masterplan for De Stadswerven. In 2005 the urban masterplan was approved by the city council. To be able to met the requirements of flood regulations, the ground level had to be raised to +4.0 meter NAP. Due to tensions between the private developers and the municipality the redevelopment of Stadswerven got delayed and suspended in 2007 (Van Herk et al., 2011). In 2009 a new masterplan for Stadswerven was developed, which is now steering for the development.

Stadswerven is surrounded by water and the added value of the water is exploited, through options to live near and on the water as well as the creation of high valued public spaces near the water. In figure 42A an overview of Stadswerven is given. In the figure 42B the normal situation and the water level is illustrated. In figure 42C an overview of the situation with a 85 cm tide is illustrated (Masterplan Stadswerven, 2009). As the figure shows, some areas in Stadswerven are flooded with a high tide. The adaptation strategies that are used to prevent Stadswerven to get flooded, are presented in the next chapter.

The involved property developers are: JP van Eesteren, Am and Dura Vermeer. These property developers have the possibility to develop the whole area in Staswerven, because of the partnership agreement they have with the municipality.

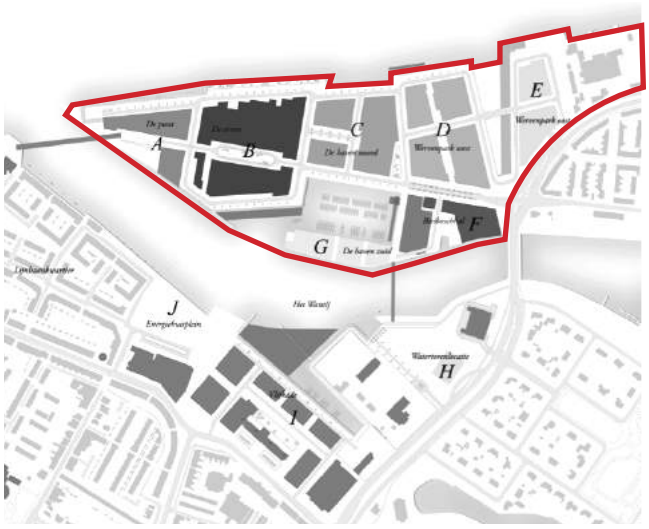

Figure 42A: Stadswerven Dordrecht (Masterplan Stadswerven, 2009).

Figure 42B: Normal situation (Masterplan Stadswerven, 2009).

Figure 42C: Situation with a 85 cm tide (Masterplan Stadswerven, 2009).

5.2 Planned adaptations

To be able to cope with the risks of flooding the Netherlands have an old water management. First the adaptation strategies in the Netherlands are presented followed by the adaptation strategies in Stadswerven.

5.2.1 Adaptations the Netherlands

In 2006 a National Spatial Strategy was approved, which shows the government's vision for the spatial development in the Netherlands until 2020. In this document the impacts of flooding and water shortage are included and form an important principle for the spatial development. The importance of the changing climate in the spatial planning is also addressed in The 2007 Program on Climate Adaptation and Spatial Planning. Adaptation is largely a spatial issue and the main challenge for the spatial planning will be making the Netherlands resilient to the changing climate. Besides adaptation, mitigation is also an important issue in this program, while mitigation relies on a global approach with global effect, adaptation is predominantly on a local or regional in level (Stead & Tasan-Kok, 2013).

The Waterboards collects taxes for the finance and the maintenance of dikes, as well as they assures the water quality. This system is not uniform across in the country and is not reflecting the individual benefits of the flood protection. The 24 waterboards are independent authorities, who can decided their own taxation systems. Some waterboards charge 'dike-tax'; for the households who live near the dyke and benefit the most from a proper maintenance of the dyke. Other households are not charged with tax on water defenses, because their properties are located on high grounds. The water defense tax is very low, only 0.15% per each 2.500 € of property value, which is insignificant compared to other housing costs.

Without the protection of the dykes, delta areas would regularly be flooded, therefore the waterboards priority is to protection areas against high water levels from the rivers. A problem however with the new requirements form the High Water Protection Program, is the fact that the Waterboards have to increase the waterboard taxes, to be able to invest in the measures that are need to meet the new requirements (Alblasserdamsnieuws, 2014)

The Room for the River program aims at setting back serval river dikes and making space for controlled floods. When the plans of the Room for the River program do not match the current land use, for example agricultural and residential use, the government buys the land of the individual landowners or offers them a replacement plot some where else, to be able to give the water the space it needs (Botzen & van den Bergh, 2009).

5.2.2 Adaptations Stadswerven

The Urban Flood Management is a local, bottom-up and integrated approach for the development of urban areas, where flooding is one of the design aspects that has to be taken into account by a multi-level consortium. Two tools were developed to test the spatial plans in Stadswerven for flood risks and damages. One by the Deltenares who developed a flooding model and on by Dura Vermeer who, developed a damage model. These two models were used to study the flood risks and the possible damages floods could cause. The Urban Flood Management (UFM) Dordrecht was active between 2005 and 2008 and was part of an international collaboration between, Dordrecht, London and Hamburg. After UFM, several projects have been created which study the flood risks in Dordrecht and Stadswerven: MARE, Carmina and a new blue green infrastructures project (Kokenberg, 2015).

Because Stadswerven is an unembanked area, the spatial plan has to manage the high water levels. Therefore the adaptation measures in Stadswerven are included in the master and zoning plan. The adaptation measures include the raising of the ground in the middle of Stadswerven to +5 meter NAP and the right side of Stadswerven is raised to + 4 meter NAP. The buildings that are located on these parts are protected from flooding, in figure 43, the adaptation strategies are illustrated (Kokenberg, 2015).

In Stadswerven a relationship with the water is aimed to be created, therefore the left side of Stadswerven is located at +2.5 to +2.8 meter NAP. The buildings that will be developed here will have to be adapted to the high water levels. Also a park and square will be located at +2.2 NAP meter, and be flooded on a daily basis due to the tide. The design of the lower parts, which can be flooded was only possible because of the fact that the water in the rivers are freshwater and not salt water. Because salt water would have destroyed the plants and threes in the park (Kokenberg, 2015).

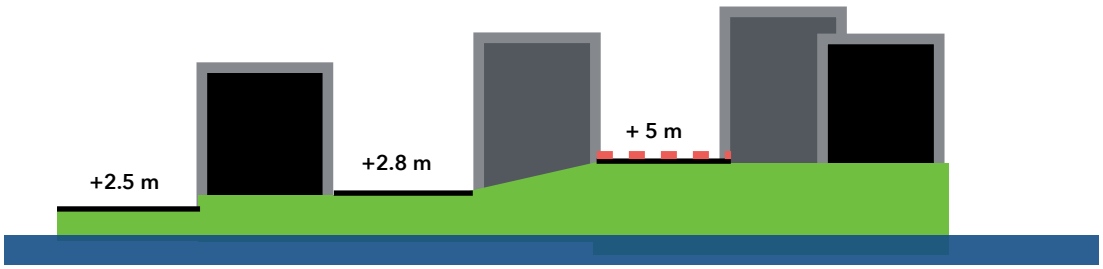

Figure 43: Adaptation strategies in Stadswerven (own ill.).

5.3 Findings

The findings from the interviews and questionnaires are presented in this chapter. An overview of the excel sheet with the findings can be found in appendix F.

5.3.1 Engagement property developers

In this part the findings on the engagement and the behavior of the property developers in adapting the developments in Stadswerven are presented. This part is mainly based on the interviews with the property developers.

Awareness

The awareness of the property developers is divided in two sub categories, their awareness of the changing climate and on the flood risks in Stadswerven and secondly on their awareness of the planned adaptation strategies.

The property developers in Stadswerven were aware of the risks of flooding due to the rainwater from the hinterland as well as from sea due to the changing climate. Besides this, Stadswerven also has to deal with a daily tide of 85 cm.

> *'Tides in Dordrecht 85 cm. The risks of flooding of the hinterland is bigger than the sea' (Property developer 1).*
> *'Very aware of the changing climate, because you can not avoid it' (Property developer 2).*

The planned adaptation strategies in Stadswerven entails an elevation of the middle part, the Maasstraat which gradually decreases to the water. Hereby the water is given space and a relationship with the water is created. A park and a square are located on these lower parts and will therefore flood on a frequent basis. This is only possible due to the fact that the water is freshwater and not salt water which would destroy the plants and trees.

> *'It is in our opinion not a battle against the water but a living with water' (Property developer 1).*
> *'With freshwater flooding you can do something with salty water everything dies' (Property developer 2).*

Most of the houses are located on the higher parts in Stadswerven and will therefore not be a threatened by floods, however the houses that are located on the lower part: the left side of Stadswerven: the wanttij side, are vulnerable to floods and have to be adapted and have an entrance at 2.8 meter.

> *'Maasstraat, the central street in Stadswerven is elevated and deliberately placed at 5 meters' (Property developer 1).*

Association

The association refers to the understanding the property developers have of the adaptation strategies and the (positive) relation the adaptation measures have on their developments. So how do they associate the benefits of the adaptation strategies with benefits of their developments.

Several studies and models have been developed to study the impacts of the river and the water flows from the hinterland. Herein the damages of the water appeared to be smaller if space was given for the water.

> *'If you consciously try to give the water somewhere to go, as we do now, the risk of damage is considerably smaller' (Property developer 1).*

The buildings that are located on the higher parts in Stadswerven, will not be flood adapted. But the buildings on the left side, the wanttij side, needs to be flood adapted. In the beginning of the project, the developers were supposed to develop all the houses in Stadswerven, but due to different reasons: one property developer said the developments there would be to expensive and not profitable to sell, while the other property developer said that the land is given back to the municipality, so they can sell it to private individuals, who will build their own house, to create a more mixed environment in Stadswerven.

> *'The buildings that are high enough will not be adjusted. Is is purely the buildings on the left side where you get measures' (Property developer 1).*

> *'But eventually we are not going to develop this anymore, we gave the land back to the municipality. And the municipality sold the land to private individuals, for self-build homes. Because the four layers of living here was so expensive, and we said, we will not be able to sell it in a profitable way' (Property developer 2).*

A urban planner at the municipality of Dordrecht stated that the involvement of the property developers in the adaptation of the buildings is limited.

> *'The problem with it is, the property developers want to make the most profit and how can they do that: by building the same thing they build anywhere else' (Urban planner municipality Dordrecht).*

According to the property developers, they do adapt the buildings, through the design and the materials they use in the buildings. But it is always a tradeoff, what kind of adaptation you will invest in.

> *'We need to make the design in a way that is aimed at preventing a house to get flooded, but we don't and can't control the nature' (Property developer 2).*
> *'For the floor on the ground floor, you take a material that is less vulnerable: screed' (Property developer 2).*
> *'We will not experiment with glass facades under the water, as in Hamburg. Too much risk and people can find it scary' (Property developer 1).*

The three property developers are joined in a consortium: OCW: Development Combination the Werven. Together with the municipality they have made the master plan and herein the adaptation strategies are included, which in this case is the raising of the ground.

> *'The master plan was drawn up together with the municipality, and herein it says that the soil will be increased' (Property developer 2).*

In the OCW, the responsibilities are divided between the three property developers, one developer is mainly responsible for the urban plan, while the other two have the responsibility to develop the buildings.

> *'Our core business is to built. Everything will be sold' (Property developer 2).*

Acquisition

The acquisition refers to the ability and the willingness of the property developers to acquire the needed technology and skills to implement the adaptation strategies and measures. The ability and willingness will heavily be influenced by the business model of the property developers.

The developers saw the developments as long term investments, which should exist even when the climate changes, however as they will not be the end owners of the buildings, some urban planners experienced a lack of engagement of the property developers in the adaptation of the buildings, because of the fact that the municipality has reduced the risks of flooding through raising the ground.

> *'We are developers. If we work on an area development, we always do it for the long term' (Property developer 1).*
> *'We find it very important to create residential areas which are future-proof. Ideally you want it to exists in over 100 years' (Property developer 1).*
> *'Sell the homes to individuals, they will soon be the owner. And the public areas goes back to the municipality' (Property developer 2).*

> *'The municipality raised the ground: For the developers there is not an incentive to change their plan, because they can build the exact same row of houses as they can build anywhere' (Urban planner municipality Dordrecht).*

An impact on the adaptation measures the municipality has implemented, is that the property developers don't have to come up with creative solutions to deal with floods. The municipality believes they could have done this differently. By dividing the land in smaller plots and ask the developers to come up with their best idea for that plot, the developers would have been challenged to come up with their best ideas. This could have given the property developers more incentives to adapt their developments

> *'With the way we have approached Stadswerven we also have taken away the creativity of the developers to come up with solutions' (Urban planner municipality Dordrecht).*

> *'I think with our current knowledge we would cut up in smaller plots and give that to different developers, and that would be a bit more work but every time ask al the developers, to come up with their best idea for that plot' (Urban planner municipality Dordrecht).*

The role of property developers in unembanked areas is very important, because here the National government, Rijkswaterstaat and Waterboards are not responsible for the flood protection. The owners and property developers are. However the municipality can give advice and steer the developments through the zoning plan and building permits.

> *'In unembanked areas the property developers are very important, because there it is the responsibility of the private developer or building owner to take flood protection measures. So*

we give an advice on how high they have to build. If they build lower, they have to show what flood protection steps they are taking' (Interviewee C).

A recent challenge are the consequences of heavy rain fall. In order to cope with this, green areas have to be created, which is something property developers could participate in.

'Many private properties have much hard, paved areas. And we want to keep it green, for climate adaptation and for the run of' (Interviewee C).

Application

The application refers to the ability of the property developer to apply the adaptation measures in their developments. If a property developer implements an adaptation measures depends on the previous steps, but also on the allocation of responsibilities.

The financial aspects of an adaptation is important for the implementation of an adaptation measures. In Stadswerven the municipality has invested in raising the ground. Which the property developers believe was necessarily, otherwise a dike around the area would had to be built, or each house would had to be adapted, which had been costly. When the property developers buy the land, they negotiate the price of the land with the municipality. Herein they take the revenues minus the expenses, to find the residual value, which indicates the amount of money they can invest in the land.

'The municipality has increased the land which was not easy' (Property developer 2).
'The municipality financed the raising of the ground' (Property developer 1)
'If ground wouldn't be raised you would have to put a dike around and then you would no longer have the view. If the homes had to be adapted independently, this would be costly and you have to pay more' (Property developer 2).

The masterplan was developed by the municipality and the OCW. Therefore the developers saw themselves together with the municipality responsible for the developments in Stadswerven.

'Together with the municipality, we are the parties that make the developments in Stadswerven possible' (Property developer 2).
'The agreement that we have made is that the design risk and in this case the risk of flooding, is not with the builders but at the municipality and OCW: developments combination the Werven' (Property developer 1).

When the master plan was developed, the property developer pointed out that they are the professionals with the knowledge and the skills to develop a balanced and good urban plan. However the property developers have to make a profit when they develop and are driven by profit-making objectives, which determines if they will make any investments in adaptation measures.

'We are professionals, we have the knowledge and skills, so it's also our responsibility to achieve a balanced and good urban plan there' (Property developer 1).
'If we do not make a profit, we do not exist any more' (Property developer 2).

5.2.2 Influences on behavior property developers

In this part the findings from the interviews with the planning institutions, municipality of Dordrecht, bank and the questionnaires of the inhabitant of Stadswerven are presented. These findings focusses on the external influences on the behavior of the property developers.

Planning institution

The urban planners at the municipality of Dordrecht are the planning institutions. The plans for Stadswerven were developed together with the OCW: development agency the Werven, where one developer acted as urban planner.

The original plan for Stadswerven was to develop 1000 apartments, but this has been reduced to 750 dwellings and apartments. Because the OCW and also the municipality believed the scale of the first plan was too big.

> *'Less is more, we want quality and ambition' (Property developer 1).*

The role of the municipality in the masterplan was and is important, therefore the developers choose to collaborate with the municipality in the development of the masterplan. Because the masterplan is made by the municipality and the property developers there is no discussion on the content of the plan. The municipality has a steering role in the developments, as owner and exploiter of the ground.

> *'Very dependent on the municipality, and therefore pulled together' (Property developer 2).*
> *'The municipality thinks with us on the details of the location, besides this they also have a public role: they are giving permits' (Property developer 1).*

> *'We (the municipality) have a steering and ground exploitation role. Transforming an area requires a lot of investments. We had to demolish the old buildings, the soil was polluted: so we had to put clean soil there. We have made a lot of costs' (Urban planner municipality Dordrecht).*

In the new master plan from 2009 the adaptation strategies were included and the water and water safety are two key elements. The main strategy entails raising the ground of the lifeline, the Maasstraat to + 5 NAP and the ground for the houses to + 4 NAP. The homes located on the left side of Stadswerven: the wanttij side will be located at +2.8 NAP, which is considered to be a height that may be flooded once a five hundred years, but to ensure that the damages of flooding are limited, the living areas will be placed on the second floor. So on the first floor parking or ateliers can be placed. The municipality is also selling 5 or 6 water plots, where floating houses will be developed.

> *'The main access road to the Maaslaan is about height constructed +5 NAP and the homes on dike level +4 NAP' (Urban planner Stadswerven).*

> *'Floating houses, which can move with the tide and with extreme water levels: people are going to design and build them themselves, we (the municipality) are selling plots of water' (Urban planner municipality Dordrecht).*

> *'The public spaces are lower and will flood from time to time. Residents should be aware that they live in a tidal area' (Urban planner Stadswerven).*

There will also be some lower parts in the plan: the park and the square, where a connection with the water is made but also an awareness of the water is created.

> *'For Stadswerven we don't want to raise the whole area, so some parts are not raised. We have chosen some parts that can flood. For example, we are going to develop a public square, which will be build on a height that it will get flooded once every year. And we have a park which will be elevated, part of it will flood on a daily basis and other parts only in extreme cases' (Urban planner municipality Dordrecht).*

The land in stadswerven was polluted, so the municipality choose to raise the ground at the same time as cleaning the ground. The height that are used: + 5 NAP and + 4 NAP are considered to be a safe height for future sea level rise and increased rainfall.

> *'Because the soil was polluted we already had to do a lot of ground work and then we could raise the level as well. Doing it at the same time' (Urban planner municipality Dordrecht).*

> *'In Stadswerven is such a height applied taking into account an upcoming and future expected increase in the water level or increasing rainfall' (Urban planner Stadswerven)*

The adaptation strategies are included in the master and zoning plan to ensure that they are taken into account in the developments.

> *'We like to implement the adaptation strategies within the masterplan and zoning plan, because that are the documents you access the developments on' (Urban planner municipality Dordrecht).*

To help and advice the municipalities in making the master and zoning plan, the province government has developed a tool: risicoapplicatiebuitendijks, which provides the municipality with an overview of the risks of flooding in unembanked area.

> *'There is also a tool available to do the flood risk assessment, from the province' (Researcher UNESCO - IHE).*

Rain is not a big challenge for Stadswerven, because it is located on an island, the water can flow into the rivers.

> *'Dordrecht is an island and we are lucky therefore that our whole internal water system, goes to rivers. And we have done some calculations, and in a lot of areas, heavy rain fall will not be a problem, because of the capacity of our internal canals and ditches are big and that has historical grown that way' (Urban planner municipality Dordrecht).*

> *'Stadswerven: is less vulnerable for heavy rainfall, is an unembanked area, the water can flow into the river, without causing much damage' (Researcher UNESCO - IHE).*

Institutional conditions

The institutions consist of the national government in the Netherlands including the Rijkswaterstaat, the Waterboards, the Provincial Government and the local government in Dordrecht.

For the flood protection of the Netherlands the Ministry of Infrastructure and Environment: form the National Government, with the executive body the Rijkswaterstaat and the Waterboards are responsible. The Ministry sets the protection standards, which are translated into the Delta program. The Waterboards are responsible for the maintenance and assessment of the premier flood defenses. The Waterboards are raising taxes, and therefore they have their own budget.

> *'The ministry (national government: infrastructure and environment ministry: rijkswaterstaat) sets the protection standards.' (Researcher UNESCO - IHE).*

> *'The waterboards are responsible for the maintenance of the premier flood defenses and also to do the assessment if they are still up to the standard or not. The waterboards have their own budget. They raise taxes as well' (Researcher UNESCO - IHE).*

But Stadswerven is an unembanked area and therefore the National Government and the Waterboards are not responsible for the protection and the people who live there are. To help the municipalities with the developments in an unembanked area, the Provincial Government has developed special regulations for the buildings and an online tool.

> *'The waterboards are responsible for the dykes, but they have to follow national policies, and the national governments says people living in unprotected area have to take care of their own risks' (Urban planner municipality Dordrecht).*

> *'The provincial government of south Holland, have special regulations on building in unambanked areas. And they have created an online tool, where you can put your digital zoning plan in and that will calculate casualties and the collective risk of the people for water issues' (Urban planner municipality Dordrecht).*

Until 2008 the Provincial Government had the authority to approve the zoning plans, but the laws were changed and now the Provincial Government has a advising role. Which made the process quicker and now the authorities who are close to the developments have the responsibility.

> *'The process is quicker and the parties that are closer to the developments / actions have the authority' (Urban planner municipality Dordrecht).*

Sometimes the National Governments intervenes with the spatial planning of the municipalities. Through policies, like Room for the River: they can demand enough space for the rivers to flow and prevent developments in unembanked areas. Because Stadswerven was already build upon, as an old harbor, it was possible to build there. Also the Waterboards can intervene with the plans of the municipality by setting rules and controlling the municipalities developments.

> *'The Waterboards are very powerful in terms of dyke raising. And they have a tool: the water test, where the waterboard can control the municipalities if they are doing their homework. Municipalities have to develop 10% open water' (Researcher UNESCO - IHE).*

The municipalities are responsible for the urban water management: sewage and protection of rain fall flooding. From the Water Plan 2009-2015 the municipality got requirements on how big the sewage capacities must be. To pay for the sewage system, the municipalities raises sewage taxes, but a problem occurs when there is an extreme rainfall. Because the municipality is responsible for the

sewage systems and the Waterboards for the water in the canals, but when there is too much water and the two systems start to interact, a collaboration between the municipality and the Waterboard is needed.

> *'When you talk about extreme rain fall, the municipalities and the waterboards start to interact, because the canal can block the outflow of the sewage and the water can come back in' (Researcher UNESCO - IHE).*

The plans for Stadswerven have been delayed in many years and the politicians are now putting pressure on the developments.

> *'Given the superb location of the area, this an important project that has considerable political attention and should be implemented' (Urban planner Stadswerven).*

> *'Stadswerven is one of the most important projects in Dordrecht, because it is the link between de historic city center and the unembanked area' (Researcher UNESCO - IHE).*

A lot of focus has been on the prevention and protection of the Netherlands against flooding, but an important actor in disaster management is the safety region. But they don't have any budget to develop plans.

> *'The delta program focusses on protection by dykes, but maybe we should also look at what we do if a disaster happens. And then the safety region is crucial. But they don't have any budget and they don't get any money from the national government to develop plans' (Researcher UNESCO - IHE).*

Economic conditions

The economic conditions refers to the housing and financial market in the Netherlands and Dordrecht. This includes the finance of the adaptation strategies in Stadswerven, the banks and the insurance companies.

In 2008 / 2009 the Netherlands was stricken by the global financial crisis, which caused the average housing prices to drop 25%.

> *'We come from an economic crisis, home prices have fallen by 25% over the average'(Property developer 1).*
> *'The last 4 years, the global financial crisis was the biggest challenge. and the housing crisis in Holland, we were creating a housing bobble, it didn't burst, but a lot of developments slowed down' (Urban planner municipality Dordrecht).*
> *'Due to the collapse of the market plans have drastically changed and there is an organic development' (Urban planner Stadswerven).*
> *'When we started: 8 years ago, the biggest challenge was not the climate change, but the economic crisis' (Researcher UNESCO - IHE).*

A consequences of the housing crisis, is that some of the houses in Stadswerven are being built by private actors: homebuilt houses and not by the developers. Because the developers were also stricken by the crisis.

Something that is affecting the price of the buildings, is the location. A property developer didn't believe that Dordrecht is a location were the most expensive houses can be build.

> *'The location does not have the yield potential as Amsterdam' (Property developer 2).*
> *'The houses can not be too expensive, because it won't sell, you do not buy a very expensive home in Dordrecht' (Property developer 2).*

An area that is located in an unembanked area is not insured against flooding.

> *'It is an area outside the dikes. In principle you are not insured against flooding there (Property developer 1).*
> *'Tell the inhabitants about the insurances. A problem with this is that I'm increasing a potential risk' (Property developer 2).*

Which a developer finds difficult to tell the future homeowners of Stadswerven, because they may exaggerate the situation in Stadswerven and make the homeowners less interested in living there.

The developers have an all risk insurance for the developments, and this also covers damages from water.

> *'All risk insurance. That means that the contractor, must be insured against all kinds of damage and also water related issues' (Property develop 1).*

When a bank gives a loan, they assess the loan on three criteria: the financial performance of the company, the resilience of the business model and the management of the company.

> *'We'll look at the financial performance of the company, the resilience of the business model and on the company's management, these were until recently the three main pillars, where a company was measured on' (Dutch Bank).*

The loan-to-value ratio depends on the function of the building. A commercial property is more risky and therefore the loan-to-value ratio is low: 65%. A houses is considered less risky and therefore a loan-to-value ratio of not more than 90% is applied

> *'For commercial real estate, we apply a general norm of loan-to-value of 65%. If the own use is never present more than 90%' (Dutch Bank).*

The size of the loan is influencing the assessment and herein the bank believes that the corporate social responsibility and environmental issues are becoming more important.

> *'When you talk about loans above 1 million, it will be tailor work and the risks of corporate social responsibility and environmental issues are increasingly important' (Dutch Bank).*

When a bank gives a loan, they assume that the costumer has an appropriate insurance, not only a home insurance is important also a self-risk insurance. If the insurance companies would change any conditions, for example due to the changing climate, this is not always communicated to the banks, while the banks need to know if an homeowner has an appropriate insurance for the loan. Therefore the banks would like to see a better collaboration with the insurance companies.

'The cooperation with insurers could be better' (Dutch Bank).
'We as a bank assumes that the infrastructure in the Netherlands is in order. And maybe that is a very dangerous assumption, but it is an assumption' (Dutch Bank).

To ensure that the value of the property is correct, the properties are valued each three years, however the bank is not sure if the flood risks is included in the valuation. Furthermore the banks assume that the infrastructure is in order and that the municipality provides the right conditions to develop on.

Banks are limited in how much they can influence developments, because they are not the only ones who can finance a project.

'A bank is not the only party that finances, you have private equity and big financial institutions in. There are many ways to get money' (Dutch Bank).

Social conditions

The findings on the social conditions is based on the interviews with the property developers, planning institutions, and the bank, as well as on the questionnaires that were answered by the residents in Stadswerven.

The people who are moving to Stadswerven are often from the surrounding area, and will therefore be familiar to the risks related to the water. However a common feature with people is that they only want the benefits and not the disadvantages of living near the water.

'The people who will live in Stadswerven, often come from the neighborhoods. So living with water is known for them' (Property developer 2).
'Residents do want the benefits of living near the water but not the disadvantages' (Property developer 2).

To be able to sell the dwellings in Stadswerven the property developers and the municipality are dependent on the public buying it. Many houses in Dordrecht are for the lower and medium income groups, according to the municipality houses with a higher quality is needed to attract and retain higher income groups.

'We want a certain quality, because Dordrecht has 120 000 inhabitants, and we mainly have a basic housing stock' (Urban planner municipality Dordrecht).

In the Netherlands the people are dependent on the government to protect and regulate things for them. But as a homeowner in an unembanked area you are responsible for your own dwelling, which is something many homeowners don't know.

'The government should protect me, the government should regulate this and that for me' (Property developer 1).
'The property owner may not be aware of his responsibility in an unembanked' (Researcher UNESCO - IHE).
'In the end you are responsible for the choice and investments you make' (Dutch Bank).

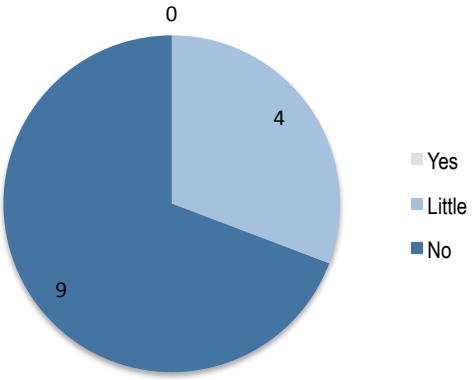

Figure 44:
Q: Do you ever feel threatened by water?

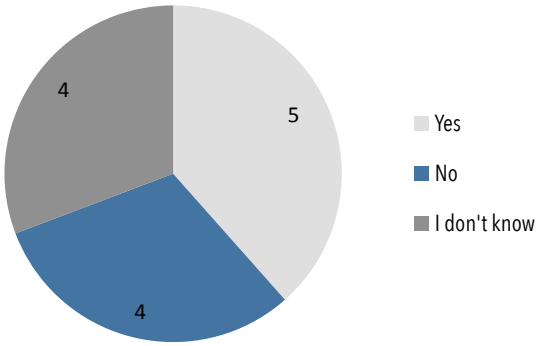

Figure 45:
Q: Do you think your home would get flooded it the sea level rises and the rain increases?

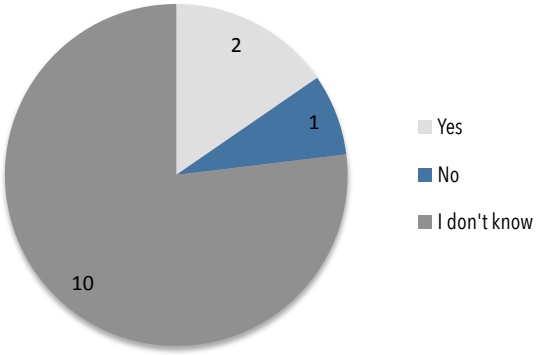

Figure 46:
Q: Do you know if you have an insurance that cover damages from flooding?

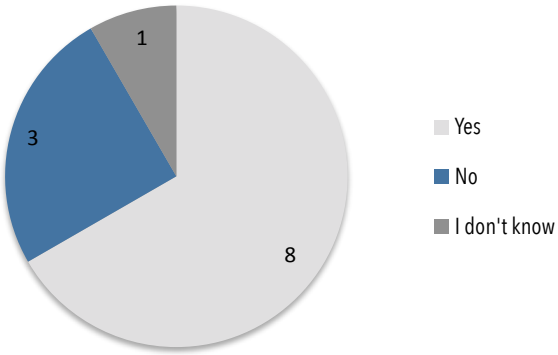

Figure 47:
Q: Is your home/neighborhood adapted to the changing climate?

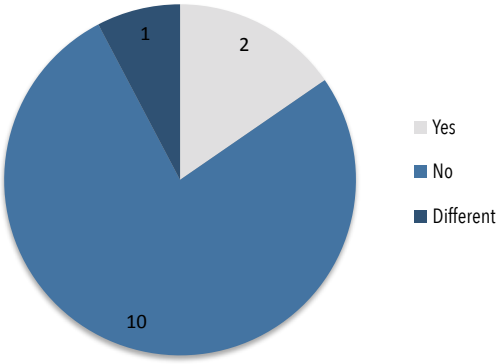

Figure 48:
Q: Did you bear the risks of flooding in mind when you bought/rented your home?

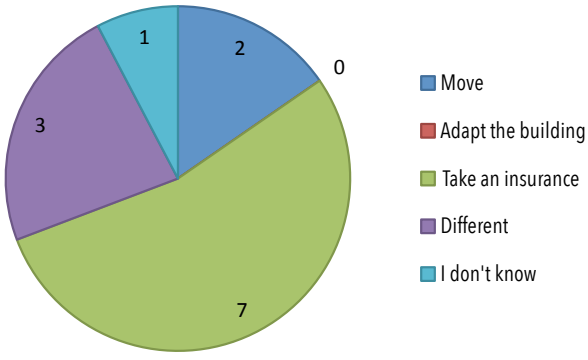

Figure 49:
Q: How would you deal with potential risks for flooding in your neighborhood?

From the questionnaires were found that, the majority of the inhabitants of Stadswerven were aware of the changing climate and all the respondents thought the sea level will rise. 9 respondents didn't feel threatened by the water, and only 4 felt a little threatened: figure 44. The risks that their house would get flooded wasn't seen as a big risk: figure 45. If they have an insurance that covers flooding, 10 of the respondents did not know and only 1 thought they did not: figure 46. Most of the respondents, 8 said that their home / neighborhood is adapted to the changing climate: figure 47. Only 2 respondents thought about the risks of flooding when they bought / rented the building: figure 48. If there would be a potential risk of flooding in the neighborhood, the majority of the respondents would take an insurance and none of the respondents would adapt their home: figure 49. When it comes to the responsibilities of a flooding in the neighborhood of the respondents the government, the waterboards and the municipality were seen as the most important actors: figure 50. When it comes to the safety and responsibility of the buildings the municipality and the owners were seen as the most important actor: figure 51.

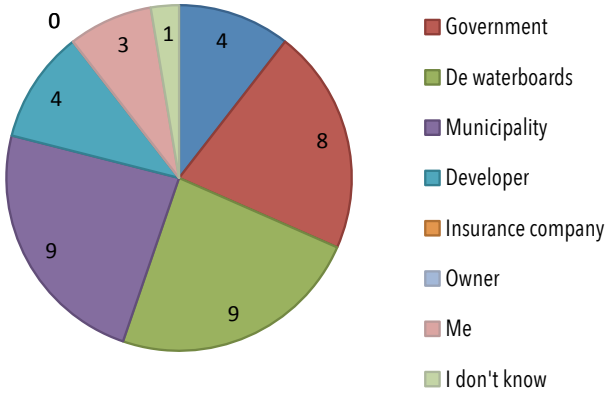

Figure 50:
Q: Who is responsible for the safety of your neighborhood regarding flooding?

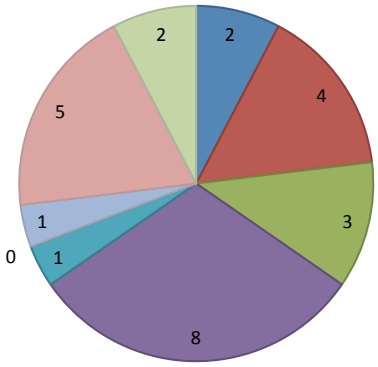

Figure 51:
Q: Who is responsible for the safety of your house regarding flooding?

An overview of the findings from the questionnaires can be found in appendix G.

Physical conditions

The **physical conditions** refers to the climate, changing climate and land in Stadswerven.
The soil in Stadswerven consists of clay and peat, which complicated the raising of the ground. However the Netherlands has lived with water for centuries and have become skilled in adapting areas to the risk of flooding.

> *'Is lika a sponge' (Property developer 2).*

Because of the raising of the ground, the risk of flooding is not seen as a big challenge in Stadswerven.

> *'The water has been taken into consideration for the last 6 years in the plans and therefore it is not a big challenge' (Urban planner municipality Dordrecht).*

In the next chapter the findings are summarized and related to the research questions.

5.4 Conclusion

In this part answers to the sub-questions are given. The answers are divided into the engagement of the property developers and the influences on the engagement of the property developers.

5.4.1 Engagement of property developers

The property developers in Stadswerven were **aware** of the changing climate, the risks of flooding and the adaptation strategy was based on the principe to live with water. To create the connection with the water some parts are deliberately placed on a lower level to increase the awareness among the inhabitants. Other parts are raised and are + 5 and + 4 NAP, these areas are not vulnerable for flooding and the buildings will not need any adaptation measures. This are the buildings that the involved property developers will develop. The lower part: +2.8 NAP on the left side: wanttij side, will be developed by private actors, who will build their own houses there. Having lower and higher parts can according to Filatova (2011) increase the flood risk awareness of individuals, because the individuals can see the impacts of the water and remember them of the possibilities of flooding.

The developers are part of the Development Combination the Werven, together with the municipality they made the zoning plan for Stadswerven and herein the adaptation strategies: higher and lower parts are included. The consortium is an effective way to include the developers early in the process and create an understanding of the flood risks in Stadswerven (Jamal & Stronza, 2009). This understanding is very important to get the developers participated in the adaptation process.

The property developers **associate** the need of an overall adaptation strategy, raising the ground with their developments. The water is given space and the buildings are protected from the water, through developing them on the higher parts, expect for the buildings on the left side: the wanttij side. If the water is given space, the damages of the water is limited, which was found by a research group, who developed a model to study the impacts of the rivers and water flows in Stadswerven. Here a connection between researchers and the planning actors is made, which according to Klein and Juhola (2014) can be a difficult, because the concepts and ideas from researchers is often not related to the decisions of the planning or developments actors.

The developers have the skills and technology to adapt the buildings to flooding, however the **acquisition** of the adaptation measures is limited due to the fact that the property developers will develop the higher located parts in Stadswevren, which don't need to be flood adapted. The decisions the property developers are making are for a large part based on their business model. The three involved developers will not be the end owners of the buildings, and their short commitment to the project is making them less exposed to the risks of flooding.

The adaptation measures the property developers invest in, are based on a cost - benefit analysis. If they believe the cost of an adaptation will lead to, too high housing prices, which they will not be able to sell, they are re-considering their investments in the adaptation measures. In Stadswerven the developers chose to not develop the buildings on the left side, because they wouldn't be able to sell them profitable. According to Zilberman el al., (2012) each individual is making their adaption decision based on economic decision-making rules. So it is understandable that the property developers, who are driven by profit making objectives, base their investments in adaptation measures on the economic aspects.

The developers in Stadswerven asses the costs and benefits of an adaptation and they will only They **apply** an adaptation measure if they believe they can make a profit on an adapted and more expensive building. The economic crisis made the developers skeptical in investing in adaptation measures on a building level. This can be related to a finding from Shearer et al., (2013) who believes the willingness of developers to address sustainability issues is strongly linked to economic conditions: the better the economic conditions are, the more willing were the developers to engage in efforts to incorporate green and sustainable principles. The low-lying dwellings and floating houses are now developed by private actors, and not by the developers.

The overall adaptation strategy of Stadswerven, with the higher and lower parts, is financed by the municipality, who invested in raising the ground. The property developers were involved in the creation of the adaptation strategy and the master plan where in they ensured that most of the developments are not threatened by floods.

5.4.2 Influences on engagement of property developers

In Stadswerven the planned adaptations are aimed at accommodate and retreat to the sea level rise. Retreat means that the water is given space, which is also part of the national policies: room for the river. In figure 52, the two adaptation strategies in Stadswerven is illustrated.
By giving the water space, the damages from flooding is limited and awareness among the inhabitants in Stadswerven is created.

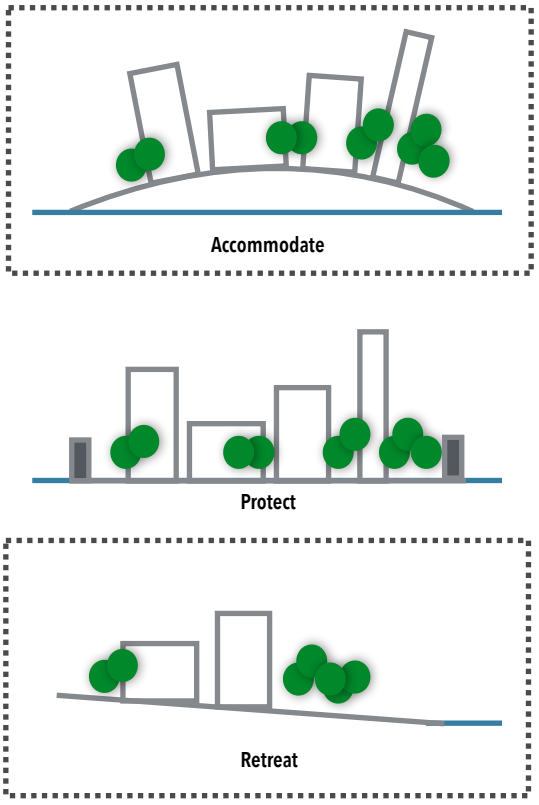

Figure 52: Adaptation strategy in Stadswerven

The **urban planners** from the municipality in Dordrecht (**planning institution**) is together with the three property developers responsible for the development of the master plan in Stadswerven, herein the adaptation measures are included. However it is the municipality that is responsible for the ground preparation and costs for raising the ground and through the ground exploitation the developers pay for the preparations and land.

The Netherlands is a welfare state, where the role of the government is strong and steering and which is influencing the developments in Stadswerven. In the Netherlands the **institutional conditions** who influences the adaptations strategies consists of the Waterboards and the Rijkswaterstaat, from the national government. They are responsible for the protection of the Netherlands against the water. However there is an exception in unembanked ares, like Stadswerven, because here the Waterboards and Rijkswaterstaat are not responsible for the protection. The municipality and the developers are bearing the flood risk, and as a house owner in an unembanked area you are responsible for the flood damages. In figure 53, the responsibilities of the institutions are illustrated. A white arrow indicates that the actor influences the other actor. The grey arrow indicates that the actor is responsible for the feature.

Although the Waterboards and Rijkswaterstaat are not responsible for the protection of unembanked areas, they have a steering and advising role. Through policies, like the Water Plan, guidelines for the development of unembanked areas are given. Also the Room for the River document can constrain developments in unembanked areas if the government believes an area should be used to give the river space.

In Stadswerven the adaptation strategies are developed by the municipality and since 2008 the municipalities don't need any approval from the provincial government. The national government and Waterboards can intervene with the spatial planning of the municipalities by setting rules and controlling the developments, but there role is not that dominate in an unembanked area. Therefore the influences form the national and regional government in the development of Stadswerven is limited, and the municipality has the responsibility to include the adaptation strategies in the master and zoning plan, to ensure that Stadswerven is adapted to the changing climate.

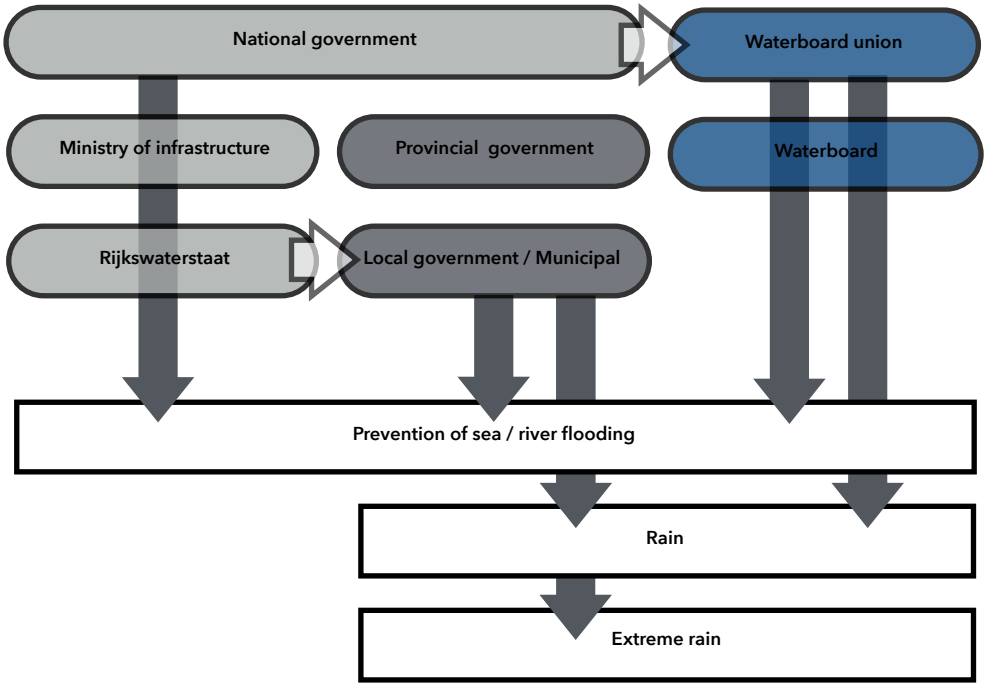

Figure 53: Institutional responsibilities

According to Shearer et al (2013)., the willingness of developers to address sustainability issues is strongly linked to **economic conditions:** the better the economic conditions are, the more willing are the developers to engage in efforts to incorporate green and sustainable principles. This is visible in Stadswerven. In the Netherlands, Dordrecht, the economic crisis hit the developers and the housing market, therefore the developers are not so willing to adapt the buildings, as this will increase the costs and the housing prices. Therefore the developers chose to give the development of the low-lying plots and floating houses back to the municipality.

In Stadswerven the developers are not the end owners of the buildings, they have an all risk insurance during the development, but hereafter this they sell it, and the risk of flooding is not theirs anymore. The home owners buying the houses in an unembanked area are not secured against flood damages, which is an aspect many homeowners in Stadswerven are not aware of (more information in next paragraph)

The banks are not (yet) influencing the behavior of the property developers, because as long as the insurance companies covers the flood damages, the banks are not affected by the flood damages. However if the insurances would change their conditions and some buildings wouldn't be insured any more the banks have a problem, and may need to increase the premium or shorten the period of the loan.

The citizens in Dordrecht determines the **social conditions** and are important for the developers, as they are the ones buying or renting the develop properties, if there wouldn't be a demand for housing the developers wouldn't build. In Stadswerven the inhabitants seemed aware of the impacts of the changing climate but unaware of the consequences a flooding could have on their properties. A majority of the respondents in Stadswerven didn't know if they had an insurance that covered flooding. Because Stadswerven is located in an unembanked area the inhabitants do not have an insurance that covers flood damages. In this case, the absence of a flood insurance should stimulate the home owners to adapt their homes, however they are not aware of this fact and therefore they are not taking any actions. Currently there will not be a risk of flooding for the respondents, because their houses are located at +5 NAP. But the future homeowners of the houses at the low-lying areas, should be aware of the risks of flooding, as this is located at +2.8 NAP.

The soil in Stadswerven consists of clay, the area is located along a river, and the area receives a lot of rainwater from the hinterland. In Stadswerven there are outer storm barriers, which can control the sea level rise, however the barriers are not closed that regular, as this would limit the water transport.

In Stadswerven the municipality and developers believe they are able to cope with the daily tide of 85 cm and rising sea levels to least 2100, a bigger problem for Dordrecht will be the old city center, which is located lower then Stadswerven. However in the city center of Dordrecht the national government and the Waterboards are responsible for the protection, so the municipality will not be the only actor who has to deal with the future flood risks in the city center.

5.4.3 Analytical framework

In figure 54 the connections between the property developers and the external features are illustrated. The property developers are directly influenced by the urban planners from the municipality of Dordrecht, the planning institutions, through the master and zoning plan and as they are the owners of the land in Stadswerven. However the property developers could also influence the adaptation and master plan through the partnership agreement they made with the municipality of Dordrecht. These agreement gave the property developers the monopoly to develop all the land in Stadswerven and as a result the planning institutions lost a bit of their power to influence the developments of the property developers. The relationship between the property developers and the planning institutions is illustrated with red arrows.
The national and regional government, the institutional conditions, are not having that much influences on the developments in Stadswerven, due to the fact that it is an unembanked area. If this had been an embanked are the role of the Rijkswaterstaat and Waterboards had been steering for the adaptation of Stadswerven. Therefore the connection is illustrated with a small arrow. The economic conditions have an influence on the housing demand and housing prices, the density and the master plan for Stadswerven and the decisions the property developers make/ made, as they are driven by profit making objective. Through a cost-benefit analysis the property developers will determine which investments they will make. This is illustrated with a bold arrow from the economic conditions to the property developers. The social conditions are influencing the housing demand,

however the demand for adapted buildings is lacking and therefore their influence on the property developers adapting the developments is limited. This is illustrated with a thin arrow from the social conditions to the property developers.

The adaptation measures in Stadswerven are mainly implemented by the municipality of Dordrecht and the private homeowners who will build the floating houses and the buildings in the low-lying areas. The property developers were very involved in shaping the adaptation strategy, however not so much in the implementation hereof. The grey arrows illustrates the involvement of the planning institutions and the public to adapt Stadswerven, compared to the light grey arrow from the property developers to the adaptation of Stadswerven.

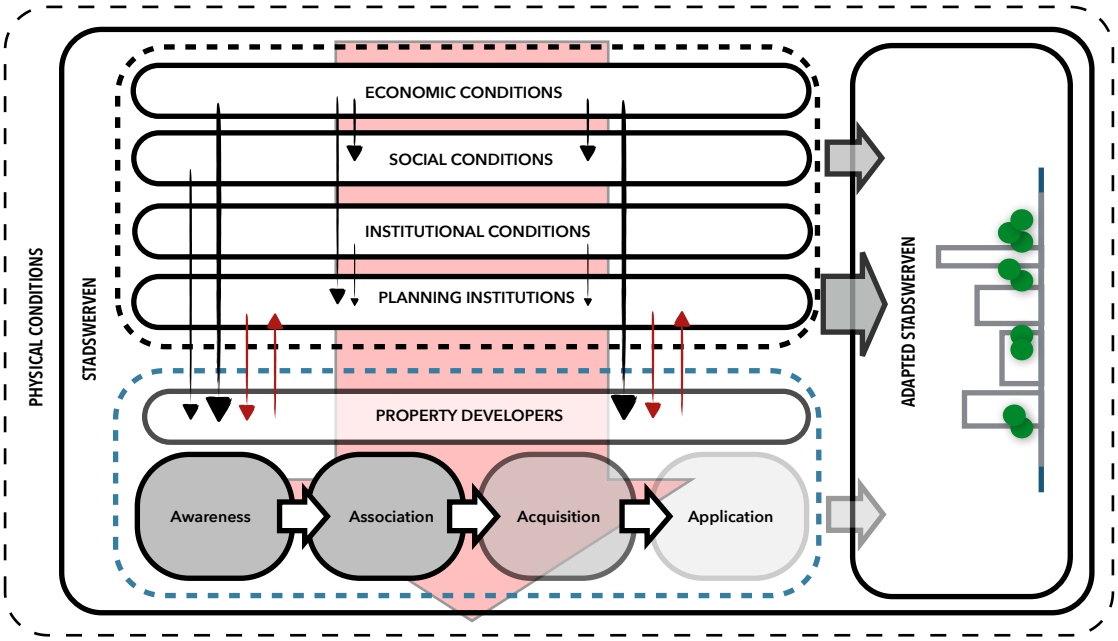

Figure 54: Analytical framework (own ill.)

(Image: Deltawerken, 2004)

6. COMPARISON OF CASE STUDIES

This chapter compares the two case studies: Frihamnen and Stadswerven. First the engagement of the property developers in Gothenburg and Dordrecht is compared, followed by a comparison of the features that influences the behavior of the property developers in Sweden and the Netherlands.

6.1 Engagement of property developers

6.1.1 Internal features

The business model of the involved property developers in the transformation of Frihamnen and Stadswerven differs. In Gothenburg most of the property developers are the developer and owner of the buildings compared to the property developers in Dordrecht, who are only involved in the planning and construction phase. The consequences of the property developers business model and their relation to the flood damages is visible in the cash flows.

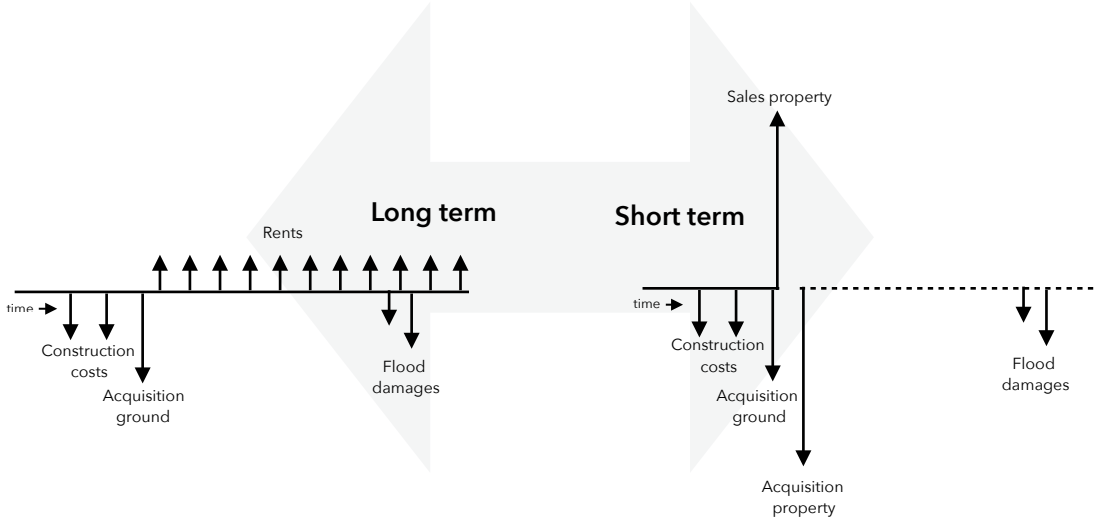

Figure 55: Cash flows long and short term developers (own ill.)

As figure 55, shows a long term property developer, who develops and owns the building, is directly affected by the flood damages, as the cash flow shows. Compared to a short term property developer, who develops and then sells the building and where the owner of the building is affected by the flood damages and cost. Therefore the property developers, who owns the building have more incentives to adapt the buildings to the changing climate, to reduce the risk of flooding and the damages of a flooding. The long term property developers in Gothenburg emphasized the fact that they remain the owner of the buildings and therefore want to avoid damages to their properties. Noticeable was a short term property developer in Gothenburg who responded differently from the long term property developers. This developer wasn't willing to develop plots that are exposed to a flood risk, because this would increase the cost.

'We will own the buildings for a long time and we want to avoid problems. We are a developer and investor' (Swedish long term property developer 3).

'We will own, manage and deliver quality housing to people in Gothenburg' (Swedish long term property developer 5).
'We will never build homes in places which will expose the accommodation of any sort of risk. Because this would only increase the costs of the buildings, and that would mean that the rents go up' (Swedish short term property developer 2).

Thus, the business model of the property developers is influencing their willingness to adapt the waterfronts and the buildings.

A second feature influencing the behavior of the property developers are the partnership agreements they have for the development of Frihamnen and Stadswerven. In Gothenburg the property developers are part of a consortium with the urban planners from Älvstranden developments. The actors in this consortium will develop the first phase of Frihamnen and are involved in the creation of the adaptation strategies. The property developers have an influences on the adaptation strategies and can come with solutions and input, however the urban planners are responsible for including the measures in the zoning plan and the development hereof.

We are on a general level in the consortium to find a model for the rising sea level and increased precipitation and we check the heights. We deal with sea level rise by raising the ground' (Swedish long term property developer 5).

The adaptation strategies that has been discussed are currently on a general level, with the focus on adapting all of Frihamnen. The adaptations that are needed on a building level hasn't been identified yet, as the property developers don't know which plot they will develop. This consortium structure gives the property developers the possibility to influence the adaptation strategies, however the urban planners from the municipality and Älvstranden developments have the final responsibility to ensure that the plan for Frihamnen are meeting the regulations and requirements from the county administration board.

This partnership agreement is similar to a building right model, where the property developers acquire the land from Älvstranden developments. However Älvstranden developments bears the risks associated with the development of the land.

In Dordrecht the property developers are also part of a consortium, with the urban planners from the municipality of Dordrecht. However this consortium provides the property developers with more influence on the adaptation strategies, as the three property developers are joined in 'Ontwikkeling Combinatie de Werven' (OCW) and together with the municipality made the master plan.

'The master plan was drawn up together with the municipality, and herein it says that the soil will be increased' (Dutch property developer 2).
'We are forming a joint plan: The OCW and the municipality. The role distribution is that the municipality thinks along with us on the details of the location' (Dutch property developer 1).

Due to the fact that the property developers are making the master plan, they have a large influence on the development and adaptation of Stadswerven. The three property developers that are joined in OCW have a development monopoly, and will develop all the land in Stadswerven. This partnership agreement is similar to a joint venture model, where the three property developers have set up a development company: OCW and together with the municipality are responsible for the

development of Stadswerven. The municipality is the owner of the land, and is therefore bearing the risk associated with the land development. This partnership agreement is beneficial for the property developers, who have the possibility to influence the zoning plan, without bearing much risk. As they can choose which plots they want to develop and then buy the land. In figure 56, the consortium structures in Gothenburg and Dordrecht are illustrated.

'What we see in Stadswerven, we have a contract with the OCW, which is 3 developers, and we have agreed that they can develop a lot of it' (Urban planner municipality Dordrecht).

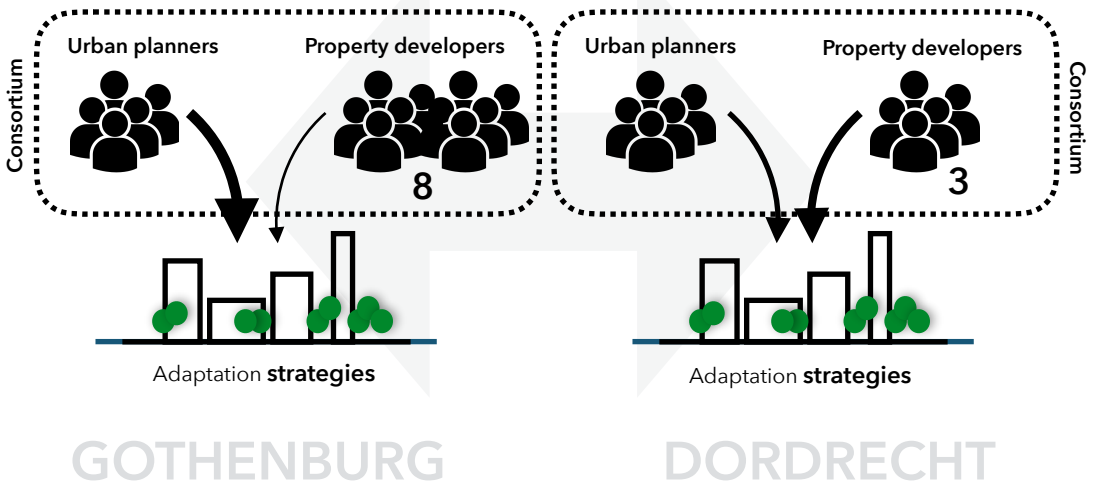

Figure 56: Consortiums in Gothenburg and Dordrecht (own ill.)

Thus the consortium structure is influencing the behavior of the property developers, with a partnership agreement where the property developers have much influence on the developments, they will use this to make the most profit, and this does not always entail the development of adapted buildings. Therefore a partnership agreement, similar to the one in Gothenburg is more effective in engaging the property developers to adapt their developments.

'Through including the developers early on in the process, the incentives for the developers to leave the developments is decreased and they have a better understanding of the content of the manifest' (Swedish urban planner B).

6.1.2 Engagement to adapt the waterfronts

A distinction can be made between the property developers engagement in adapting the waterfronts and the buildings. Both in Gothenburg and Dordrecht an overall adaptation strategy is developed, which entails the raising the ground in Frihamnen and Stadswerven. The property developers were aware of the risks of flooding, and associated raising the ground with a flood risks reduction. However the property developers are not the actors, who acquire and implement this adaptation measures, these is the responsibility of the municipality. Therefore their engagement in adapting the urban waterfronts is limited to the two first step in the receptivity theory of Jeffrey and Seaton (2004), they do however pay for the adaptation measures through the land price, which is calculated into the selling price or rents.

In figure 57, the willingness and ability of the property developers to adapt the waterfronts is illustrated. The darker the action, the more it is corresponding to the actions of the property developers in Gothenburg and Dordrecht.

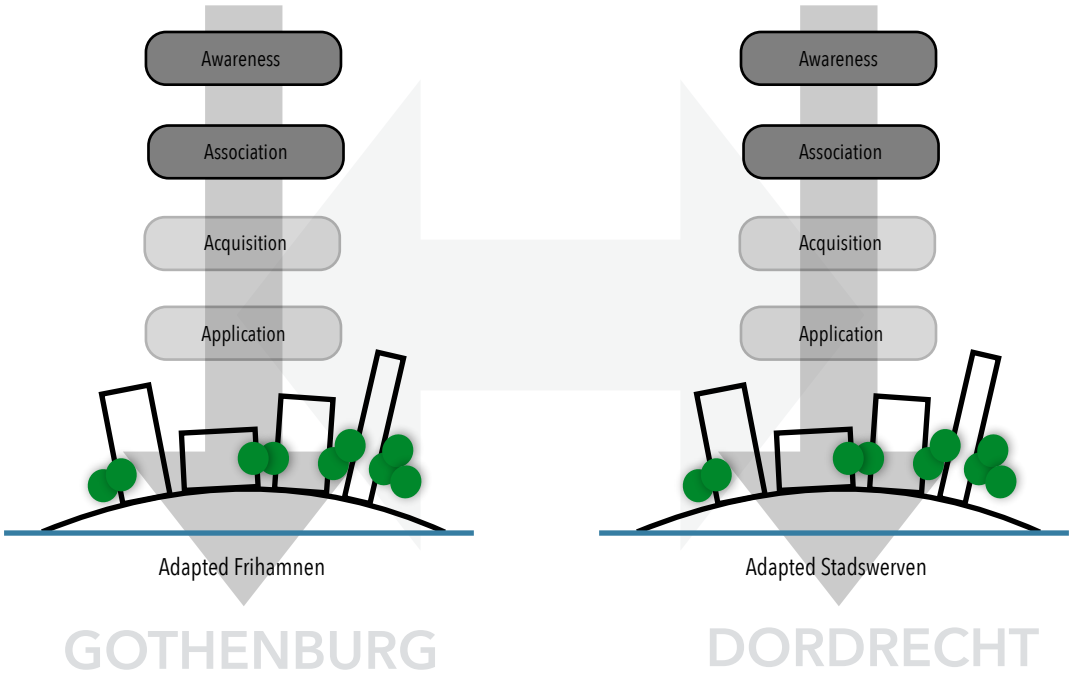

Figure 57: Comparison property developers engagement in adapting the waterfronts (own ill.)

6.1.3 Engagement to adapt the buildings

The engagement of the property developers to adapt the buildings differs from their engagement in adapting the waterfronts. Due to the fact that the ground is raised, the risks of a flooding is reduced and therefore the property developers do not associate the adaptation of the buildings with any benefits. Therefore their engagement in adapting the buildings is limited. In Frihamnen the general adaptation measures will not be sufficient enough to deal with the rising sea levels and increased precipitation, therefore the property developers are forced to adapt the buildings. However the plots in Frihamnen have not been divided and therefore the property developers do not know where exactly they will develop and what kind of influence the water will have on their developments.

'On a building level the adaptation strategies / measures have not yet been discussed' (Swedish long term property developer 1).

The property developers in Dordrecht do not associate the development of adapted buildings with any benefits. Therefore they choose to give the low-lying plots back to the municipality and only develop the higher located plots, where no adaptation measures are needed due to the raised ground. A reason that they do not associate any benefits from developing the low-lying plots, is their cash flow, where the benefits of an adaptation is compared to the cost, and as already presented in the first paragraph in this chapter, a short term property developer will not directly experience any benefits from an adapted building.

'Has to do with the revenue, if you can sell the houses for more, you have more money to invest in measures against flooding' (Dutch property developer 2).

In figure 58, the willingness and ability of the property developers to adapt the buildings is illustrated. The darker the action, the more it is corresponding to the actions of the property developers in Gothenburg and Dordrecht.

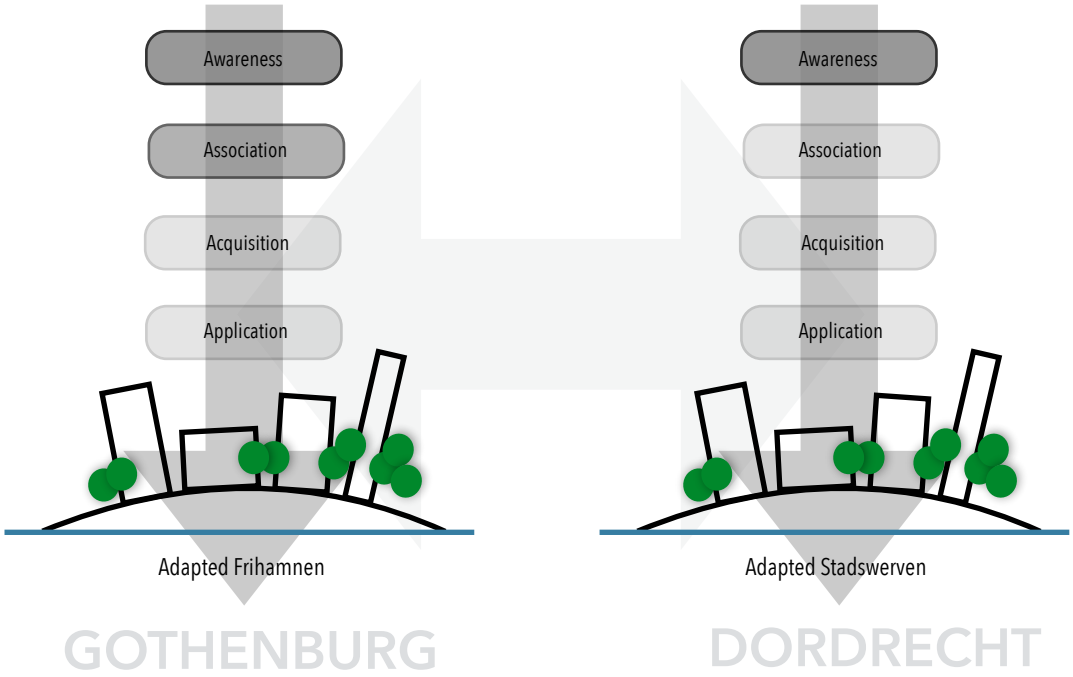

Figure 58: Comparison property developers engagement in adapting the buildings (own ill.)

6.1.4 Limitations of research

The comparison of the engagement of the property developers in Gothenburg and Dordrecht is limited due to the fact that the developments in Frihamnen are still in the planning phase. Therefore the engagement of the property developers is based on assumptions, which may have to be adjusted during and after the development of Frihamnen.

6.2 Influence on behavior of property developers

6.2.1 Direct influences

The behavior of the property developers is besides the internal features: their business model and partnership agreements, influenced by several external features. One external features that has an direct influence on the behavior of property developers are the **planning institutions**. Both in Gothenburg and Dordrecht are the urban planners from the planning institutions and the property developers collaborating, through the consortiums. The urban planners, can through the master and zoning plan directly influence the developments in the waterfronts and therefore the actions of the property developers. Through the consortiums the property developers can also influence the outcome of the master and zoning plan. In Dordrecht the property developers are making the master plan together with the urban planners. The municipality of Dordrecht is the owner of the land in Stadswerven, but due to the partnership agreement, the property developers have the right to develop all the land in Stadswerven. As a result of this agreement the urban planners have lost some of their influence on the property developers.

'I think with our current knowledge we would cut up in smaller plots and give that to different developers' (Urban planner municipality Dordrecht).

In Gothenburg on the other hand the urban planners from Älvstranden developments have a partnership agreement with the property developers where they have more power to influence the developments of the property developers in Frihamnen. The fact that Älvstranden developments allocates the land in Frihamnen in phase, emphasizes the control they have on the developments. If a property developers wants to develop a next plot, they have to participate in a second land allocation, and meet the requirements Älvstranden developments sets.

'We own the land and we can make an agreement with the developers through the contracts when selling the land, the legal agreement, the building permits and the zoning plan' (Swedish urban planner A).

Besides the master and zoning plan, the urban planners can govern the developments of the property developers through the building permits, which determines if the plans of a property developer can be implemented. However, the building permits are linked to the master and zoning plan and therefore the property developers have an influence on the approval of the building permits, as they participated in the creation of the master and zoning plan.

6.2.2 Indirect influences

The four indirect external features that influences the behavior of the property developers are: the economic, institutional, social and physical conditions. The **economic conditions** in Gothenburg and Dordrecht differs. One variation are the housing prices, in Gothenburg the housing prices are increasing, while in Dordrecht they are decreasing due to the economic crisis in 2008/2009. When an developer can receive more money for a development, they will be more willing to invest in adaptation measures. Another difference is the flood insurances, in Gothenburg this is included in the home insurances and the inhabitants of Frihamnen will receive a flood insurance, while the inhabitants of Stadswerven do not have a flood insurance.

The **institutional conditions** in Sweden and the Netherlands are also different. The Netherlands have an old water management, where the Rijkswaterstaat and Waterboards are responsible for the flood

protection. The Waterboards who are responsible for the maintenance of the protections, have their own budget, which they raise from waterboard taxes. This water management structure is not present in Sweden, and the municipality of Gothenburg has the responsibility to protect its inhabitants from flooding. This is a challenge for the municipality, as they don't have the budget to do this. However Stadswerevn is an unambanked area, and here the Rijkswaterstaat and Waterboards are not responsible for flood protection. Therefore the municipality in Dordrecht is facing the same challenges as the municipality in Gothenburg.

Due to the housing shortages in Sweden and Gothenburg the national and regional government is demanding the urban planners to increase the building density in Frihamnen. This is something which is not the case in Dordrecht, where the building density is adjusted downwards.

The **social conditions** in Gothenburg and Dordrecht are related to the housing demand and preferences of the public. Their preferences do not differ that much, except that the housing demand in Gothenburg is much higher. The flood awareness of the inhabitants in Gothenburg and Dordrecht is limited and therefore they are not demanding flood adapted houses. If there is no demand for adapted houses, the property developers will not invest in adaptation measures that aren't requested.

'There is a housing shortage of around 11.000 - 14.000 homes in Gothenburg' (Swedish long term property developer 3).

Only 3 respondents toke the risk of flooding into account when they bought a house in the waterfronts of Gothenburg, compared to 28 who did not take the risk into account (Questionnaire Gothenburg).

In Stadswerven only 2 respondent toke the risk of flooding into account when they bought their house, compared to 10 who did not take the risk into account (Questionnaire Stadswerven).

The **physical conditions** in Gothenburg and Dordrecht are also quite similar to each other. Both waterfronts are located along a river and close to the city center. The ground in the waterfronts consists of clay and complicates the raising of the ground, however it is not making it impossible only more expensive.

'Very tough geotechnical conditions in Frihamnen: 100 meters of clay in the soil. If you want to build up more than 0.5 to 1 meter you need to pile all the land, and that will be very costly' (Swedish urban planner A)

The location of a development is essential for the investments the property developers will make. The location partly determines the housing prices, which influences the property developers willingness and ability to invest in adaptation measures. Gothenburg is an attractive city and the housing prices are high, while Dordrecht is seen as a less attractive city than Amsterdam (by the property developers) which limits the investments the property developers can do in Stadswerven.

'The location does not have the yield potential as Amsterdam. Is a fight between funds, yield and what we can do there' (Dutch property developer 2).

6.3 Differences Frihamnen and Stadswerven

By comparing the engagement of the property developers in Gothenburg and Dordrecht, the fourth sub-question: ***Are the property developers differently engaged in the adaption of the waterfronts in Gothenburg and Dordrecht and what are the reasons here for?*** is answered.

In table 6, an overview of the different conditions in Gothenburg, Frihamnen and Dordrecht, Stadswerven are presented. These differences are based on the findings from the interviews and the document analysis.

	Gothenburg	**Dordrecht**
Housing market	Growth of housing price: between 10% to 100%	Drop of housing prices: around 25%
Housing demand	Very high housing demand	Low housing demand: however a housing demand for exclusive housing.
Protection sea and river flooding	Municipality	Rijkswaterstaat and Waterboards
Finance of protection measures	Regular taxes	Water board taxes
Protection measures	none	Outer barriers, which can be closed.
Watermanagement rain	Municipalities	Municipalities and Waterboards
History watermanagement	From1999 (some actors)	From 1200
Insurance	Included in Home insurance	Unembanked ares: excluded from Home insurance
	Frihamnen	**Stadswerven**
Planned adaptation strategy	Accommodate	Accommodate and retreat
Size of developments in the waterfronts	1000 homes in first phase, in total 15000 homes	750 homes
Density in waterfront	Density increased (9000 to 15000)	Density decreased (from 1000 to 750)
Role property developers	Developers and owners	Developers
Consortium	Similar to Building right model	Similar to Joint venture model

Table 6: differences Gothenburg and Dordrecht

To answer the question, yes the property developers are differently engaged in the adaptation of the waterfronts in Gothenburg and Dordrecht. The main reasons here for are:

- The **business model** of the property developers: In Gothenburg the property developers are developing and owning the buildings. Compared to Dordrecht were the property developers are only developing the buildings. This difference is influencing the engagement of the property

developers in adapting the buildings. Due to the fact that the short term property developers will not be directly affected by a flooding, while a long term property developer will have a direct financial benefit from adapting their developments.

- The **partnership agreements** between the urban planners and the property developers. In Gothenburg the consortium structure is similar to a building right model and in Dordrecht the structure is similar to a joint venture model. In Gothenburg the property developers have the possibility to influence the adaptation strategies and spatial plans, while in Dordrecht the property developers are together with the urban planners making the adaptation strategies and spatial plans. Another difference between the consortiums are the amount of involved property developers, which is 8 in Gothenburg and 3 in Dordrecht, for a similar size of development, 1000 houses in Gothenburg and 750 in Dordrecht.
- The **economic conditions** in Gothenburg and Dordrecht differ. The first difference is the housing demand, which is influencing the housing prices and the willingness and ability of the property developers to invest in adaptation measures. In Gothenburg the housing demand and prices are high, which makes the property developers more willing to invest in the adaptation measures. Compared to Dordrecht, where the property developers decided not to invest in the low-lying buildings, as they needed to be adapted and that would increase the housing prices above the prices the inhabitants were willing to pay for it. The economic conditions of a development s closely related to the location**,** as the location often influences the housing demand and the housing prices. Gothenburg is an attractive location, where the housing prices are increasing compared to Dordrecht where the housing prices have drop since the economic crisis in 2008/2009. The location also determines the adaptation measures that are needed, as the negative impacts of the changing climate is location specific.

In figure 59, the features that influences how engaged the property developers are in the adaptation of the waterfronts in Gothenburg and Dordrecht are illustrated.

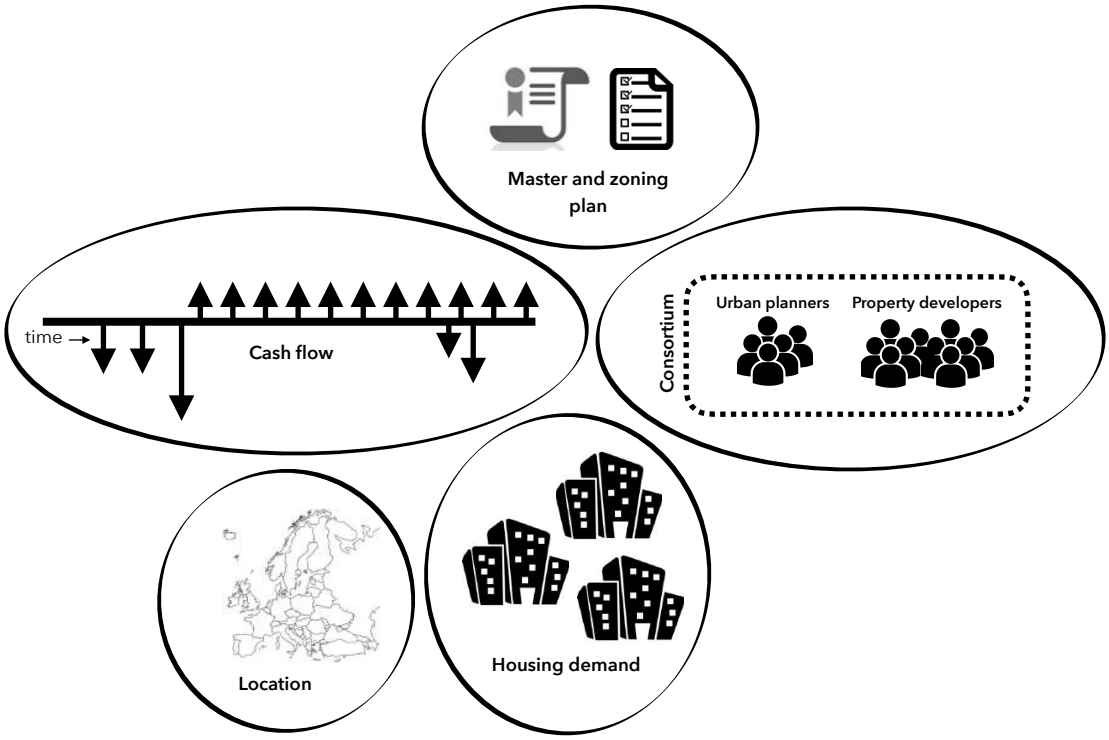

Figure 59: Features influencing the engagement of the property developers in adapting the urban waterfronts.

(Image: own photo, September 2015, Gothenburg)

7. DISCUSSION

This chapter reviews the used theories, the theoretical framework of the study and ends with a modified framework, based on the findings from the case studies.

7.1 Theories

7.1.1 Receptivity theory

The engagement of the property developers was studied with the receptivity theory by Jeffery and Seaton (2004). Through this theory the willingness and ability of the property developers in Gothenburg and Dordrecht to adapt the urban waterfront to the changing climate was investigated. The theory consists of four components: the awareness, the association, the acquisition and the application. From the case studies it appeared that the willingness and ability to adapt can be divided into two categories: their willingness and ability to adapt the land in the waterfronts and their willingness and ability to adapt the buildings in the waterfronts.

In both waterfronts an overall adaptation strategy for the land was defined, which roughly entails raising the ground. Herein the municipalities and the urban planners have a key role, as they are the owners and makers of the master and zoning plan. Through the development consortiums, the property developers have also been engaged in defining the adaptation strategies for the waterfronts. Where they put the emphasize on the development of an overall adaptation strategy that can cope with the changing climate. The property developers believed it is more time and money efficient to have an adaptation strategy for the whole area instead of adapting the buildings separately. Therefore the property developers were aware and associated the adaptation of the land with benefits for their developments. However the acquisition and application of the adaptation measures for the land, so the raising of the ground is mainly the responsibility and task of the municipalities and the urban planners. For this reason the property developers are not directly involved in the acquisition and application of adaptation measures in the waterfronts. Nevertheless they are engaged and pay for the adaptation measures through the land price.

> *The municipality is responsible that the conditions are correct and they may say you are allowed to build on a level, but every 5 years this will flood and then it is the responsibility of the developer to handle it in any way (Swedish long term property developer 5).*
>
> *'If ground wouldn't be raised you would have to put a dike around and then you would no longer have the view. If the homes had to be adapted independently, this would be costly and you have to pay more' (Dutch property developer 2).*

On a building level the property developers were less willing to adapt their developments. They have the ability, referring to the technical knowledge and skills to adapt their developments, however they do not immediately associate the negative impacts of the changing climate on their buildings. As earlier mentioned, the property developers prefer an overall adaptation strategy for the whole waterfront, instead of adapting the buildings separately. When a whole area is adapted to the changing climate, it is less essential to adapt the buildings. Therefore the property developers in Gothenburg and Dordrecht are preferring the adaptation of the land in the waterfronts compared to the adaptation of the buildings. However a reason for the property developers to adapt the buildings,

can be the fact that the land is not raised high enough, then the property developers associate the risks of flooding with their developments and the adaptation of the buildings become essential.

The investments of the property developers are based on a cost-benefit analysis, where the benefits are compared to the cost, in case of an adaptation the benefits of an adaptation is compared to the costs of an adaptation. Due to the fact that the negative impacts of the changing climate are uncertain, the benefits of an adaptation are also uncertain making it difficult to determine the benefits. Therefore adaptations may be postponed or avoided, until more information is available or the need of an adaptation is essential. This is noticeable in the developments in Dordrecht, where the property developers preferred to develop the buildings on the higher located parts. How the property developers in Gothenburg will behave is unclear, due to the fact that they are still in the planning phase. Therefore the property developers acquisition and application of the adaptation measures in the buildings in Frihamnen were based on assumptions, which can differ from their actual actions.

7.1.2 Adaptation process

The four components of the receptivity theory are related to the three stages in the adaptation process defined by Moser and Ekstrom (2010). The adaptation process consist of understanding, planning and managing an adaptation. In figure 60 the relationship between the four components of the receptivity theory and the three stages of the adaptation process is illustrated.

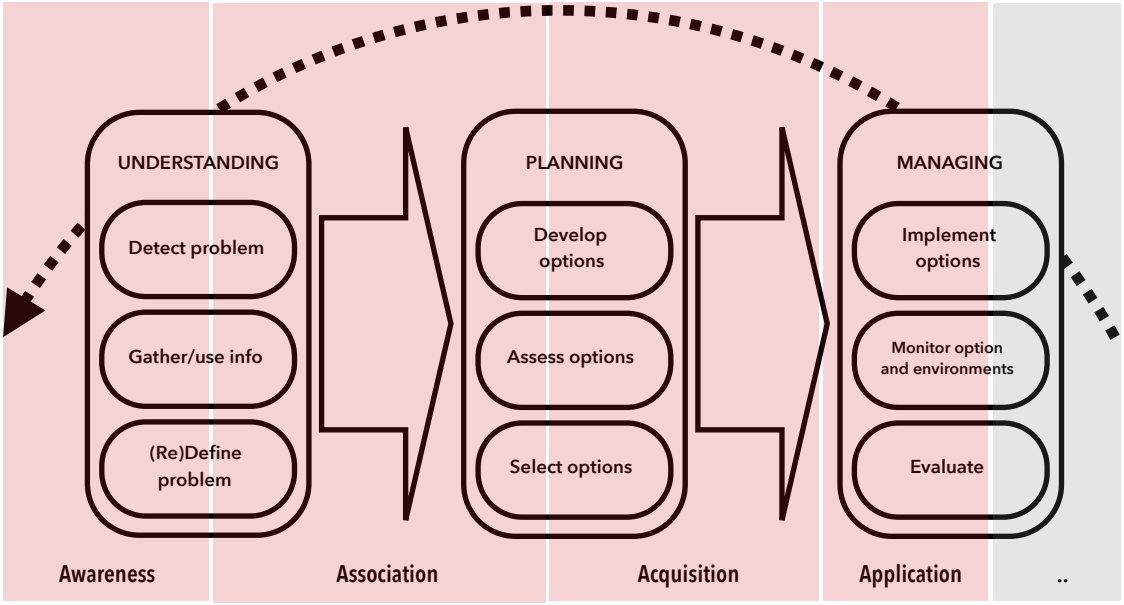

Figure 60: Receptivity theory and the adaptation process combined.

As the figure illustrates the stages in the adaptation process consists of several sub-stages, which can be related to more than one component of the receptivity theory. The first stage, the understanding stage, is related to the property developers awareness of the negative impacts of the rising sea levels and increased precipitation and their engagement in the planning and developing of the adaptation strategies. It is also related to the association the property developers have with adapting the waterfront and the buildings. The second stage, the planning stage, is related to the property developers association and acquisition of an adaptation measure in the transformation of the waterfronts. For example the selection of an adaptation measures will be based on a cost-benefit analysis. The final stage, the managing stage, is related to the application/ the implementation of an

adaptation measure, as the figure shows the stage also consists of an evaluation of an adaptation measure which is not studied with the receptivity theory. With the receptivity theory the willingness and ability of the property developers to adapt is studied and not the behavior of property developers after implementing an adaptation measure. Therefore the receptivity theory does not have a definition for this component, which is illustrated with a grey rectangle. However the evaluation stage is important, due to uncertainties with the changing climate and the outcomes of an adaptation.

In Gothenburg the adaptation strategies are in the understanding and planning stages, which as already mentioned is related to the awareness and association of an adaptation. As a result the adaptation process is not completed and barriers can still occur, which may delay or prevent the adaptation of. This was also mentioned by Moser and Ekstrom (2010), who identified several barriers which can delay or prevent an adaptation. The barriers that may occur in the three stages are summarized in appendix N. In Dordrecht most of the adaptation measures have already been implemented, and therefore the barriers that occurred in the adaptation process are known. The main barriers here were the economic crisis in 2008/2009, which delayed and changed the developments in Stadswerven and the development model in Dordrecht which gave the property developers in Dordrecht a development monopoly in Stadswerven, which changed their engagement in adapting the buildings in the the low-lying areas.

'When we started: 8 years ago, the biggest challenge was not the climate change, but the economic crisis' (Dutch urban planner C).

'We come from an economic crisis, home prices have fallen 25% over the average'(Dutch property developer 1).

Both in Gothenburg and Dordrecht it is important to consider the fact that the adaptation of a waterfront and buildings is a circular process. This implies that after the selection and implementation of an adaptation measure, it has to be monitored to ensure that the waterfronts and buildings are able to cope with the changing climate. The transformation of a waterfront is a long process and therefore making the adaptation process long as well. When the adaptation process is long, changes in the developments and climate can occur, which changes the nature of the adaptation. Therefore the adaptation strategies have to be flexible and adjustable to these changes. In Frihamnen, the adaptation strategies include the flexibility to respond to the changing climate and to the actions and adaptation measures the municipality of Gothenburg may take to cope with the changing climate in the whole of Gothenburg.

7.1.3 Public and private good

According to Tompkins and Eakin (2012) and Geaves et al. (2014) a distinction can be made between private and public goods and the adaptation thereof. According to Geaves et al. (2014) adaptations that are included in the master and zoning plan are public adaptations, because the public is protected by the adaptation measures. According to Tompkins and Eakin (2012) private actors are less willing to invest in public goods, however from the case studies the property developers appeared to be more willing to develop an overall adaptation strategy for the whole waterfront than investing in adaptation measures in the buildings. This may be caused, due to the role and responsibility the municipality has in implementing and investing in the overall adaptation strategy.

'It is the area that has to be adapted not profitable to do this per building' (Swedish long term property developer 4).

7.2 Theoretical framework

7.2.1 Internal features

The theoretical framework, based on the theoretical background, makes a distinction between the internal and external features influences on the behavior of the property developers. The internal features are the conditions the property developers can affect. The first one is the business model of the property developer. Property developers base their decisions on profit making objectives, wherein a cost-benefit analysis govern their actions. As already mentioned in the previous chapter, the decision to invest in an adaptation will be based on the benefits hereof. When a property developer is involved in a long term development and owner of the properties, the negative impacts of the changing climate will have a direct impact on their properties and profits. The kind of property developer they are, is up to the property developers themselves. However the planning institutions have an influences in this as well, as they can choose and select the ones they want to work with.

'We will own the buildings for a long time and we want to avoid problems. We are a developer and investor' (Swedish long term property developer 3).

The risk of flooding for property developer, who are only involved in the development and construction phase is low, which according to Shearer et al. (2013) makes them less willing to invest in flood adaptation measures. However from the case studies, the short term involved property developers do not ignore the negative impacts of the changing climate and the risks of flooding. As they are engaged in the development of the adaptation strategies. But they are not investing in major adaptation measures in the buildings, for example in Dordrecht the property developers decided not to develop the floating houses and the buildings in the lowest-lying parts. From a cost-benefit analysis the profit of these buildings would not be as high as for the buildings on the higher located areas, where less investments in adaptation measures are needed. Hence when the property developers have the ability to decided where they are going to develop, they will choose the area, that will generate them the most profit. However when land becomes scarce and the demand is high, property developers will be more willing to take the risks of developing the low-lying parts as well. Because a higher demand gives them the incentives to cover the higher costs of the adaptation measures.

'The higher levels have already been exploited. The lower areas, haven't been build for a reason' (Swedish long term property developer 1).

The property developers who remain the owners of the buildings, will have more incentives to adapt the buildings to the changing climate, to avoid damages and high costs, compared to short term property developers. However this does not imply that the short term property developers, who develop and sell the buildings, will not adapt the buildings. With the negative impacts of the changing climate becoming more visible in inhabitants daily life, the public will become more aware of the risks of flooding and the impacts it has on their buildings. Therefore the public may prefer a building that is adapted and able to cope with the changing climate and risks of flooding compared to a building which is vulnerable for flooding. The public influences on the behavior of the property developers will be further explained in the next paragraph.

The second internal feature is the partnership agreement or the development consortiums in Frihamnen and Satdswerevn. Both in Gothenburg and Dordrecht the involved property developers are part of a consortium. The structure of the consortiums differs, in Gothenburg the consortium, is

comparable to a building right model and in Dordrecht the consortium, is similar to a joint venture model. In the building right model the property developers are involved in the creation of the adaptation strategies, but the municipality remains the responsible actor for the inclusion of the adaptation measures in the zoning plan, while the joint venture model in Dordrecht gives the property developers the possibility to influence the zoning plan, as they are together with the municipality making the zoning plan.

'The municipality makes the zoning plan, and that is where you set the conditions' (Swedish long term property developer 4).

'The master plan was drawn up together with the municipality, and herein it says that the soil will be increased' (Dutch property developer 2).

The differences of the consortiums, has an influences on the behavior of the property developers, due to the influences they can exercise on the developments in Frihamnen and Stadswerven. When the property developers have much influences on the developments, they will use this to make the most profit, as they are driven by profit making objective.

7.2.2 External features

The external features influencing the behavior of the property developers, were divided into five categories. The first and direct feature influencing the behavior of the property developers are the urban planners from the municipalities, the planning institutions. The studied literature indicated that the role of the planning institutions in the adaptation of an area is crucial, as they have the possibility to include the adaptation strategies in the master and zoning plan. According to several authors: Wamsler et al., 2013, Hurlimann et al., 2014, Djordjeivc et al., 2011 & Carter et al., 2015 the spatial planning is therefore a key mechanism to include adaptation in the development of an area. From the case studies the key role of the planning institutions in adapting an area was also noticeable. In both Gothenburg and Dordrecht they were the driving actor behind the adaptation strategies and the implementation hereof.

'It lies at the municipality to develop a zoning plan that manages risks' (Swedish long term property developer 4).

'The agreement that we have made is that the design risk and in this case the risk of flooding, is not with the builders but at the municipality and OCW: developments combination the Werven' (Dutch property developer 1).

The urban planners and the property developers are joined in a consortium, where the adaptation strategies and plans for the waterfronts are discussed and defined. As already mentioned the consortiums in Gothenburg and Dordrecht differ, and have a different influences on the behavior of the property developers. If the urban planners give the property developers the power and the monopoly to develop a large part of the waterfront, they will use it to only develop the most profitable areas, which was the case in Dordrecht. Here the property developers had and still have the power to develop the areas they find the most interesting. In Gothenburg on the other hand, the development model, älvstranden developments, is structured in a manner that the property developers don't know which plot of the first phase they will develop. Only after the development of the zoning plan the property developers will divide the land. This is stimulating the property developers to develop a zoning plan which is beneficial for all of them, as they don't know which plot they will receive.

'The development model in älvstranden invites the developers early in the process and together we have created a manifest, a sort of treaty which is related to the zoning plan and where the joined ambitions are included' (Swedish urban planner A).

Due to the role and responsibilities the urban planners in Gothenburg and Dordrecht have in transforming the urban waterfronts, as makers of the master and zoning plan, provider of the building permits, and owner of the land, they can steer and be selective in the property developers they select for the transformation of the waterfronts. However the urban planners, who are employed at the municipalities, are also influenced by several features. These features have been divided into four conditions and are presented below. In figure 61 the theoretical framework with the four conditions is illustrated.

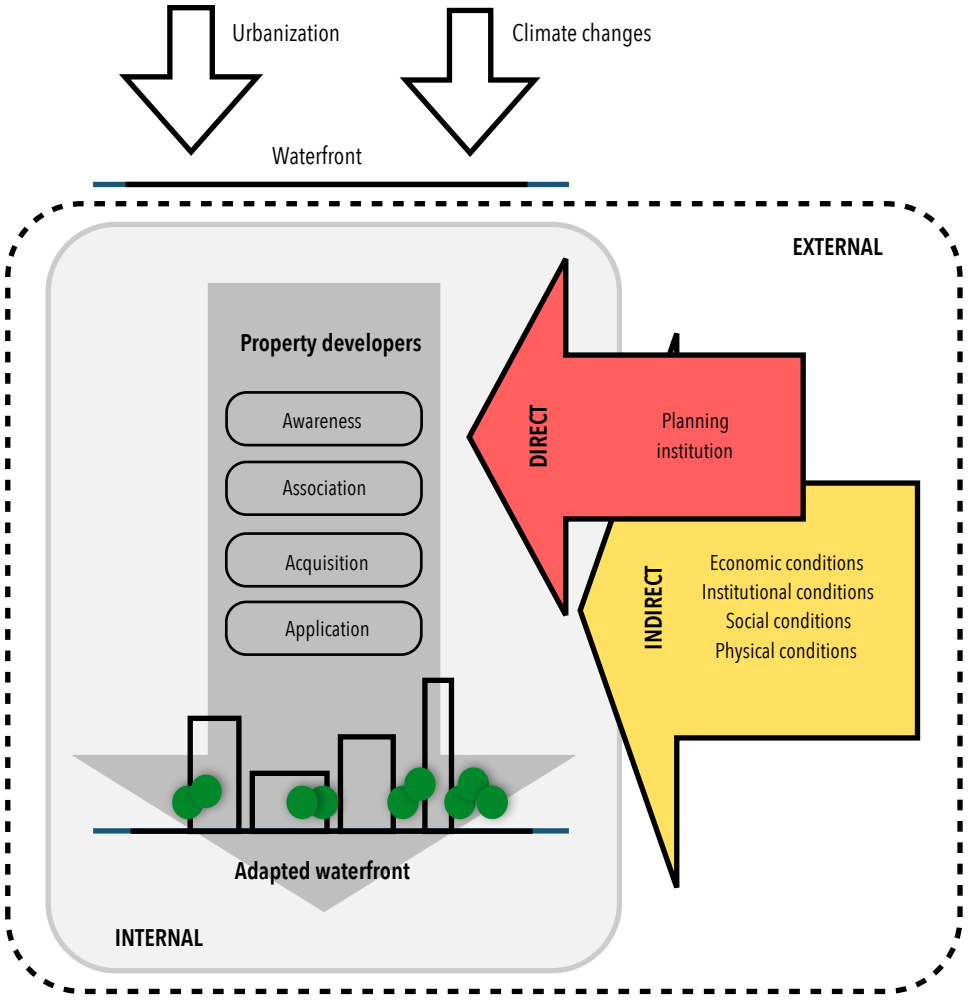

Figure 61: Theoretical framework

The **institutional conditions,** refers to the influences of international, national and regional governments. According to Carter et al. (2011) governments can hinder adaptations on a local level. In Sweden the national government has focused more on mitigation strategies than on adaptation strategies, which is complicating the adaptation of Gothenburg. The municipality of Gothenburg is responsible for the adaptations on a local level, while they are restricted by limited funding, technical expertise and leadership, which are complicating the implementation of the adaptation measures in Gothenburg. However the Swedish government is influencing the developments in Frihamnen

through their policies and interest. Currently the housing demand is extremely high and as a result the government is increasing the development of housing in Gothenburg from 3500 a year to 5000 a year and therefore the density of the buildings in Frihamnen is increased. This has multiple effects on the developments, with more properties being developed, the costs for the adaptations of Frihamnen can be divided among more people, which is a positive aspects. However more properties and higher buildings is putting more weight on the ground, which requires the foundation to be stronger than first expected.

A second challenge with an increased density in Frihamnen, is the risk that the housing demand may drop, and cause the developments in Frihamnen to become vacant. The current plans for Frihamnen includes 15 000 apartments and 45 000 workplaces, which should be realized in 2035. However 2035 is far away and many conditions: among the economic, social and physical conditions can change. This was the case in Dordrecht where the first masterplan was adjusted after the financial crisis in 2008/2009, from 1000 to 750 dwellings. This change also had an influence on the adaptation measures the property developers were willing to take and invest in. As they decided to develop the buildings that needed less or none adaptation measures.

The Netherlands have an old water management where the national government: the Rijkswaterstaat and the Waterboards are responsible for the flood protection of the public. This has resulted in a water management structure that is financial and organizational able to cope with the rising sea levels and increased precipitation in the Netherlands, which is not present in Sweden.
However Stadswerven is an unembanked area and here the Rijkswaterstaat and Waterboards are not responsible for the inhabitants flood protection, although the national and regional governments provide the municipality of Dordrecht with interest, national polices and laws they have to pursue, the municipality of Dordrecht is responsible for the adaptation of Stadswerven.

'Given the superb location of Stadswerven, this is an important project that have had considerable political attention and should be implemented '(Dutch urban planner municipality Dordrecht).

A second condition influencing the behavior of the urban planners and property developers are the countries and cities **economic conditions**. The housing demand is affected by the economic conditions of a city, if there is a high housing demand, the housing prices are most likely going up. The housing prices are also effected by the location of developments. Frihamnen which is located near the city center of Gothenburg and along the river is perceived as very attractive, therefore the housing prices in this area are high, which provided the property developers with incentives to develop here. Stadswerven is also located near the city center and along the river, although Dordrecht is by the property developers perceived as a less attractive city than for example Amsterdam, and therefore the housing prices will not rise as much as in Amsterdam, which is effecting the willingness of the property developers to adapt the buildings.

'The location does not have the yield potential as Amsterdam' (Dutch property developer 2).
'The houses can not be too expensive, because it won't sell, you do not buy a very expensive home in Dordrecht' (Dutch property developer 2).

Insurances are a tool to manage economic risks, according to Zilberman et al. (2012) insurances are therefore reducing the property developers engagement in adapting their developments. The ability to insure was also emphasized by several property developers as a condition to develop, without an

insurance they would not develop. However when a flooding occurs more often, the insurance companies may not be able to insure the houses anymore. As a result the demand and prices of these properties can decrease, which will negatively effect the owners, users and the banks. This however can be avoided if the areas and buildings are adapted to the changing climate and risks of flooding.

'The insurance companies will not be able to insure the houses for flooding, if the flooding is not longer sudden and accidental' (Swedish insurance company).
'In a couple of years we may not be able to insure anymore and then the owners/users and the banks will have a problem' (Swedish insurance company).

'If you can't get an insurance, you wouldn't build' (Swedish property developer 5).
'An insurance is critical. If you don't have the ability to insure the project, you need a much stronger economy' (Swedish property developer 1).

The influences of the insurances on the adaptation of the land and buildings was limited, due to the reason that the flood damages in Gothenburg and Sweden has been limited. However when the first properties will become unlivable and the flood damages and costs are increasing and occurring more frequent, the insurance companies may decided to change the insurance conditions, which can lead to higher premiums or that a building isn't insured anymore, than the owners and banks will suffer great economic losses. Therefore the insurance companies can have a large influence on the behavior of urban planners and property developers to adapt their developments.

This was the case in England, where 500 000 houses have difficulties in receiving a flood insurance, due to their location in a flooding vulnerable area. This is causing the value of the houses to drop and is threatening the homeowners with high economic losses (Association of British insurance, 2015).

The influences of banks on the behavior of the property developers to adapt their developments has briefly been studied, similar to a research by Shearer et al. (2013) this study found that the involvement of the banks in climate related questions is limited. They are not directly effected by the damages of a flooding when the buildings are insured, however when the insurance conditions changes they can be threatened by the costs and the value can drop of the buildings due to a flooding.

'We'll look at the financial performance of the company, the resilience of the business model and on the company's management, these were until recently the three main pillars, where a company was measured on' (Dutch bank).

'We as a bank assume that the infrastructure in the Netherlands is in order. And maybe that is a very dangerous assumption, but it is an assumption' (Dutch bank).

Comparable to the insurance companies, banks are currently not effected by the risks of flooding and therefore the property developers ability to receive a loan or the price of the loan is not related to the risks of flooding. However with the changing climate, insurance companies and eventually the banks will be effected by the damages and costs of floods, if no adaptations are made. To avoid this, banks will reflect the economic risk to the lenders of the money, which are the property developers and homeowners.

A third condition influencing the behavior of the property developers are the **social conditions**, which refers to the housing preferences and demand of the public. According to Ford and King (2015) the public awareness of the risks of flooding is important for stimulating property developers to adapt. When a homeowner and user is aware of the risks, they may chose to move to areas which are safe from flooding or into buildings which are adapted and would not be damaged by floods, which can result in fewer none adapted developments in high flood risk areas. However when the flood awareness among the public is lacking, and homeowners are not demanding adapted buildings, the property developers have no incentives and reasons for changing their developments.

From the questionnaire in the waterfronts in Gothenburg and Dordrecht, was found that the risk of flooding was not experienced as a major threat for the inhabitants. If the flood risks would increase, the municipality was pointed out as the responsible actor for the flood protection of the area and the buildings. However this is not the case in Stadswerven, which is an unembanked area and here the owner of the building is responsible for its protection and flood related damages, which was something many of the respondents in Stadswerven didn't know. This indicates a lack of awareness among the public in Stadswerven.

However the changing climate and the negative impacts hereof are becoming more and more visible and international and national governments are putting it higher on their political agenda. In December 2015, the United Nations Framework Convention on Climate Change was held in Paris. Where governments on an international level discussed the negative impacts of the changing climate and needed adaptation and mitigation measures, which is stimulating the public to become more aware.

> *'Successful adaptation not only depends on governments, but also on the active and sustained engagement of stakeholders including national, regional, multilateral and international organizations, the public and private sectors, civil society and other relevant stakeholder' (United Nations Framework Convention on Climate Change, 2015).*

When the awareness among the public is growing, the property developers can experience a changed demand. This can provide the property developers with more incentives to adapt the buildings. Another reason for property developers to adapt the buildings, would be a housing shortage, which provides the property developers with an assurance that the adapted buildings will be sold, even if the housing prices are a bit higher. In Gothenburg there is an extreme high housing shortage, and therefore inhabitants are willing to pay a high price for housing. In Dordrecht on the other hand, the property developers weren't sure if they would be able to sell the more expensive and adapted houses, and therefore they decided not to develop these buildings.

Thus the public has an influences on the adaptation of the buildings, however as long as they are unaware of the risks the changing climate entails, they will not demand adapted houses. Which gives the property developers no reason to develop more adapted and expensive houses. Informing the public of the risks, should according to Filatova et al. (2011) be the responsibility of the national and local government. Both in Gothenburg and Dordrecht the municipalities are informing the inhabitants of the risks of flooding through workshops and exhibitions, however these approaches only reaches a limited public and many remain uninformed. According to Filatova (2013) flood insurance could be an effective risk-communication device, as a monthly payment will give the people a clear message of the flood risk. In Sweden and the Netherlands this could be an approach

the governments and insurances can take to increase the public flood risk awareness and indirectly stimulate the property developers to adapt the developments.

The final condition, influencing the behavior of the property developers are the **physical conditions.** Both in Frihamnen and Stadswerven the location is one of the reasons the property developers were interested in transforming the areas into residential neighborhoods.

> *'Areas close to water is interesting for everybody. Somehow it is more exclusive to have a view over water than a field' (Swedish long term property developer 5).*
> *'People buy the location because it is near the water' (Dutch property developer 2).*

The fact that the area is low-lying and vulnerable for flooding is not stopping the property developers from developing there, as they are confident the adaptation measures of the waterfronts, the raising of the ground, is reducing the risk of flooding. Although the Dutch property developers have the technical skills to adapt the buildings, the raised ground in Stadswerven makes it unnecessary to adapt the buildings. In Frihamnen the ground will also be raised, however not as much as in Stadswerven and therefore the buildings have to be adapted, how this will be done is not identified yet. But the Swedish property developers believed they have the technical skills to be able to implement the adaptation measures.

A challenge when adapting the waterfronts and buildings are the uncertainties related to the rising sea levels and increased precipitation. Which is not only effecting Frihamnen and Stadswerven, but also the low-lying ares in the city center of Gothenburg and Dordrecht. The impacts and damages of a flooding in the city center would be bigger than in the waterfronts and therefore an overall adaptation strategy for Gothenburg and Dordrecht is needed on the long term. Those adaptation strategies are influencing the adaptation measures that are needed in Frihamnen and Stadswerven. Therefore the urban planners and property developers have to deal with climate related uncertainties as well as institutional uncertainties regarding the adaptation and mitigation of Gothenburg and Dordrecht. In figure 62 some uncertainties of the changing climate are illustrated.

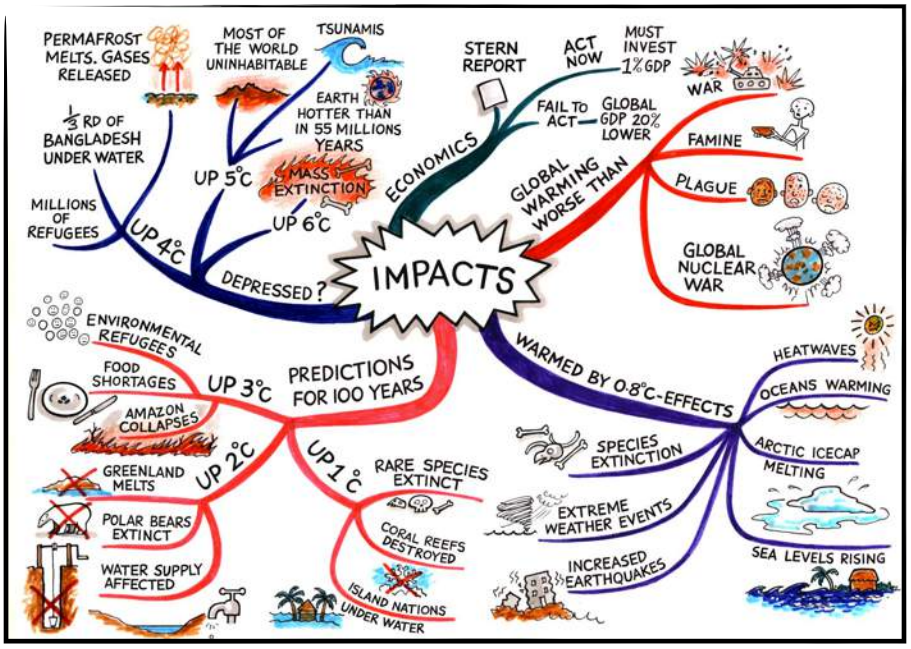

Figure 62: impacts of the changing climate (The British Geographer, 2015)

7.3 New framework

The case studies provided the research with findings and new insights which led to a modified framework, in figure 63 the framework is shown. In this framework the role of the planning institutions and the urban planners has become more central, and is therefore put parallel to the property developers. With a red arrow their direct involvement in the adaptation of the waterfront is illustrated. Their direct role in the adaptation of the waterfronts is caused due to their role in making the zoning plan and including the adaptation strategies herein.

The indirect features influencing the urban planners and the property developers are: the economic, institutional, social and physical conditions. Some of these conditions: the institutional and social, are influencing the urban planners more than the property developers. For example the national and regional government are steering the spatial plans of the urban planners through policy documents and interests. The economic conditions on the other hand are influencing the property developers more than the urban planners, as the property developers require private capital to be able to invest in the properties, which is vulnerable to economic cycles of growth an recession. This was also mentioned by Congreve (2012).

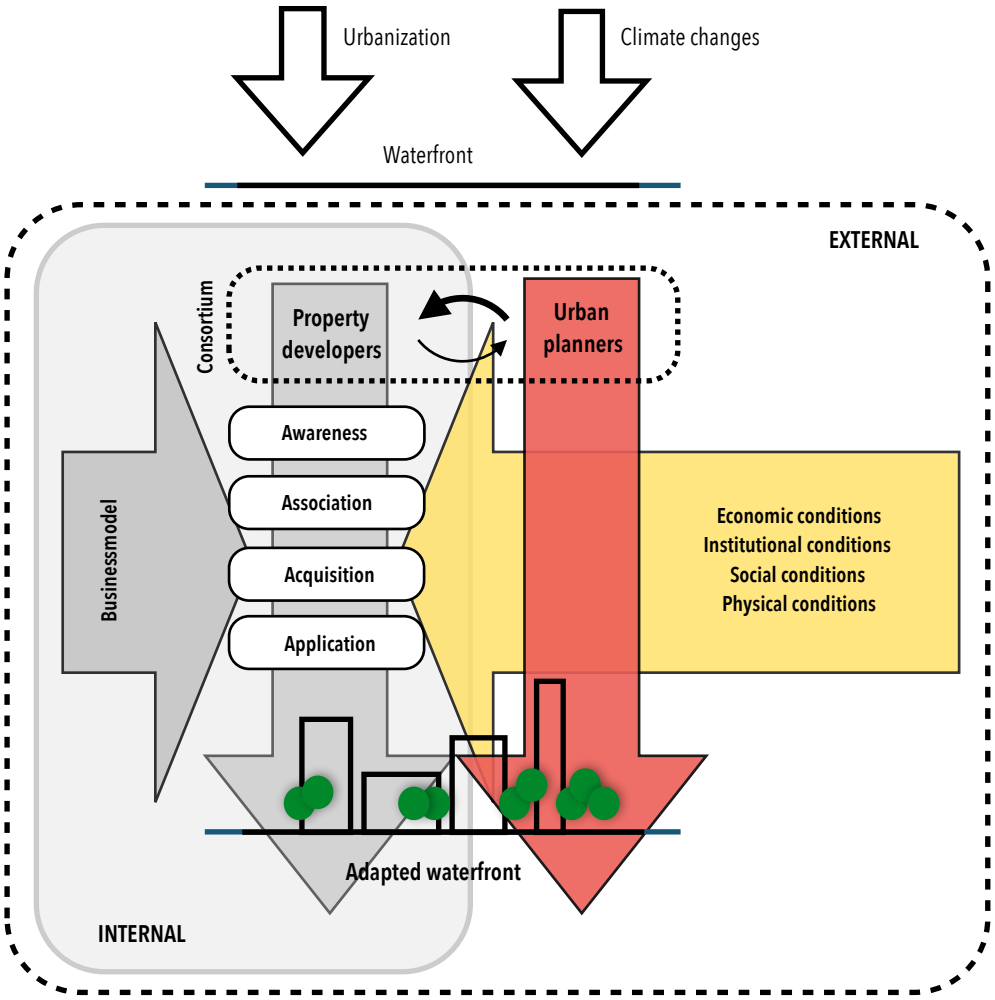

Figure 63: Modified framework (own ill.)

The property developers and the planing institutions are connected through a consortium, which gives the property developers the possibility to influence the adaptation strategies. However the planning institutions are also influencing the property developers through the master and zoning plan, the building permits and as the owner of the land. As already presented the structure of the consortium is therefore influencing the engagement of the property developers. A second internal feature influencing the engagement of the property developers is their business model. A long term property developer will associate the adaptation of their properties, with benefits, as it reduces the flood damages costs. Compared to a short term property developer, who is not directly effected by the flood damages. Therefore the influence of the business model is illustrated with a grey arrow towards the willingness and ability of the property developers to adapt.

8. CONCLUSION

This chapter presents the key findings from the research, and the features that are influencing the behavior of the property developers. Followed by recommendations for Gothenburg, Dordrecht, and further research.

8.1 Influences on the behavior of the property developers

8.1.1 Internal features

The internal and external features influencing the behavior of the property developers were identified through the case studies and the case study comparison. The first internal feature influencing the behavior of the property developers is their **business model**. The business model effects the cash flow of the property developers. Herein a distinction can be made between short and long term property developers.

The short term property developers are only involved in the planning and construction of the buildings, thereafter they sell the buildings to the homeowners. This is visible in the cash flow, where they are not directly effected by the flood damages, as they are not the owner of the building when the flooding occur. Although they have the responsibility to deliver qualitative housing, their incentives for adapting the buildings is limited, due to the cost-benefit analysis. If the property developers are not able to receive a higher price for the adaptation measure they take, the cost will be higher than the benefits, making it less attractive for the short term property developers to invest in adaptation measures.

The long term property developers on the other hand, are directly effected by a flooding, and will therefore experience a direct benefit from adapting their developments.

'The four layers of living was so expensive, and we said: we will not be able to sell it in a profitable way' (Dutch short term property developer 2).

'If we do not make a profit, we do not exist any more' (Dutch short term property developer 2).

'We will own the buildings for a long time and we want to avoid problems. We are a developer and an investor' (Swedish long term property developer 3).

The second internal feature is the **partnership agreement** the property developers have with the urban planners. The structure of the partnership agreement influences the engagement of the property developers in adapting the land and the buildings in the waterfronts. Through the consortiums, the property developers have the possibility to discuss and define the adaptation strategies. If the property developers are given a lot of influence on the adaptation strategies and the creation of the zoning plan, they have the possibility to choose how engaged they want to be in the adaptations. Their engagement in the adaptations is based on a cost-benefit analysis, which compares the costs and the benefits of an adaptation. Due to the fact that the property developers are driven by profit making objectives, they will develop properties that gives them the most profit. Currently their is no specific demand for adapted houses and if there is no demand for adapted houses, the property developers will not benefit form developing it.

8.1.2 External features

The external features are influencing the internal features and the behavior of the property developers. The first feature are the **urban planners**, who make the master and zoning plan, own the

land and allocate the land. As owner of the land, they can choose the partnership agreement they want to work with and hereby determine the influence they will have on the property developers. As maker of the master and zoning plan, the urban planners have the responsibility to provide the city with plans that manages the risks of flooding. Therefore the urban planners have a key role in adapting the urban waterfronts. Both in Gothenburg and Dordrecht the adaptation strategy was to raise the ground and here fore the urban planners from the municipality are responsible. As a result the property developers do not associate the adaptation of the buildings with any benefits, because the risk of flooding is reduces with the higher land levels.

'It lies with the municipality to develop a zoning plan which manages risks' (Swedish long term property developer 4).

'The municipality raised the ground: For the property developers there is not an incentive to change their plans, because they can build the exact same row of houses as they can build anywhere' (Dutch urban planner A).

A countries and cities **economic conditions** influences the actions of the property developers. When the housing demand and prices are high, property developers are more able and willing to invest in adaptation measures which increases the costs and thereby the price of the buildings. Because they are able to sell the more expensive houses on the market. However when the housing demand is low, the property developers will not invest in expensive adaptation measures, which they cannot sell.

'The market determines the value of the home, measures cost money and the market determines the maximum' (Dutch short term property developer 1).

With an insurance, actors are able to manage the financial risk related to damages of their properties. Currently the insurance companies have not changed their insurance conditions, however when floods occur more frequent, insurance companies may change the conditions. Influencing the property owners to demand and prefer adapt buildings, which are insured and able to cope with floods. Also the banks are effected by changed insurance conditions, as their money is invested in houses, which can drop in value if it is no longer insured and damaged by floods.

'In a couple of years, we may not be able to insure anymore and then the owners/ users and banks will have a problem' (Swedish insurance company).

The **institutional conditions** refers to the decisions and policies of the national and regional governments. The planning institutions are part of the municipalities, which are governed by the national and regional governments, who provides the municipalities with national interests and laws they have to pursue. The political interests changes over time and are related to the elected political party in the government. These interests are translated into the master and zoning plan, which is steering the waterfront developments.

The influences the national and regional governments have on the adaptation of an area, depends on the water management structure of the country. The Netherlands is an example of a country with a very old water management structure, which is not present in Sweden. Here the Rijkswaterstaat and the Waterboards are responsible for the flood protection and these organizations have the budget and the skills to invest and implement the needed adaptation measures. This has protected the Netherlands from the water for centuries.

'The Rijkswaterstaat sets the protection standards' … 'When a dyke is not up to standard it has to be reinforced: and that is the responsibility of the Rijkswaterstaat and the Waterboards' (Dutch urban planner C).

The housing demand and preferences of the public refers to the **social conditions** in a city. When there is housing shortage, the housing prices goes up (scarcity: high demand and low supply, causes prices to go up). Making it attractive for property developers to develop here and if the flood risk awareness of the public is lacking, the demand for adapted houses will be limited. This is influencing the property developers in a negative way, as they can continue to build the same houses as they have always done.

Developments are location specific and influenced by the **physical conditions** of the location. The transformation of the low-lying urban waterfronts is related to the lack of space cities have to expand on. When the higher located areas have been exploited the low-lying areas are left. The transformation of the low-lying waterfronts is more expensive, as measure have to be taken to adapt the area. However the location of urban waterfronts: near the water and the city center is also making it an attractive area to develop. Therefore property developers and property owners are willing to invest in the urban waterfronts.

'The higher levels have already been exploited. The lower areas, haven't been build for a reason' (Swedish long term property developer 1).
'People buy the location because it is near the water' (Dutch short term property developer 2).

The negative impacts of the changing climate are becoming more visible in cities and if floods would occur frequently in the low-lying waterfronts, the positive aspect of living close to the water, could evolve into a negative aspect. Then the property developers would not develop here, unless the developments are able to cope with the changing climate.

The above mentioned features influencing the behavior of the property developers are connected and related to each other, the next paragraph presents how the features are connected.

8.1.3 Connections between features and property developers

In figure 64, the connections between the features influencing the behavior of the property developers are illustrated. The red arrow between two features, illustrates an influence one feature has on another feature. The dotted arrow illustrates a possible or future influence a feature can have on another feature. The business model, partnership agreement, housing demand and master and zoning plan have a large influence on the behavior of the property developers.

The business model is influenced by the housing demand and the economic conditions in a specific location. The influences of the insurance companies and banks on the business model is nowadays limited, however this may change if the insurance companies changes the insurance conditions. The partnership agreement is not directly influences by any of the features, but determined by the urban planners and property developers, Therefore this condition can be changed by the urban planners and property developers and thereby influence the engagement of the property developers in the adaptation of the waterfronts and developments. The housing demand is influenced by the location, the economic conditions of the location and in the future maybe also by the insurance companies. If the insurance companies changes their insurance conditions, houses which aren't adapted and located in low-lying waterfronts can become less demanded. The master and zoning plan is made by

the urban planners, who are influenced by the interests and policies of the national and regional governments. The master and zoning plan is also influenced by the insurance conditions, as the master and zoning plan should provide the property owners with the right conditions to be able to receive an insurance. Insurances are a condition that can have a large influence on the adaptation of waterfronts and buildings. To receive a flood insurance the properties have to meet certain criteria, when floods occur more frequently, these criteria can change, influencing the property developers to adapt their developments to be able to receive an insurance. The flood risk awareness of the public influences the housing demand. If the public is aware of the flood risk they may demand flood adapted houses, which is influencing the property developers to adapt their developments.

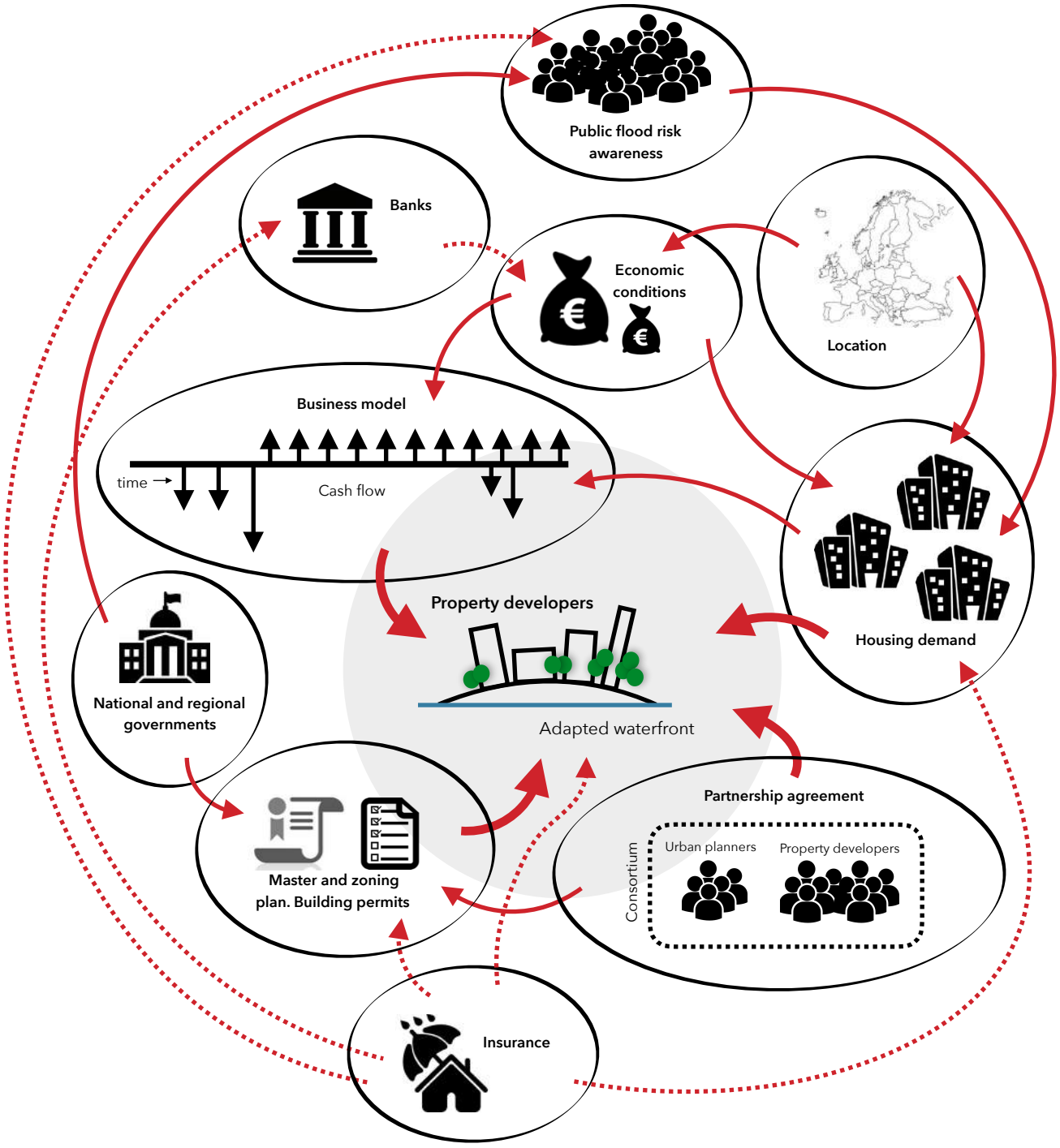

Figure 64: Connections between features (own ill.).

8.1.4 Recommendations adaptation of waterfronts

- **Select long term property developers** for the waterfront transformations, they have more incentives to adapt the developments than short term property developers. Or ensure that the short term property developers are stimulated to adapt the developments, through for example holding the short term property developers responsible for flood damages after the handover of the buildings. In Sweden the property developers are responsible for the buildings until 10 years after realization, however the negative impacts of the changing climate are visible on the long term and then 10 years can be too short.
- Select a partnership agreement, where the **urban planners have more influence** than the property developers, than the other way around. Property developers are driven by profit making objectives and this will steer them in their decisions and actions. Therefore it is important that the urban planners are governing the interests of the public and ensuring that the developments are adapted to the changing climate.
- The negative impacts of the changing climate are uncertain, therefore it is important to develop **adaptation strategies that are flexible and adjustable** to the changing climate and the housing demand. The transformed waterfronts are often not the only flooding vulnerable area in a city, therefore the adaptation strategies of the waterfronts should take the overall adaptation strategies for the city into account, to avoid double work and obstacles in the implementation of the cities adaptation strategies.
- The housing demand and the housing prices are receptive to economic growth and recession. In case of an economic growth, the density in the waterfronts is often increased, due to a high housing demand and high housing prices. However when a city is hit by an economic crisis, the demand decreases and the density has to be reduced to avoid vacancy and financial loses. A reduced density can also lead to the development of less adapted buildings. Therefore the **spatial plans should be divided into several phases**, which can be developed separately and by itself is able to cope with the risk of flooding.
- The insurance companies, can provide flood insurances as long as the floods are sudden and accidental, when floods would occur more often, insurance companies can change the flood insurance conditions. Therefore the involved actors in waterfront developments should **collaborate with the insurance companies** to ensure that the properties can be insured against flooding and for a accepted price.
- **Increase the public flood risk awareness**, if the public is aware of the consequences of the changing climate and floods, the public may demand houses which are adapted and able to cope with the changing climate and flood risk. This can stimulate the property developers to develop adapted buildings. The awareness can be increased through workshops, websites with information on the flood risk in your neighborhood and a raised premium for your home insurances.

8.2 Gothenburg

8.2.1 Frihamnen

The plans for Frihamnen are in progress and the adaptation strategies are continually adjusted to the new plans. Because of the consortium the property developers are informed and involved in the assessment of the adaptation strategies. The measures aims at adapting the whole waterfront, through the creation of higher parts, as well as the creation of lower parts for the collection and transport of rainwater. The building specific adaptation measures have not yet been identified, however these measures are crucial, when not all of the land is raised, due to the high costs here fore. With the general adaptation measures Frihamnen is able to cope and manage the flood risk until around 2070, if the global sea level rises with 1 meter by 2100, hereafter the developments will not meet the building regulations, due to the rising sea levels. However not only Frihamnen is effected by the rising sea levels, also the city center of Gothenburg will be afflicted by floods and therefore an overall adaptation strategy for Gothenburg is being developed. However a challenge with the adaptation of Gothenburg, is the limited budget and organizational facility the city of Gothenburg has to implement and maintain the adaptation measures.

Most of the property developers in Gothenburg were aware of the flood risk and are willing and able to be in engaged in the needed adaptation measures. The main reasons here for are: the **partnership agreement**, which is making the property developers aware and involved early on in the adaptation and development process of Frihamnen. The phased land allocation in Frihamnen is also increasing the incentives for the property developers to adapt their developments, as they have to prove to the urban planners that they are engaged in the adaptation of Frihamnen to be able to be selected for a next land allocation. The **business model** of the property developers in Gothenburg is stimulating the property developers to invest in adaptation measures to avoid flood damages. Due to the fact that many of the involved property developers remain the owners of the buildings. The **housing demand** in Gothenburg is high, which is causing the housing prices to go up. Therefore the property developers are more willing and able to invest in the adaptation measures. However the housing demand of the public is not so focussed on adapted buildings, and therefore the property developers decision to invest in adapted buildings can be limited. The housing demand is closely related to the **location**. Frihamnen is an attractive location, because it is located near the city center and close to the water. Hence, the conditions in Gothenburg are indicating that the property developers will be engaged in adaptation and transformation of Frihamnen. However the adaptation measures haven't been implemented yet and the conditions stimulating the property developers to be engaged, can change and cause the property developers to become less engaged in the adaptation of Frihamnen.

8.2.2 Recommendations for Gothenburg and Frihamnen

To be able to implement the overall adaptation strategy for Gothenburg, the municipality needs financial and organizational support. A national and regional water authority could provide Gothenburg with this support. This water authority structure would be similar to the Rijkswaterstaat and Waterboards in the Netherlands, where the national authority sets the standards and with the support of regional authorities implements and maintain the adaptation measures. To ensure that their is a budget for the adaptation measures, the water authority can raise a separate water tax or the measures can be financed through the existing sewage tariff, which needs to be adjusted in order to be able to finance the adaptation measures. To be able to charge the inhabitants with a changed sewage tariff the sewage tariff law has to be changed and the flood risk awareness of the public has to be increased to be able to justify a raised tarifff. The presence of a national and regional water

authority can become very important with the changing climate and an increased risk for flooding in Gothenburg and other parts of Sweden.

In Gothenburg there is an extreme high housing shortage, causing the housing prices to go up. To solve the housing shortage the building density in Frihamnen is increased, however a risk with the high exploitation of Firhamnen is that the housing demand in Gothenburg changes and decreases. If the climate changes become more visible and the public becomes more aware of the flood risk, they will demand houses that are adapted and less vulnerable to floods. With the high exploitation the adaption of the buildings may not be the current priority. This can lead to vacancies and financial losses for the actors who have invested in Frihamnen. To avoid this the plans for Frihamnen should be flexible and adjustable to the changing demand and climate. The phased land allocation and development of Frihamnen is a good start and this idea should be sustained even if the politicians want to increase the pace and the amount of developments.

'The process before a zoning plan becomes legal is long. During this time a lot can happen, the market can change and developers can lose interest or build somewhere else' (Swedish long term property developer 5).

Currently the flood insurance is included in the home insurance, however if floods would occur more frequent the insurance companies may change the insurance conditions. Therefore it is important that the developments in Frihamnen meet the insurance conditions to avoid financial damages for the property owners and banks.

'If the developers are not adapting the buildings, the owners / users will have problems later on, when they will not be able to get an insurance' (Swedish insurance company).

A final recommendation for the developments in Frihamnen is to increase the flood risk awareness of the public. Currently the flood risk awareness of the public is limited, many are aware of the changing climate and the rising sea levels, however this does not appear in their housing demand. Therefore the demand of adapted buildings is limited, causing the property developers to postpone or avoid the adaptation of the buildings. The flood risk awareness can be increased through workshops and dialogues with the public, which have been held in Frihamnen. However a challenge with these events is a limited audience. In the Netherlands the government is increasing the flood risk awareness through a website, where the inhabitants can see the risk of flooding in their neighborhood. In appendix K an overview of the website is presented. FullSizeRender (2)

'Yet, I haven't met a tenant, who has been interested in the flood risk. They are not long term oriented: the tenants seems to be short term oriented' (Swedish long term property developer 1).

8.3 Dordrecht

8.3.1 Stadswerven

The transformation of Stadswerven has started and part of the adaptation measures have already been implemented. The adaptation strategies were develop by the property developers and the urban planners from the municipality of Dordrecht. The aim of the adaptation strategies was to raise some parts, which are protected from the water and create some lower parts were the water is given space and which can increase the public flood risk awareness. With these adaptation measures Stadswerven is protected against flooding. A big challenge for Dordrecht remains, which is the adaptation of the city center, that is located below sea level, however here the municipality of Dordrecht is supported by the Rijkswaterstaat and Waterboards to implement the adaptation measures.

The awareness of the property developers in Dordrecht on the flood risk was there, however they were not so engaged in the implementation of the adaptation measures. The main reasons therefore are: the **partnership agreement**, which gave the property developers a lot of influence on the development of the adaptation strategies and the spatial plan. Herein the municipality of Dordrecht got the main responsibility for the implementation of the adaptation measures. For the development of Stadswerven, three property developers were selected and these property developers have the development monopoly. Due to this agreement the urban planners have a limited influence on the property developers. Which led to the property developers only developing the higher located parts. The **business model** of the property developers is also influencing their limited engagement in the adaptation of the buildings. None of the property developers will remain the owner of the buildings and therefore they will not be directly effected by the flood damages. The **housing demand** and prices in Dordrecht have dropped since the economic crisis in 2008/2009, which makes it less attractive for the property developers to invest in adaptation measures, that will increase the housing prices and thereby make the buildings to expensive and unsaleable. Also the **location** is influencing the housing prices and the price the public is willing to pay for a house. Dordrecht is not regarded as the most attractive city in the Netherlands and therefore a maximum housing price in Stadswerven is limiting the property developers to invest in adaptation measures. The adaptation of Stasdwereven is mainly done by the municipality, who raised the ground.

8.3.2 Recommendations for Dordrecht and Stadswerven

The houses in Stadswerven are located in an unembanked area and therefore they are not insured against flooding. This matter was something many of the new habitants in Stadswerven were not aware of. The houses of the first inhabitants were located on the higher parts, therefore the risk of flooding is limited. However the low-lying parts of Stadswerven, which will be developed by the private home owners, will be more vulnerable for flooding and the absence of a flood insurance can give the homeowners high finical costs. Therefore it is important to inform the future homeowners of Stadswerven of the fact that they are not insured against flooding.

'It is an area outside the dikes. In principle you are not insured against flooding there' (Dutch property developer 1).

The property developers that are selected for the partnership agreement are short term property developers and therefore they have less incentives for adapting the developments. By selecting property developers that remain the owner of the properties, the property developers would be more willing to invest in adaptation measures, to avoid flood damages. The partnership agreement

that is selected provides the property developers with much influence on the developments and the adaptation strategies. As well as it gives the urban planners less influence on the property developers. If another partnership agreement would be used, the urban planners could have more influence on the property developers and their engagement in adapting the waterfront developments. This was also mentioned by an urban planner at the municipality of Dordrecht.

'I think with our current knowledge we would cut up in smaller plots and give that to different developers, this would be a bit more work to every time ask al the developers, to come up with their best idea' (Dutch urban planner).

The flood protection of a developed unembanked areas is the responsibility of the homeowners and this may become difficult when the sea levels are rising and the precipitation increases. Support from the Rijskwaterstaat and Waterboards can become crucial, therefore the made agreements with the Rijkswaterstaat and Waterboards should be overlooked and perhaps adjusted to the increased flood risk in unembanked developed areas.

The images in figure 65 shows the developments in Stadswerven, the photos were taken on the 8th of October 2015.

Figure 65: Images Stadswerven (own images).

8.4 Recommendations for further research

8.4.1 Insurance companies

Insurance companies have an influence on the adaptation of waterfront developments, however this influence is limited due to the reason that property owners are still able to receive a flood insurance. If the insurance conditions changes, property owners will probably become more engaged in adapting their buildings, to avoid the fact that some buildings are not insured. A further research could study possible outcomes of flood insurance conditions and the actions that have to be taken to avoid that buildings aren't insured against flooding.

The Swedish insurance company that was interviewed, stressed the importance of working together with the government and municipalities, as they should set the right development conditions in the master and zoning plan. However the collaboration is not optimal, as the government is focussing on mitigation rather than adaptation. A further study on the collaboration of the insurance companies, governments and municipalities, could provide both parties with useful insights on how properties can be insured against flooding.

'The government has the responsibility to adapt and we have to work together. But that is not working out so well, we are trying to talk to them and to have a collaboration with them, but they previous and current government is more into mitigation, for example CO2 reduction than adaptation' (Swedish insurance company).

8.4.2 Finance and valuation of properties

Banks are an important actor in the finance of new developments. Currently they do not influence the developments of the property developers, as they have not been effected by the negative impacts of the changing climate due to the insurance companies that covers the flood damages. However these conditions may change and then the value of the properties may drop. A changed value of the properties in flooding vulnerable areas effects the homeowners and the banks who have lent the homeowners the value of the house before it was damaged or threatened by floods. Therefore banks (and homeowners) are very dependent on the decisions the insurance companies make. A study on the collaboration of banks and insurance companies, could provide the banks and the homeowners with insights, whereby they can avoid high financial loses on their properties.

'When an insurance companies gives the signal that a house is located in a flood risk area, we have to raise the premiums or not covering it anymore, but we are not informed of this. The collaboration with the insurance companies could be improved' (Dutch bank).

Another challenge with the valuation of properties, is the valuation of sustainable interventions in the properties. Currently the banks are looking at the financial performance of the company, the resilience of the business model and the company's management when they give a loan. The sustainable aspect of a development is less important, however with the changing climate and changed insurance demands this can change. A study on the valuation of sustainable developments could contribute in the development of more resilient waterfronts.

'There is still a world of finance and a world of sustainability, which have to meet each other' (Financial department Gothenburg municipality).

8.4.3 Partnership agreements

The partnership agreement is influencing the engagement of the property developers, however in this research the impacts of the partnership agreement on the behavior of the property developers have only been mentioned briefly. A further study on the different partnership agreements and the influences they has on the behavior of property developers to adapt developments to the changing climate, could provide urban planners with valuable insights on how to arrange a partnership agreement where the property developers are engaged in the adaptations.

8.4.4 Actual property developers engagement in Frihamnen

In this research project the engagement of the property developers to adapt Frihamnen was based on assumptions, however the actual engagement of the property developers may change, due to changed economic, institutional, social and physical conditions. Therefore a further research on the actual engagement of the property developers would be interesting. As well as a comparison between the property developers proposed behavior and actual behavior.

8.4.5 Adaptation of existing cities

The focus of this research project was on the adaptation of urban waterfronts, however the urban waterfronts are not the only vulnerable areas in cities. Many cities have an old center, which is located on low-lying land, with the changing climate these areas are becoming vulnerable for floods. The adaptation of cities and the existing infrastructure and buildings is different from the adaptation of waterfronts. Therefore a further study on the adaptation of city centers could provide urban planners, property developers and the cities inhabitants with useful insights.

(Image: own photo, January 2016, Gothenburg)

REFLECTION

In this final chapter the study is reflected upon from the perspective of the researcher. The aim of this reflection is to look back on the research and reflect how and why the used research approach worked or didn't work. It consists of four parts: the relationship between research and design, the relationship between graduation theme and research subject, the relationship between methods of graduation lab and chosen method and the international character of the research.

Relationship between research and design

The aim of this research was to investigate the level of engagement of the property developers in the adaptation of the urban waterfronts and what influences their engagement. This was investigated with an empirical research strategy, which had a qualitative character. From the theoretical background and studied theories a theoretical framework was created. This framework formed the basis for the case studies and the analyzing of the findings.

In the beginning I didn't make a connection between the theory and the case studies and therefore much of the focus during the research project was on the case studies. Through twenty interviews with involved actors in the waterfronts in Gothenburg and Dordrecht, a questionnaire and several policies and planning documents, a significant amount of data was available to analyze and draw conclusions from. However, these findings were not connected to the studied literature. Although the studied literature was used for the case selection, interviews and analysis of the findings, a connection had not been made explicit in the report. By going back to the theoretical background, an enhanced theoretical framework was created, that enabled me to understand the connections between the studied literature, existing theories, and the findings from the case studies.

Eventually the approach led to an understanding of the complexity in the engagement and the influence on the behavior of the property developers in the adaptation of flooding vulnerable waterfronts in Gothenburg and Dordrecht. Although the case studies remained throughout the research, the research questions, aim and method were modified. Making the research process more circular than linear. This was something I was not aware of and I assumed that when one aspect of the research was written, for example the research questions, this would not change anymore. However this was not the case and throughout the research adjustments have been made to the research design which has improved the results and the end report. In figure 66 the circular process of this research project is illustrated.

The selected case studies: Frihamnen and Stadswerven where selected in the beginning of the research after two exploratory interviews and a document analysis. Gothenburg was the starting point of the research and the selection of Frihamnen was quickly made, as the transformation of this waterfront is a major project in Gothenburg. In the Netherlands several waterfront developments were studied, to find the most suitable one for the comparison with Frihamnen. Through a brief research of Dutch waterfronts, Stadswerven was selected which is located in an unembanked area, which turned out to be a crucial aspect for the comparison. In an unembanked area the Rijkswaterstaat and the Waterboards do not have the responsibility to protect the inhabitants. These organization do not exist in Sweden and therefore the institutional conditions are quite similar in Frihamnen and Stadswerven, which enabled a comparison between the two waterfronts.

The elaborated selection of a case study in the Netherlands was important for the case study comparison. If another case study had been chosen, the comparison had been more difficult to make and this had effected the findings and the conclusions that were drawn. This illustrates how important it was to have an elaborated case study selection to avoid problems later on in the process and in the case study comparison.

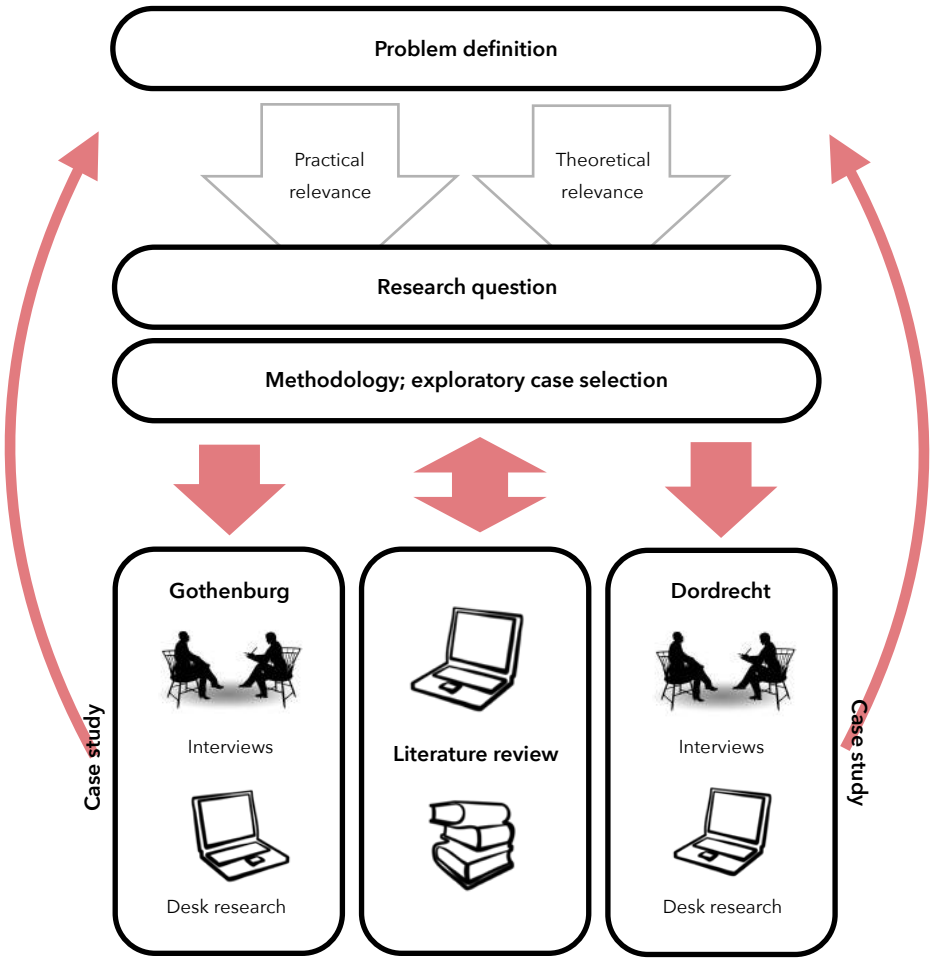

Figure 66: the circular process of this research project is illustrated.

The theory for the theoretical framework is partly based on the theory of receptivity (Jeffrey and Seaton, 2004) to study the willingness and ability of the property developers to adapt the urban waterfronts. This theory consist of four components: the awareness, the association, the acquisition and the application. Secondly the theoretical framework is based on several conditions that influences the behavior of the property developers which have been derived from several authors: Shearer et al. (2013), Ford & King (2015). Birkmann et al. (2010) and from IPCC fifth assessment report (2014a), these conditions are: the planning institutions, the economic conditions, the institutional conditions, the social conditions and the physical conditions.

The receptivity theory enabled me to relate the findings from the case studies with the willingness and ability of the property developers to adapt the urban waterfronts. However, the property developers in Gothenburg are in the planning phase and therefore the acquisition and application of the adaptation measures could only be based on assumptions and on the intended actions of the

property developers. In Dordrecht on the other hand the acquisition and application of the adaptation measures could be based on the actual actions of the property developers. Therefore the receptivity theory was more applicable to study the willingness and ability of the property developers in Dordrecht. However using another model to study the behavior of the property developers in Gothenburg hadn't changed the fact that the behavior of the property developers in adapting Frihamnen would had to be based on assumptions.

The mentioned conditions influencing the behavior of the property developers were also identified from the case studies. However a certain feature influencing the behavior of the property developers, for example the housing demand, can be related to more conditions: the economic, the institutional and the social conditions. As well as one condition can consist of multiple features, for example the economic conditions consists of housing prices and insurances, leading to a more extended theoretical framework with more features than what I presented in the framework. The theoretical framework is adjusted after the findings, but a further divination of the conditions has not been made, because this would have been to extensive and not possible to carry out in this master thesis. Therefore I chose to keep the theoretical framework as presented in this research project. The framework after adjustments is illustrated in figure 67.

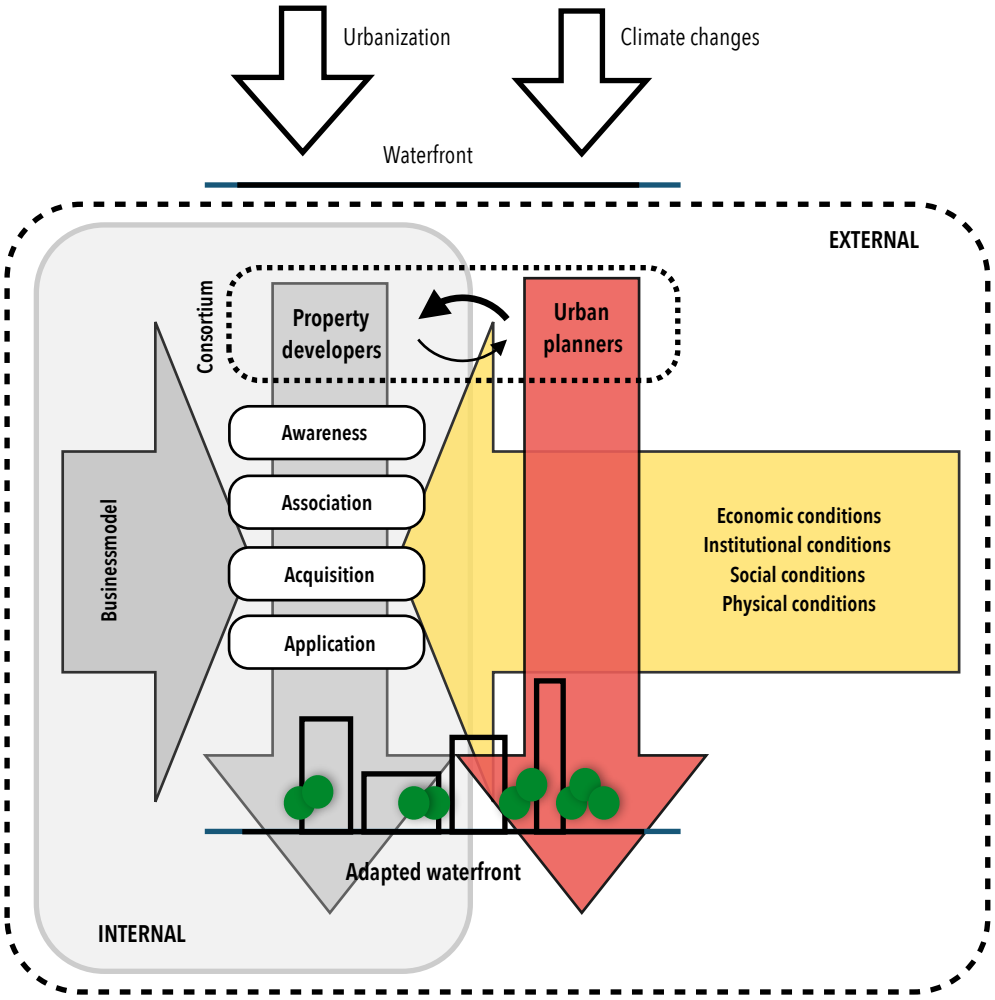

Figure 67: Framework

Relationship between graduation theme and research subject

Defining the research subject was the first part of the study. It started with an idea to solve the problems with the rising sea levels through binding the Ice in Antarctica and transforming the Sahara desert into a green biosphere. However after some considerations, I could agree with my mentor that it would be a to ambitious study for a master thesis. This lead to the idea of studying the development of coastal cities in a sustainable manner. Also this would have been a to broad subject. When I eventually had the idea of studying the transformation of waterfronts, I wanted to take some courses at Civil Engineering from the master Water Management to broaden my knowledge on managing and controlling water in waterfront developments. But this is not the idea of writing a master thesis at the Urban Area Development laboratory for the master Real Estate and Housing and therefore I had to refine the focus of the study into a more course related subject.

The process of narrowing down the study into a researchable and manageable subject was a challenge, because I have the tendency to deviate from the subject and end up doing a little bit of everything instead of one thing thoroughly. A second challenge with narrowing down the subject, was the fact that I had to let go of my first idea that I could solve the problems of sea level rise as well as coming up with global solutions for the development of sustainable waterfronts. Eventually with the support of my mentors I was able to narrow down the subject into this research project: the influences on the engagement of property developers in adapting urban waterfronts to the changing climate in Sweden and the Netherlands, which has been very interesting and manageable to study. This process of defining the research is showed in figure 68.

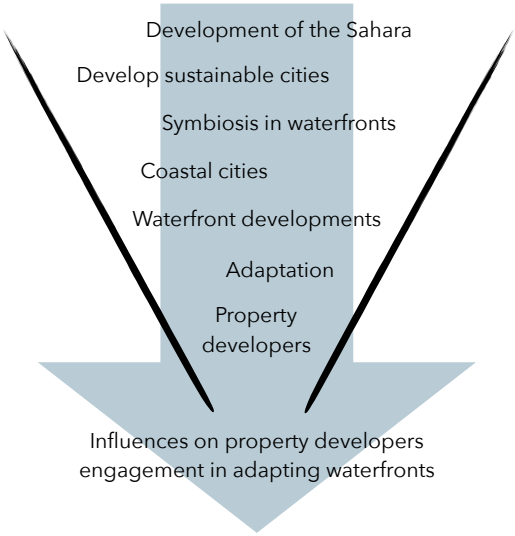

Figure 68: Research definition

Finally the research subject relates to the Urban Area Graduation laboratory in several aspects:

- The focus of the research is on the transformation of two urban waterfronts.
- The development process with the involved actors are studied.
- The climate changes and the influences hereof on developments is the key subject of the research.

Furthermore the research relates to a growing global interest and awareness of the negative impacts of the changing climate and the need to adapt. Below a quote from the COP21 in Paris 2015 is presented, which identifies how important the engagement of multiple stakeholders is.

'Successful adaptation not only depends on governments, but also on the ***active and sustained engagement of stakeholders*** *including national, regional, multilateral and international organizations, the public and private sectors, civil society and other relevant stakeholder' (United Nations Framework Convention on Climate Change, 2015).*

Relationship between methods of graduation lab and chosen method

The data is collected through semi-structured interviews and a questionnaire. These methods of data collection are generally used at the urban area graduation laboratory. An important aspect of a qualitative research is the analysis of the data. Through coding, categories that share some characteristics can be grouped. A commonly used program to analyze data is Atlas.ti, however for this research the transcribed interviews were documented in Swedish, Dutch and English, making it more difficult to use Atlas.ti. Therefore I chose to analyze the data in excel, which enabled me to translate and immediately categorize the data that shared similar characteristics. The coding categories had a deductive character, which directly related the findings with the theory and the theoretical framework.

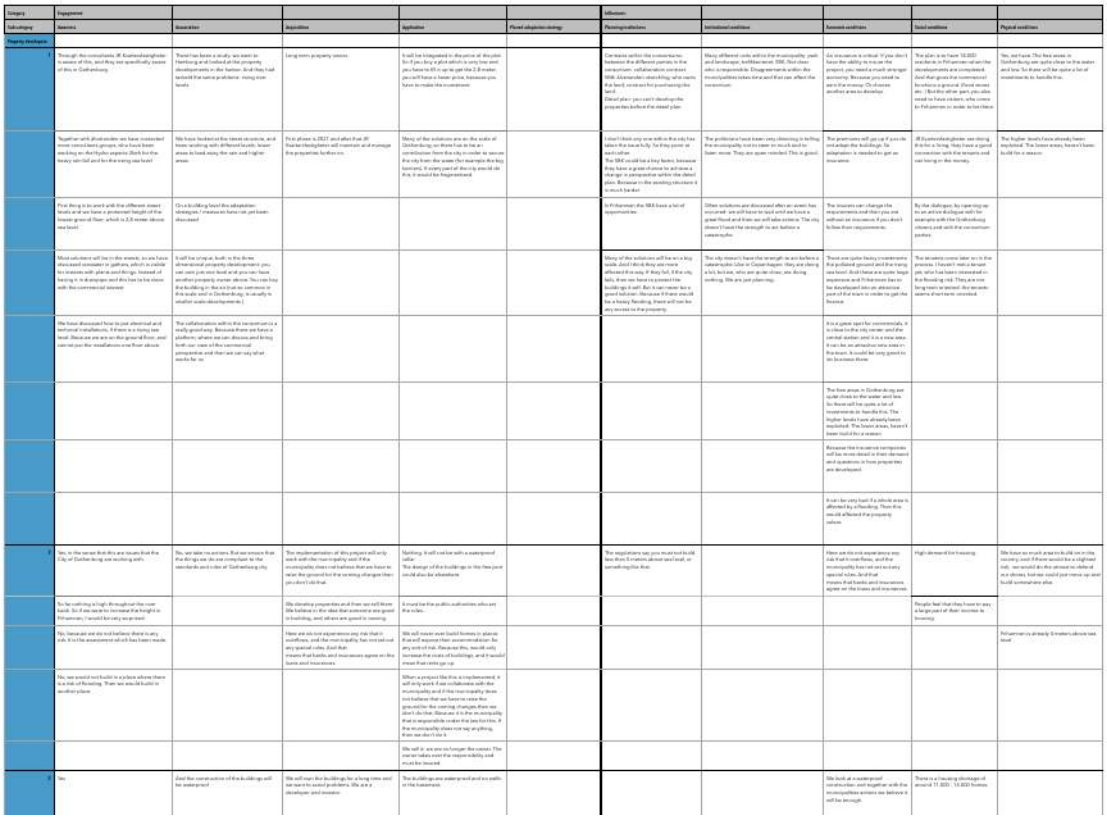

Figure 69: An overview of the analysis from excel.

Although excel was an efficient way of coding the interviews, the amount of data in excel grew rapidly, and eventually some irrelevant data was also added. This could had been prevented, if I had been more selective in the parts I added to the categories in excel. In figure 69 an overview of the analysis in excel is shown.

International research

This study is conducted in Gothenburg and Dordrecht, giving the research project an international character. Both in Sweden and the Netherlands, English is a widely used language among professionals, however many of the interviewees indicated that they could express themselves better in their native language, and therefore a majority of the interviews were conducted in Swedish and Dutch. This was not a problem because of my Swedish and Dutch background and knowledge of the languages. However it did delay the process, because the interviews were transcribed into Swedish and Dutch, and then translated into English to enable a comparison and transparency of the case studies. A positive outcome of transcribing the interviews in Swedish, was the fact that I improved my Swedish writing skills very quickly.

From August until January I conducted the research at the City Planning Office in Gothenburg. The fact that I was working at the municipality in Gothenburg improved the accessibility of information on the case: Frihamnen, because the involved actors from the municipality were working next to me, as well as access to relevant policy documents and plans were given. While in Dordrecht it was more difficult to obtain relevant information on the case: Stadswerven and find the right actors for the interviews. Eventually 13 interviews were conducted in Sweden compared to 7 in the Netherlands. This led to an more in-depth understanding of the situation in Gothenburg and Frihamnen. However the aim of the research was a comparison between Gothenburg and Dordrecht, and therefore I decided to leave some gained knowledge on Gothenburg out to make the comparison more equal.

Conducting an international study can be a challenge, considering the different institutional contexts, regulations and planning processes. Due to my studies in the Netherlands I was more informed on the Dutch situation. To be able to understand the Swedish situation, I had to review the Swedish institutional context, planning and development aspects. Most of this information was only available in Swedish, which would have been a difficulty for a non Swedish speaking person. To understand the Swedish situation was a bit time consuming, however with my Swedish background I didn't encounter any difficulties in studying it. Despite the challenges of conducting an international study, it was more than worth it and the findings enlarged my knowledge on urban waterfront transformations and gave me the possibility to work with professionals in Sweden and the Netherlands.

(Image: own photo, September 2015, Gothenburg)

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(Image: own photo, December 2015, Sandkär)

APPENDIX A

Selection of case in the Netherlands

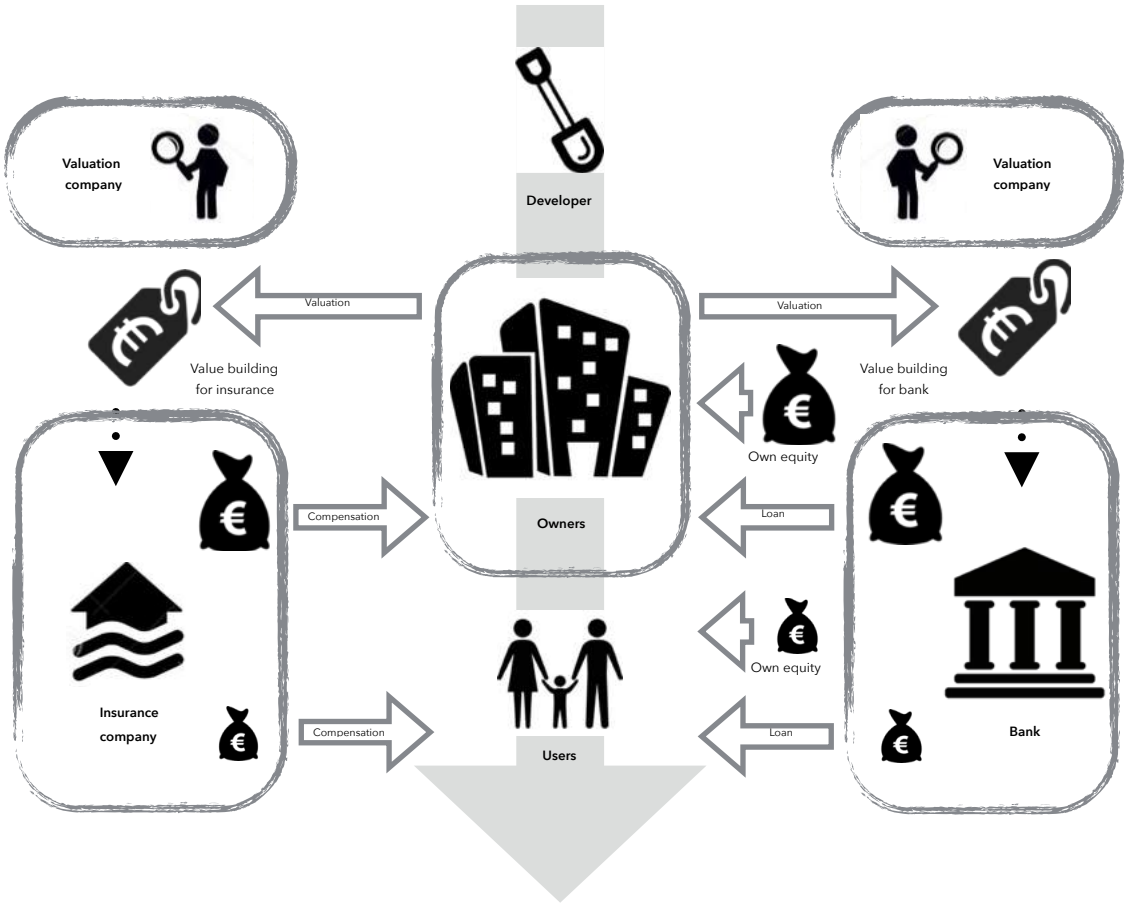
City	Advantages of the case	Disadvantages of the case
Rotterdam	Rotterdam has a high amount of urban assets that are exposed to coastal flooding and river flooding. Due to Rotterdam city's critical location, it has become a pioneer in climate change and spatial planning. Rotterdam's municipality have policy documents that deals with urban resilience, climate change, adaptation and mitigation. (Stead & Taşan-Kok, 2013)	The urban waterfronts in Rotterdam are not located outside the dykes, like Gothenburg, which makes it difficult to compare. (the context is not the same) Rijnhaven with floating houses seemed like an interesting case, but the tender failed, because the submitted plans did not meet the requirements. (Peter van Veelen)
Amsterdam	Waterfont developments in Ijburg, Where there are examples of multiple land use; shops, schools, restaurant, housing and recreation. The area will house 45.000 inhabitants and jobs for 12.000 people (Steenbergen & Van Bemmelen, 2011).	But IJburg has a system of sluices, dykes and embankments to protect IJburg from the IJmeer and rising sea levels (Steenbergen & Van Bemmelen, 2011). Therefore IJburg is not as vulnerable for flooding as Gothenburg. (the context is not the same.)
Dordrecht	Area is located outside the dykes, which makes it vulnerable for the rising sea level. Stadswerven is in being developed at this moment and will be a mixed urban waterfront, which is close to the water.	Stadswerven is a little bit further in the development process, but this does not have to be a disadvantages.
Katwijk	In Katwijk a combination is made of a flood defense and a parking garage. Both interventions are placed in a dike, which made the development of the dike much more expensive (9 million euro more), but it is also generating money on the long run. The investors of the dike are; the Rijkswaterstaat, the province, water board, municipality, residents and tourists. They are also the ones who are gaining the profit on the long term (Heijden, 2013). This development is an example of a waterfront development where the developers were involved in the adaptation.	The Katwijk case is on a very small scale and can not really be compared with Gothenburg. Therefore this case is not selected for the comparative case study.

APPENDIX B

Meeting Ruben Verbena DuraVermeer

From the meeting with Ruben Verbena from DuraVermeer, the financial aspects of banks, insurance companies and valuation companies and the relation to urban area development was revealed.

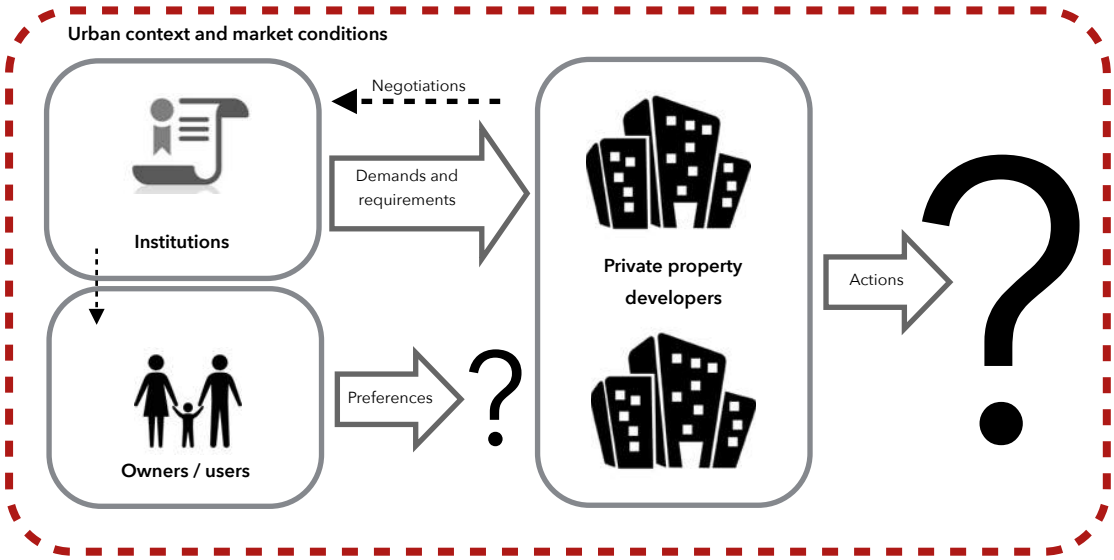
Based on this meeting the figure below was made.



This model shows the relation between and investment and the access to capital to invest in a building and capital to compensate for the damage of a building in case of a flooding. In this process the valuation companies are playing an important role, because they are the ones who value the buildings, and thereby determining the capital banks and insurance companies can provide owners and users with.

Meeting Peter van Veelen gemeente Rotterdam

Peter van Veelen enhanced the conceptual model with adding that the urban context and market conditions are very important for the development of urban waterfonts.



The market conditions influence the demand for ground and thereby the price of the land. Low lying waterfronts with risk for flooding, must be safe before developments can be made. If the municipalities would secure the area before selling the ground, different interventions are needed. These interventions, like raising the ground level and building dike cost money and makes the land price higher. In case of a bad economy, there will be little demand for expensive land. So in this case the municipality can choose to sell the land for a low price, but without any interventions to it, which means that the developer and investors will have to take the responsibility in adapting the land to the rinsing sea level.

The urban context is also important for the involvement of developers. If a low lying urban waterfont is secured by dams and sluices, a developer will not feel any responsibility in adapting the area to the rising sea level, because this is already regulated on a higher level.

So the market conditions and urban context influence the decisions municipalities and developers are making in low lying urban waterfronts, and has to be taken into account when two areas are being compared.

APPENDIX C

Interview schedules: Property developers

I. Introduction

The aim of my research is to understand the incentives for developers to adapt the built environment to the changing climate. Which in this case is the rising sea level and increased precipitation.

The study will compare two developments; Frihamnen in Gothenburg in Sweden and Stadswerven in Dordrecht in the Netherlands. Both developments are located close to the city center and along a river.

Much focus has been on climate adaptation strategies of public institutions; municipalities and in the Netherlands the waterboards and the Rijkswaterstaat; a national agency which is dealing with the water questions.

But I am very interested in the private actors and especially in private property developers. Because of the large impact they have and can have on the development and shaping of an area.

The research is in co-operation with the city planning office in Gothenburg and a research group form Chalmers.

The interview is divided into two parts; in the first part the focus will be on the behavior of developers and the second part will be on the external influences that has an impact on your decisions. And the interview will take approximately one hour.

Through the interview, do not hesitate to interrupt me if you have any questions. And there are no right or wrong answers.

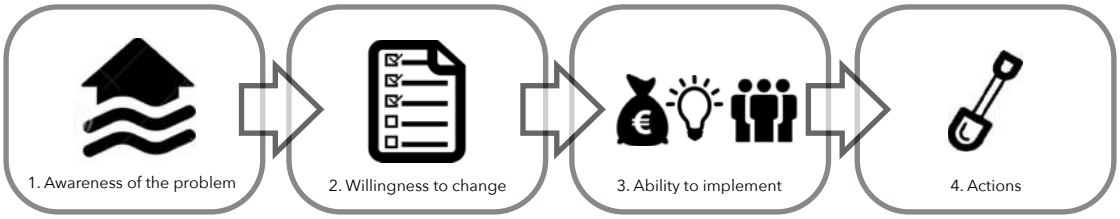
Your answers will only be used for my study in order to get an understanding of the behavior of and incentives for private property developers to adapt urban waterfronts to the increased risk of flooding.

Ok to record the interview?

II. Before the interview

- **Could you give a brief description of your role in [company]?**
- **What are the connections of [company] with Frihamnen / Stadswerven?**
- **What kind of company are you; (short / long term developer, investor)?**
- **How long have you been involved in the developments in Frihamnen?**
- **How long will Hauschild + Siegel Architecture be involved in the developments in Frihamnen?**

Part 1: Behavior of the private property developers



1. Is Hauschild + Siegel Architecture aware of the risks the rising sea level and increased precipitation can have on developments in Frihamnen / low lying areas?

2. Is Hauschild + Siegel Architecture taking actions to deal with the rising sea level and increased precipitation, to avoid the buildings from getting flooded? (In Frihamnen)

3. How is Hauschild + Siegel Architecture planning on financing any of these actions?

4. Do you have the skills within Hauschild + Siegel Architecture to execute / implement these actions?

5. Is the technology available to execute / implement these actions?

6. What would Hauschild + Siegel Architecture need to be able to implement these actions?

7. Have you worked within a consortium before

8. Have Hauschild + Siegel Architecture already implemented any flood adaptation measures?

9. Will the design of the buildings in Frihamnen be similar to developments in higher located areas?

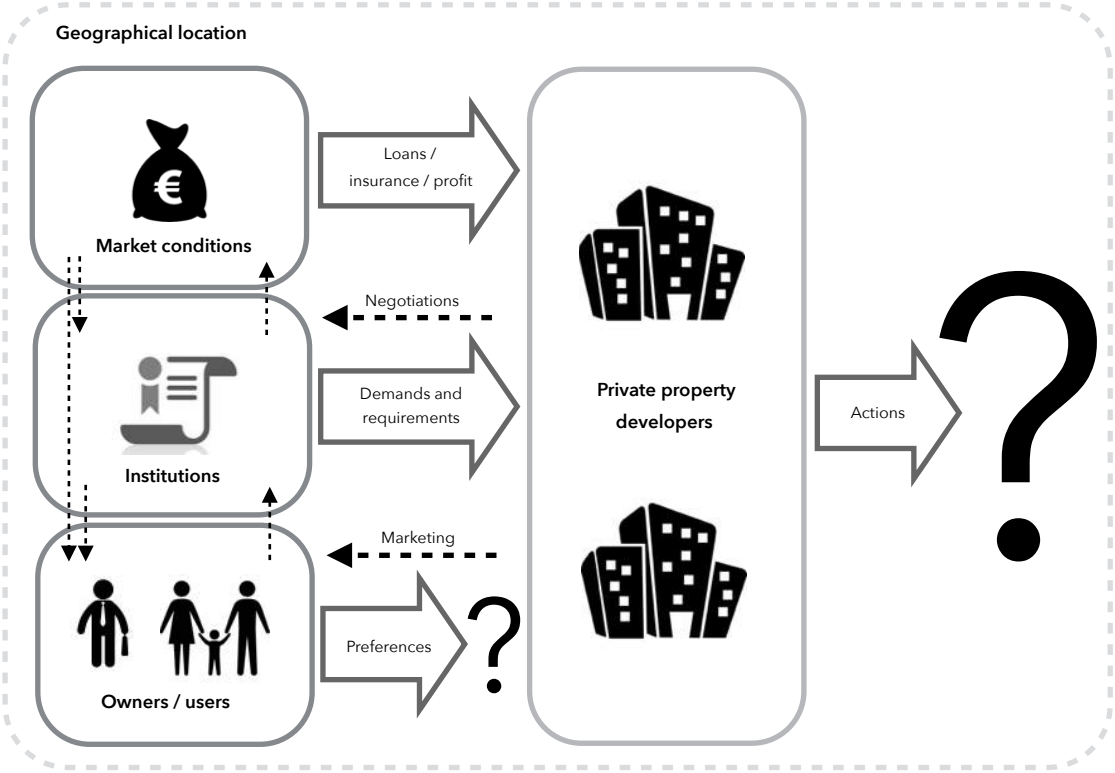
10. Do you believe that Hauschild + Siegel Architecture will develop buildings that are adapted to the changing climate? (In Frihamnen)

11. Developments in flood prone urban areas demand an adaptation of the area / buildings to make the development possible, who should be responsible for this?

12. What would be a reason for Hauschild + Siegel Architecture to adapt the buildings to the changing climate?

13. Have you experienced a changing price for adapted buildings?

Part 2: Influences



1. Why is Hauschild + Siegel Architecture developing in Frihamnen?
2. Is the location; close to the city center and near the water a reason for Hauschild + Siegel Architecture to develop there?
3. What influences does the location have on the design and construction of the buildings?

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4. What is Hauschild + Siegel Architecture going to develop in Frihamnen?
5. How will you finance the developments? (loan?)
6. Will you be able to get a loan for the developments in Frihamnen
7. Are the banks taking the risks of flooding into account when they give a loan?
8. Can the costs for adapted buildings be to expensive to realize (in Frihamnen)?

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9. What regulations are steering for your developments in Frihamnen?
10. Is Hauschild + Siegel Architecture insured against flooding during the development phase
11. Do you know if the Hauschild + Siegel Architecture is insured against flooding after the realization?
12. If you weren't insured would this change your development?

13. **Is the municipality influencing/ steering your developments?**

14. **Do you see any obstacles related to the municipalities / policy documents ?**

15. **Is the municipality influencing or stimulating the development of adaptive buildings in Frihamnen?**

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16. **What housing demand is there in Gothenburg?**

17. **Has the demand of buildings changed recently? (regarding the changing climate)**

18. **Are the owners / users of the building influencing your developments concerning the risks of flooding?**

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19. **Do you believe that adapted buildings are worth more?**

20. **Do you believe that an adapted area is worth more? (An area which will not get flooded.)**

21. **Would you use this for marketing?**

22. **What is the biggest challenge in Frihamnen?**

23. **How will you solve this challenge?**

Interview schedule: institutions

I. Introduction

The aim of my research is to understand the incentives for developers to adapt the built environment to the changing climate. Which in this case is the rising sea level and increased precipitation.

The study will compare two developments; Frihamnen in Gothenburg in Sweden and Stadswerven in Dordrecht in the Netherlands. Both developments are located close to the city center and along a river.

Much focus has been on climate adaptation strategies of public institutions; municipalities and in the Netherlands the waterboards and the Rijkswaterstaat; a national agency which is dealing with the water questions.

But I am very interested in the private actors and especially in private property developers. Because of the large impact they have and can have on the development and shaping of an area. I am having some interviews with public actors**, to find out to what extent institutions are influencing private property developers to adapt the built environment.**

The research is in co-operation with the city planning office in Gothenburg and a research group form Chalmers.

Through the interview, do not hesitate to interrupt me if you have any questions. And there are no right or wrong answers.

Your answers will only be used for my study in order to get an understanding of the behavior of and incentives for private property developers to adapt urban waterfronts to the increased risk of flooding.

I would like to record the interview, is this fine with you?

II. Before the interview

- Could you give a brief description of your role in [institutions]?
- What are the connections of [institutions] with Frihamnen / Stadswerven?
- How long have you been involved?
- How long will you be involved in the developments in Frihamnen / Stadswerven?

1. Climate adaptation in Frihamnen and Stadswerven

- **How are you dealing with the risk of flooding in Frihamnen / Stadswerven?**
- **How are flood adaptation strategies included in the masterplan / zoning plan?**
- **Are there other documents that are used for climate adaptation strategies?**
- **What is the most challenging part of the development of Frihamnen / Stadswerven?**
  - Why?
- **What kind of adaptation strategies are there?**
- **How will you financing the adaptation strategies? / How have you financed the adaptation strategies?** (Raising of ground level, älv protection and outer storm barriers)

2. Important actors in the process

- **With whom are you working on the flood risks and climate adaptation strategies?**
- **Who is the most important actor?**
- **How important are the private property developers?**
- **Are private property developers willing to adapt the built environment to the changing climate?**
- **How could this relationship be improved?**
- **What could you do to improve the involvement of private property developers in climate adaptation measures?**
- **Would you choose to improve it?**
  - Why?

3. Future ambitions and regulations

- **How are you planning to deal with the rising sea level and increased precipitation in the future?**
- **Which actors will become very important in this process?**
  - Why?
- **If you had unlimited resources what measures would you taken at this point to ensure that the areas are not flooded in the near future?**

APPENDIX D

Survey Swedish

Hej,

Klimatet håller på att förändras och det kommer att bli mer och mer synligt i städerna. I min forskning kommer jag att studera effekterna av det förändrade klimatet på utvecklingen av områden nära vattnet.

I samverkan med Göteborgs stadsbyggnadskontor, Chalmers och TU Delft i Holland studerar jag beteendet av byggherrar i relation till riskerna för eventuella översvämningar. För att få en komplett bild av situationen är jag intresserad i din upplevelse av översvämningsrisker.

Dina svar kan bidra i utvecklingen av ett hållbart samhälle och kommer endast att användas för den här forskningen.

Tack,
Caroline Nilsson

Allmän information

Kön:

Man	
Kvinna	

Ålder:

Område:

Hus:

Hyresrätt	
Bostadsrätt	
Villa	
Radhus	
Fritidshus	
Annat	

Ägare av boendet *(t.ex. Framtiden):*

Gata:

Våningsplan:

Email *(friviligt):*

Del 1 - Medvetenhet

1. Tror du att de pågående klimatförändringar i världen kommer att påverka lokalklimatet i Göteborg?

Ja	
Lite	
Nee	

2. Vad tror du kommer att hända med havsnivån?

Den går upp	
Den går ner	
Inget	

3. Är att leva nära vattnet ett mervärde för dig?

Ja	
Nej	
Annat	

---

4. Känner du dig någonsin hotad av vattnet?

Ja	
Lite	
Nej	

5. Tror du att ditt boende kan översvämmas om havet stiger och nederbörden ökar?

Ja	
Nej	
Jag vet inte	

6. Hur allvarligt skulle det vara för dig om ditt boende blev översvämmat?

Mycket allvarligt	
Allvarligt	
Neutral	
Inte allvarligt	
Irrelevant	

7. Vet du om din försäkring täcker skador som orsakats av översvämningar?

Ja	
Nej	
Jag vet inte	

8. Är ditt boende skyddat mot översvämningar på något sätt?

Ja	
Nej	
Jag vet inte	

9. *(Fråga 8 = ja) Hur är ditt boende **skyddat**?

---

10. Här ditt hus/område anpassat till det förändrade klimatet? (*exempel på anpassningar är: högre marknivåer, gröna tak, källare som klarar av översvämningar)*

Ja	
Nej	
Jag vet inte	

11. *(Fråga 10 = ja) Hur är ditt boende **anpassat?**

Del 2 - Åtgärder

12. Tänkte du på riskerna av översvämningar innan du köpte / hyrde ditt boende?

Ja	
Nej	
Annat	

---

13. Skulle information om risker för eventuella översvämningar vara värdefulla i samband med köp / hyra?

Ja	
Nej	
Annat	

---

14. Hur skulle du hantera eventuella risker av översvämning av ditt område?

Flytta	
Anpassa boendet	
Ha en försäkring	
Annat	

---

15. *Om du väljer att anpassa boendet:
    1. Hur skulle du göra?

---

    2. Hur mycket för det kosta? *(Ange gärna både i SEK och i procent av boendekostnad (räntor + avgift eller hyra)*

---

    3. Vem bör ta ansvaret ?

---

16. *Skulle du vara beredd att betala extra för en översvämningsförsäkring?
    1. Vad ska den extra försäkringen täcka?

---

    2. Hur mycket skulle du vara beredd att betala extra? *(Ange i SEK per månad)*

---

17. Vem **är** ansvarig för säkerheten när det gäller översvämningar i ditt närområde?

Staten	
Kommunen	
Byggherre	
Försäkringsbolagen	
Ägaren	
Jag	
Annan;	

---

18. Vem **är** ansvarig för säkerheten när det gäller översvämningar av ditt boende?

Staten	
Kommunen	
Byggherre	
Försäkringsbolagen	
Ägaren	
Jag	
Annan;	

---

19. Vem **bör ha** ansvaret för säkerheten när det gäller översvämningar i ditt närområde?

Staten	
Kommunen	
Byggherre	
Försäkringsbolagen	
Ägaren	
Jag	
Annan;	

---

20. Vem **bör ha** ansvaret för säkerheten när det gäller översvämning av ditt boende?

Staten	
Kommunen	
Byggherre	
Försäkringsbolagen	
Ägaren	
Jag	
Annan;	

---

21. Enligt din mening, vem eller vad behöver göras för att förhindra översvämningar inom en snar framtid?

Tack för din medverkan!
Caroline

Survey Dutch

Hoi,

Heeft u 5 minuten?

Het klimaat is aan het veranderen en dit wordt steeds zichtbaarder in steden. In mijn afstudeeronderzoek bestudeer ik de effecten van het veranderende klimaat op de ontwikkelingen van gebieden dicht bij het water.

In samenwerking met de gemeente Gothenburg, Chalmers University of Technology in Gothenburg en de TU Delft, bestudeer ik het gedrag van ontwikkelaars. Om een compleet beeld te krijgen, ben ik erg geïnteresseerd in uw beleving van overstromingsrisico's.

Uw antwoorden kunnen bijdragen aan de ontwikkeling van een duurzamere samenleving en zullen alleen gebruikt worden voor dit onderzoek.

Bedankt,
Caroline Nilsson

Algemene informatie:

Geslacht:

Man	
Vrouw	

Leeftijd:

Woonwijk:

Woning:

Huurwoning	
Koopwoning	
Anders	

Eigenaar van woning:

Straat:

Verdieping:

Email *(optioneel):*

Deel 1 - Bewustzijn

1. Heeft volgens u de wereldwijde klimaatveranderingen invloed op het lokale klimaat in Dordrecht?

Ja	
Een beetje	
Nee	

2. Wat denkt u dat er met de zeespiegel gaat gebeuren?

Die stijgt	
Die gaat naar beneden	
Niks	

3. Vindt u het een toegevoegde waarde om bij het water te wonen?

Ja	
Nee	
Anders	

4. Heeft u zich ooit bedreigd gevoeld voor het water?

Ja	
Een beetje	
Nee	

5. Denkt u dat uw woning zou kunnen overstromen als de zeespiegel stijgt en het neerslag toeneemt?

Ja	
Nee	
Ik weet het niet	

6. Hoe ernstig zou het voor u zijn als uw woning overstroomt?

W

Heel ernstig	
Ernstig	
Neutral	
Niet ernstig	
Irrelevant	

7. Heeft u een verzekering die overstromingsschade verzekerd?

Ja	
Nee	
Ik weet het niet	

8. Is uw woning tegen een overstroming beschermd?

Ja	
Nee	
Ik weet het niet	

9. *(Antwoord 8 = ja) Hoe wordt uw woning beschermd?

---

10. Is uw woning/woongebied aangepast op het veranderende klimaat? *(Voorbeelden van aanpassingen zijn: wonen op een hoger gelegen grondniveau, groene daken, een kelder die een overstroming kan weerstaan)*

Ja	
Nee	
Ik weet het niet	

11. *(Antwoord 10 = ja) Hoe is uw woning/woongebied aangepast?

Deel 2 - Maatregelen

12. Nam u de mogelijke risico's van een overstromingen mee in uw afwegingen bij het kopen/huren van uw woning?

Ja	
Nee	
Anders	

13. Zou (meer) informatie over mogelijke overstromingen in uw woonwijk waardevol zijn voor uw aankoop/huurcontract?

Ja	
Nee	
Anders	

14. Hoe zou u omgaan met eventuele risico's van overstromingen in uw omgeving?

Verhuizen	
Woning aanpassen	
Een verzekering afsluiten	
Anders	

15. *Als u uw woning zou aanpassen:
    1. Hoe zou u uw woning aanpassen?

---

    2. Hoeveel mag dit kosten? *(Vermeld zowel in euro's als in de percentage van uw maandelijkse woonlasten.)*

---

    3. Wie is volgens u hier verantwoordelijk voor?

---

16. *Als u kiest voor een verzekering?
    1. Wat moet de verzekering dekken?

---

    2. Hoeveel zou u bereid zijn te betalen voor een verzekering? *(Euro's per maand)*

---

17. Wie is er verantwoordelijk voor uw veiligheid bij een overstroming in uw woonwijk?

De Rijkswaterstaat	
De Overheid	
De Waterschappen	
De gemeente	
De ontwikkelaar	
Een verzekerings-maatschappij	
De eigenaar	
Ik	
Anders	

18. Wie is er verantwoordelijk voor uw veiligheid bij een overstroming van uw woning?

De Rijkswaterstaat	
De Overheid	
De Waterschappen	
De gemeente	
De ontwikkelaar	
Een verzekerings-maatschappij	
De eigenaar	
Ik	
Anders	

19. Wie zou verantwoordelijk moeten zijn voor uw veiligheid bij van een overstroming in uw woonwijk?

De Rijkswaterstaat	
De Overheid	
De Waterschappen	
De gemeente	
De ontwikkelaar	
Een verzekerings-maatschappij	
De eigenaar	
Ik	
Anders	

20. Wie zou verantwoordelijk moeten zijn voor uw veiligheid bij een overstroming van uw woning?

De Rijkswaterstaat	
De Overheid	
De Waterschappen	
De gemeente	
De ontwikkelaar	
Een verzekerings-maatschappij	
De eigenaar	
Ik	
Anders	

21. Volgens u, wat moet er gedaan worden om overstromingen in de toekomst te voorkomen en wie moet hier verantwoordelijk voor zijn?

Bedankt voor uw antwoorden!
Caroline

APPENDIX E

Summary interviews Sweden

Category	Engagement:			
Sub-category	Awarness	Association	Acquistition	Application
Property developers:				
1	Through the consultants company 1 is aware of this, and they are specifically aware of this in Gothenburg	There has been a study: we went to Hamburg and looked at the property developments in the harbor. And they had tackeld the same problems: rising river levels.	Long term property owner,	It will be integrated in the price of the plot. So if you buy a plot which is very low and you have to fill it up to get the 2,8 meter, you will have a lower price, because you have to make the investment.
	Together with älvstranden we have contacted more consultants groups, who have been working on the Hydro aspects. Both for the heavy rain fall and for the rising sea level	We have looked at the street structure, and been working with different levels: lower areas to lead away the rain and higher areas.	First phase is 2021 and after that company 1 will maintain and manage the properties further on.	Many of the solutions are on the scale of Gothenburg, so there has to be an contribution from the city in order to secure the city from the water (for example the big barriers). If every part of the city would do this, it would be fragmentized.
	First thing is to work with the different street levels and we have a protected height of the lowest ground floor, which is 2,8 meter above sea level.	On a building level the adaptation strategies / measures have not yet been discussed		
	Most solutions will be in the streets, so we have discussed rainwater in gathers, which is visible for instants with plants and things. Instead of having it in drainpipe and this has to be done with the commercial interest	It will be unique, both in the three dimensional property development: you can own just one level and you can have another property owner above. You can buy the building in the air (not so common in this scale and in Gothenburg, is usually in smaller scale developments.)		
	We have discussed how to put electrical and technical installations, if there is a rising sea level. Because we are on the ground floor, and cannot put the installations one floor above.	The collaboration within the consortium is a really good way. Because there we have a platform, where we can discuss and bring forth our view of the commercial perspective and then we can say what works for us		

Category	Influences:				
Sub-category	**Planning institutions**	**Institutional conditions**	**Economic conditions**	**Social conditions**	**Physical conditions**
Property developers:					
1	Contracts within the consortiums: between the different parties in the consortium: collaboration contract. With älvstranden utveckling, who owns the land; contract for purchasing the land. Detail plan: you can't develop the properties before the detail plan.	Many different units within the municipality: park and landscape, trafikkontoret, SBK. Not clear who is responsible. Disagreements within the municipalities takes time and that can affect the consortium.	An insurance is critical. If you don't have the ability to insure the project, you need a much stronger economy. Because you need to earn the money. Or choose another area to develop.	The plan is to have 18.000 residents in Frihamnen when the developments are completed. And that gives the commercial functions a ground. (food stores etc.) But the other part, you also need to have visitors, who come to Frihamnen in order to be there.	Yes, we have. The free areas in Gothenburg are quite close to the water and low. So there will be quite a lot of investments to handle this.
	I don't think any one within the city has taken the issue fully. So they point at each other. The SBK could be a key factor, because they have a great chance to achieve a change in perspective within the detail plan. Because in the existing structure it is much harder.	The politicians have been very directing in telling the municipality not to steer to much and to listen more. They are open minded. This is good.	The premiums will go up if you do not adapt the buildings. So adaptation is needed to get an insurance.	JR Kvartersfastigheter are doing this for a living, they have a good connection with the tenants and can bring in the money.	The higher levels have already been exploited. The lower areas, haven't been build for a reason.
	In Frihamnen the SBK have a lot of opportunities.	Often solutions are discussed after an event has occurred: we will have to wait until we have a great flood and then we will take actions. The city doesn't have the strength to act before a catastrophe.	The insurers can change the requirements and then you are without an insurance if you don't follow their requirements.	By the dialogue, by opening up to an active dialogue with for example with the Gothenburg citizens and with the consortium parties.	
	Many of the solutions will be on a big scale. And I think they are more effected this way. If they fail, if the city fails, then we have to protect the buildings it self. But it can never be a good solution. Because if there would be a heavy flooding, there will not be any access to the property.	The city doesn't have the strength to act before a catastrophe. Like in Copenhagen: they are doing a lot, but we, who are quite close, are doing nothing. We are just planning.	There are quite heavy investments: the polluted ground and the rising sea level. And these are quite large expensive and Frihamnen has to be developed into an attractive part of the town in order to get the finance.	The tenatnts come later on in the process. I haven't met a tenant yet, who has been interested in the flooding risk. They are not long term oriented: the tenants seems short term oriented.	
			It is a great spot for commercials, it is close to the city center and the central station and it is a new area. It can be an attractive new area in the town. It could be very good to do business there.		
			The free areas in Gothenburg are quite close to the water and low. So there will be quite a lot of investments to handle this. The higher levels have already been exploited. The lower areas, haven't been build for a reason.		
			Because the insurance companies will be more detail in their demand and questions in how properties are developed.		
			It can be very bad if a whole area is affected by a flooding. Then this would affected the property values.		

Category	Engagement:			
Sub-category	Awarness	Assocciation	Acquistition	Application
Property developers:				
2	Yes, in the sense that this are issues that the City of Gothenburg are working with.	No, we take no actions. But we ensure that the things we do are compliant to the standards and rules of Gothenburg city.	The implementation of this project will only work with the municipality and if the municipality does not believe that we have to raise the ground for the coming changes then you don't do that.	Nothing. It will not be with a waterproof cellar. The design of the buildings in the free port could also be elsewhere.
	So far nothing is high throughout the river bank. So if we were to increase the height in Frihamnen, I would be very surprised.		We develop properties and then we sell them. We believe in the idea that someone are good in building, and others are good in owning.	It must be the public authorities who set the rules.
	No, because we do not believe there is any risk. It is the assessment which has been made.		Here we do not experience any risk that it overflows, and the municipality has not set out any special rules. And that means that banks and insurances agree on the loans and insurances.	We will never ever build homes in places that will expose their accommodation for any sort of risk. Because this, would only increase the costs of buildings, and it would mean that rents go up.
	No, we would not build in a place where there is a risk of flooding. Then we would build in another place.			When a project like this is implemented, it will only work if we collaborate with the municipality and if the municipality does not believe that we have to raise the ground for the coming changes then we don't do that. Because it is the municipality that is responsible under the law for this. If the municipality does not say anything, then we don't do it.
				We sell it; we are no longer the owner. The owner takes over the responsibility and must be insured.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Property developers:					
2	The regulations say you must not build less than 5 meters above sea level, or something like that.		Here we do not experience any risk that it overflows, and the municipality has not set out any special rules. And that means that banks and insurances agree on the loans and insurances.	High demand for housing.	We have so much area to build on in the country, and if there would be a slightest risk, we would do the utmost to defend our shores, but we could just move up and build somewhere else.
				People feel that they have to pay a large part of their income to housing.	
					Frihamnen is already 4 meters above sea level

Category	Engagement:			
Sub-category	Awarness	Assocciation	Acquistition	Application
Property developers:				
3	Yes	And the construction of the buildings will be waterproof	We will own the buildings for a long time and we want to avoid problems. We are a developer and investor.	The buildings are waterproof and no wells in the basement.
	We participates in Frihamnens general works to raise the ground level. The city is also planning further actions (the outer barriers		Botrygg will start it's developments in 2017-2018 and we will be finished in 2021, then Botrygg will sell 100 apartments: condominiums and manage 200 rental apartments.	Normal financing, with 1 to 2% higher costs. The sales prices justify the costs
				The municipality needs to take the responsibility, because these areas are extensive and involves several developers.

Category	Influences:			
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions
Property developers:				
3			We look at a waterproof construction and together with the municipalities actions we believe it will be enough.	There is a housing shortage of around 11.000 - 14.000 homes.
			We are not insured, we have to build sustainable.	

Category	Engagement:			
Sub-category	Awarness	Assocciation	Acquistition	Application
Property developers:				
4	Yes, in general we are. I have been involved in developing climate adaptation strategies in Helsingborg.	It is the area that has to be adapted not profitable to do this per building	We are long term. Owned by pension funds. We shall manage and develop.	The city sells the land: yet not clear how it will be sold. The land can become cheaper if you need to make action to raise the ground.
	We have watched it together, it's all about how high you can put the houses. And this discussion we have had with the municipality. We have discussed putting it at 3.5 meters.	The technology exists, if we would build on a waterfront which can be flooded. Installations could be higher, etc. But that is not the intention in this project.	It is the area that are adapted not profitable to do so per building (only if it absolutely must's).	As planning is right now, it will be the same buildings as if we were to build elsewhere. It is about how to founds and coordinates the body once you have added levels.
	We have been involved in workshops, where the city's thoughts about walls and future dams are presented.	It is not we who do it, but the city. It is much easier to raise the soil in general than to build houses to low down and adapt them. It's nothing you do, unless you absolutely have to. Then it is about the choice of material in those areas that could be flooded.		But it is clear that it will be more expensive if we have to adapt the building and add a higher floor, then it will be more expensive.
		It is the fact that the buildings are at the right level.		They will have a greater value than those that are not. So it will be on the long term.
				Municipality: they make the zoning plan, and that is where you set the conditions.
				It is important to bring order of the whole and it is Gothenburg city that does the work and we are of course part of a good plan.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Property developers:					
4	It lies with the municipality to develop a detailed plan to manage risks.		I do not think that banks are looking at the risks. We exploits, the risk must be eliminated in the plan. It lies with the municipality to develop a zoning plan which manages the risks.	We look at the residential function and the market price.	
			Insurances goes after the zoning plan, and would there be flaws in the zoning plan, the municipality is responsible for those shortcomings. And then, the insurance can take up compensation of the municipality. Because the municipality is responsible for the detailed development plan / solution works.	Shortage of apartments.	
			If there isn't a general solution for flooding, then the buildings will be worth more. But if there is a general solution, then the buildings will not be worth more.		
			I do not think that banks are looking at the risks. We exploits, the risk must be eliminated in the plan. It lies with the municipality to develop a detailed plan to manage risks.		
			Insurance goes after the zoning plan, and if there would be flaws in the zoning plan, the municipality is responsible for those shortcomings. And then, the insurance can take up indemnification of the municipality. Because the municipality is responsible for the detailed development plan / solution works.		

Category	Engagement:			
Sub-category	Awarness	Assocciation	Acquistition	Application
Property developers:				
5	Yes absolutely. Two strategies: - To fix them rising water levels: there is a specified lowest building level. Each building will be on, and it means that it may raise the ground in the Frihamnen. - If you look at a little more frequent heavy rains we have had at the last. To manage it, then it is clear you look more at the local disposal of surface water. And digging into one or two channels well into the area, which can collect water there. And lead it out into the river, so there is a very comprehensive plan like this, we can solve it.	We are on a general level in the consortium to find a model for the rising sea level and increased precipitation.	Long-term owner.	When you look at the stormwater collection in canals it doesn't have to be much more expensive than the traditional way: digging pipelines in the ground for the stormwater collection. So a more local water collection, can make it less expensive. And the water can have an added value for the city image.
	The risk of flooding in Frihamnen I think is pretty small right now, due to the land that will be raised.	We check the heights. We deal with sea level rise by increasing the ground.	We are owned by the City of Göteborg and has currently no mandate to sell of any thing. We will own and manage and deliver quality housing to people in Gothenburg. And good surrounding environment not only housing.	When looking at the actions for the rain which are connected to the house, it is not really any more cost. Quite the contrary, to build a house of bricks which becomes heavier and requires a bigger foundation reinforcement, is a more expensive way to build. So, the easier the design you have, the cheaper it tends to be, even if the facade itself is quite expensive. But the construction will be much cheaper.
	We will build on what is today considered a safe level in Frihamnen, what the future will bring in about 50 or 100 years, we don't know. But what you can see for now and in 20 to 30 years ahead, it will be a safe level.	For rain, the buildings will be similar to other developments (Guldheden).		The municipality needs to take the responsibility that the conditions are correct, and they may say you are allowed to build on that level, but every 5 years this will flood and then it is the responsibility of me the developer to handle it in any way.
				If each developer should do an inspection of the sea level in 30 years, this seems like a big waste, it should be coordinated elsewhere, whether it is the city, state, or whoever it is. But I do not think you can put on each developer to develop that kind of forecast.

Category	Influences:			
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions
Property developers:				
5	The municipality has the responsibility to provide housing in Gothenburg, and it can be reached in different ways, to attract private property developers and investors. We're owned by the city and in this way the municipality can point at us if there aren't any private interests.	Framtiden will own and manage housing as the aim and objective is to provide really great homes for those who live here, and be part of the developments of Gothenburg as a city, and it can be done in different ways: build new homes.	I think the risks for Frihamnen has been taken care of as far as we can see. So the risks are more regarding the value of the neighborhood. It is the same when you would buy a house for 5 million and the banks think you may pay to much, they will make their own valuation.	And motives when you look at the people who will live there, is that it has to work. They are not supposed to be afraid that their apartment is flooded every 5 years.
	The municipality has a very large impact on it. In the zoning plan the most important issues are adressed: how big is a block away, how many buildings, how high, and so on.		If you can't get an insurance, you wouldn't build. You would rethink: change the technology, build different or build some where else.	The zoning plan is a democratic process. As a citizens you have the opportunity to appeal a plan.
	There are four different rent levels: - A level is 1000 SEK / m2 year:is really cheap for new construction. - A level is 1400 SEK / m2 year. - A level is 1850 SEK / m2 year that is perhaps the normal rent in new construction. - And a fourth level that is not defined.		You can insure anything but the premium will differ.	The new developer company will supply 1400 homes every year. From 2018. And a part of this will be in Frihamnen.
	We focus on all four, it was like package. We will deliver all. To solve all production with only 1,000 / m2, it is not economical. So one must find other business modeler to get it together. One must challenge the way they do their calculations: what is it that is profitable or not. We are looking at a very long perspective when we look at economics. Perhaps not only on this project.			Areas close to water is interesting for everybody. Somehow it is more exclusive to have a view over water than a field.
	The housing shortage in Göteborg, Sweden, Europe, now we will increase the pace of housing construction.			It is an economical incitament to build something that is maintained over time.
	The municipality has a plan monopoly.			We want costumers who are satisfied.
				This makes the process very long. 5 to 7 years before a zoning pla becomes legal. During this time a lot can happen, the market changes, developers loses interest or you build somewhere else.
				Huge demand of housing. Around 150 000 queuing people on Boplats (rental housing que)

Category	Engagement:				
Sub-category	Awarness	Assocciation	Acquistition	Application	Planned adaptation strategy
Planning institution					
A	They rely very much on that it will be solved. I don't think they see the same risks.	I think we are working in a good model. They become aware of the issue early, and they are involved in the planning process. And we have been very clear with the issue.	We sell the land to them and then we can fund the expansion and climate protection. We (älvstranden) build nothing, everything is built by external developers.	From älsvstranden and the consortium we can finance the short and medium term strategies of what we do. it's the long view that becomes the next point with financing and so. That needs to be sorted out.	Working with two strategies: - A short and medium term; local protection in Frihamnen modeling the soil; creating high points for buildings and low points, to take care of heavy rain. (torrential rain problem) Ability to develop solution with city planning; high points and low points, with - A long term; Strategies based on, and working alternatively with an outer barrier. Depends on how they other areas choose to do (and what the city chooses for strategie). Find a solution that works for both; local can build on, if necessary, otherwise the problem is solved with an outer barrier.
				it are not the developers who push the issue, but the City Planning office, sanitation and water office and älvstranden developments.	The strategy is based on being able to build out area by area. Each area protects itself. Is not based on the construction of a huge barrier, and then builds on the inside. The choice for this; the area is very large and very costly and internal flexibility to build a big barrier. Is about the combination of heavy rainfall and rising sea levels. If you build a wall around the area; when the water is collected on the inside and then flooded it over from within.
					Based on higher streets and lower at the waterfronts. The buildings are higher at the street and can be wet on the waterfront side. There will be a need to put temporally protection between the buildings, someone has to be responsible for this. Not clear yet who this should be.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
A	The buildings will be climate-proof in itself that they are part of the climate protection. Hospital; 3.8 meters Local streets; 2.6 meters Finished floor; 2.8 meters (residential)	Rents are high; so we have put demands on the rents. So the developers will certainly respond that this is the biggest challenge; Social mixed accommodation	For the short and medium-term prospect; elevation of local roads lies in the calculation. It is funded though the land sales. The land is sold for the market price and the price will cover the costs of the local road network. Theoretically, some of the money that is received from the developers for the sale of land to the City Planning Office, will be distributed to traffic office who builds the higher roads.		Very tough geotechnical conditions in Frihamnen: 100 meters of clay in the soil. If you want to build up more than 0.5 to 1 meter you need to piling all the land, and it will be very costly. Trying to work in a nuanced way with heights.
	- We own the land and sell the land; can make an agreement with the developers; contracts when selling the land: legal agreement - Building permits - Detailplan - Property builders.	So the roads and climate protection is build by the traffic office, who receives the money from älvstranden, who receives from selling the ground.	The financing of Frihamnen is a bit easier because a lot will be developed and the adaptations can be included herein. And those who are involved are pretty aware of the issues.		Climate adaptation is difficult, although we have found a good solution. But climate change adaptation in combination with bad GEO technical conditions is a financial challenge.
	The development model in älvstranden invites the developers early on in the process. Together we have created a manifest: a sort of treaty which is related to the zoning plan and where the joined ambitions are included.	In the masterplan the governments inters are discussed which include the countries security. Is it only the municipalities how should have the responsibility for this, where is the national government and regional government.			
	In the long term Frihamnen requires extra measure, which requires a collaboration between the developers.				
	Through including the developers early on in the process, the incentives for the developers to leave the developments is decreased and they have a better understanding of the content of the manifest.				

Category	Engagement:				
Sub-category	Awarness	Assocciation	Acquistition	Application	Planned adaptation strategy
Planning institutions:					
B		They are involved during the workshops and it seems like they understand the situation in Frihamnen. But they are also waiting for the city to take actions / the leadership.	The developers have an understanding how to design and develop and they are calculating the costs of these measures to ensure it is feasible. Therefore it is important to include them in the process.		It is on an overall level that we have identified areas of low-lying areas and ridges (higher parts) and the higher parts are connected with a network of paths to ensure that you can leave your apartment or working place in a safe way. The low-lying areas are for collecting water during a normal rain but also in extreme events to ensure that the buildings and streets will not be flooded.
					Before 2070 Frihamnen can cope with the climate change, with it's integrated strategy of high and low areas in the plan. There are no hard barriers in the short / mid long perspective, but after 2070 there will be a break and after this all the areas in älvstaden will be dependent on the city making a bigger strategy. Which can be a huge barrier out side the city or it can be along the river banks, that is not yet decided.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
B	- Delområden stratgie för Frihamnen: Where the climate risks for Frihamnen are described. - The overall climate strategy plan for Gothenburg: dagvattenutredning: zooms in om Frihamnen and looks on how the water systems can be structured. - Tematiska tilläget till översiktsplan - Kvaliteitsprogram	In the consortium: älvstranden is selling the land and Stadsbyggnadskontoret is mainly focusing on the bigger task: to make Gothenburg sustainable and an attractive city. These to prespectives can be conflicting.			After 2070 the city as a whole will have a problem with the rising sea level and an solution for the whole city is needed. This can be the outer barriers or a barrier along the river banks. A problem / challenge with the barrier along the river banks is to connect the barrier of all the neighborhoods with each other. If one barrier is delayed or damaged the water can access an whole area. A barrier along the river banks can also disturb the connection and relation with the water. Therefore the outer barrier may be a better solution for Gothenburg: a more cohesive solution.
	Space: it will be a very high dense area. There is a competition for space.	Länstyrelsen: They approve the detail plan. Therefore they are also very important in the process in Frihamnen. If they agree on the detail plan for the first phase, the developments in Frihamnen can start.			
	The developers: they have to follow the zoning plan, where the requirements for a plot / their plot is described.				
	älvstranden will create the higher and lower areas through: - Traffic office who is responsible for the canals and the streets: and the creation of the canals will be challenging. - Park and nature office who is responsible for the parks.				
	Stadsbyggnadskontoret and älvstranden are the projekt leaders of the developments in Frihamnen, under the umbrella are the 9 developers. And together this is a consortium for the first detail plan. There will be more detail plans and other developers or the same developers can be involved in the consortiums for these detail plans.				
	Stadsbyggnadskontore: City planning office Kretslopp och vatten				
	And in the zoning plan, it can be described that the buildings have to be able to cope with water, it will not be described how; so developers can be innovative.				
	They are responsible for making the strategy. Then älvstranden and the developers in the consortium are responsible for executing / implementing the strategies.				

Category	Engagement:				
Sub-category	Awarness	Assocciation	Acquistition	Application	Planned adaptation strategy
Planning institutions:					
C		Unique in älvstaden development is that the developers don't know which area in Frihamnen first phase they will develop. So everybody wants to make the best out of the whole area.	Because of the situation in Sweden, where the municipality has the monopoly of building permissions and detail development plans, they have to full fill our recommendations otherwise they can't develop.		In Frihamnen, where there is nothing we will raise the ground level. But in Lindholm, a neighborhood area, we have to build some kind of river shelter. And we will start with this rather soon.
					For the river shelter we don't know how this will be financed, but it should be possible to raise the shelter with 1 meter extra if needed. And we have to start building river shelter today, even if there will be an outer storm surge barrier, because you don't want to close them to often. So you have to raise the banks on both river sides.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
C	Report on vulnerability of Gothenburg for extreme weather events. Put the responsibility back to each company and administration with in the city. For example: Kretslopp och Vatten, trafikkontoret. And when it is everybody's responsibility without coordination it doesn't work very well.	Our county administrative board (länstyrelsen) took in into two detail plans in the end of 2013 / beginning 2014 to look at them a bit extra, about how we deal with climate adaptation.	The finance will depend on how much the exploitation can take and the rest will be through tax payers.		I think to adapt to the rising sea levels in combination with the really bad GEO technical conditions. Because it is over 100 meter of clay, before you reach firm rock.
	Then we started with heavy rainfall, because we have an environmental program in the city, and we searched money for this in the frame of environmental program and we got money for making a more depend comprehensive plan on the theme water.	It is an interesting time: because the cities organizations are not organized for this, at this moment. But as we have pointed out: the traffic office should be responsible for doing things, but they have to organize themselves. And I think that will take a year, before they can start building, but during this year we can clarify the finance part as well.	But in the future I would like to see a tax system like in Copenhagen. (VA-taxan)		how much will the sea level rise in the future, no one knows.
	City planning authority:We do the planing: the detail plan, the comprehensive plan, building permissions. In Sweden, the city has the monopoly on planning.	If you should build storm surge barriers, that is a lot of money which you have to put down at one time, and that will costs about 10 billion Swedish crowns. You need a staff, the whole year. You need about 40 people who can run these barriers. And you need 150 million Swedish crowns a year for the maintenance and management of the barriers. It is a heavy piece to deal with and from my perspective this would be an affair for the state, well the municipality could offer some money, but not al. And this storm surge barrier will also protect the national road to Karlstad and Oslo, it will protect the rail road as well and other surrounding municipalities.	I think that money must be marked for the purpose, because the general taxes can go to everything if the politicians say that. To be able to mark the money for one purpose or change the VA-taxan, the laws have to be changed.		
	During a flooding we accept 0.2 meter of water in the streets or pedestrian lans.	County administration board : is more involved as a control station.			
	We have at our comprehensive plan in map 2, pointed out risk levels or risk area: Here you have to take care of rising sea levels or that are risk areas which you have to observe. This is also in the detail development plan.	But right now we are the most important, because we have the mission from our politicians to coordinate the climate adaptation in the city.			
	we have now for normal buildings 1 meter higher than extreme high water levels, and for functors important for the society we have 2 meters as secure level.	And it took a year before we got them loose and we had a lot of discussions with our county about our strategy, the mid and long term strategy and how to be flexible, because the climate changes are build on scenarios and it is not economical reasonable to secure on a very high level today but it will perhaps be in the future. So we had to watch IPPC reports and adapt when we need it. And finally they accepted that. This delay costs more than 70 million Swedish crowns. This money could have been used to invest.			
	How to adapt flexible in this area and when can we not rely on the building heights, from our recommendation. And we must build some kind of river shelter and how should we deal with this in the future.				
	But right now we are the most important, because we have the mission from our politicians to coordinate the climate adaptation in the city.				

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
D	The city Planning office is responsible for planning the new building, so that it can withstand the heavy rain, but that there is no clear responsibility who should build / finance those measures, and especially if you're talking about existing environments.	VA-taxation: Consists of two parts: - Construction charges: pay 1 time when connecting property: property owner pays; may be the developer. - Operating Fee: You pay for the water they consume; Today I pay for water and for drain. Will now split this, that you pay for; water (drinking water), waste water (douche, toilet and laundry) and surface water (rain). Because not everyone has a surface water connection to municipal water. Today, they pay the same sewage charges. Drain sewage; collection name for wastewater and storm water, even if they do not have a connection point for stormwater, is not available in all areas.			
		It is not in the law, but has become an standard (used by the Court when it has ended up in the twist) that you should not have a flooding in your house more than 1 time every 10 years. This should be changed. There is a European standard that says every 30th year. So now we work on new guidelines, so that it will be every 30 years. It places new demands on dimensioning the pipeline. Many pipelines have to be changed.			
		There are limits to what we will fund with the VA subscriber's money. And that means that when we talk heavy rain, then 100 years of rain or more, it is not a VA issue. Who should pay; it's not a VA issue, the legislation is not such in Sweden. But who should pay, there is no good answer. is not regulated in Sweden.			
		From Water and sanitation, who got the assignment from the municipal council. It is required to have a VA-tariff complying with the law.			
		VA-taxation can not be used for heavy rain. Is not regulated in the law in that way.			
		VA- taxation can be a tool to guide developers. a proposal is that the water fee depends on the pipeline connection that you order from us which design it has. And it is clear if there is a very large plot and only hard surfaces then you need a giant pipeline. But if you have a delay then one can manage with a smaller, and it will be the cheaper.			
		it is the Urban planning office responsibility; Planning rain management. When it rains so much, the pipes are already full, so it has to be dealt with through elevation and green areas			
		You may need to have rules for the developers who build and sell; We are always thinking one hundred years perspective when we are working with the VA and you do that in the urban development of the law as well. But it is in the developer's behalf just building their house and then sell and on to the next.			
		We want a VA-taxation that pursue claims, either the developers of a new area have to pay or that they must slow down the rain, but it's very difficult to ask them to do this, because the requirements in a zoning plan, the plan and building permit does not allow it. And then you have an unclear legislation.			
		In 10 years we have made demands on rain water delay, in connection with a building permit for real estate. A simple requirement which we haven't followed so much.			
		Perhaps we should determine that there must be a delay of rainwater and lead it out on the lawn or have its own magazine (as in Germany).			

APPENDIX F

Summary interviews The Netherlands

Category	Engagement:			
Sub-category	**Awarness**	**Assocciation**	**Acquistition**	**Application**
Property developers:				
1	Certainly. Tides in Dordrecht 85 cm. The risks of flooding of the hinterland is bigger than the sea.	The current ground level of the site is 2,2 -2.3 meters, we want to make a square which can overflow and we worked with the town, all kinds of scale models and studies made of, what is the effect of rising sea level. And there also came to the conclusion that the threat is not so much of the sea, so from the tidal effect but from the hinterland.	We are developers. If we work from area development we always do it for the long term.	Water can come to the public road. Rules stated that the entrance should be on + 2.8m.
	What we seek here, and we have appointed with each other, is that the water is designed to physically come in some places. It is in our opinion not a battle against the water but in fact living with water.	We will not experiment with glass facades under water come to be, as in Hamburg. Too much risk and people can find it scary.	We find it very important to create residential areas that are future-proof. Ideally you want it to be over 100 years still stands.	What can happen is that the car park might come under. And we take that into account too.
	Maasstraat, the central street in Stadswerven is elevated and deliberately placed at 5 meters. So that the area slopes downwards. At the first houses that is located on the quay runs down, toward the water. This is done deliberately, so you come to the water and experience.	According to studies by the flood showed that if you consciously try to give the water somewhere, as we now do, the risk of damage is considerably smaller.		Raising of the ground financed: The municipality, which have the entire land exploitation.
		The buildings that are high enough will not be adjusted. Is is purely the buildings on the left side where you get measuers.		We (OCW) negotiate each sub-plan which we will develop with the municipality on the land value. In fact, based on the residual value: revenue - expenses. That is the starting point. And then we need to find somewhere to meet.
		I notice that in our country, but also in the entire field in the Netherlands remain underexposed climate change.		The costs are passed on in the price. Ultimately, that measures that will uitvoren architectural in this case.
				The agreement that we make is that the design risk and in this case the risk of flooding, is not with the builders but at the municipality and OCW.
				I think we as a developer (responsible but I think a big word. Because then you're really talking about injury claims) but we have the responsibility to have to consider in a professional manner with it. I could not say later that I did not know. We are professionals, we have the knowledge and skills, so it's also our responsibility to achieve a balanced and good urban plan there. Which you then on a given way, shape is going to give.

Category	Influences:	
Sub-category	Planning institutions	Institutional conditions
Property developers:		
1	The master plan was made together with the municipality.	This project is the municipality's main product in the city. If this plan with all investments would fail has already done the church, then that is a big problem.
	The municipality has the land exploitation which of course is a very difficult, the municipality is responsible for the cleanup, it's an old shipyard site	By times and under political pressure to implement the first stage of city sites, we did together with the municipality made choices. Now the market has attracted we OCW and municipality to send more quality. So that we can make the ambition.
	When I joined there was already an urban plan, by all sorts of financial problems the plan of only apartments is the wrong schal, you could imagine it before in Amsterdam. We said the plan does not fit in Dordrecht, this should really come to the small scale.	
	First 1000 homes now 750 homes. Fewer apartments and more dwellings. Less is more, we want quality and ambition. And the amount of housing may be overridden. If we make a good quality plan, rather recording prices may even rise.	
	We are forming a joint plan: The OCW and the municipality. The role distribution is that the municipality thinks along with us with the details of the location, further they have their public law role, they are conducting reviews in permits and comparative.	

Category			
Sub-category	**Economic conditions**	**Social conditions**	**Physical conditions**
Property developers:			
1	Now there is a high demand for investments in rental property: the free rental sector. And here are perhaps opportunities in. But even if everything is just in the owner-occupied sector.	Very soon, we look at the government in the Netherlands. The government should protect me, the government should regulate this and that for me.	So that it becomes a whole. Connected to center, by means of a bridge.
	It is an area outside the dikes. In principle you are not insured against flooding there.	The market determines the value of the home, measures cost money and the market determines the maximum. If a house can cost up to 390 000 euro and I would have to create 430 000 of the measures that I do not get sold.	De kwaliteit van het water willen we gebruiken om op die plek de lading te geven en een uniek woon milieu creëren wat ook binnen de regio zijn weergave ken
	From the social principle the intention was to get around such insurance in the Netherlands. There's been a lot of sense, because by then people say in the East, no, they will not pay it. So that did not happen.	consumers also want to be independent. We can realize dwellings themselves with energy	
	We come from an economic crisis, home prices have fallen by 25% over the average.		
	all risk insurance. That means that the contractor, which must also close and there we get to see the policy of. Which is insured against all kinds of damage and water could also be related.		
	But strictly speaking, it is so, people do have a building and contents insurance, but they are in an area outside and, strictly speaking, you are not insured because of flooding risks. The paragraph flood risks is explicitly excluded.		
	What you are going to get and we have asked for quotations, we have a policy on an individual basis: so a residential building and a consumer, but it is terribly expensive and it will cost you 400 euros per year.		
	Tell the inhabitants about the insurances. my problem is, if I do this, I'm increasing a potential risk		

Category	Engagement:			
Sub-category	Awarness	Assocciation	Acquistition	Application
Property developers:				
2	Very aware of the changing climate, because you can not avoid it.	The intention was to develop buildings along the quay and also won to move into the first layer and is parking on the ground floor or workshops. Because if you know what's more you have more views and suggest that there is a flood, and you have the dock, had the street and the sidewalk then the water flows into the house. Ideas to increase the ground floor with a 30 cm, or even with 3 steps. But ultimately we are going to develop this no more, we gave them back to the church. And the church has sold them to private individuals, self-build homes.	Core business is to built. Everything will be sold.	We do not require an additional investment in order to make it possible. Because the congregation makes it ready for building.
	Here we have deliberately not built dyke but made a mound and the mound is a little made gradually, the water can rise to a region somewhat lower. In this case is a road and the housing remain dry.	The four layers of living was so expensive, as we have said, we can not put it profitable way. The building was too expensive to sell, if you buy a house in Amsterdam, you pay for 80m2 4 t and you can not ask in Dordrecht. The property here already 220000-230000 euro.	Sell the homes to individuals, they will soon be the owner. And public areas go back to church.	If ground wouldn't be raised you would have to put a dike around and then you no longer view. If the homes had to be adjusted independently, it is a cost story, to pay it anymore.
	With freshwater flooding you can do something with salty water everything dies. Fresh water can be used to create things with: squares and parks can overflow, can the fresh water.	The municipality has increased the land was not easy, was sagging floor: pile driving for two years and has sand is situated in order to make the sound.		Master Plan was created by the municipality and CPAs. Together with the municipality, we are the parties that make possible developments in Stadswerven.
		Is a cost recovery to increase throughout the area, is quite expensive. The municipality has a lot of expenses and efforts put into it, the clearing of the ground. and when you are going to increase throughout the area, it does not pay.		If we do not make a profit, we do not exist any more.
		In Stadswerven we have done the same: to live to a higher level.It is risk management, if you have a house and you already have your expensive installations in the living room and it can get 40 cm of water, that is not you. So what does everyone, everyone moved upward.And for flooring on the ground floor, you take a material that is less vulnerable: screed.		
		We need to make the design so that there is over after thought at preventing. But nature we have not owned. We design it so that you make it's probably not in your life that's going to happen, but if it happens then you should keep in mind in material and function usage.		

Category	Influences:				
Sub-category	**Planning institutions**	**Institutional conditions**	**Economic conditions**	**Social conditions**	**Physical conditions**
Property developers:					
2	Very dependent on the municipality, and therefore pulled together.	But the city of Dordrecht have already made a lot of costs, the interest is paid by the municipality, or interest that they do not receive.	Only one or two parties that the insurance.	If you're going to live somewhere, then you know the place or you have to come from without. 90% who come to live here come from Dordrecht and who know that the city regularly flooded. So the feeling is already there.	the location does not have the yield potential as Amsterdam. Is a fight between funds, yield and what we can there.
	The master plan was drawn up together with the municipality, and it says that the soil is increased. No discussion about what is to come, we have put together.	The municipality currently has the most pain.	Has to do with the revenue, if you can sell the homes for more, you have more money to invest in facilities against flooding.	The first homes are truly the pioneers, and therefore also the price lower. We reward them as if they are going to live there. You have to start somewhere.	People buy the location because it is near the water.
			the location does not have the yield potential as Amsterdam. Is a fight between funds, yield and what we can there.	If the residents are not going to buy because they do not have insurance, we will not build it. The customer is simply first, as there is no question we will not do it.	
			Land we do not yet buy. We only buy at the start of the sale. We do not need to make investments in the soil.	In Stadswerven many people want to live in the vicinity of Dordrecht	
			Yes, we are always assured for CAR: Construction all risk, is really a construction insurance. But I have looked at the conditions of flooding and that is not specific to it. Insurers know everything.	The people who are there, often come from the environment. So living with water are known.	
			Yes, if we do not get insurance for something we build underwater then we will not build. Also has to do with what you build and what the risk is.	Residents do want the benefits of living near the water but not the disadvantages.	
			We try to think of nice things but what it can afford and what costs are opposite.	You create something and then you take care of attraction. And eventually people say, I really want to live there. and if people really want to live, then the price goes up	
			The houses can not be too expensive, because it does not sell, you do not buy a very expensive home in Dordrecht.		

Category	Engagement:				
Sub-category	Awarness	Assocciation	Acquistition	Application	Planed adaptation strategy
A	Today every winter and that is every year, we see that water flows on the street and into peoples houses. (2012, 2013, 2014) Because of that we are very aware of the risks of high water.	They are important, because they take that development role, which is a risky role, you can make money but also loose a lot of money. And that is exactly their perspective, they are there to make money, while we have the perspectives of it has to be safe and it needs add something to the city. We think more as an investor, we want this to benefit for now and in the future, while a developer looks at it in the short term, they want to get their money back.	The municipality raised the ground: For them there is not an incentive to change their plan, because they can build the exact same row of houses as they can build anywhere. With the way we have approached stadswerven we also have taken away the creativity of the developers, to come up with solutions.	We have a big pot of money of where we bought the land and were we prepared the land to be ready to build on. Which we hope to get returns on, when developers buy the land.	Is an unambanked area, so not protected, so we have to do calculations on what sea levels we are expecting now and with the climate change. How high do we want to build. And what measures can we take to build adaptive.
	The problem with it is, they want to make the most profit and how can they do that: by building the same thing they build anywhere else, because they already have the design and they can buy their stock in bolk, they can do the same thing they do anywhere. But not every location is the same and especially such a location, requires special measures and that is also why the development of those water houses is not done by a developer, but we are selling the water ourselves, to people are going to do that. Personally I don't think developers are interested in doing does projects because the profit margins are lower and they have to step out of their comfort zone.	I think with our current knowledge we would cut up in smaler plots and give that to different developers, and that would be a bit more work but every time ask al the developers, to come up with their best idea.		Within the government structure, it has it's own model, so it is a different department than my department. Because they need to protect the profit, while I have to implement water strategy.	For Stadswerven we don't want to raise the whole area, so some parts are not raised. We have chosen some parts that can flood. For example, we are going to develop a public square, which will be build on a height that it will get flooded once every year. And we have a park which will be elevated, part of it will flood on a daily basis and other parts only in extreme cases.
				We are the most important actor, because we see our selves as the spider in the web. And we have the links to every one. In Stadswerven we own the land and we are making the zoning plan and we are the first one to communicate with the people.	The extreme rain fall is a recent phenomena, that we are looking into in the Municipality. Dordrecht is an island and we are lucky therefore that our whole internal water system, goes to rivers. And we have done some calculations, and in a lot of areas, heavy rain fall will not be a problem, because of the capacity of our internal canals and ditches are big and that has historical grown that way. Part of that has to do with the fact that we are an island and we have to deal with our own water system, and it is historical that we have a lot of different ditches, we kept a lot of them in place in the '50' when we developed the new neighborhoods, we kept that historic water system in tact.
					For the 2009 masterplan water and water safety was a key element, because it is going to be a high dense central city environment and therefore you don't have a lot of public space. So you want to use the river as your public space, and that has really put the thought of living with water and we need to have a good water system very prominent in the master plan.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
A	We have a steering and grond exploitation role. Transforming an area requires a lot of investments. We had to demolish the old buildings, the soil was polluted: put clean soil there and you first make a lot of costs. And at the end when your are building and selling the facilities you get that money back. You go through plus and minuses.	The Stadswerven in 1990 was a port / harbor area. and they went bankrupt and then the city of Dordrecht bought the land. So we are the owner of the land, and therefore we can control what kind of development we want there.. But we are not a developer ourselves, there for we work and have contacts with other parties.	It is not that much more you have to invest in a sewage pipe of 60 cm or 70 cm, it is not that much more investment, the biggest investment is doing the sewage system. Costs are when you have to replace your sewage system, are we doing now.	We want a certain quality, because Dordrecht has 120 000 inhabitants, and we mainly have a basic housing stock. And with relatively small apartments, with low quality. This neighborhood needs to be something better, newer and bigger.	The water has been taken into consideration for the last 6 years in the plans and therefore it is not a big challenge. We have an approach and we know it will be in a safe way. It could be if the water levels rise dramatically, but then we first have a bigger problem in the historical city center, before we have it in Stadswerven.
	We like to implement it within the masterplan and zoning plan, because that are the documents you access the developments on. The people who get the building permits and see if everything is correct to the zoning plan, will only look at the zoning plan and they wouldn't look at special climate adaptation documents. So by integrating those, you know that they will look if it meets those standards to	The city of Dordrecht was within UFM, in a cooperation with Hamburg, Bergen and other European cities. And we learned a lot from what they were doing, and because we were making a new master plan we could implement those new things right away.	The last 4 years, the global financial crisis was the biggest challenge. and the housing crisis in Holland, we were creating a housing bobble, it didn't burst, but a lot of developments slowed down.	The historical city center in Dordrecht is a growing concern, we are talking to home owners on measures they can take themselves. We know there is a tipping point, a point in time where the water will be so high, and that people will say, I can't live here anymore and I can't protect my own house anymore. And then we need collective measures. Our big struggle right now is to find that tipping point. It could be this winter or in 100 years.	
	Because the soil was polluted we already had to do a lot of ground work and then we could raise the level as well. Doing it at the same time	Waterplan: from 2009 to 2015. Which also have does rough outlines and which describes how big sewage capacity their must be		But the developers are saying it is still tough to sell houses, so they want to cut down on the price and if you cut down on the price, you cut down on quality. Or statement is we have a lot of basic houses, we need more special houses.	

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
A		Zoning plan: the provincial government of south Holland, have special regulations on building in unambanked areas. And they have created an online tool, where you can put your digital zoning plan in and that will calculate casualties and the collective risk of the people for water issues. What you do, you put your zoning plan in and you calculate how many people will live there, what are the functions and it will give you a map with green, orange and red spots. The housing spots in Stadswerven will have a green color, but spots like the public square and parks will have an orange or red color. Is a good application to use, when you are thinking on what to do			
		The provincial governments, wants you to take measures, but we have the strategy to not take does measures in the public spaces, because we want them to flood. And you can do that because people are not living there, no one is stupid enough to go there when it is flooded.			
		Until 2008 the provincial government had the authority to approve local zoning plans, since then the laws has changed and since then the provincial government only have an advising role. At the end the local government are now responsible for their own zoning plan, and that is also why that application is made, so that the provincial government has a tool to advice you on what to do. Because they don't have the opportunity to actually approve or disapprove. The process is quicker and the parties that are closer to the developments / actions have the authority. If we would come to an agrement, we always had to wait on the provincial government to give the approval. And now you can act quicker.			
		The national government are not involved in zoning plans. The national government on water safety has a very divers role, they are responsible for the rivers and the transport over rivers. And they are on a national level responsible for Room for the River: so rivers have enough room to flow. Sometimes they do intervene with our zoning plans, they have a policy guideline for big rivers, in which they claim all the unprotected land, so it can be future room for the river. Stadswerven is an unambanked area, but very build up area, like stadswerven what it used to be, they have given it a special status: it is a yellow area. In yellow areas, policies does not apply. But if you would look more to the east, there does rules do apply. The national level: they are the ones who are predicting the different water levels. We do not have that knowledge inside and what they do, they develop policies on how safe people should be, how many casualties can there be. If they make these rules more strict, that means we have to adapt in our city to comply with does stricter rules. A lot of that comes from the national level: Rijkswaterstaat and the delta program, under the IEM.			
		- National government - The provincial government (state level) - Other municipalities: Rotterdam and also smaler towns. - European union, we have partners in Hamburg. - Knowledge institutions: UNESCO, TU Delft, University of Utrecht, Rotterdam and Wageningen - Waterboards: separate layer of government just for water safety - Rijkswaterstaat: national body for water			
		A lot of people are working on it, slowing it down. but it could be different. But not for al cities, Dordrecht is very active but not every municipality is that. More on a local level and give the funds to the local level, because they know the city.			
		Waterboards and national government will become important, because they have a lot of funds on a national level. That is also how the dutch government in general is build up, local cities and councils don't have a lot of tax income, our main income is through the national government. We don't have a budget we can sift around. It is providing a lot of safety and we are at a very low point in the deltas and we are very safe. A lot of people are working on it, slowing it down. but it could be different. But not for al cities, Dordrecht is very active but not every municipality is that. More on a local level and give the funds to the local level, because they know the city.			

Category	Engagement:				
Sub-category	Awarness	Assocciation	Acquistition	Application	Planed adaptation strategy
B				Rijkswaterstaat and The Development Agency (OCW). With the OCW is developing the municipality's plans	Stadswerven will be placed on a height that meets the provincial safety standards, the public space is reduced landscaped and overflowing from time to time. Residents should be aware that they live in a tidal area.
					The main access road to the Maaslaan is about height constructed +5 NAP and the homes on dike level +4 NAP.
					Housing construction plans are adjusted accordingly. Homes with waterproof walls and water homes.
					In Stadswerven is such a height applied taking into account an upcoming and future expected increase in the water level or increasing rainfall.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
B		For the municipality, however, given the superb location of the area an important project that has considerable political attention and should be implemented. The current market currently offers more perspective which is also reflected in the activities which are planned.	This is a plan that has been running for years. In the boom times was made of a high density of underground parking etc. Due to the collapse of the market plans have drastically changed and there is an organic development. .The High deficits arising thereof are largely written off by the municipality. It is a project where a lot of money will be necessary.		
		The municipality does urge improves on the implementation of plans especially now the market.For the developer that is also a reason to make steps.			

Category	Engagement:				
Sub-category	Awarness	Assocciation	Acquistition	Application	Planed adaptation strategy
Planning institutions:					
C					The delta program was really set up to anticipate the future climate change and sea level rise. So in the delta program for river and coastal flooding we developed the strategy were we have really proven that for the next 100 years we can go ahead with the either the current strategy of raising the dykes or with an alternative strategy which is based on the multi- layer safety. For example, regional flood defenses and where we look at better evacuation possibilities. That plan has been made to cope with sea level rise and climate change for 2100, were there is about a sea level rise of 85 cm. We have the funds to pay for that and the organizations.
					Rising sea level: Waterboards and the ministry IEM. And how will become more important is the safety region, the safety region should be responsible, because the delta program says we focus on protection by dykes, but maybe we should also look at what we do if a disaster happens. And then the safety region is crucial. But they don't have any budget and they don't get any money from the national government to develop plans. They even have to become smaler, and so they don't have the financial capacity nor the capacity in staff, to develop good plans to prepare for evacuation and emergency respons. Safety region: south holland-south. No resources to make them more important.
					Rain: municipality and waterboards. Maybe the civil society will become more important. Many adaptation measures have to be taken at the individual property level. House owner or developers. Many areas have already been developed and then the house owner, can unpaved his garden or install flood protection. It is their own responsibility to take measures against extreme rain fall. For the extreme rain fall nobody is really responsible: or the property owner. Same as with fooding in unambanked areas, no one is really responsible.

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
C	Many projects with Dordrecht: - Mare project: about adaptive responses, for flood risk management. - Carmina project: similar to mare project - Begin project: on bleu green infrastructure. Was supposed to involve Gothenburg, but is maybe Malmö.	Main pillar of flood risk management is prevention or protection, with dykes. The ministry (national government: infrastructure and environment ministry: rijkswaterstaat) sets the protection standards. Now we have new protection standards, from the Delta program. When a dyke is not up to standard it has to be reinforced: and that is the responsibility of the ministry (national government: infrastructure and environment ministry:rijkswaterstaat) as well but together with the waterboards. Is a 50 - 50 % that pay the reinforcement.	When we started: 8 years ago, the biggest challenge was not the climate change, but the economical crisis, when we were doing this project.	But the property owner may not be aware of his responsibility. Communication about the risk is important, what he can do. And the municipality can take measures in the public space. But this is limited. Therefore I think that the property owner will become more important.	
	In the inner city of Dordrecht we want to develop a long term adaptation strategy. For the moment, you can do it with individual protection measures, but maybe at a certain moment after 2050 it may not be enough anymore, and then you have to look at different measures, which can be on a regional scale, close the storm surge barriers, or build a dyke ring.	The waterboards are responsible for the maintenance of the primaire flood defenses and also to do the assessment if they are still up to the standard or not. The waterboards have their own budget. They raise taxes as well.			
	For them the main interest is the flood protection, so it will still be a struggle where you have to integrate flood protection with other spatial objectives. To really find the room to do that. The future has to tell us. For the Netherlands the main challenge will be to integrate dyke raising with spatial development. Many dykes can't be raised any more, because the buildings have been built very close to the dykes.	Than you have the province which is more for the spatial planning, could include flood risk zoning, but not necessary. Than you have the municipalities, they are responsible for the urban watermanagement: for the sewage and protection for rain fall flooding. Role in spatial planning. And together with the safety region they also have a role in emergency management.			
	We are specialist in protection. Not specialist in emergency respons. Is also our special position, we know so much about protection. You have to prevent a disaster. Whole structure is aimed at this.	Municipality takes care of the sewage system.			
	When we started de project, there was already an ongoing urban development program, it is a brownfield, old industrial harbor area, which is being regenerated. We where a side traject, and now the multi-layer safety is part of the masterplan. And to some extend in the zoning plan.	One of the most important projects in Dordrecht, because it is the link between de historic city center and the unembanked area. Dordrecht really want to develop this area, therefore it got an priority. Some projects have been cancelled. But not this.			

Category	Influences:				
Sub-category	Planning institutions	Institutional conditions	Economic conditions	Social conditions	Physical conditions
Planning institutions:					
C		In Dordrecht we have already an existing consortium, for flood risk management, for the dyke ring area. Which includes all level of governments: the municipality, the waterboards, the province, the safety region: independent level of government, they fall under the responsibility of the municipality. But the safety region is in our case: South Holland-south, so that is bigger than alone Dordrecht. It is really a region. But smaller than a region. Not a big organization, the major of Dordrecht is the head of the safety region. And the national government, the ministry of IEM, which also includes the rijkswaterstaat.			
		The Waterboards are very powerful in terms of dyke raising. And we have a tool: the water test, where the waterboard can control the municipalities if they did their homework. In every development municipalities have to develop 10% open water. So they are checking if they are meeting that rule or not. But that is not really a collaboration, that instrument should also be improved.			
		For rain fall, it is similar, but for extreme rain fall this is lacking. So there I'm not sure if we have the right structure in place, because there are no taxes in place for that. Here the collaboration between the municipality and waterboards. Because the normal design rain fall happen every 2 or 10 years, here the organizations can deal with this, because the municipality is responsible for the sewage and the waterboards for the surface water: canals. But when you talk about extreme rain fall, these two start to interact, because the canal can block the outflow of the sewage and the water can come back in. Here they really have to collaborate, and that will be a challenge.			
		The municipality raises taxes for the sewage.			

APPENDIX G

Results questionnaires

	Country	Question	Repsons	Number
1	Sweden	**Do you think the chaning climate is**	Yes	27
			Little	5
			No	0
	The Netherlands		Yes	9
			Little	4
			No	0
2	Sweden	**Vad tror du kommer att hända med havsnivån?**	It rises	31
			It drops	0
			Nothing	0
	The Netherlands		It rises	13
			It drops	0
			Nothing	0
3	Sweden	**Är att leva nära vattnet ett mervärde för dig?**	Yes	29
			No	2
			Different	1
	The Netherlands		Yes	13
			No	0
			Different	0
4	Sweden	**Känner du dig någonsin hotad av vattnet?**	Yes	3
			Little	9
			No	20
	The Netherlands		Yes	0
			Little	4
			No	9
5	Sweden	**Tror du att ditt boende kan översvämmas om havet stiger och nederbörden ökar?**	Yes	9
			No	18
			I don't know	5
	The Netherlands		Yes	5
			No	4
			I don't know	4

6	Sweden	**Hur allvarligt skulle det vara för dig om ditt boende blev översvämmat?**	Very severe	18
			Severe	11
			Neutral	3
			Not severe	0
			Irrelevant	0
	The Netherlands		Very severe	7
			Severe	5
			Neutral	0
			Not severe	1
			Irrelevant	0
7	Sweden	**Vet du om din försäkring täcker skador som orsakats av översvämningar ?**	Yes	11
			No	7
			I don't know	14
	The Netherlands		Yes	2
			No	1
			I don't know	10
8	Sweden	**Är ditt boende skyddat mot översvämningar på något sätt?**	Yes	8
			No	13
			I don't know	10
	The Netherlands		Yes	3
			No	5
			I don't know	4
10	Sweden	**Här ditt hus/ område anpassat till det förändrade klimatet?**	Yes	6
			No	16
			I don't know	10
	The Netherlands		Yes	8
			No	3
			I don't know	1
12	Sweden	**Tänkte du på riskerna av översvämningar innan du köpte / hyrde ditt boende?**	Yes	3
			No	28
			Different	1
	The Netherlands		Yes	2
			No	10
			Different	1

13	Sweden	**Skulle information om risker för eventuella översvämningar vara värdefulla i samband med köp / hyra?**	Yes	29
			No	3
			Different	0
	The Netherlands		Yes	8
			No	3
			Different	1
14	Sweden	**Hur skulle du hantera eventuella risker av översvämning av ditt område?**	Move	11
			Adapt the building	13
			Take an insurance	10
			Different	3
				0
	The Netherlands		Move	2
			Adapt the building	0
			Take an insurance	7
			Different	3
			I don't know	1
17	Sweden	**Vem är ansvarig för säkerheten när det gäller översvämningar i ditt närområde?**	State	3
			Municipality	24
			Developer	4
			Insurance company	3
			Owner	4
			Me	2
			I don't know	3
	The Netherlands		The Rijkswaterstaat	4
			State	8
			The Waterboards	9
			Municipality	9
			Developer	4
			Insurance company	0
			Owner	0
			Me	3
			I don't know	1

18	Sweden	**Vem är ansvarig för säkerheten när det gäller översvämningar i ditt närområde?**	State	2
			Municipality	11
			Developer	2
			Insurance company	4
			Owner	15
			Me	6
			I don't know	4
	The Netherlands		The Rijkswaterstaat	2
			State	4
			The Waterboards	3
			Municipality	8
			Developer	1
			Insurance company	0
			Owner	1
			Me	5
			I don't know	2
19	Sweden	**Vem är ansvarig för säkerheten när det gäller översvämningar i ditt närområde?**	State	8
			Municipality	25
			Developer	4
			Insurance company	4
			Owner	9
			Me	2
			I don't know	1
	The Netherlands		The Rijkswaterstaat	2
			State	4
			The Waterboards	3
			Municipality	8
			Developer	1
			Insurance company	0
			Owner	1
			Me	5
			I don't know	2

20	Sweden	**Vem är ansvarig för säkerheten när det gäller översvämningar i ditt närområde?**	State	4
			Municipality	15
			Developer	8
			Insurance company	4
			Owner	21
			Me	2
			I don't know	0
	The Netherlands		The Rijkswaterstaat	5
			State	5
			The Waterboards	4
			Municipality	10
			Developer	3
			Insurance company	0
			Owner	0
			Me	6
			I don't know	1

APPENDIX H

Europe

The changing climate is a problem for several European countries, the different demographic and economic trends makes the European countries diverse. However similarities can also be identified, the health and social welfare of the population in all the European countries have been improved. The European population has increased in most countries, primarily due to the the net immigration and the European population is aging, which has an impact on the economic and social state of the countries (IPCC, 2014a).

Mitigation and adaptation in Europe

In European countries mitigation and adaptation policies are developed and stimulated by the European Union (EU), due to the changing climate. The EU member states have an overall EU mitigation policy as well as an individual mitigation policy. On an international, national and local level adaptation policies have been developed, although limited research on the implementation of these policies exists. Due to the changing climate, the average temperatures are rising and this is mainly the case in Northern Europe, where the winters are getting warmer and warmer. Europe will also face an increase in extreme weather events, like heat waves, droughts and heavy precipitation. The global mean sea level is increasing, which is causing extreme sea level events to occur in Europe. Coastal flooding is a key challenge for several European cities, infrastructures and port facilities. According to the IPCC the number of people being affected by a coastal flooding in Europe can vary between the 775.000 and 5.5 million people per year in 2080 (IPCC, 2014a) (see appendix 6 for an overview of recent flood events).

The costs in Europe is estimated to be between the 2.6 and 3.5 billion per year in 2100, for coastal adaptation. For the protection from river flood, the costs will reach the 1.7 billion per year in 2020, to 3.4 billion per year in 2050 and 7.9 billion per year in 2080. In Sweden the costs for adaptation, information, campaigns and research will extend to 2.4 billion between 2010 and 2100. In the Netherlands the costs for protection from coastal and river flooding will vary between the 1.2 and 1.6 billion per year until 2050 and between the 0.9 and 1.5 billion between 2050 and 2100 (IPCC, 2014a).

European legislations

The European Union flood risk regulations and policies have a considerable impact on the national flood policies and strategies. Implementation of Directive 2007/60/EC on the assessment and management of flood risks increases policy interactions between the domains of water and spatial planning (Roth & Winnubst, 2014, p. 233). Due to this policy, the European countries were obliged to asses and map the risk of flooding and develop a flood risk management plan for 2015. So the European policies have created new opportunities to integrate the flood risk management in the spatial planning, but the success will depend on the national framings and institutions. In the next paragraphs the adaptation strategies and institutions in Sweden and the Netherlands will be presented.

APPENDIX I

Gothenburg - Public	**Role**
City planning office Gothenburg	Responsible for the development of the masterplan of Gothenburg, building permits, maps and aerial photos.
älvstranden development	Responsible for the realization of the Vision plan for älvstaden and the development of älvstaden.
Water and sanitation Gothenburg	Working on safe, efficient and environmentally sound water supply and sewage collection.
County administration board	Regional government. Approval of master and zoning plan of municipality Gothenburg.
Developers in Frihamnen	**Role**
Botrygg Göteborg AB	Developer of rental and ownerships dwellings.
Magnolia Bostad AB	Focus on the sustainability of the area and developer of rental dwellings.
Rikshem AB	Developer of rental dwellings near the water.
JR Kvartersfastigheter	Specialist in complex city developments
NCC AB	Focus on offices in combination with dwellings
Framtiden	Developer of mainly rental dwellings
Hauschild + Siegel Architecture	Smaller developer of urban villas, with the focus on how the buildings will meet the water.

Dordrecht - Public	**Role**
Municipality Dordrecht	The municipality of Dordrecht made the masterplan for Stadswerven with the OCW and they have an agreement on the financial and procedural aspects of an area in Stadswerven. And is the owner of the ground in Stadswerven.
Ontwikkelings Combinatie de Werven (OCW)	OCW is working together with the municipality of Dordrecht, in the development of the Masterplan for Stadswerven. OCW consists of three developers; AM, Dura Vermeer en J.P. van Eesteren.
Urban Flood Management Dordrecht	International project, which works on the development of sustainable urban areas, that are located outside the dykes. That is taking the risk of flooding into account.
Rijkswaterstaat	Develops, manages and maintains the national network of roads and water
Waterboards	Responsible institution for the sewage treatment and water system management, which includes the protection of the Netherlands against the water.
Specialist: Chris Zevenbergen	TU Delft andUNESCO-IHE professor and working at Dura Vermeer. Has done previous research in Dordrecht and on the Urban flood management.
Specialist: Berry Gersonius	Involved in the water safety study in Dordrecht, part of the research team of Chris Zevenbergen.
Developers in Stadswerven	**Role**
AM	Urban planner in Stadswerven
Dura Vermeer	Developer in Stadswerven
J.P. van Eesteren	Developer in Stadswerven

APPENDIX J

Regulations in Sweden

Regulations in Sweden, the descriptions are based on parts from the report: *Styrmodell för etablering av älvkantskydd*.

- According to the Planning and Building Act (Law 2010:900) all municipalities are required to adopt a master plan which serves to guide decisions about land use and development of the built environment within the municipal territory (Nilsson et al., 2012, 757). The Commission on Climate and Vulnerability has made it mandatory for municipalities to consider the risk of accidents, flooding and erosion in planing and localizing building. In the new Planning and Building Act that took effect in 2011, the Swedish Parliament decided to include the environmental and climate concerns into the act (Nilsson et al., 2012).

- According to the Civil Protection Act (Law 2003:778) municipalities are obligated to work on a plan of action and have a law guiding the crisis management during extreme events (Law 2006:544). However, the focus in the civil protection act, made by the Swedish Civil Contingencies Agency, is not on long-term climate change, but more on preparedness and responses to accidents (Nilsson et al., 2012).

- Through the Municipal Act (Law 1991:900), the municipalities have the planning monopoly. They are primarily responsible for the urban planning and the land use and built environment. Therefore the municipalities have a wide discretion for the decisions related to climate adaptation, as long as it does not clashes with national interests and other regulations.

- The Environmental Code (Law 1998:808), sets the legal framework for climate adaptation measures related to nature conservation, program of national interest and environmental impact assessments.

- According to the Law on Municipalities and County Administrative Board actions before and during extraordinary events in peacetime (Law 2006: 637) the municipalities are obligated to make a risk and vulnerability analysis. Municipalities and county councils must analyze and summarize the effects of extraordinary events on their business in a risk and vulnerability assessment.

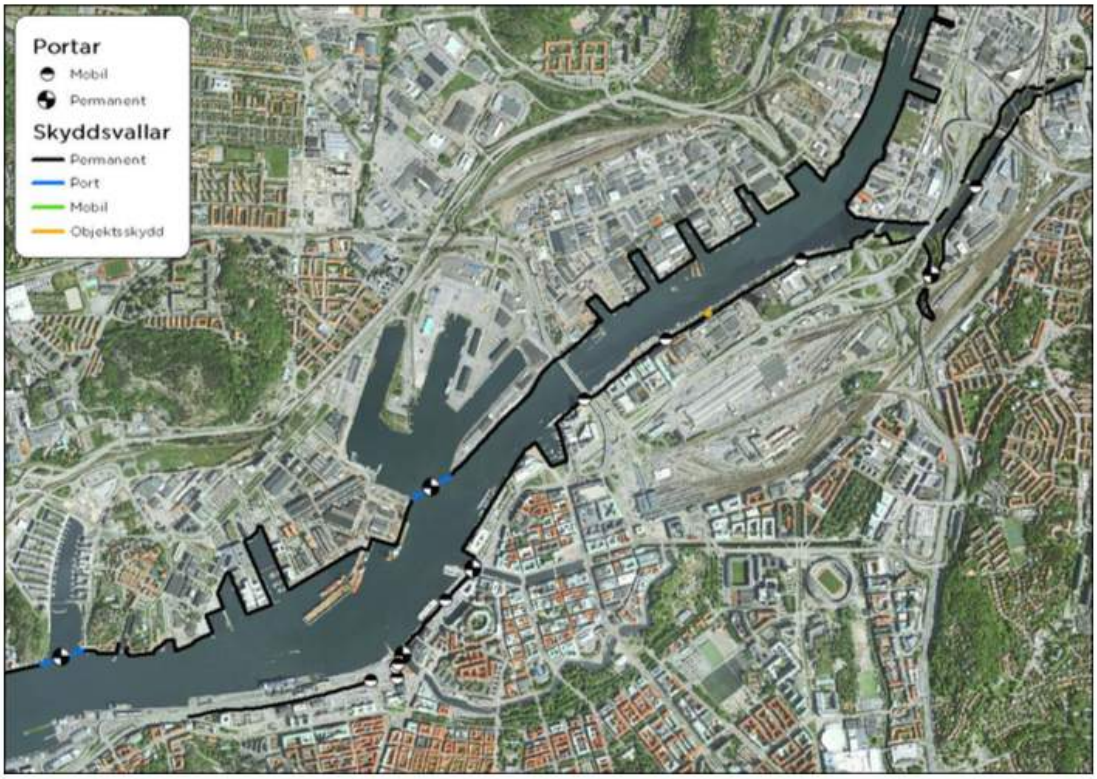
- The Law on Public Water Services (Law 2006: 412) regulates how the municipality will organize water supply and drainage. The Law on Public Water Services does not require the dimensioning for future climate.

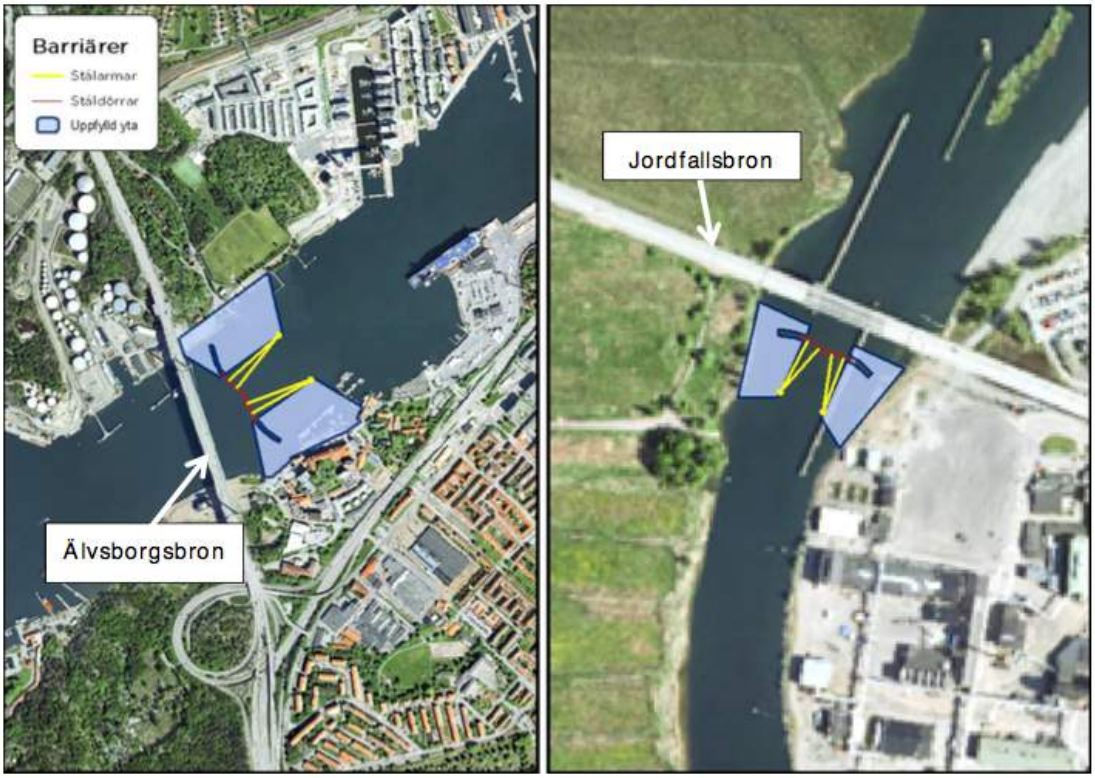
- The Food Act (Law 2006:804), may be important for the climate adaptation work for the safeguarding of drinking water, agriculture and human health.

APPENDIX K

Alternatives protection Gothenburg

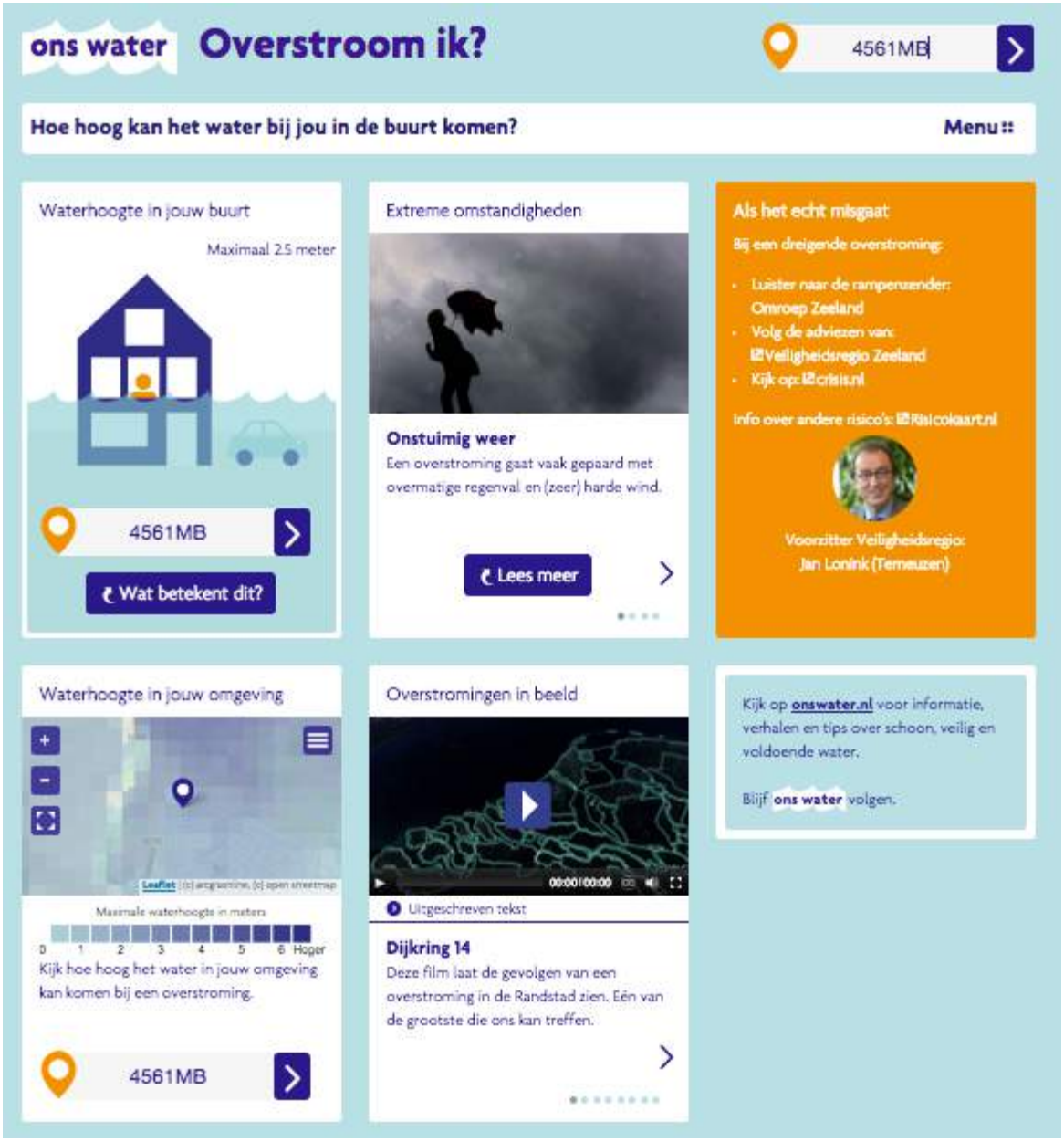
River protection and outer storm surge barrier (Rämboll, 2014).





APPENDIX L

Overview Dutch website on flood risk



APPENDIX M

Overview interviews Sweden and the Netherlands

Sweden:	Person	Company	Role	Interview
1	**Ulf Moback**	City planning office, Gothenburg municipality	Planning institution	25 sept 13.30 - 14.30
2	**Hanna Areslätt**	Älvstranden developments	Planning institution	11 sept 14.00 - 15.00
3	**Caroline Valen**	Älvstranden developments	Planning institution	21 sept 13.00 - 14.00
4	**Marie Falk**	Water and sanitation office, Gothenburg municipality	Institutional condition	9 sept 13.00 - 14.00
5	**Lars Westholm**	County administration board	Institutional condition	28 sept 15.00 - 16.45
6	**Joachim Arcari**	Botrygg Göteborg AB	Property developer	Email
7	**Clas Hjort**	Magnolia Bostad AB	Property developer	28 sept 16.30 - 17.30
8	**Robert Bengtsson**	Framtiden	Property developer	1 okt. 13.00 - 14.00
9	**Magnus Jälminger**	Rikshem AB	Property developer	23 sept 9.00 - 10.00
10	**Jonas Dahlstrand**	JR Kvartersfastigheter	Property developer	21 sept 15.00 - 16.00
11	**Magnus Borelius**	Finance department Gothenburg municipality	Institutional condition	30 sept 10.00 - 11.00
12	**Staffan Moberg**	Swedish insurance	Economic condition	16 sept 15.30 - 16.30
13	**Mats Berntsson**	Ytter bygg	Social condition	14 sept 15.00 -16.00
The Netherlands:	**Person**	**Company**		**Interview**
14	**Bas Overdevest**	Bank: ABN AMRO	Economic condition	14 okt 9.30 - 10.30
15	**Paul Bezemer**	Municipality Dordrecht	Planning institution	7 okt 10.00 - 11.00
16	**Dick van 't Hoff**	Developments combination the Werven	Planning institution	Email
17	**Berry Gersonius**	Municipality Dordrecht	Institutional condition	7 okt 13.30 - 14.30
18	**Maarten van der Meer**	Waterboards	Institutional condition	14 okt 13.00 - 14.00
19	**Gilbert Kokenberg**	AM	Property developer	15 okt 10.00 - 11.00
20	**Sander Mesu**	J.P. van Esteren	Property developer	8 okt 14.30 - 15.30

APPENDIX N

Understanding stage

Detect problem	- Existence of a signal - Detection of a signal - Threshold of concern - Threshold of response need and feasibility
Gather/ use of information	- Interest and focus - Availability - Accessibility - Relevance - Credibility and trust - Legitimacy - Receptivity to information - Willingness and ability to use
(Re)define problem	- Threshold of concern - Threshold of response need - Threshold of response feasibility - Level of agreement

Planning stage

Develop options	- Leadership in leading process - Ability to identify and agree on goals - Ability to identify and agree on a range of criteria - Ability to develop and agree on a range of options - Control over process - Control over options
Assess options	- Availability of data / information to assess options - Accessibility / usability of data - Availability of methods to assess and compare options - Perceived credibility, salience and legitimacy of information - Agreement on assessment approach - Level of agreement on goals, criteria and options
Select options	- Agreement on selecting options - Sphere of responsibility/influence/control over option - Threshold of concern over potential negative consequences - Threshold of perceived option feasibility - Clarity of authority and responsibility over selected option

Managing stage

Implement options	- Threshold of intent - Authorization - Sufficient resources (fiscal, technical, etc.) - Accountability - Clarity/specificity of option - Legality and procedural feasibility - Sufficient momentum to overcome institutional stickiness, path dependency, and behavioral obstacles
Monitor outcomes & envrionment	- Existence of a monitoring plan - Agreement, if needed, and clarity on monitoring targets and goals - Availability and acceptability of established methods and variables - Availability of technology - Availability and sustainability of economic resources - Availability and sustainability of human capital Ability to store, organize, analyze, and retrieve data
Evaluate effectiveness of option	- Threshold of need and feasibility of evaluation - Availability of needed expertise, data, and evaluation methodology - Willingness to learn - Willingness to revisit previous decisions - Legal limitations on reopening prior decisions Social or political feasibility of revisiting previous decisions