What makes a climate adaptation frontrunner?

The municipal transition towards successful climate adaptation

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Summary:
The increased flood experiences in Denmark have led to the demand of municipal climate adaptation plans. The thesis focuses on the municipalities' experiences with their climate adaptation plan and a frontrunner municipality's management of the climate adaptation transition through Loorbach's Transition Management theory. The goal of the thesis is to provide the Danish municipalities with a framework to use through the adaptation transition.

The following research questions are formulated to clarify this: *How well are the municipalities within the Capital Region of Denmark planning their actions in the climate adaptation plan; and how have the water utility, companies, citizens, and housing associations been mobilised and utilised through governance activities by a frontrunner municipality in the transition towards successful climate adaptation actions? Finally, what characterises a frontrunner municipality in relation to climate adaptation actions?*

A comparative evaluation analysis through ten indicators makes it possible to score the adaptation actions within the climate adaptation plan for the 29 municipalities within the Capital Region. Five frontrunner municipalities are found: Copenhagen, Brøndby, Frederiksberg, Vallensbæk and Gladsaxe.

A case study of Gladsaxe Municipality clarifies their frontrunner status. Gladsaxe and Nordvand water utility have had a very strong collaboration, which strengthen the transition. It is found that the climate adaptation group, which consists of employees from different departments in Gladsaxe Municipality and Nordvand, has led to an innovative, strong process of creating the transition vision, transition agenda (the climate adaptation plan) and transition paths (the actions within the plan). Furthermore, the municipality has focused on involving the citizens, companies etc., which has been vital for the frontrunner transition work. Gladsaxe has had an innovative process approach towards the three first clusters of the Transition Management theory: strategic, tactical and operational, but needs to improve the reflexive cluster.

The characteristics of a frontrunner municipality are gathered in nine goals, as a framework for other municipalities to adopt and adjust to their own climate adaptation transition situation. The nine goals are:

1. Giving direction to future planning	2. Reframing rain as a resource	3. Translating the vision into content
4. Building the agenda	5. Networking with other actors	6. Innovate new solutions
7. Develop transformational projects	8. Involve and engage other actors	9. Adjustment of the transition

Summary in Danish

De oplevede danske konsekvenser af klimaændringerne er flere oversvømmelser, grundet den øgede mængde ekstremnedbør og det stigende havniveau. Denne tendens har ført til kravet om udarbejdelsen af kommunale klimatilpasningsplaner. Det forhåndenværende speciale fokuserer på kommunernes erfaringer med deres klimatilpasningsplan samt en frontløber-kommunes håndtering af klimatilpasnings-transitionen. Loorbachs Transition Management teori benyttes til at forstå dette. Målet med specialet er at give de danske kommuner en ramme til at forstå og arbejde med gennem deres klimatilpasnings-transition.

Følgende problemformulering er udarbejdet for at belyse ovenstående: *Hvor godt planlægger kommunerne inden for Region Hovedstaden deres klimatilpasningshandlinger i klimatilpasningsplanen; og hvordan er forsyningsselskaber, virksomheder, borgere og boligforeninger blevet mobiliseret og udnyttet gennem 'governance activities' af en frontløber klimatilpasningskommune under deres transition? Slutteligt, hvad kendetegner en frontløber kommunes klimatilpasningshandlinger?*

En sammenlignende evalueringsanalyse gør det muligt at analysere de 29 kommuners klimatilpasningshandlinger inden for Region Hovedstadens klimatilpasningsplaner og tildele dem point efter, hvor godt de tager hensyn til ti opstillede indikatorer. Herudfra findes fem frontløber kommuner: København, Brøndby, Frederiksberg, Vallensbæk og Gladsaxe.

Et nærmere casestudie af Gladsaxe Kommune præciserer, hvad der forårsager deres status som klimatilpasningsplansfrontløber. Casestudiet viser bl.a., at Gladsaxe og Nordvand har haft et meget stærk samarbejde gennem klimatilpasningsarbejdet, hvilket styrker transitionen. Det konstateres ydereligere, at klimatilpasningsgruppen, som består af medarbejdere fra forskellige afdelinger i Gladsaxe Kommune og Nordvand, har ført til en innovativ, stærk proces i forhold til at skabe *transition vision*, *transition agenda* (klimatilpasningsplanen) og *transition paths* (klimatilpasningsplanens handlinger). Desuden har det kommunale fokus på at inddrage borgerne, virksomhederne m.v. været afgørende for Gladsaxes frontløber klimatilpasning transition status. Gladsaxe har haft en innovativ procestilgang til de tre første faser af Transition Management: *strategic*, *tactical* og *operational*, men der er fortsat behov for at forbedre den *reflexive* fase.

Kendetegnene for en frontløber klimatilpasningskommune er samlet i ni nedenstående mål, hvilke kan danne rammen for andre kommuners transition, de skal blot tilpasse målene til deres egen klimatilpasning transition situation.

1. Retningsgiv den fremtidige planlægning
2. Se regn som en ressource
3. Omsæt visionen til indhold i klimatilpasningsplanen
4. Opbyg agendaen
5. Netværkssamarbejde med andre aktører
6. Udvikl nye innovative løsninger
7. Udvikl transformations projekter
8. Aktør involvering og engagering
9. Justering af transitionen

Acknowledgements

The last four months have been very interesting and insightful, and we will like to say thank you to everybody who has helped us gaining a deeper understanding of the challenges behind the Danish municipal climate adaptation transition.

We will like to say a special thank you to the five people below, as they have put time aside for us to interview them. This data has been key data during the analysis and supports our final framework for other municipalities to follow:

- Kathrine Stefansen, Gladsaxe Municipality
- Lise Jangmark, Nordvand
- Annette Kolte-Olsen, Nordvand
- Dennis Schultz, Gladsaxe Housing Association (Gladsaxe Almennyttige Andelsboligforening)
- Elsebeth Dahl Pedersen, Novo Nordisk

We will furthermore like to thank the 21 participating municipalities within the Capital Region, who kindly have participated in our survey concerning their experiences with the climate adaptation action plan.

Lastly, we will like to acknowledge the debates and valuable inputs our supervisor, Sanne Vammen Larsen, has provided us with during the last four months.

Preface

This thesis is written as the final master project on the master programme Sustainable Cities at Aalborg University Copenhagen, Denmark. The thesis has been developed during four months (February 2nd 2015 – June 3rd 2015).

The focus of the thesis has been the Danish municipalities' experiences with their climate adaptation action plan and how a frontrunner municipality manage to become a frontrunner in this transition. The goal of the thesis is to provide the Danish municipalities with a framework to follow through the transition.

The references are to be found in the end of the thesis, and they are listed after the Harvard system. (Anglia Ruskin University, 2015).

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1 Introduction

This introducing chapter explains the overall problem of more precipitation and rising sea level in Denmark including the consequences. It also presents climate adaptation as one of the solutions and the national goal to climate adapt all municipalities through the development of municipal climate adaptation plans. This leads to the problem area, which revolves around the actions within these plans as well as the municipal transition towards successful implemented climate adaptation actions. Via a problem formulation, which consists of three research questions, the final goals of this thesis are then presented.

1.1 Setting the scene for climate adaptation

The climate changes are affecting Denmark in many ways. Denmark has multiple times experienced flooding due to cloudburst events or storm floods, which have had great consequences on both transport, IT, energy, health and the social area. A flood has great economic consequence for many actors, which has led to the realisation of the need for planned climate adaptation. However, how are the municipalities supposed to create the climate adaptation plans and involve other actors to participate? What should the right climate actions include? These are some of the questions the Danish municipalities are forced to deal with and this thesis looks deeper into.

1.1.1 More precipitation and rising sea level in Denmark

In Denmark and the rest of the world climate change has led and will continue to lead to a higher temperature and thus to serious changes in the natural systems. These changes include among other things an increase in the amount and intensity of precipitation as well as a rise in the seawater level in Denmark. (DMI, 2014).

It is raining more and more in Denmark. In their new report about Danish climate changes, the Danish Meteorological Institute (DMI) (2014) states that the yearly average amount of precipitation has been raising since the middle of the 20th century. Furthermore, the intensive heavy rain events, where 100 mm rain falls within few hours, also have increased in frequency. All this is due to the global warming, which is created by both human behaviour as well as random climate variations. (DMI, 2014).

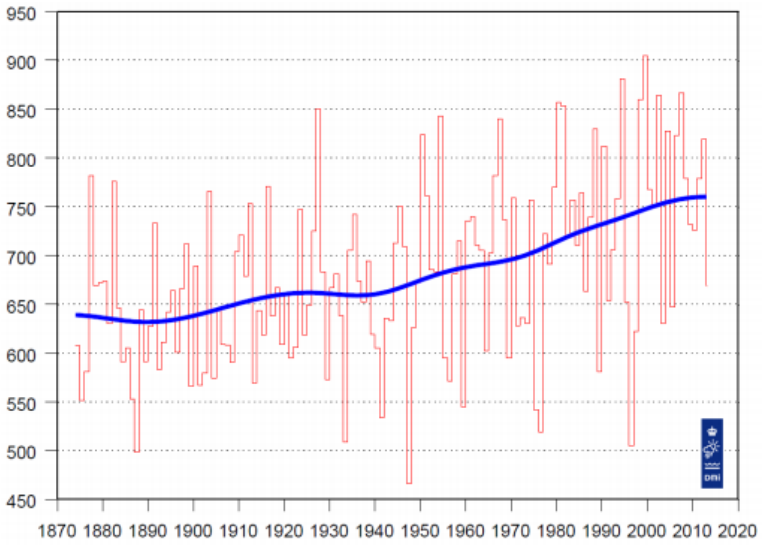


Figure 1: Annual precipitation in Denmark since 1870, where the blue line is the average of nine consecutive years.

By simulating 23 different climate models, based on the work by IPCC, which is the UN's Intergovernmental Panel on Climate Change and one of the leading actors within climate research, DMI shows that the average precipitation pattern will continue to change. This pattern includes a tendency for more precipitation in Denmark towards 2100 with a yearly increase of 1.6% to 6.9% (lowest and highest IPCC-scenario) compared to the reference period 1986-2005. The pattern also differs from the different seasons: From 2081 to 2100, the average amount of precipitation during winter will have increased with 3.1% to 18.0% compared to the reference period, but the precipitation will decrease in the summer period with -0.5 to -16.6 %. (DMI, 2014). However, even though the amount of summer precipitation will decrease, the intensity of the rain events will most likely increase during summer leading to more challenging heavy rain events. (DMI, 2014).

In 1990, the average intensity of precipitation in Denmark was 5.0 mm/day, and it is estimated that this average will have increased to 5.2 mm/day by 2050 and 5.6 mm/day by 2100. This also means that the amount of days per year with more than 10 mm precipitation are going from 19 days per year in 1990 to 22 in 2050 and 26 in 2100. Furthermore, the amount of days per year with more than 20 mm precipitations are going from 2 days per year in 1990 to 3 in 2050 and 5 in 2100 (DMI, 2014).

The other water related climate issue is the sea level rise, which depends on the global ice melting and the expansion of the water. Since 1900, the average sea level by the Danish coasts has increased by 1.7-2.2 mm/year (Figure 2), which is about the same as the average rise of the global sea level. However, just as with the precipitation, the pattern of the sea level rise is estimated to continue. In Denmark the average sea level is estimated to increase with 0.1-0.9 meter (best and worst IPCC scenario) in the period 2081-2100 compared to the reference period 1986-2005. (Stocker, et al., 2013.). DMI even estimates the maximum rise to be 1.2 meter. (DMI, 2014).

Together with the increasing amount of precipitation, the sea level rise is going to cause and have already caused a lot of damage through storm floods.

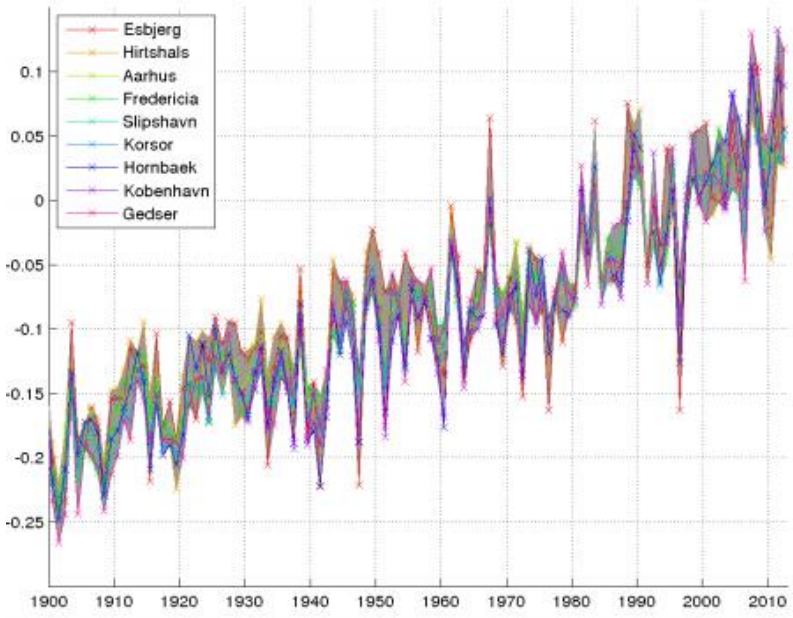


Figure 2: Annual mean sea level at nine different cities in Denmark.

The sea level rise will cause different amounts of issues in the Danish coastal cities, as some parts of the land is still rising, which it has done since the ice weight from the last Ice Age disappeared. It is especially in the northern part of Denmark that the land is still rising. Copenhagen and Aarhus are rising with 0.5mm annually. However, it is estimated that the coastal cities that are raised by less than 0.75mm annually can expect to experience problems and flooding due to the rising sea level. The problem will therefore be a reality for the Danish coastal towns south of Helsingør, Grenå and Hanstholm. The southwest of Jutland, Vadehavet, is the place that has had and will continue to have the biggest problems with storm floods, as the land lowers. (Hansen, 2011).

The biggest problem with the increased rising of the sea level is the increasing risk of flooding, which leads to the loss of nature such as marshes and sand dunes. Furthermore, agriculture may risk "suddenly" to lie directly next to the sea and may release nutrients, resulting in algal blooms, and finally impermeable towns will more often experience flooding.

1.1.2 Climate adaptation as a solution

In their analysis of the second IPCC rapport (impacts, adaptation and vulnerability) (2014), the Danish Ministry of Environment emphasises climate adaptation as the solution towards water related climate change issues in Denmark. (Danish Nature Agency, 2014). Although mitigation will decrease the need for adaptation, investments in climate adaptation is also important, because of the inevitable changing precipitation pattern and rising sea level. Adaptation has the potential to change or avoid certain damages in the human and nature systems, and further take advantage of favourable opportunities within these systems. (Field, et al., 2014). This means that with climate

adaptation, the Danish society is able to make urban areas (and rural as well) more robust and less vulnerable towards water damage caused by the precipitation and sea level rise.

On a geographically greater scale climate adaptation is an important topic as well. The EU has for instance created the European Climate Change Adaptation Platform (Climate-ADAPT), which is a partnership between the European Environment Agency and the European Commission, and aims to support climate adaptation within Europe. (Climate-ADAPT, 2015a). Within Europe, it is estimated that the yearly costs of climate adaptation in the 2050's are going to be 1.5 billion Euros. This might seem like a lot, however, the costs of the restoration and compensation if the countries within Europe are not investing in climate adaptation is estimated to be six times as high. (Danish Ministry of Environment, 2014). This makes climate adaptation an important solution and economically beneficial.

Figure 3: Example of climate adaptation (Sustainable Urban Drainage System) SUDS solution in Tåsinge Plads, Østerbro, Copenhagen.

In Denmark, the Nature Agency within the Danish Ministry of Environment has initiated Klimatilpasning.dk as the main national platform for Climate adaptation. The platform was launched in 2009, as one of the results of the national adaptation strategy of Denmark, which was adopted in 2008. The aim of the platform was and still is to ensure that the public authorities (as well as companies and citizens) would incorporate climate change into the future planning and development (Climate-ADAPT, 2015b). On the platform both citizens, municipalities and companies can get access to existing knowledge about climate adaptation including the latest research and development.

There are several ways to climate adapt, but Klimatilpasning.dk divides them into three different braches according to what problem they address. 'Rain and cloudburst'-solutions include methods such as sustainable urban drainage systems, where rainwater is being retained on the surface; rainwater management in the sewers, such as separation of rainwater and wastewater; and cleansing of rainwater such as roadbeds, which cleans the road water. 'Raising sea level'-solutions include methods such as building dikes at the coastline and implementing sluices and pumping

stations. Finally 'preparedness'-solutions include methods such as mobile dams, which can be transported easily to locations with increased risk of flooding; and systems for warning, monitoring and controlling potential risks. (Klimatilpasning, 2013).

1.1.3 Flooding in urban areas

The urban areas are vulnerable due to the many impervious surfaces like roads and pavements. A higher sea level increases the risk of floods during storms, and the extreme rain events, such as cloudbursts, where for instance one month's worth of rain falls within a couple of hours, are making it very difficult for the urban sewage system to cope with the huge amount of water. Too much rainwater can lead to the sewage system breaking down, and thus urban floods occur. A well-known Danish example of such an urban flood is the cloudburst event of the 2nd of July 2011. This event mainly happened in Copenhagen and had massive negative consequences on both transport, IT and telecommunication, energy, health and the social area. (Emergency Management Agency, 2012). In addition, it has been estimated by the insurance companies of Denmark that the event caused 4.88 billion DKK in property damages. (Forsikring & Pension, 2014).

It is clear that storms and extreme rain events can have both economic, environmental and social consequences, just as it is clear that the risk of these events happening again will increase due to the changes in the precipitation pattern and sea level. The 31st of August 2014, Copenhagen was yet again exposed to a comprehensive cloudburst, which according to the Technical and Environmental Mayor of Copenhagen, Morten Kabell, indicates the seriousness of the climate changes and the importance to act. (Astrup, 2014).

1.1.4 The requirement of municipal climate adaptation plans

In Denmark climate adaptation is implemented on a local level, which is why climate adaptation planning is a municipal responsibility, although it is based on both the national framework and EU framework (The Flooding Directive, Oversvømmelsesdirektivet) (Danish Ministry of Environment, 2015a). After the adoption of the Danish national adaptation strategy in 2008 and the launch of the klimatilpasning.dk platform in 2009, the municipal focus on climate adaptation has been increased. Some municipalities even started to develop climate adaptation plans and integrate them in their municipal plan. However, the real push came in 2012 with the 2013 Economy agreement for Danish municipalities. Here the Danish Ministry of Finance and the Local Government Denmark (KL) agreed that all municipalities had to develop a climate adaptation plan before the end of 2013. (Danish Ministry of Finance, 2012). In December 2012, based on this agreement, the Danish government then published an action plan for climate securing Denmark, containing an overview of already initiated climate adaptation initiatives as well as future initiatives. (Danish Ministry of Environment, 2012). Shortly after in the beginning of 2013 a guidance for the municipalities on how to construct their climate adaptation plans was published. (Danish Ministry of Environment, 2013).

The guidance both contains the legal requirements in relation to the climate adaptation plans as stated by the economic agreement, as well as suggestions on how to construct the different sections within the plans. The legal requirements are (Danish Ministry of Environment, 2013):

- The climate adaptation plans must contain a *mapping of the flood risk* within the municipality. A part of the agreement is that the government must help with this by making data and maps available for the municipalities.
- The plans must also give an *overview of and prioritise* the actual climate adaptation actions in order to ensure the implementation.
- The government also has to change the regulatory basis in order to accommodate the plans if necessary.
- The climate adaptation plans must be integrated either into the municipal plan or as an official appendix to the municipal plan.

The implementation in the municipal plan secures a broad and open debate with the citizens. It also creates synergies with for instance the urban development or nature, and it makes it possible for the plan to interact with the planning of the central government and regions (such as water- and nature planning). (Danish Ministry of Environment, 2013).

1.1.5 The National Mobile Climate Adaptation Team

In a period between 2012 and 2013, The Danish Nature Agency created a mobile climate adaptation team (Rejseholdet), which travelled to different municipalities in order to help them developing climate adaptation plans. The municipality could assist in the preparation of mapping, preparation of the action plan, and organisation of the process or the realisation of opportunities. (Danish Ministry of Environment, 2013). Many municipalities have used this opportunity. At the CRES Conference, about critical climate impact, adaptation and vulnerability in Denmark, Louise Grøndal, Danish Nature Agency, said that around three quarters of the Danish municipalities have had a meeting with the mobile climate adaptation team at least once. The municipalities that have not used the guidance of the team are mainly located in the central, northern and eastern part of Zealand. (Grøndal L., 2015).

The Danish Nature Agency has made it possible from 2015 to 2016 for the municipalities to receive guidance from the Mobile Water Supply Team (Rejseholdet om vandforsyning). Here it is possible for the municipalities to be advised in groundwater, drinking water, water supply and the related climate adaptation issues connected to the water cycle. (Danish Nature Agency, 2015)

Almost all municipalities have now developed their climate adaptation plan; many of them with the help of the mobile climate adaptation team. These plans all contain the legal requirements as mentioned earlier; however, since there only exist suggestions for how to structure the actual climate adaptation plan, it is valid to believe that not all climate adaptation plans are equally good. This leads to the problem area of this thesis.

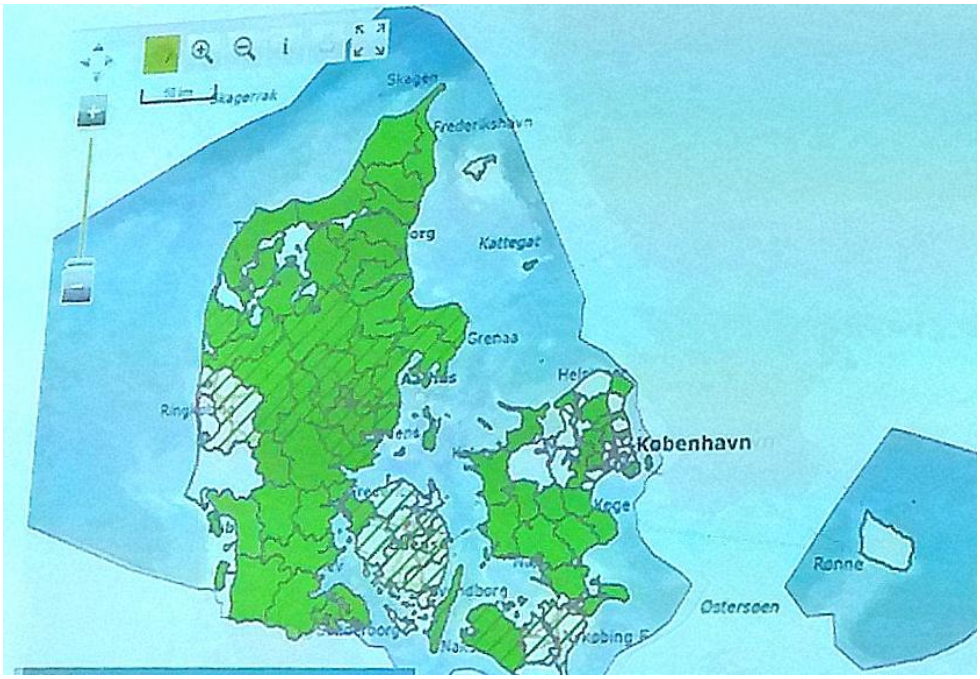


Figure 4: The meetings of the mobile climate adaptation team (Rejseholdet). Green = municipalities that the mobile climate adaptation team have visited. Hatched = municipalities that have had a joint visit with other municipalities of the climate adaptation team. The picture is from a conference presentation.

1.2 Problem area

The problem area of this thesis takes its point of departure in the limited requirements for the actual structure of the municipal climate adaptation plans and how this can be seen as problematic. Furthermore, the concept of climate adaptation is narrowed to only cover climate adaptation solutions that are established on the surface and not below the ground. Transition Management theory is also introduced in order to approach some of the problems.

Throughout the problem area, three research questions are presented. Afterwards, these are summed up as the problem formulation of this thesis.

1.2.1 Geographic scope of the study

In order to narrow the scope of this thesis, the focus of the problem area is on the 29 municipalities within the Capital Region of Denmark. These municipalities are interesting to focus on, as Copenhagen has been exposed to two comprehensive floods within the last four years (2011 and 2014), but also because the region is the biggest in both population size, 1.766.677 people, and population density, 698 people per km^2 (The Danish Regions, 2010). This means that many people are living within a relatively small impermeable area at risk of floods. Furthermore, the Capital Region states in its climate strategy from 2012 that the goal for the region is to become the most climate prepared region in Denmark (Capital Region, 2015), which makes the region seem ambitious and thus perfect for this thesis.

1.2.2 The lack of structure can create too much freedom

No strict structure for the climate adaptation plans exist. However, the governmental guidance (Danish Ministry of Environment, 2013) does come up with a suggestion of how to structure the climate adaptation plan. This is done through four different sections:

- *'Background and preconditions'* explains the climate challenges within the municipality.
- *'Risk image'* shows the potential for high damage within the municipality by putting together the risk mapping and a value mapping.
- *'Main structure'* explains the municipal vision and goals for climate adaptation and how they interact with the other municipal interests of the areas. In addition, risk areas are identified based on the risk image, and plans for how to address these risk areas are also presented.
- *'Action plan'* concretises the plans for the risk areas through initiatives and projects, which describes the content, expected effects, need of information, partners, economy, financing and other relevant elements.
  (Danish Ministry of Environment, 2013, pp. 6-7).

These suggestions are illustrated through the picture below from the Climate Adaptation Plans and climate local plans Guidance. (Danish Ministry of Environment, 2013).

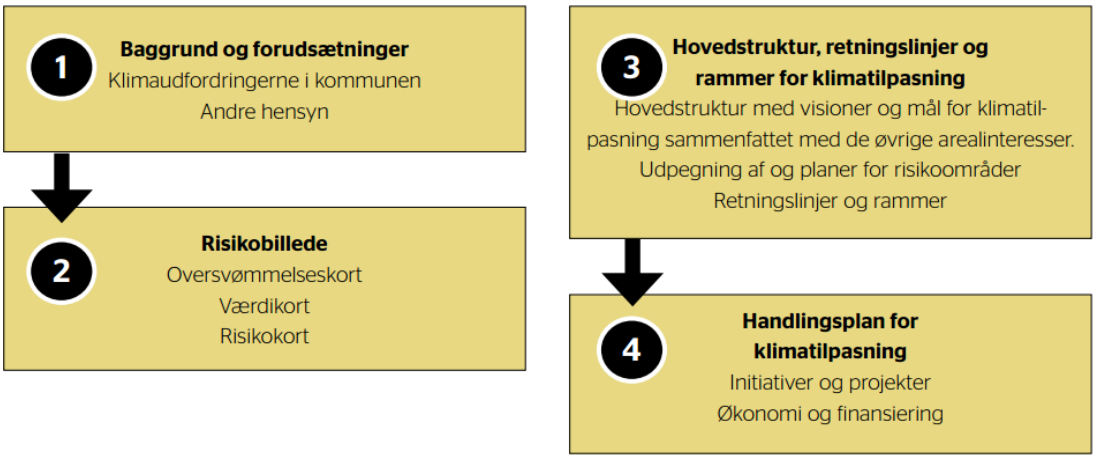


Figure 5: The Climate Adaptation Plan's main elements.

The suggestions do of course include the required parts, but a lot is still up to the municipalities to decide themselves. This leaves the municipalities with some freedom in how to interpret and address the climate adaptation planning. This is especially the case with how the climate adaptation actions should be included in the climate adaptation plan. Although it is a requirement for the climate adaptation plan to give an overview of the actions and prioritise them, the guidance also states that *"there are no specific requirements to the extent of the actions for climate adaptation* [within the climate adaptation plans]." (Danish Ministry of Environment, 2013, p.6). Thus, it seems that the municipalities are free to decide how much of an effort they will put into the actual climate adaptation plan's actions, as long as they give an overview and are prioritising these actions. Via a quick preliminary study of all the 29 municipal climate adaptation plans within the Capital Region in relation to this thesis, the assumption was confirmed. While 28

of the 29 municipalities have followed the legal requirements from the agreement between the Government and Local Government and have presented this content more or less similar in the climate adaptation plans, the climate adaptation actions are presented in several different ways and with seemingly different levels of quality. For instance, the 28 out of 29 municipalities are using between two and 44 pages of their climate adaptation plan to describe the desired actions, which leads to the assumption that some municipalities must do better or at least put a greater amount of workload into the action plans than others. This significant difference in how well the different municipalities (at least within the Capital Region of Denmark) are planning their climate adaptation actions can be seen as a serious problem. Although the action plan ensures the implementation of actions, a successful implementation requires a well-planned action plan. A successful implementation of climate adaptation is therefore uncertain in some municipalities. This problem leads up to the first research questions for this thesis:

How well are the municipalities within the Capital Region of Denmark planning their actions in the climate adaptation plan?

This question opens up for a comparative evaluation of the actions within the different climate adaptation plans, which makes it possible to point out who are planning their climate adaptation actions well and who are planning them less well. In addition, such an evaluation will also show what well-planned actions contain compared to the less well-planned actions.

1.2.3 The transition towards successful climate adaptation actions

Achieving a fully climate adapted municipality takes a long time. It is a long-term transition to go from a strictly sewer based rainwater management (where the wastewater and rainwater flows in the same pipes) to successful climate adaptation actions that are surface based. With the agreement between the Government and Local Government about the requirements for a climate adaptation plan, this transition started officially. However, because of the big difference in how the actions have been included in the different municipal climate adaptation plans, it seems that the municipalities are managing the transition very differently and with varied success across the region. Thus, it is assumed that municipalities with well-planned actions within their climate adaptation plan are managing the transition towards successful climate adaptation actions better (or at least significantly different) compared to municipalities with less well-planned actions.

Transition Management (Loorbach, 2010), which is a governance approach for sustainable development, states that a transition is managed via different types of governance activities and how the different actors are mobilised and utilised by the government through these activities. (Loorbach, 2010). By applying Transition Management on the municipal transition towards successful climate adaptation actions, it can now be assumed that the municipalities with well-planned actions within their climate adaptation plan are mobilising and utilising different actors through governance activities better (or at least significantly different) compared to municipalities with less well-planned actions.

The different actors that are being mobilised and utilised by the municipality in this transition are of course important to narrow down. Many actors are influencing the transition, but this thesis

choose to focus on those who either are co-developing climate adaptation together with the municipality or own a significant share of private property and are thus relevant for the municipality to engage and involve in relation to climate adaptation. This includes the municipality themselves, the local water utility, citizens, housing associations and companies.

By taking point of departure in one of the municipalities that was best at planning their actions in the climate adaptation plan – a frontrunner – and applying the ideas of Transition Management as well as the actors of the focus, a second research question emerges:

How have the water utility, citizens, companies and housing associations been mobilised and utilised through governance activities by a frontrunner municipality in the transition towards successful climate adaptation actions?

This question is thus linked to the first research questions, and seeks to understand why some municipalities are better than others, in relation to climate adaptation actions. In this sense, the second research question is used to explore the governance activities within the transition of a frontrunner municipality, while the first research question seeks to identify this frontrunner municipality. However, the second research question is not restricted to the planning of the actions themselves as the first research question is; instead it includes the strategic, tactical, operational and reflexive aspects of climate adaptation in order to understand how the transition of a frontrunner municipality works. When this transition has been understood fully, a third and final research question becomes relevant:

What characterises a frontrunner municipality in relation to climate adaptation actions?

This question thus seeks to generalise the found knowledge of the second research questions, and turn it into a framework for other municipalities to follow. This could for instance be the remaining municipalities in the Capital Region, who have planned their climate adaptation action less well in the climate adaptation plan. Thus, all three questions becomes linked and collectively create a broad problem formulation for this thesis.

1.3 Problem formulation

Based on the three research questions of the problem area, the problem formulation is as follows:

How well are the municipalities within the Capital Region of Denmark planning their actions in the climate adaptation plan; and how have the water utility, companies, citizens, and housing associations been mobilised and utilised through governance activities by a frontrunner municipality in the transition towards successful climate adaptation actions? Finally, what characterises a frontrunner municipality in relation to climate adaptation actions?

2 Theoretical frame

This chapter introduces and explains Transition Management (Loorbach, 2007; Loorbach, 2010) as the theoretical frame used to understand and perceive the case study analysis of this thesis. This case study seeks to answer how the local water utility, citizens, companies and housing associations have been mobilised and utilised through governance activities by a frontrunner municipality in the transition towards successful climate adaptation actions, as well as what characterises a frontrunner municipality in relation to climate adaptation actions. Transition Management as a theory has already been integrated in the problem formulation of this thesis because it has been used to shape the research question. The problem formulation and Transition Management are thus intertwined. The Transition Management has also been used to structure the case study, how it is presented, and the majority of the interviews behind the case study.

The chapter consists of three main sections. First, Transition Management is presented as a theory and governance approach to sustainable development. Second, existing cases, where Transition Management has been applied are presented to give a more practical insight to the theory. Third and finally, Transition Management is adapted to be in line with this exact thesis.

2.1 Transition Management as theory

In the following, Transition Management is introduced as a governance approach, including the Transition Management Framework and the Transition Management cycle, which both are important elements of the theory. However, first, it is argued why climate adaptation can be seen as a transition. This is necessary in order to validate the application of Transition Management on the case of this thesis.

2.1.1 Climate adaptation as a transition

Loorbach (2007) defines a transition as "*a continuous process of societal change, whereby the structure of society (or a subsystem of society) changes fundamentally*" (Loorbach, 2007, p. 18). Transition is thus about a societal transformation. Climate adaptation development and implementation can be seen as a societal transformation and thus as a transition because of the following three characteristics (Loorbach, 2007, p. 18):

- "*It concerns large scale technological, economic, ecological, socio-cultural and institutional developments that influence and reinforce each other*"
- "*It is a long term process that covers at least one generation (25 years)*"
- "*There are interactions between different scale levels (niche, regime, landscape)*"

The process of climate adaptation development and implementation contain all three characteristics, and Transition Management can thus be used to manage and understand such a process:

Even though many of the first Danish climate adaptation plans are only covering a five to ten-year span, the real development of climate adaptation covers more than one generation. Many rain scenarios are looking 50 to 100 years forward, which means that the development of climate adaptation have to do the same.

Furthermore, interactions between niche, regime, and landscape are also taking place. Climate adaptation has started as a niche development, but because of heavy rain events, flooded areas and thus great damage the last couple of years, the theoretical landscape has changed. The politicians have been forced to do something about it. When the Government and Local Government Denmark agreed in 2012 that every municipality had to develop a climate adaptation plan, it created a so-called window of opportunities, allowing climate adaptation to move from a niche development to a part of the water management regime. However, this movement is still ongoing, and is still affected by the continues changes in the theoretical landscape. (Geels, 2002).

Finally, the actual movement of climate adaptation from a niche development to the dominant part of the regime is so comprehensive that it will concern large-scale technological, economic, ecological, socio-cultural and institutional developments. In order to climate adapt, different institutions, companies and the civil society have to plan, develop and implement new and creative technologies. This will cost billions of DKK; but it will change the environmental surroundings significantly. In addition, it will change how the society sees water and water management, as it gradually are being more and more surface based instead of sewer based. Suddenly water becomes more visible and a potential for seeing water as a resource occurs. However, these changes do not just occur one after another. Change is difficult, and the long-term transition of climate adaptation is thus a complex matter.

Loorbach also points out that "*Transition Management focuses at the frontrunners in society, and related to desired sustainability transition, these are frontrunners that promote sustainable development*" (Loorbach, 2010, p. 172). This fits perfectly with the thesis' ambition to approach and analyse the municipal frontrunner in relation to climate adaptation actions. Furthermore, "*it [Transition Management] tries to structure and coordinate those informal networks of actors that, collectively and over time, are able to influence regular policy*" (Loorbach, 2010, p. 172). All this means that Transition Management in fact can be used to create an analytical framework in order to analyse and structure the different actors within the chosen frontrunner municipality and how they affect the development and implementation of climate adaptation actions. However, in order to be able to do so, Transition Management and the underlying mechanisms must first be understood.

For understanding Transition Management properly, this thesis takes point of departure in Loorbach's idea of Transition Management. This include his Transition Management framework and the Transition Management cycle, which will act as key elements in creating the analytical framework of this thesis. The ideas of Transition Management primarily come from Loorbach's book from 2007 '*Transition Management – New mode of governance for sustainable development*', and his academic articles, which contain concretised and slightly renewed thoughts on Transition Management.

2.1.2 Transition Management as governance approach

Governmental top-down steering is an outdated type of effective management mechanism especially in relation to promoting sustainable development. Through the last decades these centralised government-based nation states (at least within western European countries) have

been gradually surpassed by governance, where policies are being developed together with many different social actors. The main benefit with this network-oriented and decentralised, decision-making structure is that: "*interaction between all sorts of actors in network often produces (temporary) societal consensus and support upon which policy decisions are based"* (Loorbach, 2010, p.161). However, societal change cannot be governed without the government type of steering due to the general lack of coordination and direction within governance. New modes of governance must thus in a way accommodate both sides by reducing the lack of coordination and direction while increasing the effect of governmental planning in relation to societal change in the long terms. (Loorbach, 2010) This opens up for Transition Management as a governance approach.

Issues such as climate change involve a great amount of societal and steering complexity. Transition Management addresses this by including elements such as "*actor-network interaction, different levels, different social domains with specific characteristics, plurality of actor perspectives, and new instruments practices and approaches that emerge within the field of steering and government*" (Loorbach, 2010, p.166). These elements can further be explained through complex system theory; however, the most important thing to note is that the elements within Transition Management, makes the transition "*multilevel, multiphase processes of structural change in societal systems*" (Loorbach, 2010, p.166).

Based on the complex system theory, together with the idea of governance and experiences, Loorbach builds a Transition Management Framework, which "*discriminates between different types of governance activities that influence long-term change*" (Loorbach, 2010, p.163). This makes the framework innovative as well as suitable for analysing and structuring ongoing governance processes. Transition Management is innovative because 1) "*it offers a prescriptive approach toward governance as a basis for operational policy models*" (Loorbach, 2010, p.163), meaning that it focuses on finding the best course of action instead of mere suggestions; and 2) "*it is explicitly a normative model by taking sustainable development as long-term goal*" (Loorbach, 2010, p.163).

2.1.3 The Transition Management framework

In order to translate the complexity behind the multilevel and multiphase understanding of transitions, the Transition Management Framework simplifies it into a more manageable size and shape (which is still not too simple nor too prescriptive). It does so by identifying four different types of governance activities: Strategic, tactical, operational and reflexive (Loorbach, 2010). These activities are all related to societal transition and it is through these activities that the Transition Management Framework becomes "*an analytical lens to assess how societal actors deal with complex societal issues at different levels but consequently also to develop and implement strategies to influence these 'natural' governance processes*" (Loorbach, 2010, p.168). The point is that these activities are clearly recognisable throughout any governance process. The four activities and their content are explained as follows (Loorbach, 2010):

Strategic activities are: "*processes of vision development, strategic discussions, long-term goal formulation, collective goal and norm setting, and long term anticipation*" (Loorbach, 2010,

pp.168-169). These activities have in common that they all relate to the 'culture' of the system because they include "*debates on norms and values, identity, ethics, sustainability, and functional and relative importance for society*" (Loorbach, 2010, p.169).

Tactical activities are: *"steering activities that are interest driven and relate to the dominant structures (regime) of a societal (sub-) system"* (Loorbach, 2010, p.169). This relates to the idea of multi-level perspective (Geels, 2002), where the regime is the dominant practices, rules and technologies. The strategic activities include *"all established patterns and structures such as rules and regulations, institutions, organisation and networks, infrastructure and routines*" (Loorbach, 2010, p.169)

Operational activities are: "*experiments and actions […] that have a short-term horizon and are often carried out in the context of innovation projects and programs in business and industry, in politics or in civil society, and are generally referred to as 'innovation'*" (Loorbach, 2010, p.170). Within Transition Management, the term 'innovation' is associated with "*all societal, technological, institutional and behavioural practices that introduce or operationalise new structures, culture routines or actors*". (Loorbach, 2010, p.170)

Reflexive activities are: "*monitoring, assessments and evaluation of ongoing policies, and ongoing societal change*" (Loorbach, 2010, p.170). An important thing with these activities is that they are combined with the three other types of governance activities. This means that they should not be seen as detached activities coming after the actual governance, but as an integrated part of it. (Loorbach, 2010)

Transition Management Types	Focus	Problem Scope	Time Scale	Level of Activities
Strategic	Culture	Abstract/societal system	Long term (30 years)	System
Tactical	Structures	Institutions/regime	Mid term (5–15 years)	Subsystem
Operational	Practices	Concrete/project	Short term (0–5 years)	Concrete

Figure 6: Types of Transition Management / governance activities and their focus. Notice that reflexive is not shown because it is related to the other three activities.

The table above sums up the types of governance activities within Transition Management and what they focus on. By identifying these activities, the Transition Management framework can thus be used to assess how the different actors deal with and contribute to the transition. (Loorbach, 2010). In such, the framework "*[functions] as a structuring tool for the process of Transition Management*" (Loorbach, 2007, p.126). However, the framework can still seem a bit fuzzy in relation to practical use. This is why the Transition Management cycle is subsequently introduced, as a way to put the framework into a more practical frame. (Loorbach, 2010).

2.1.4 The Transition Management cycle: Enabling the framework

Based on the four different governance activities, Loorbach and Rotmans (2006) have created the Transition Management cycle, which consists of four different activity clusters, each representing a type of governance activity. By doing this, the framework makes it possible to implement the Transition Management approach in a more context specific way, where each cluster includes different elements as well as different actors. By managing these elements and actors correctly, the Transition Management cycle can thus be used to navigate a transition successfully. Below, the Transition Management cycle is presented, followed by an explanation of each of the four clusters.

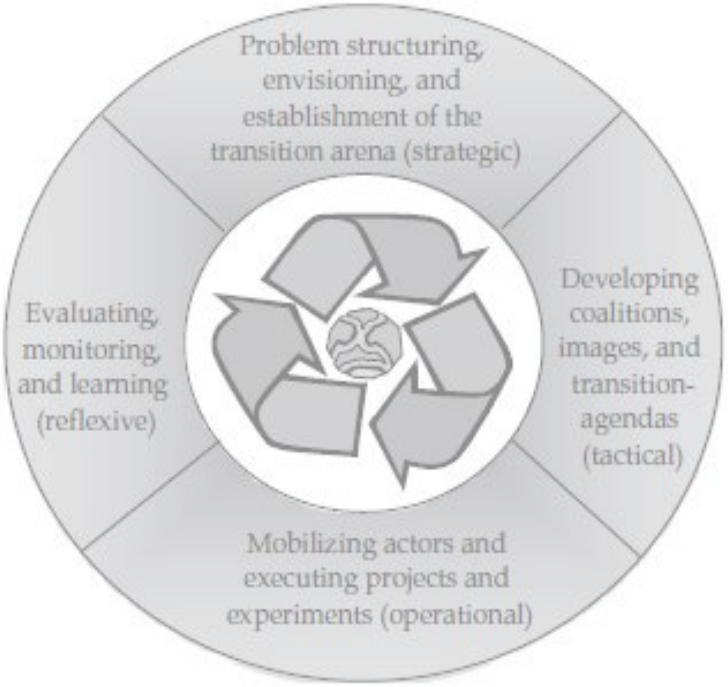


Figure 7: The Transition Management cycle with the four clusters based on the governance activities.

The four clusters of Transition Management (Loorbach, et al., 2008); (Loorbach, 2010):

1. Strategic cluster (long-term time scale) - "*Structure the problem in question, develop a long-term sustainability vision and establish and organize the transition arena*" (Loorbach, 2010, p.172).

The strategic cluster contains the transition arena, which is a network where different frontrunner actors are being identified. Here it is possible for the different actors to share information and understanding in relation to the initial desired problem, which the desired transition stems from. It is within this arena that long-term alternative visions are being developed, and directions of possible solutions for the desired transition are being discussed.

2. Tactical cluster (mid-term time scale) - "*Develop future images, a transition agenda and derive the necessary transition paths*" (Loorbach, 2010, p.172).

The tactical cluster is where the transition agenda is developed. This agenda acts as the compass, which the developers follow through research and learning, and it is furthermore shaped by the vision (from the strategic cluster), and the so-called transition images and transition paths. The images are different scenarios, which accompany the vision. Thus, the images describe the current state of the system, the urgency to act and most importantly the desired future state of the system. The paths are essentially the routes to the different transition images, because they show the changes necessary to achieve the images through intermediate goals. Both images and paths are co-produced through negotiating and exchanging between actors, who represent certain interests and are dealing with developing programmes as well as financial and institutional regulations on a daily basis in relation to the transition. This can also cause regulatory, institutional and economic barriers.

3. Operational cluster (short-term time scale) - "*Establish and carry out transition experiments and mobilise the resulting transition networks*" (Loorbach, 2010, p.172).

The operational cluster contains concrete experiments (actions) that fits with the transition paths and vision. Here, different actors are being mobilised so they contribute to the overall transition. This also includes actors, which have an interest in and/or influence on the experiments in the transition, but do not necessarily deal with it on a daily basis. Ideally, transition experiments ought to complement and strengthen each other, as well as "*[contribute] to the sustainability objective, [be able to] be scaled up, and [be] significant and measurable*" (Loorbach, 2010, p.176).

4. Reflexive cluster - "*Monitor, evaluate, and learn lessons from the transition experiments and, based on these, make adjustments in the vision, agenda, and coalitions*" (Loorbach, 2010, p.172).

The reflexive cluster monitors and evaluates the other three clusters in order to identify potential improvements. General speaking the reflexive cluster looks at how the transition arena functions, how the transition agenda has been implemented, and what insights and impacts the experiments and actions create. This leads to a social learning among the involved actors and could result in a change in the vision, agenda and coalitions if necessary.

2.1.5 Connecting the four clusters of the cycle

Partnerships, coalitions and networks and how they are created, are crucial for all four clusters. In general, it is important to emphasise the special connection between the different clusters. Although, the visual presentation of the Transition Management cycle as well as the apparent order of the four clusters shown and mentioned above, do indicate a certain way, in which the clusters seam connected, this is not the case. It is merely a way of illustrating the importance of

connection between the clusters. In reality, no steps within the Transition Management cycle are actually fixed. (Loorbach, 2010)

In a normal transition process, the strategic cluster might come first because it includes the development of the vision, just as the tactical cluster might come second because it includes the creation of different images and paths on how to fulfil this vision. However, based on what has been going on in the tactical cluster, it could become relevant to go back to the strategic cluster and change something. Also it could become relevant to change something in the tactical cluster, based on something that has been going on in the operational cluster. This is where the strength of the reflexive cluster should be utilised as a sort of ubiquitous or omnipresent cluster. Thus, by being reflexive no matter the cluster, it is possible to cross the Transition Management cycle and change for the better. (Loorbach, 2010). An example would be to go back and change the original vision because it was discovered in the operational cluster that the projects needed for fulfilling this vision were simply not possible in practise or had to be altered significantly, thus changing the outcome.

The reflexivity of the Transition Management cycle is a key element, and makes it a flexible tool for analysing and organising the different governance activities within a transition process. In the end, Transition Management as approach could be described as "*a reflexive approach towards long term social change through small steps based on searching, learning and experimenting*" (Loorbach, 2010, p.178).

2.2 Examples on how Transition Management is used in the real world

Only a limited amount of cases exist, where true Transition Management is applied in the real world. However, Loorbach and others do present different concrete cases, where Transition Management has been used to analyse and structure different transitions.

One example is a case of a region, where Transition Management was used to create more regional cooperation. This was initially through a designing and an envisioning process, where participants were selected in relation to the desired transition of eight Dutch municipalities (*strategic*). The creation of a transition arena was used to define a joint problem as well as define guidelines for the transition and consequently initiate the vision (*strategic*). Through Transition Management, it was also stated that sub-themes of this vision should be further developed in smaller groups (*tactical*). Finally, it was concluded what areas the region should focus on in the future (*tactical*), and concrete actions were then formulated based on the sub-themes in order to transition successfully (*operationa*l). (Loorbach & Rotmans, 2009).

Another and more concrete example (with a relation to climate adaptation) is a company using Transition Management to expand their business opportunities in relation to sustainable roofs. The relevant actors co-created the vision that no roof in the Netherlands should be seen as just a roof, but instead have a synergetic value, and that every roof gradually should be transformed towards being more sustainable (*strategic*). A transition arena was thus created in the form of a platform for different municipalities and their departments in charge of water management, roof manufactures, relevant knowledge institutions and companies. Here the focus was how to

accelerate the transition (*strategic*). This platform then developed a number of ambiguous pathways for this transition including ideas for roof energy, water buffering, air cleaning, heat storage, and cooling buildings (*tactical*). Finally, a number of concrete projects have then been initiated based on the concepts created by the platform, and green roof projects in some of the major Dutch cities have already been completed (*operational*). (Loorbach & Rotmans, 2009).

Even though these two examples of Transition Management are very much different in relation to area and end goal, they both contain governance processes, which can be divided into either strategic, tactical or operational. More cases exist, but they all share this kind of structure no matter the subject. Together, these cases show how wide a range Transition Management can be applied in. While the two examples take place within a regional and a business context respectively, other known cases take place within the industry, different sectors such as the health sector and agriculture, and on a more national and international level. (Loorbach & Rotmans, 2009).

The knowledge about these cases can be used to discuss how to use Transition Management including the framework and cycle, in this thesis.

2.3 Applying Transition Management to the thesis

Transition Management can be complex to work with. In fact, it is not completely ideal as a frame of understanding for the case study of this thesis in its original form and intention. In order to use the ideas of Transition Management, it is thus necessary to change and adapt them to the right context.

2.3.1 Looking backward and structure instead of looking forward and navigate

One of the common characteristics of Transition Management within the existing cases is that it is used as a tool to look forward and steer a transition. It seems that municipalities, companies etc. have deliberately used the clusters of the Transition Management cycle, for instance to create a transition arena with frontrunner actors, and subsequently create different images and paths for new ideas and so on and so forth. This use make sense, since it is how Transition Management was intended. Transition Management requires the observer to be a part of and follow the transition in order to actually be able to manage it. However, because of the timeframe of this thesis, it is impossible to comply with this requirement, given that a full transition can take up to 30 years or even more (see Figure 6). This means that in order to apply the Transition Management framework to the case study, it must be executed in an alternative way.

It varies from municipality to municipality, *when* the transition of climate adaptation started. However, it is fair to say that the transition was initiated for some in 2008, when the national government adopted the overall strategy for climate adaptation, and was officially started in 2012 when it was decided that the municipalities had to create climate adaptation plans. This means that the transition has been more or less ongoing for the last seven years. The transition has presumably been ongoing without the use of Transition Management, but this does not mean that the same governance activities (strategic, tactical, operational and reflexive) do not occur

and have not occurred already. Thus it is assumed that these activities can still be identified using the Transition Management Framework to look backwards in time.

By using Transition Management on a frontrunner municipality in relation to climate adaptation to look backward instead of forward, as other cases have used it, Transition Management becomes an analytical framework for analysing and structuring the governance activities within a frontrunner municipality that have already happened. By structuring these as the Transition Management cycle suggests (into either strategic, tactical, operational or reflexive), a practical overview of what have happened in relation to climate adaptation governance is thus created. The idea here is that by structuring this way, governance activities, which have had a significant influence on the successful climate adaptation within the frontrunner municipality, suddenly become identifiable. Thus, it is possible to pinpoint certain governance activities within certain clusters (or a combination) as significant reasons for successful climate adaptation.

The Transition Management cycle and its clusters defines the structure of how the case study is presented in this thesis. Based on the data, which has been gathered, governance activities are being identified within each of the four clusters. In order to make a general and prescriptive framework for the transition towards successful climate adaptation actions, the Transition Management Framework, as it is exemplified below (see Figure 8), is then used to identify important goals for the transition within each cluster. In addition, important governance activities, transition instruments, and actor capabilities, which are necessary for the goals to be fulfilled are also being identified. (Loorbach, 2007). Furthermore, the necessary actors to involve in each cluster is also integrated in the framework, making it more appropriate. In total, this create a general framework for other and maybe less successful municipalities to follow in their own transition. The advantage with this general framework is that it makes the criteria for municipal participation be based on process and different activity clusters, but it is still not overly rigid. However, all transitions are different from municipality to municipality even though they have roughly the same goal in relation to climate adaptation. This means that if other municipalities adopt this prescriptive framework, the process needs to be discussed and adapted. (Loorbach, 2007).

Type of governance activity	Goals	Activities	Transition Instruments	Capabilities
Strategic	Integration	System demarcation problem structuring	Integrated systems analysis	Systems thinking
	Giving direction	Envisioning	Transition Arena, Transition visions	Creativity, guts, innovative ideas
	Reframing	Exchange of perspectives, developing new discourse	Transition Arena, Integrated systems analysis Transition vision	Communication and network skills, integrative capabilities
Tactical	Translating	Developing inspiring images, strategies	Transition images, transition paths	Creativity, independence
	Agenda-building	Exchange of goals, negotiations, shared goal-formulation	Transition agenda transition coalitions	Thinking in terms of co-production, negotiation skills
	Networking	Coalition building	Transition paths Innovation networks	Communication and consensus building
Operational	Innovation	Experimenting	Transition experiments, testing grounds	Learning and communication
	Development	Implementation	Experiment portfolios	Project management
Evaluation	Social learning	Monitoring and evaluation Inventory of learning experiences	Transition monitoring	Expert knowledge Structuring skills
	Adaptation	Adjustment of vision, agenda New experiments	Participatory evaluation	Reflexive thinking Reflexive attitude

Figure 8: Transition Management Framework divided into goals, governance activties, transition instruments and actor capabilities (actors will be included in final framwork). This illustrated framework is just an example and only illustrates its structuring capacity. The content will be adapted to case study of this thesis.

2.3.2 Incremental vs. transformational adaptation

As previously mentioned, Transition Management is reflexive and happens in small steps. This incremental approach is a key element in Transition Management, where short-term innovations are created within the long-term sustainable transition. However, when it comes to climate adaptation as a transition, it can be argued if an incremental approach is actually sufficient enough or if it calls for a more transformational approach.

The afore-mentioned cases, which also used Transition Management (see Chapter 2.2), where driven by a wish to create business opportunities and more regional cooperation. As a contrast, climate adaptation as a transition has been driven by a direct threat of flooding. Both large climate changes and high vulnerability are seen as major external drivers for a transformational approach to adaptation. This could for instance be dramatic events such as major floods (Kates, et al., 2012), which more than once have occurred in Denmark.

As Kates et al. point out, *"The differences between incremental and transformational adaptation may not always be clear cut*" (Kates, et al., 2012, p. 7156). However, some differences can be made. Park et al. (2012) manage to capture and define transformation quite well:

"*A discrete process that fundamentally […] results in change in the biophysical, social, or economic components of a system from one form, function or location (state) to another, thereby enhancing the capacity for desired values to be achieved given perceived or real changes in the present or future environment*" (Park, et al., 2012, p.119)

This definition means that incremental adaptation is a change, where the incumbent or dominant system or process is maintained, while transformational adaptation is a change, where a fundamentally new system or process are created. The key difference thus lies within the extent of the change being pursued. (Park, et al., 2012).

Climate adaptation (at least as it is seen in this thesis) depends heavily on transformational changes, since it is about creating a fundamentally new rain management system in order to rely less on the else incumbent and dominant sewer system. However, this does not mean that Transition Management, when applied to this thesis, only will identify transformational oriented governance activities, but merely that incremental and transformation change properly co-exist within the context of climate adaptation. Park et al. (2012) express this through a case study of climate adaptation (although within the wine-industry and not water management). As analytical frame, the Transition Management cycle of Loorbach and Rotmans is converted into two concentric, but linked action-learning cycles. Both cycles still include the same four clusters as the original cycle, but they each focus on incremental and transformational adaptation respectively. The notion here is that the transition process jumps back and forth between to two cycles.

Park et al. (2012) also hypotheses that "*the information needs and policy support required by decision-makers to undertake informed and effective adaptation actions, differs according to the extent of adaptation being pursued*" (Park et al., 2012, p.118). Even though the idea of incremental and transformational adaptation is not used actively in the analysis of this thesis, this hypothesis is kept in mind during the discussion. The ability to distinguish between incremental and adaptation, gives a more realistic view on how Transition Management can be seen and perceived within the context of this specific thesis.

3 Methodology

This chapter explains the methodologies behind the research of this thesis. It does so by first explaining the overall research design including a research diagram that shows the research process as well as how the research questions, collected data and analysis are linked together. Next, the data gathering is explained through the research methods used. These methods are divided into either comparative evaluation or case study, since these two are separate analyses of the thesis

3.1 Research design

The research process behind this thesis has been designed as three different phases. The first phase is the problem formulation, where the problem has been formulated through a study of current knowledge about the changing weather patterns and sea level, as well as climate adaptation plans in a Danish context. Furthermore, the problem area have narrowed the scope down to a regional level with the focus on climate adaptation actions in the Capital Region. In the end, the final problem has been formulated as three research questions.

The second phase is a broad comparative evaluation analysis of the climate adaptation actions, which are described in the different climate adaptation plans of the 29 municipalities in the Capital Region. The goal with this analysis is to find out how well these municipalities are planning their actions in the climate adaptation plan, based on indicators inspired by Hofor and the Danish Ministry of Environment. The data behind the evaluation analysis is quantitative and qualitative. Besides the evaluation of the municipal climate adaptation plans, the analysis also includes a survey, which has been sent out to the municipalities in the Capital Region. Solely based on the climate adaptation plans and the ten indicators, an adaptation score has been given to each municipality, in order to determine frontrunners in relation to climate adaptation action planning. Finally, one single municipality has been picked out as frontrunner municipality for an in-depth case study.

The third phase is a single in-depth case study analysis of Gladsaxe Municipality, which has been determined as a frontrunner municipality in relation to climate adaptation action planning from the evaluation analysis. The goal of the case study is to find out how the local water utility, citizens, housing associations and companies have been mobilised and utilised through governance activities by Gladsaxe Municipality in their transition towards successful climate adaptation actions. Prior to the case study, a State of the art research has also been carried with the focus on governance, collaboration and dialogue in relation to the municipal development of climate adaptation.

Transition Management Framework has functioned as the theoretical and analytical framework for the case study, by structuring the analysis into the four governance activity clusters *Strategic*, *tactical*, *operational* and *reflexive,* and identifying the theoretical concepts in the case of Gladsaxe Municipality. The goal of the case study (and the underlying research question) is thus shaped by the use of this framework. The research data behind the case study is qualitative and include elite interviews, archival records and a deeper document analysis. Finally, the strengths and

weaknesses of Gladsaxe Municipality's transition towards successful climate adaptation are being discussed in the context of Transition Management in order to derive a general framework on what characterises a frontrunner municipality in relation to climate adaptation actions. Below is the research diagram, which shows the process of the research and how the research questions, analyses, and data sources and theoretical framework are linked together.

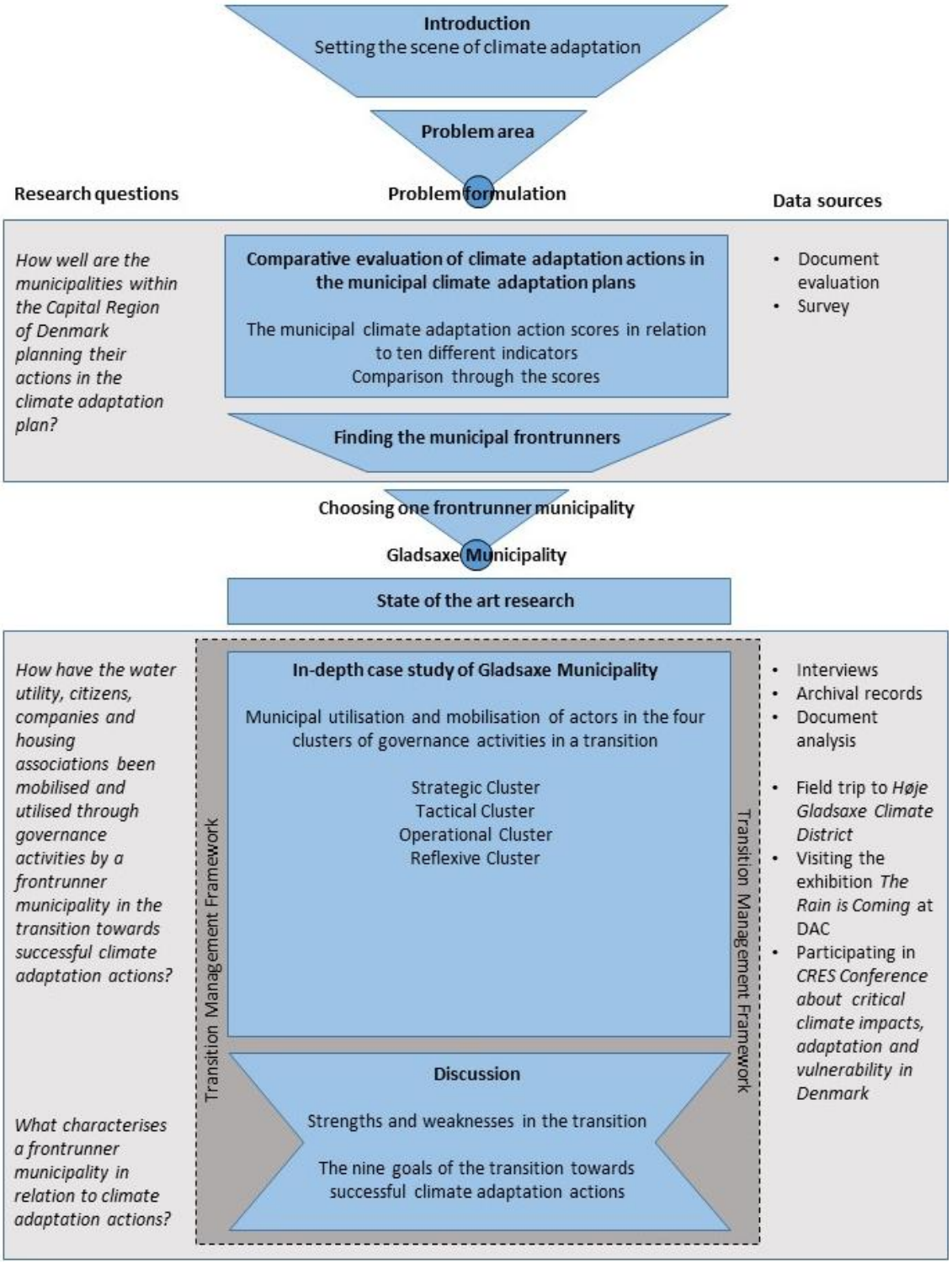


Figure 9: Research diagram

3.2 Research methods for the comparative evaluation analysis

The goal of the comparative evaluation analysis is to find out how well the 29 municipalities in the Capital Region are planning their actions in the climate adaptation plan and to subsequently find a frontrunner that does this better than the others. The research behind is both quantitative and qualitative and consists of a comprehensive evaluation of the municipal climate adaptation action planning in the Capital Region. In order to compare the municipalities, each municipality is being awarded an *adaptation score* based on how ten different indicators are included in the actions within their climate adaptation plan. The adaptation scores determine which municipalities that are frontrunners in relation to climate adaptation action planning and thus eligible for an in depth case study. Although the adaptation score is solely based on the evaluation of the climate adaptation action planning, a survey has been sent out to all 29 municipalities (with 21 responses) in order to validate the evaluation as well as obtain deeper information about the different municipal approaches to climate adaptation. The following sections will explain these two research methods.

3.2.1 Evaluation of climate adaptation action planning

An evaluation is a systematic collection of data, which "*provides a basis for creating knowledge about implementation, organisation, and effects of concrete initiatives, which have been created in order to change the societal conditions*" (Olsen & Rieper, 2014, p.16). In this case, the data is the 29 municipal climate adaptation plans of the Capital Region, while the concrete initiatives are the actions described in these plans.

In order to be able to evaluate and compare the climate adaptation actions within the municipal climate adaptation plans, the content must first become somewhat quantifiable. The solution has been to create a number of indicators that represents important aspects of climate adaptation actions. These indicators and how they were chosen are explained in Chapter 3.2.1.2. By converting each indicator into a score and apply them to each climate adaptation plan, the municipalities thus get a final adaptation score. This final adaptation score is used to compare the different municipalities. In order to make the evaluation a bit more nuanced, the adaptation score also depends on the extent to what each indicator is included. In this evaluation, they can be divided into *fully, partially* or *not included* indicators. This means that the more indicators included in the planned actions and the greater extent they are included to, the better the adaptation score.

3.2.1.1 Scoring and weighting

Below, the different kind of scores are presented according to the level of inclusion as well as a clear definition of the different levels. For visual reasons later on, the different levels and scores have been assigned a colour.

Level of inclusion	Score	Definition of level
Fully included indicator	1	Actions contain an explanation on how the indicator is included
Partially included indicator	0.5	Actions include the indicator but it is not explained how it is included
Not included	0	Actions do not include the indicator in any way

In practise, the procedure has been to go through every climate adaptation plan, while looking for the presence and level of inclusion of these indicators. In order to get the highest score 1, an indicator must be fully included at least once within the actions. The key difference between a fully included and a partially included indicator is the explanatory part. Below is an example on an indicator called *synergies with added value*, where it is partially included:

"*Rainwater has, if possible, to be a part of the urban space as a recreational element as well as increase the natural diversity in the urban areas*" (Allerød Municipality, 2015, p.1).

The example above describes a municipal wish to create different kinds of added values with rain water, however, it is never explained how, for instance through what actions it is going to happen. Below is another example with the same indicator, where it is fully included

"*By utilising the establishment of detention basins by the Ringsted track for connecting the main recreational paths better together, […] we can create a recreational network of paths, maps with nearby experiences, a connection to the municipal sustainable urban drainage system projects, new football fields, and more, which will expand value of experience*" (Vallensbæk Municipality, 2014, p.18).

The example above describes the wish for added value in the form of recreational value, activities, and experiences, but it also explains how to actually obtain these added values. (In this case through the utilisation of specific detention basins).

Figure 10 below illustrates an example on an evaluation of two municipalities and their climate adaptation action planning. It also shows the indicators chosen for the evaluation. As it is seen, the ten indicators have been divided into five categories, although not equally divided. In order to create this equality between the categories, each indicator has been assigned a weighing so each category counts the same. This also, creates a more realistic and fair evaluation of the climate adaptation action planning.

Indicators	Climate adaptation projects	Added value	Other plans	Other municipalities	Water utility	Economy	Financing	Timeframe	Citizens	Businesses	
Categories	**Expected effects**	**Synergies**		**Collaborations**		**Time and money**			**Dialog**		**Adaptation Score**
Weighting	2	1	1	1	1	0,67	0,67	0,67	1	1	
Municipalities											
Hørsholm	1	1	0,5	1	1	0	0,5	0,5	1	1	8,2
Ishøj	1	1	0,5	1	1	0	0,5	0	0,5	0	6,3

Figure 10: Example on evaluation of two municipalities and their climate adaptation action planning.

3.2.1.2 The ten Indicators for the evaluation

The following section explains and exemplifies all ten indicators. Afterwards the process of choosing these indicators is presented.

The ten indicators for the evaluation

Category 1: Expected effects

Indicator 1: Climate adaptation actions

Expected effects of climate adaptation actions are how a certain climate adaptation action is intended to influence the existing system or surroundings. An example could be an assessment on how an implementation would affect the risk of floods or nearby environment.

Category 2: Synergies

Indicator 2: Added values

Synergies with added values are the extra benefits that climate adaptation actions can create besides risk reduction of floods. This added value is often recreational. An example could be a rainwater basin that works as both a rainwater container during cloudbursts and beatification element to a park. However, the added value could also be the possibility for activities such as skateboarding in a dry rainwater basin or a changed local biodiversity through greening.

Indicator 3 other plans

Synergies with other plans are the integration of climate adaptation actions in other municipal plans than the climate adaptation plan. This could for instance be in the wastewater plan, in order to set a more realistic and fair service target for the citizens and companies. It could also be in the Natura2000 plan in order to protect certain plant- and animal species even more. The important thing is how the integration is mentioned in the climate adaptation plan.

Category 3: Collaborations

Indicator 4: Municipalities

Collaboration with other municipalities is the process where a climate adaptation action is developed or implemented together with neighbouring municipalities. Neither rainwater nor seawater know any municipal borders, so it can be crucial for municipalities to work together, especially if they share a catchment area. An example could be a collaboration between the municipalities in order to climate adapt the catchment area of a lake running through both municipalities; or coast municipalities working together in order to climate adapt the beaches and close-lying infrastructure and buildings.

Indicator 5: Water utilities

Collaboration with water utilities is the process where a climate adaptation action is developed or implemented together with the local water utility. Often these utilities have useful resources such as knowledge, work force, and data. They also have the main responsibility for the underground sewer network.

Category 4: Time and money

Indicator 6: (*)Economy

Economy is the estimation of how much the climate adaptation actions will cost to develop and implement. This can be presented either as a total sum of cost for all actions within a municipality or as one cost for each action.

Indicator 7: (*)Financing

Financing is the overview on which actor is going to finance what action and with how much. Typically, the financing is split between the municipality and the local water utility company. Citizens and companies usually finance their own projects.

Indicator 8: (*)Timeframe

Timeframe is the overview of when the climate adaptation actions are scheduled to be initiated and finished. This is often presented on a timetable.

Category 5: Dialogue

Indicator 9: Citizens and housing associations

Dialogue with citizens and housing associations is the municipal involvement of the local citizens and housing associations in relation to climate adaptation actions. Municipalities are only able to climate adapt public property. This means that they are interested in engaging citizens and housing associations in order to make them climate adapt their own property. An example of dialogue could be different communication methods such as campaigns, accessible information material, workshops and information meeting on how to climate adapt. It could also be demonstration projects developed by the municipality in order to educate and inform citizens and housing associations about the possibilities of climate adaptation.

Indicator 10: Companies

Dialogue with companies, is the municipal involvement of the local companies. Just as with citizens and housing associations, the municipality is interested in engaging the companies in order to make them climate adapt their own property. This dialogue can also be campaigns, accessible information material, workshops, information meetings as well as demonstration projects.

(*) In relation to the three indicators *economy*, *financing* and *timeframe*, it is difficult to determine whether they are partially included or fully included according to the original definitions, because they are all more or less based on numbers. Therefore, the level of inclusion depends on whether it is the minority or majority of the actions that is being accounted for in relation to each of the three indicators.

As previously mentioned, the categories (and thus the indicators) chosen for the evaluation, represents important aspects of climate adaptation actions. The selection of categories and indicators are based on suggestions by both the Danish Ministry of Environment and the water utility company Hofor. Both actors have each made a suggestion for what a climate adaptation plan should contain, and both suggestions contain a section with action planning, where certain elements have been suggested for the municipalities to include.

In their municipal guideline on how to create a climate adaptation action plan, the Ministry of Environment suggests "*expected effects, need for information, collaboration partners, economy and finance*" (Danish Ministry of Environment, 2013, p.7) as relevant elements. Hofor's suggestions include "*Additional internal organization […] Establishing cooperation forums […] Detailed knowledge level […] competence development […] Standardisation of authority processing [and] citizen Information*" (Hofor, 2015, p.6).

Although the suggestions from the two actors are overall different, common denominators can be found such as a focus on collaboration/cooperation and knowledge/information. These are the basis for the four indicators *collaboration with other municipalities*, *collaboration with the water*

utility, *dialogue with citizens and housing associations*, and *dialogue with companies*. The indicators *expected effects of climate adaptation actions* as well as *economy* and *financing* are also directly inspired by the suggestion from the Ministry of Environment. The two indicators *synergies with added value* and *synergies* with other plans, have been added because of personal interest but also because it was discovered quite early in the evaluation process that synergies in general seemed to be an important part of the majority of the climate adaptation plans. Finally, the indicator *timeframe* was added, because it seemed to have a natural connection with economy and finance.

In the end, the indicators and categories can be divided into two different groups. Those that only involves the municipality:

- Expected effects of climate adaptation actions
- Synergies with added value
- Synergies with other plans
- Economy
- Financing
- Timeframe

And those that directly involves other actors than the municipalities:

- Collaboration with other municipalities
- Collaboration with the water utility
- Dialogue with citizens and housing associations
- Dialogue with companies

This division has structured the presentation of the evaluation (see Chapter 4). The indicators that directly involves other actors are also directly related to the theoretical term of *governance activities* within Transition Management, which is used as the theoretical and analytical framework for the case study later on. These four indicators are thus important and recurring elements throughout this thesis.

3.2.1.3 Selecting the climate adaptation plans

The climate adaptation plans have been easily accessible through the national climate adaptation forum 'klimatilpasning.dk', which contains a municipal map that includes web-links to the latest climate adaptation related planning in each municipality. The found climate adaptation plans were either an integrated part of the municipal plan or a separate document (although still as an appendix to the municipal plan). However, an additional internet research has also been carried out in order to double check the novelty of the plans. This turned out to be a good idea, since newer information was found in some of the cases. This information includes revised and approved editions of the climate adaptation plans containing new revised actions, and separate climate adaptation action plan documents that concretise the actions even further compared to the climate adaptation plan. This also means that the evaluation and comparison of climate adaptation action planning are actually not solely based on the climate adaptation plans, but in some cases also on separate climate adaptation action plans.

3.2.1.4 Limitations of the evaluation

The evaluation is based on the conversion of relatively complicated text into a simple score. This has led to a less nuanced image of the municipalities and their climate adaptation actions despite the three levels of inclusion (fully, partially and none). This makes the evaluation focus more on the presence of an indicator and less on its actual quality. Another problem is that, for simplicity reasons, an indicator only needs to be included (either fully or partially) at least once in order to count as either fully or partially included. This makes the number of planned actions in a climate adaptation plan, which include the same indicator, irrelevant to the adaptation score. Thus, a municipality, whose climate adaptation actions include certain indicators just once, will get the same adaptation score as a municipality, whose climate adaptation actions include the same indicators twice or more. Loosing this nuanced image is unavoidable when simplifying something this complex. However, in the case study later, some of these nuances will be restored for one of the frontrunner municipalities.

Another limitation is that the evaluation does not contain every indicator important to climate adaptation action planning. In their suggestions for what elements, which action planning should contain, Hofor also mentions the internal organisation, competence development and authority processes. These all relate to the internal mechanisms of a municipality, and are possibly important elements in relation to climate adaptation action planning. However, to involve these elements as indicators would be unnecessary as the climate adaptation plans do not include them.

3.2.2 Survey

A survey is a quantitative (and in this case also qualitative) analysis that is good at creating an overview of the attitudes towards a particular topic. It can be used to obtain a snapshot of the examined subject, and makes it possible to generalise. However, it is not possible to obtain an in-depth focus, as there is no immediate opportunity to ask for a clarification of an answer due to the method's one-way communication. The result of such an analysis is quantifiable, so data can be compared. Surveys are suited to find the dissemination of a phenomenon among a group and then highlight the trends. (Andersen, 2010). The survey is used in this thesis to gain a deeper knowledge about the municipal approach to climate adaptation, which is not accessible through the climate adaptation plans.

3.2.2.1 Distribution

The survey has been distributed to the 29 municipalities in the Capital Region of Denmark through e-mails. It has been distributed through the questionnaire programme SurveyXact, and has been open for two workweeks, from March the 16th 2015 at 12:15 to March the 28th 2015 at 10.00. In addition, a reminder has been sent out March the 23th 2015 at 11:30.

3.2.2.2 Content

The survey consists of 16 questions. (Appendix E). The survey has been shaped in order to gain the respondents' attention and interests. Furthermore, the questions have been formulated in accordance to Ib Andersen's recommendations. (Andersen, 2010, pp. 175-178). These questions are both open and closed. When closed questions have been used, a response option called

'other' has been available, where the respondents have had the opportunity to express themselves. This has been to avoid miscommunication. (Andersen, 2010).

The intention of the survey is to be able to map the work of the municipalities in the Capital Region in relation to climate adaptation planning as well as their work experiences with other stakeholders. The latter relates to the four indicators from the evaluation of the climate adaptation action planning, which involved other actors than the municipality. In addition, information on how the knowledge of the national mobile climate adaptation team (Rejseholdet) has been utilised, has also been gathered though the survey.

3.2.2.3 Responds and respondents

The survey has a response rate of 62 % (18 municipalities). In addition, 10 % (3 municipalities) have answered some of the questions. These answers have been included in the further work. Five of the respondents work as head of the department, which deal with climate adaptation, twelve respondents work as an environmental employee, three as urban planner and one as a climate adaptation employee. The municipal employees answering the questionnaire are thus seen as qualified to answer the questions in the survey. In total, the response percentage and the respondents' occupation improves the reliability of the survey and validation of the data. Below the data about the responds and respondents are shown.

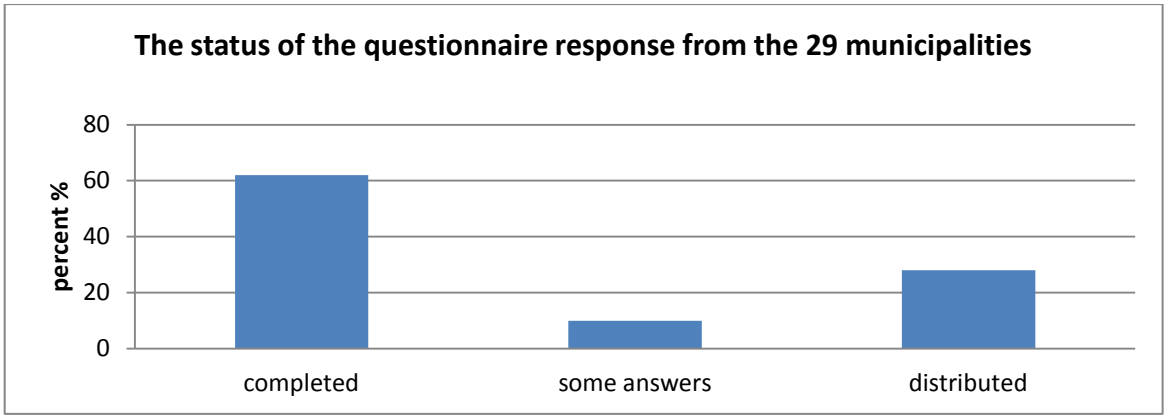


Figure 11: The status of the survey response from the 29 municipalities

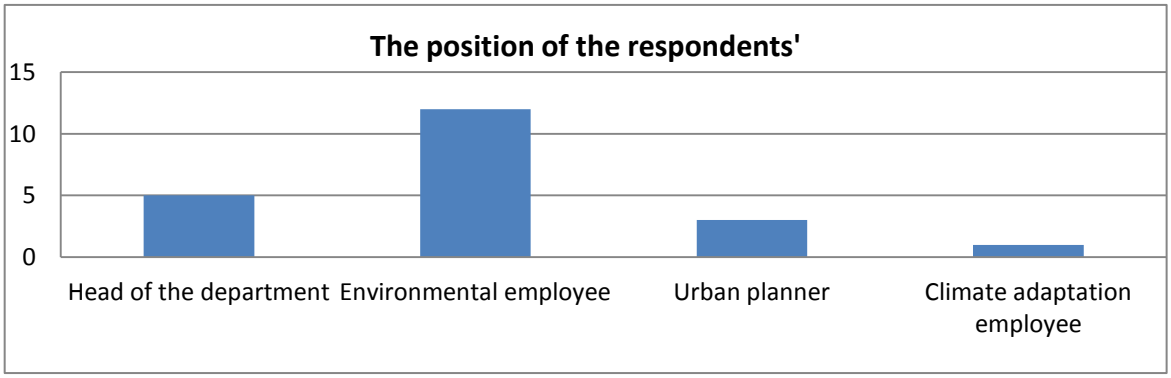


Figure 12: The position of the respondents

3.3 Research methods for the case study analysis

The goal of the case study is to find out how the water utility, citizens, housing associations and companies have been mobilised and utilised through governance activities by a frontrunner municipality (in this case Gladsaxe Municipality) in the transition towards successful climate adaptation actions. Furthermore, it seeks to point out what characterises a frontrunner municipality in relation to climate adaptation actions. It thus takes point of departure in the frontrunner municipality, which was chosen in the comparative evaluation. It is a single in-depth case study of Gladsaxe Municipality based on qualitative data from documents, archival records and five interviews. It uses Transition Management as the theoretical framework and analytical framework. This means that the visual presentation of the case study later is divided into the four governance activity clusters *strategic, tactical, operational and reflexive*. It is thus the municipal mobilisation and utilisation of the water utility, citizens, housing associations and companies within these four clusters, which have been the objective to identify. The case study then concludes with a discussion on the strengths and weaknesses of the Gladsaxe's adaptation transition, which leads to a proposed framework for what characterises a frontrunner municipality in relation to climate adaptation actions.

3.3.1 Collecting data for the state of the art

In order to set the current frame of knowledge in relation to the case study, a state of the art research has been carried out. The focus has been on academic articles dealing with municipal climate adaptation and especially with why collaboration and dialogue are important to the development of climate adaptation and how climate adaptation solutions can be created with the help from external actors. Nordic cases have been preferable in the state of the art, since Nordic countries in general have the same type and magnitude of climate change problems as well as the same planning system and approach as Denmark. However, cases from both Canada and Australia have also been included to underline important points. Furthermore, no articles are older than 2012.

Google Scholar and Aalborg University Online Library have been used as search engines and following search words have been used to frame the state of art:

Climate change adaptation, collaboration, governance, municipality, water utility, citizens, companies etc.

3.3.2 Sources of evidence

A case study is an in-depth and detailed examination of a given case. Case studies are usable when dealing with *how* and *why* a contemporary and uncontrollable (for the researcher) situation or phenomenon is going on. (Yin, 2014). Thus, the very essence of case studies is to try to illuminate a set of decisions, including "*why they were taken, how they were implemented, and with what result*" (Yin, 2014, p.15). All this fits well with the goal of the case study in this thesis, as well as the Transition Management Framework, which focuses on governance activities.

The following sections describe the three different types of sources of evidence used in this case study. These are all based on Yin's *six sources of evidence.* (Yin, 2014).

3.3.2.1 Document analysis

In the comparative evaluation, the climate adaptation plan of Gladsaxe Municipality was the base for the evaluation of the municipal climate adaptation actions planning. However, due to the focus on actions, a lot of information related to the general vision, strategies and tactics of the plan were intentionally left out of this evaluation. This information becomes relevant to the case study and thus a further analysis of the climate adaptation plan is therefore necessary. In addition, the municipal wastewater plan is also relevant to analyse in order to further understand its relation and contribution to the climate adaptation planning in Gladsaxe Municipality.

Other important document data sources are the web pages of both Gladsaxe Municipality, the utility company Nordvand, and KLIKOVAND, which is a collaboration between the municipalities and water utilities in the Capital Region of Denmark. These contain additional information about specific climate adaptation projects.

3.3.2.2 Archival records

In relation to one of the climate adaptation projects in Gladsaxe Municipality (Gedvad), it has been necessary to include minutes and presentations from three workshops arranged by the utility company Nordvand for the local residents of the Gedvad-area. Both have been accessible though the web page of Nordvand. The presentations contain among other things the general agenda for the meetings as well as content of the climate adaptation projects, while the minutes contain the residents' opinions and feedback in relation to the process of the projects they are involved in.

3.3.2.3 Interviews

In order to explore the views, experiences, and motivation of the relevant actors, six people have been interviewed; four of them separately and two of them together. Five of the interviews are elite interviews and the last one is a single stop-interview. The five elite interviews make it possible to achieve a deep understanding of a specific topic, as long as the interviewer is well prepared and has done the research within the interviewee's knowledge domains. "*An interviewer who demonstrates that he or she is well acquainted with the interview subject will get respect and be able to achieve a degree of symmetry in the interview relationship*." (Kvale & Brinkmann, 2009, p. 167). This leads to a much more valuable and beneficial interview. (Kvale & Brinkmann, 2009). This kind of interview demands a proper preparation and needs to be semi-structured, causing the creation of an interview guide with topics and questions to be created prior to the interview. Although the questions could be changed or more questions could be added according to the answers of the interviewees. (Kvale & Brinkmann, 2009). This have contributed to more flexible and adaptive interviews.

In relation to the semi-structured interviews, all but one has been conducted face to face. The last one has been conducted as a phone interview. A phone interview can have certain barriers compared to the face-to-face interview due to the distance between interviewer and interviewee. This can create less trust from the interviewee, which then in return answers limited. In addition, it is also impossible to read each other's body language. This can create misunderstandings; for instance, when sarcasm is used.

3.3.2.3.1 Choosing the interviewees

Due to the goal of the case study, the most relevant actor groups to include for interviews are the municipality, the local water utility, citizens, housing associations and companies. These represent the actors that are able to influence the process of climate adaptation directly. However, due to the fact that the municipal mobilisation of citizens in relation to climate adaptation often happens through housing associations, citizens are less relevant to interview. The following presents the interviewees for the case study as well as the type of interview and its main purpose.

Kathrine Stefansen, Gladsaxe Municipality

- Team coordinator in the department of water and climate, Deputy Chief in the department of utility and finally Project Manager of the climate adaptation group.
- Elite interview, face-to-face.
- The goal of the interview was to achieve a clarification of the municipality's experiences with their climate adaptation transition. Especially, how they have utilised their different capabilities and collaborated with different actors in the four clusters (strategic, tactical, operational and reflexive). (Appendix A)

Lise Jangmark, Nordvand - Project Manager

- Lise primarily deals with the realisation of the projects. She is in charge of the project proposal phase and the preparation of the detailed projects. Lise has the overall view and gathers all the loose ends.
- Elite interview, face-to-face, together with Annette Kolte-Olsen
- The goal of the interview was to clarify Nordvand's experiences with Gladsaxe's and their own climate adaptation transition. Especially, how they have utilised their different capabilities and collaborated with different actors in the four clusters (strategic, tactical, operational and reflexive). (Appendix C)

Annette Kolte-Olsen, Nordvand – Planner

- Annette is used to collaboration with the municipalities, for instance in relation to creating the wastewater plan and climate adaptation plan. She is primarily working with the early stages of projects, where she is dealing with the initial planning and co-creating the strategies. Furthermore, she has been a representative in the municipal climate adaptation group in Gladsaxe.
- Elite interview, face-to-face, together with Lise Jangmark

Dennis Schultz, Gladsaxe Housing Association (Gladsaxe Almennyttige Andelsboligforening (GAA). (GAA owns and manages Marielyst)

- Operating manager at Marielyst and other housing associations departments of GAA
- Elite interview, face-to-face.
- The goal of the interview was to understand their experiences with the collaboration between them and Gladsaxe Municipality as Nordvand when implementing the climate adaptation actions in Marielyst and Kildevænget (the operational cluster). Furthermore, achieve an understanding of how the municipality has contributed to the climate adaptations. Finally, understand their approach and amount of inclusion of the residents. (Appendix B)

Elsebeth Dahl Pedersen, Novo Nordisk in Gladsaxe

- Elsebeth has been the project manager through the first three years of the development of the new head quarter of Novo Nordisk located in Bagsværd. This surrounding landscape of this new construction has a climate adapted focus and Elsebeth has been in charge of the steering group, and worked together with the architects in relation to landscape and building.
- Elite interview, phone interview.
- The goal of the interview was to understand the collaboration between them and Gladsaxe Municipality as Nordvand, and how the municipality has contributed to the climate adaptation. (Appendix D)

Resident in Marielyst Rundgården

- Stop-interview, face-to-face
- The goal of the stop-interview was to get an in-sight of his experiences with the changes made in the now climate adapted Marielyst Rundgården.

3.3.2.3.2 Developing the questions

Since Transition Management is the theoretical and analytical framework for the case study, the majority of the interviews are structured according to the four governance activity clusters strategic, tactical, operational, and reflexive. (See Appendix A,B,C and D). The municipality and water utility Nordvand are the main actor groups in relation to climate adaptation development, and are in the transition process also included in all four clusters. This means that it has been important to ask them questions, which relate to their work with climate adaptation in all four clusters as well, including questions about how they have developed their climate adaptation vision, how they have developed the climate adaptation plan, how they have implemented their projects, how they have evaluated their processes, etc.

GAA and Novo Nordisk are mainly part of the operational cluster, which relates to the actual implementation of the projects. This means that the questions for these actors have mainly been operational cluster related and especially focused on how they have experienced the municipal work with climate adaptation of their own property.

3.3.3 Limitations of case study

The case study is limited to the gathered data, and only the main factors have been included in the analysis. However, the reality is more complex and there are several factors, which also could have been analysed, although these are less crucial.

Due to the problem formulation, only the municipality, water utility, citizens, housing associations and companies are analysed as important actors. However, there are several other actors, who have a role and interest in ensuring the climate adaptation in Denmark in general. The analysed actors have been chosen, because they have the direct power to establish a climate adaptation solution. (see Chapter 5.2 for more).

3.4 Other research methods

While the thesis has been constructed, three excursions have been made to strengthen it.

- March 18th 2015. A guided tour at DAC (the Danish Architectural Centre), on the exhibition "the rain is coming". The exhibition displayed the frontrunner climate adaptation projects/solutions in Denmark, and the visit served as an inspiration for the project, as Gladsaxe's Høje Gladsaxe Climate District was showcased.
- April 20th 2015. Participating in the conference "Critical climate impacts, adaptation and vulnerability in Denmark". The conference contributed with an insight on the Danish climate adaptation work, such as the status and the challenges from different professions. Especially the gained knowledge of the mobile climate adaptation team (Rejseholdet) tasks and amount of municipal use has been utilised in this project.
- May 11th 2015. Field trip to Høje Gladsaxe Climate District, visiting the (almost) finished climate adaptation actions in Marielyst (Rundgården) and Høje Gladsaxe Sports Park. The trip provided an impression of the climate adaptation plan's results.

4 Comparative evaluation of the climate adaptation action plans

This chapter presents the comparative evaluation of the climate adaptation actions within the 29 different municipal climate adaptation plans in the Capital Region. The goal is to find out how well these municipalities are planning their actions in the climate adaptation plan, and subsequently find the frontrunner municipality that has the best set of actions. This is done by applying the ten indictors developed specifically for this evaluation, which convert the content of the actions into adaptation scores. The municipality with the highest adaptation score is the frontrunner and is thus eligible for further study in the case study later on. The evaluation is also supported by data from the survey sent out to the municipalities, although it does not affect the adaptation score. (see Appendix E).

First, the chapter explains the municipal experiences with climate change based on the survey in order to set the scene. Next, the actions within the climate adaptation plans are being evaluated collectively based on the indicators. This is to show how the region in general has dealt with planning the actions. This section will also bring out concrete examples in relation to some of the indicators. Then the municipalities all get an adaptation score based on the indicators, and the frontrunner is thus identified. In addition, a final section reflects upon possible factors and characteristics that 'well-planned' municipalities share.

An important thing to mention is that Allerød is the only municipality in the region, which has not published a full climate adaptation plan yet. However, they do have a section about climate adaptation within their municipal plan, which describes their main goal and intentions. These have been the base for the evaluation of Allerød Municipality, although they are incomplete compared to a genuine climate adaptation plan. Nevertheless, the evaluation is not taken this into account, and are thus treating Allerød on equal terms with the other municipalities.

4.1 Introduction - Dealing with climate change and adaptation

In order to set the scene for the actual evaluation of the climate adaptation actions, the following two sections contain the municipal experiences with climate change, including what kind of impacts they have felt; as well as the main challenges in relation to developing the climate adaptation plans.

4.1.1 The municipal experiences with climate change

With the purpose of achieving a better understanding of the municipalities' experiences with climate change, a survey has been sent out. (Appendix E). The survey finds that all of the responding municipalities have experienced one or more floods within the last 10 years. The survey further finds that the municipalities are experiencing the climate change in multiple ways. The diagram below illustrates that the impact of extreme precipitation is felt the most (90 % of the municipalities) compared to other impacts. The second and third most felt impacts are from the rising sea-level and change in the groundwater balance. Both extreme precipitation and rising sea-level are visual problems, as they are causing floods. This might be the reason why people is especially aware of these two impacts. Finally, one municipality has highlighted the coastal

damages, and only two municipalities experience drought during summer as a problem. This can have many reason, but it could be because the municipalities see drought as a problem that the citizens must manages themselves completely, or because the municipalities do not experience the Urban Heat Island effect, as much as southern European cities for instance do. The fact that municipalities are aware of floods from rain and sea can also be seen in how they consider climate adaptation. 45 % of the municipalities consider adaptation as being important to the municipality to some extent, while 55 % consider it as very important to the municipality. It is therefore no doubt a topic, which is receiving a lot of municipal attention.

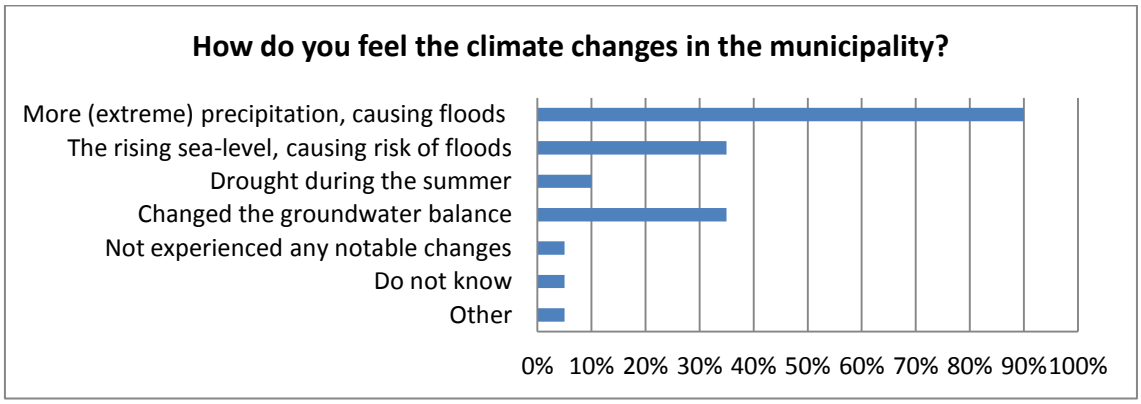


Figure 13: The municipalities' experiences with the climate changes. They could choose as many statements as they agreed with.

4.1.2 Dealing with climate adaptation

In relation to answering on what the biggest challenge has been when developing the climate adaptation action plan 47 % of the municipalities have mentioned the coordination with the external actors (such as utilities, consultants, neighbouring municipalities). Getting the necessary map data and coordinating the work within the municipality have also been a significant challenge.

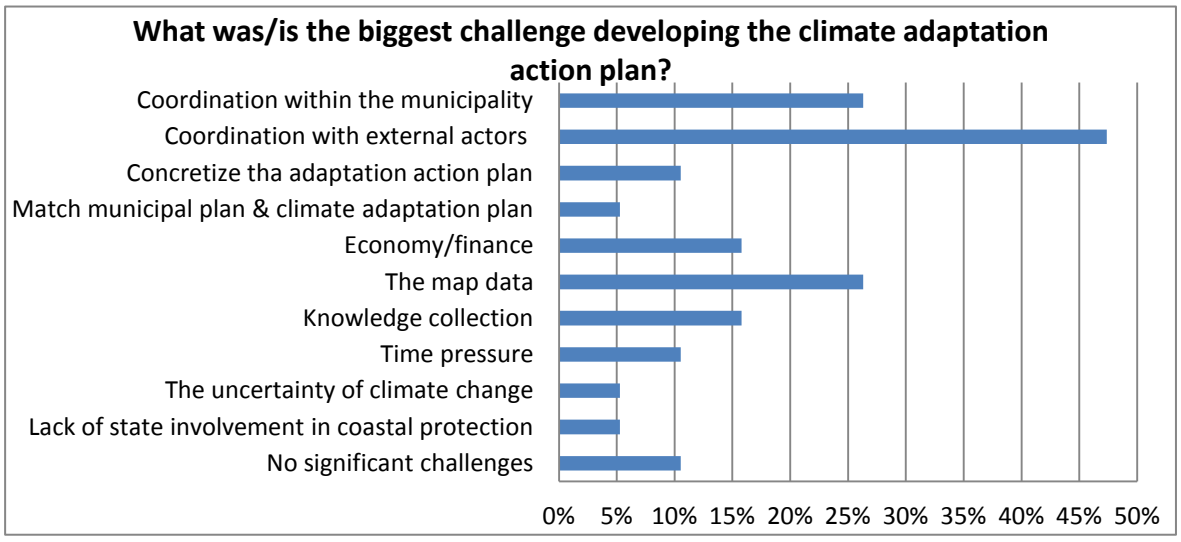


Figure 14: The biggest challenge when developing the climate adaptation action plans. Free space was given for the municipalities to fill in their answer. The statements are summarized in this graph.

4.2 Evaluation of climate adaptation actions

The evaluation of the actions within the climate adaptation plan is based on ten indicators. The definition of these indicators as well as why they were chosen are stated in the methodology chapter 3. Below are the ten indicators presented together with how they each have been included in all the municipal climate adaptation actions combined. This means that *synergies with added value* for instance is fully included in 90 % of all climate adaptation plans in the Capital Region, while being partially included in the remaining 10 %.

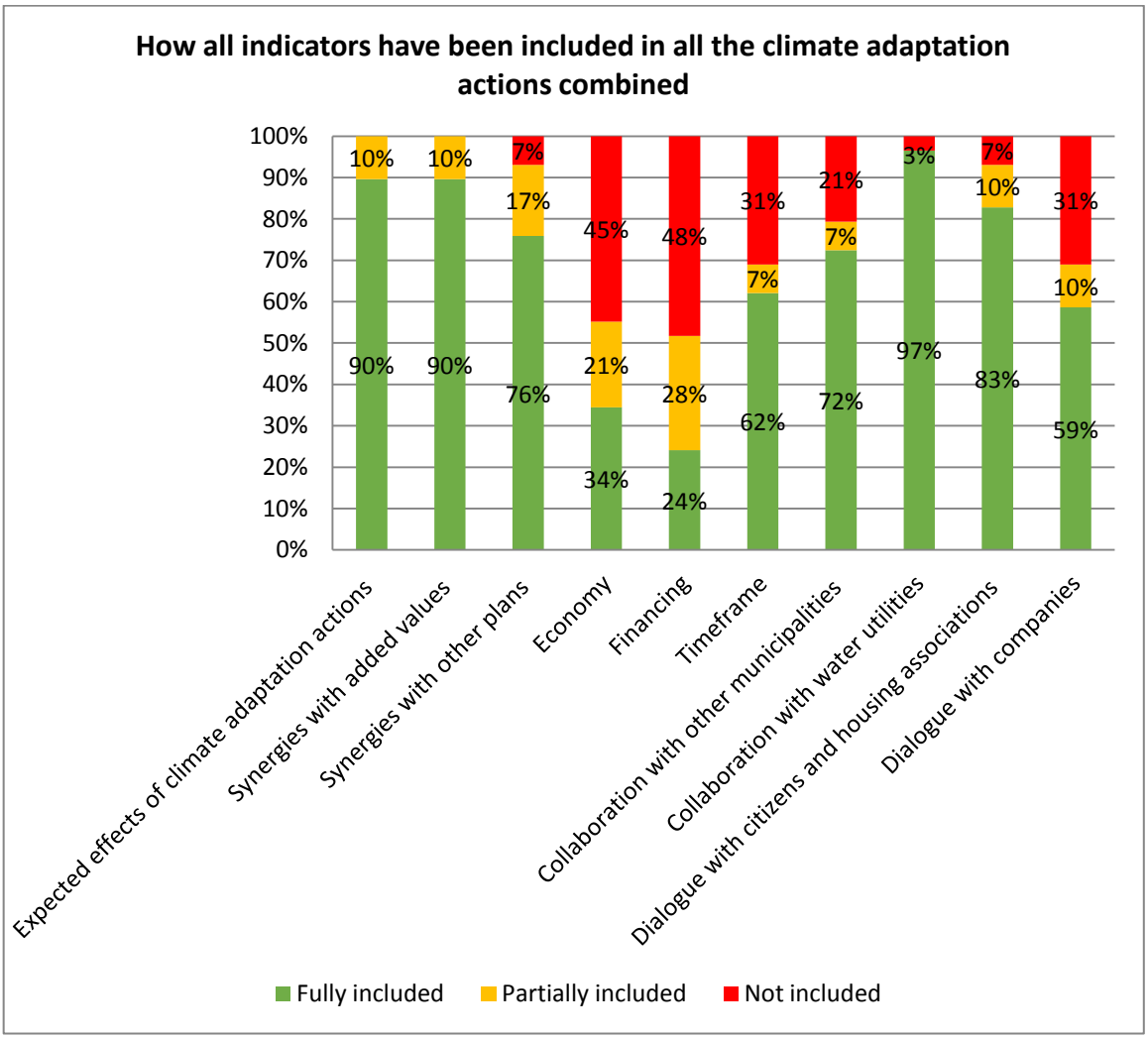


Figure 15: How all indicators have been included in the all climate adaptation plans combined. (Appendix F)

Level of inclusion	Definition of level
Fully included indicator	Actions contain an explanation on how the indicator is included
Partially included indicator	Actions include the indicator but it is not explained how it is included
Not included	Actions do not include the indicator in any way

4.2.1 Dealing with climate adaptation actions through expected effects, synergies as well as time and money.

This section deals with the indicators that are influenced mainly by the internal municipal work with climate adaptation. These include the indicators *Expected effects of climate adaptation actions, Synergies with added values, Synergies with other plans, Economy, Financing and Timeframe.* The section also involves relevant data from the survey and concrete examples to show how the indicators have been included.

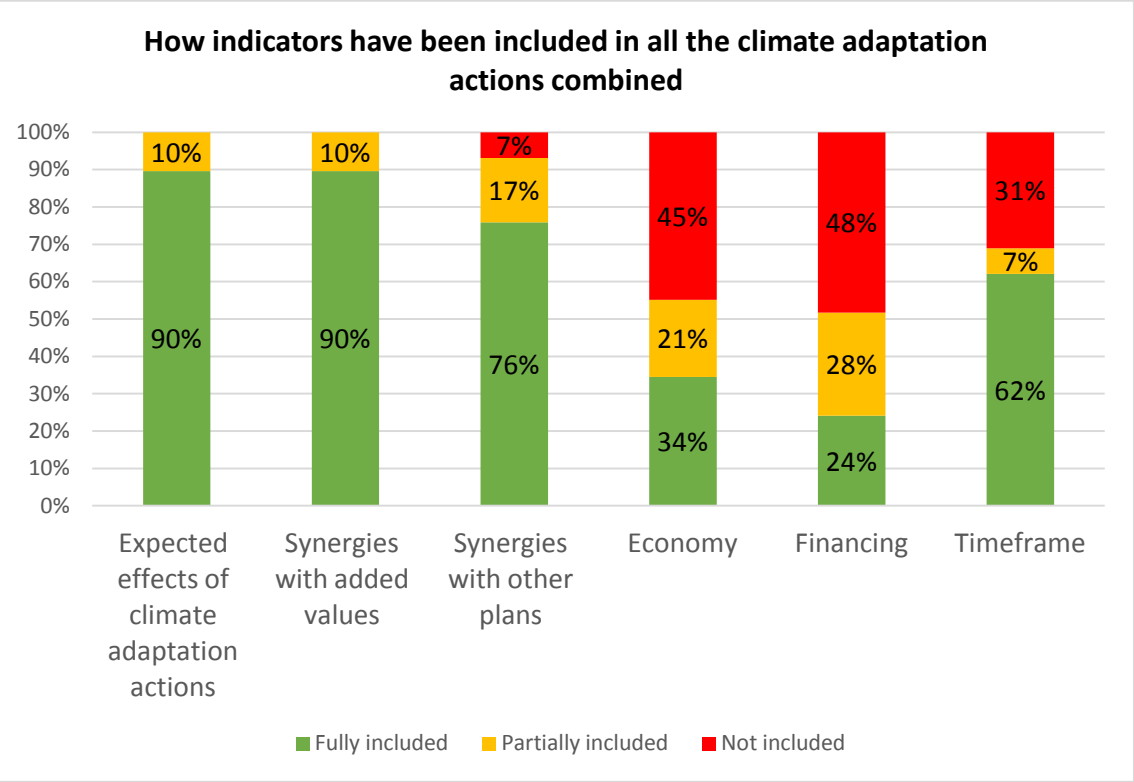


Figure 16: How indicators (that are not influenced by other actors than the municipality) have been included in all the climate adaptation plans combined.

4.2.1.1 Expected effects

The indicator *expected effects of climate adaptation projects* concerns how a climate adaptation action addresses the climate problems and/or in what way the action is going to influence the surroundings. According to the evaluation, the municipalities are doing very well within this indicator, as 90 % of the municipalities fully include the indicator, while the remaining 10 % partially include it.

Most municipalities have chosen exact projects and ranked them in the order, which they need to be implemented. This is done based on the risk mapping. Some even divide the actions into themes according to what problem they address, such as *risk due to the extreme rain*, *rising sea level*, *groundwater level* (Gentofte Municipality, 2014); (Dragør Municipality, 2014). Other themes depends on the area such as *urban areas*, *rural areas* and *further investigation* (Fredensborg Municipality, 2014); (Hillerød Municipality, 2013). Other are based on the timeframe such as

short, *middle* and *long-time* framed actions. (Frederikssund Municipality, 2014); (Hørsholm Municipality, 2014). The concreteness of the actual actions varies from plan to plan. Albertslund Municipality has, as other municipalities, decided to use a table to list the actions and rate the expected effect within certain areas. (See Figure 17). The actions are evaluated in relation to expected effects on climate adaptation, cloudburst securing and different synergetic affects. Overall, Albertslund has done a very thorough and communicative work in relation to this indicator. (Albertslund Municipality, 2012).

	Aktivitet	Status	Primæreffekter	
			Klimatilpasning	Skybrudssikring
KOMMUNE				
R	Klimasikring af Albertslund Centrum	2012-2013	xxx	xxx
R	Demonstrationsprojekt, håndtering af vejvand ved LAR	2013	x	x
R	Demonstrationsprojekt på kommunale bygning	2012-2015	x	x
R	Grøn struktur	2012-	xx	xx
R	Udvikling af Hersted Industripark	2012-2025	xxx	xxx
KR	Spildevandsplan	2013	xxx	xxx
R	Vandforsyningsplan	2013	x	o
R	Lokalplanlægning	2012-2013	xxx	xx
FORSYNING				
K	Risikokortlægning	2011-2012	xxx	xxx
B	Beredskabsplanlægning	2011-2012	xxx	xxx
BR	Øge kapaciteten i Rådhusbassin og Kanalen	2012-2016	xxx	xxx
R	Udbygning af bassinkapacitet i Store Vejle Å dalen	2012-2015	xxx	xx
R	Nyt vådområde i Kongsholmparken	2013	xxx	xx
R	Øget bassinkapacitet i Egelundsparken	2012	xxx	xx
KR	Hersted Industripark	2013-2025	xxx	xx
R	Tilbagebetaling af tilslutningsbidrag for regnvand	2011-	x	x
R	Renovering af kloaksystemet	2012-2025	x	xx
SAMARBEJDER				
KR	St. Vejle Å samarbejdet	2012-	xx	xx
KR	Harrestrup Å	2012-	xx	xx
KR	Vestskoven	2012-	x	o
R	Vand i Byer (VIB)	2010-2014	xx	xx
R	Demonstrationsprojekt af permeabel belægning	2012	x	x
R	Gate21	2012-	xx	xx
KR	Green Cities	2012-	x	x
KOMMUNIKATION				
	Kommunikation	2012-	xxx	xxx

K = kortlægning, B = beredskab, R = robust regnvandssystem

0 = ingen effekt, x = god effekt, xx = større effekt, xxx = størst effekt

Figure 17: Albertslund Municipality's climate adaptation plan - List of actions as well as their level of expected effect (number of x's) on climate adaptation and cloudburst securing. Water environment, biodiversity, recreational value, actor involvement and demonstration value, has also been assessed as an effect.

4.2.1.2 Synergies

Synergies with added value relates to the extra benefits that climate adaptation actions can create besides the risk reduction of floods. According to the survey, 56 % of the municipalities strive to achieve synergetic effects when adapting to the climate change. 39 % do it to some degree, and 5 % do not consider it. The synergistic effects are therefore an elements, which many municipalities are aware of and are utilising while planning climate adaptation actions. More or less the same trend is observed through the evaluation of the climate adaptation plans, where 90

% of the municipalities fully include synergies with added values as an indicator and the remaining 10 % partially include it.

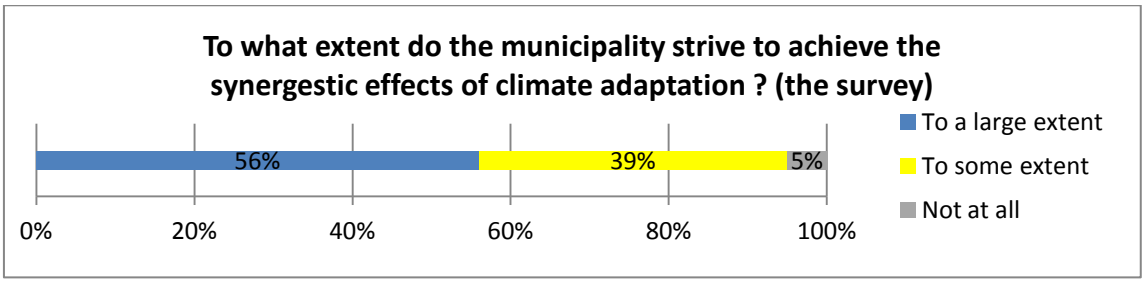


Figure 18: To what extent do the municipality strive to achieve the synergistic effects of climate adaptation? (The survey)

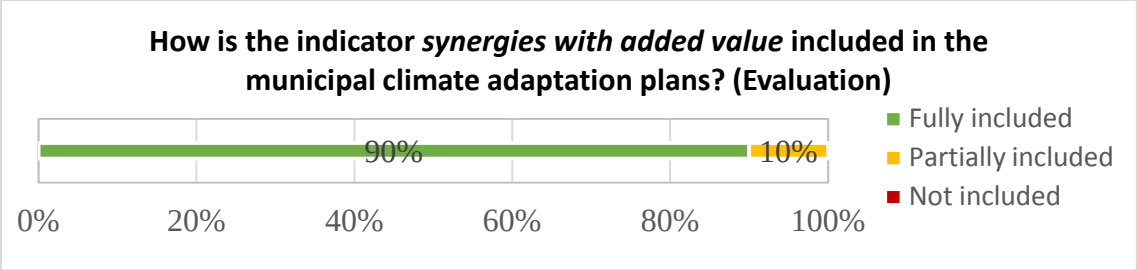


Figure 19: How is the indicator synergies with added value included in the municipal climate adaptation plans? (Evaluation)

Most of the municipalities in the survey mention that climate adaption actions lead to an increased recreational value, while some mention that it leads to a more attractive city, identity creation, security, multi-functionality and more varied urban spaces. The same trends appear in the climate adaptation plans. Here most municipalities focus on the recreational value, where rainwater is seen as a resource through the development of sustainable urban drainage systems (SUDS). Albertslund Municipality even rates the synergistic effects of each climate action similar to how they rate the expected effects. (see Figure 17). This includes the water environment, biodiversity, the recreational value, involvement of citizens and the demonstration value. Each action is assessed as having no effect, good effect, bigger effect and biggest effect in relation to these synergies. By doing it like this, the synergetic effect of a climate adaptation action becomes clear. (Albertslund Municipality, 2012).

Synergies with other plans relate to how the climate adaptation plans integrate actions in other municipal plans. The evaluation of the climate adaptation actions shows that the majority of the municipalities are doing a great job in including synergies with other plans. 76 % of the municipalities fully include synergies with other plans, while 17 % partially include it. Finally, 7 % do not include it in any way. The amount of mentioned synergies with other plans varies, but most municipalities mention the wastewater plan, the municipal plan, local plans and the municipal emergency plan. For instance has Gentofte Municipality made a table in their climate adaptation plan showing what other plans that are involved in the climate actions. This is mostly

the municipal plan, local plans, wastewater plan, green structure plan, infrastructure plan and Natura 2000. (Gentofte Municipality, 2014).

Finally, in relation to synergies, a so-called word-cloud has been created. This cloud contains the words, which the municipalities associate with climate adaptation the most. The bigger the word, the more it has been mentioned by different municipalities. SUDS (sustainable urban drainage systems) is the most climate adaptation associated word, but also urban, dikes, rainwater, water, green, cloudburst, greening and recreational are repeated relatively often.

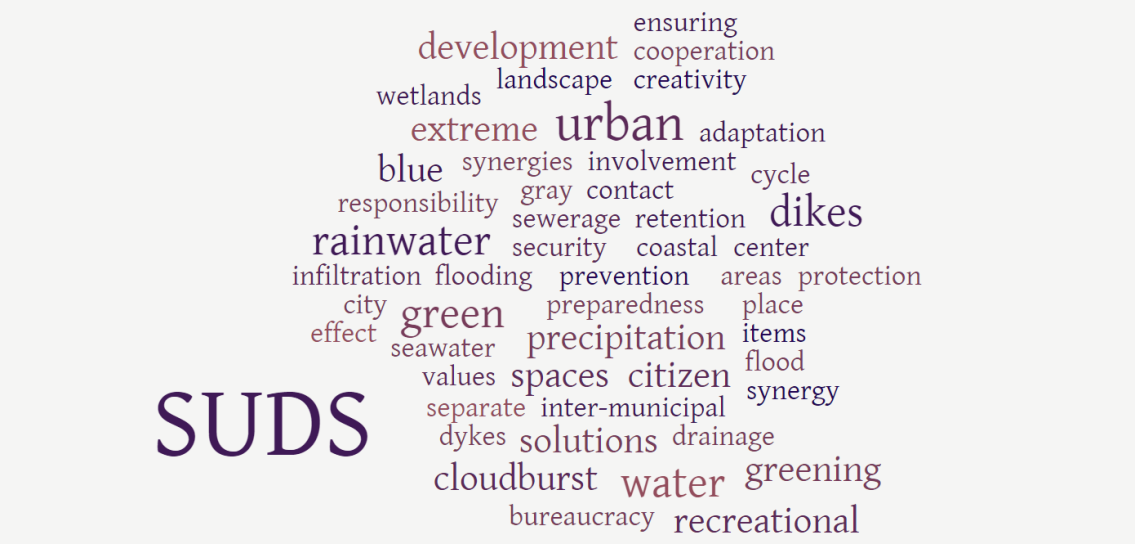


Figure 20: Word-cloud of what the municipalities associate with climate adaptation.

4.2.1.3 Time and money

Time and money is an important category, as it secures the implementation of the needed climate adaptation actions in time, even though the projects may well be secured in other ways than reflected in the climate adaptation plan. The municipalities are not as strong in this category as in the others. The municipalities are doing a mixed job at including the economy indicator in the climate adaptation actions. 34 % of the municipalities fully include economy as an indicator, while 21 % partially include it. Finally, 45 % do not include it at all. The municipalities who have included the economy in the climate adaptation actions have estimated the cost of the climate actions or most of the actions. These are often shown in a table. See Figure 21 for an example. (Egedal Municipality, 2015).

At including financing in relation to climate adaptation actions, the municipalities are doing a mixed job as well. 24 % of the municipalities are fully including financing as an indicator, while 28 % partially include it. Finally, 48 % do not include the financing at all. Most of the municipalities, who have looked into financing, have divided the actions into who is responsible for construing it and thus responsible for financing it. Often this is either the municipality, the water utility or the private property owners (when establishing their own climate adaptation solutions). Copenhagen, Høje Tåstrup, Frederiksberg, Egedal and Bornholm municipality have found the responsible actors to finance each of the concrete climate action, and have therefore clearly placed the responsibility.

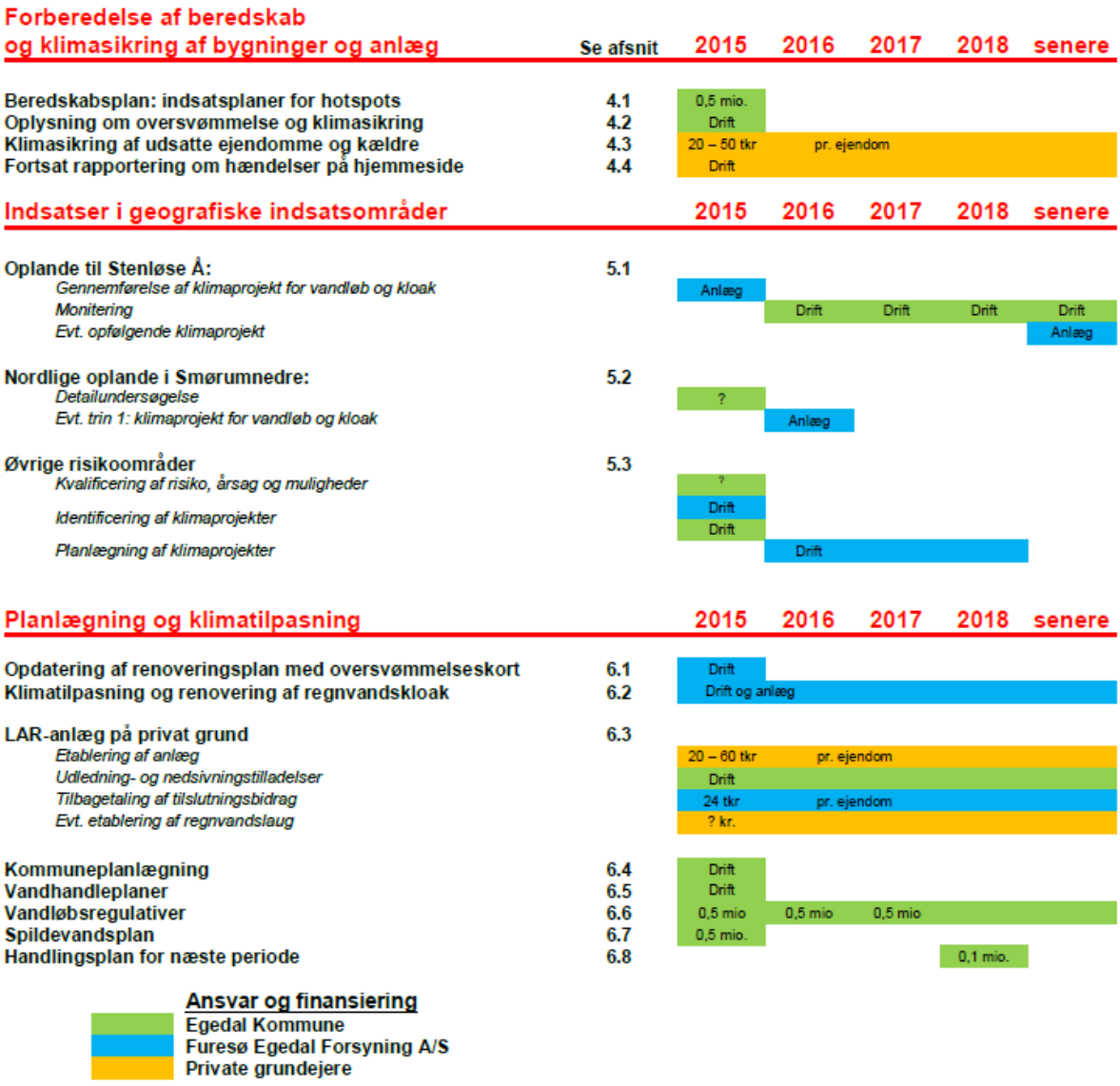


Figure 21: Egedal Municipality's climate adaptation plan, with time schedule for different climate adaptation actions including economy and financing for all actions.

In including the timeframe of the implementation of the climate adaptation actions in the climate adaptation plan, the majority of the municipalities are doing a great job. 62 % of the municipalities fully include timeframe as an indicator, while 7 % partially include it. Finally, 31 % do not include it at all. The timeframes often run three to five years into the future. Others, such as Gentofte Municipality has most of their actions time framed as either 10 or 50 years into the future. (Gentofte Municipality, 2014).

4.2.2 Dealing with climate adaptation through collaboration and dialogue

The section deals with the indicators that are influenced by other actors besides the municipality itself. These include the indicators: *Collaboration with other municipalities, Collaboration with water utilities, Dialogue with citizens and housing associations* and *Dialogue with companies.* The section also involves relevant data from the survey and concrete examples to show how the

indicators have been included. This section is especially interesting because these indicators are related to the ideas of Transition Management, which is being applied in the case study later on. These four indicators thus create (together with the municipal frontrunner) a connection between the comparative evaluation of the climate adaptation actions and the case study.

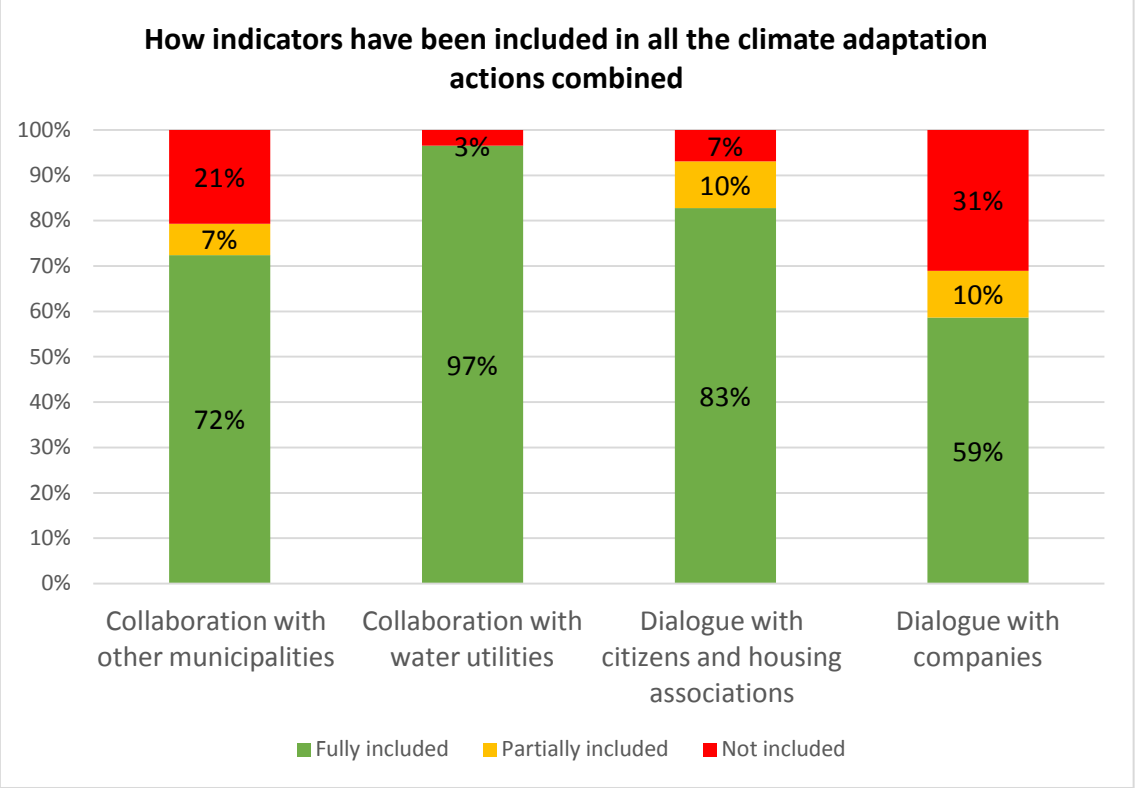


Figure 22 - How indicators have been included in all the climate adaptation actions combined (Evaluation)

4.2.2.1 Collaboration

Since water do not know any municipal-boarders, chances are that two or more municipalities share catchment areas. This makes inter-municipal collaborations quite relevant in many cases, and it is therefore an important indicator in the evaluation. According to the survey, 67 % of the municipalities collaborate with neighbour municipalities in relation to climate adaptation actions, 28 % of the municipalities do not, and 6 % are planning to collaborate with other municipalities. This suggests that many municipalities are aware of the importance of the inter-municipal work. This is also relatively in line with the climate adaptation plan, where 72 % of the municipal climate adaptation plans fully include *collaboration with other municipalities* as an indicator, while 7 % partially include it, and 21 % do not include it at all. However, it is difficult to criticise the municipalities, which are not collaborating with other municipalities. Since inter-municipal collaboration is very much influenced by geography, some neighbouring municipalities may not share any critical catchment areas, which makes close collaborations less important. Other municipalities, such as the Regional Municipality of Bornholm, does not even have a neighbouring municipality. Thus, a full understanding of inter-municipal collaboration in relation to climate adaptation (and lack thereof) demands a further study in the regional and municipal geography as well as risk areas. However, it is not a part of this thesis.

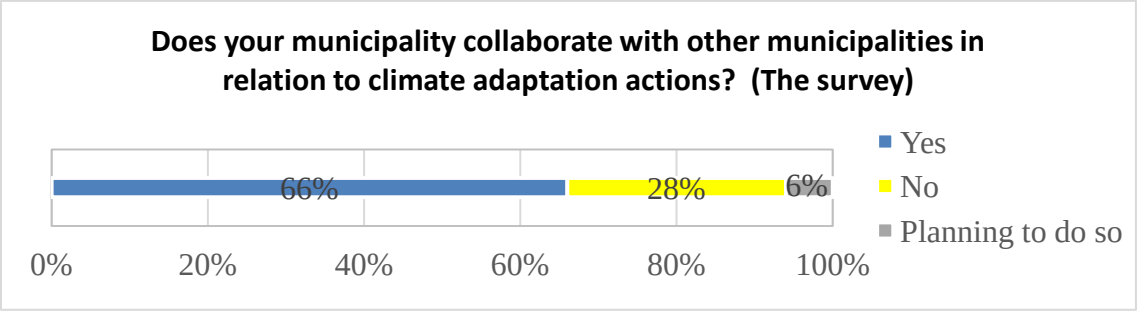


Figure 23: Does your municipality collaborate with other municipalities in relation to climate adaptation actions? (The survey)

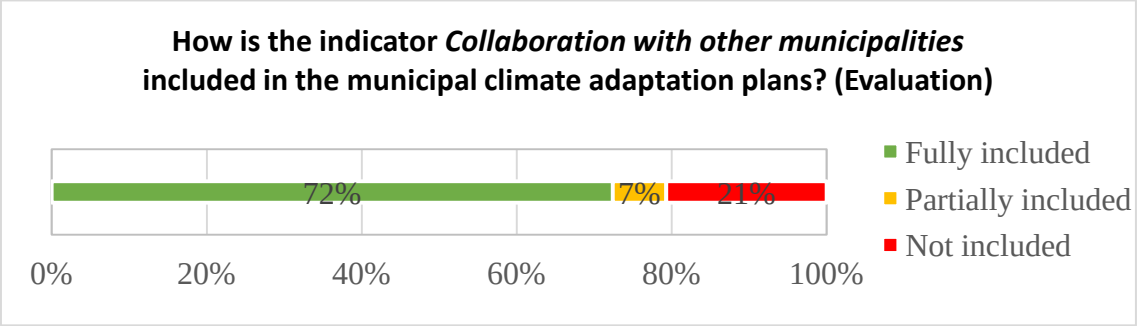


Figure 24: How is the indicator 'Collaboration with other municipalities' included in the municipal climate adaptation plans? (Evaluation)

Examples on inter-municipal collaboration in relation to climate adaptation could for instance be the collaboration between Fredensborg, Hørsholm and Rudersdal. These three municipalities share the Usserød Å, which have caused floods and damages and thus resulted in the municipalities beginning to solve the problem together. (Fredensborg Municipality, 2014; Hørsholm Municipality, 2014; Rudersdal Municipality, 2014). Another example is the collaboration between the northern coast-municipalities Helsingør, Gribskov and Halsnæs, which have created a joint working-group in order to investigate the possibilities for and interest in securing properties, constructions, beaches, recreational areas and culture values. (Gribskov Municipality, 2014; Halsnæs Municipality, 2014) However, properly the best and strongest collaboration is between Brøndby and Vallensbæk. These two neighbouring municipalities have acknowledged the fact that they have the same challenges in relation to flooding, which is why they have developed an overall climate adaptation strategy together. This have resulted in 14 joint actions between 2013 and 2015. These include among other things climate protection of infrastructure, emergency plan for extreme rain and flooding, risk management for municipal buildings, coordinating warning systems, demonstration projects with sustainable urban drainage systems, and a joint working-group for the so-called *Green H*. The joint working-group is especially interesting because its purpose is to coordinate and identify specific possibilities for creating synergetic added value with other planning across the two municipalities in relation to climate adaptation.

Since water utilities among other things are in charge of maintaining the sewers and managing the wastewater, it is assumed from the beginning that municipalities are in a close collaboration

with their local water utility company, when developing climate adaptation. This is clear in the document analysis where 97 % of the municipalities fully include the collaboration with water utility, while the remaining 3 % do not include it at all.

There is plenty of examples on how municipalities and local water utilities are collaborating. Typically, the area of focus is divided clearly. Many water utilities are maintaining and dimensioning the sewer systems with a climate adaptation factor, while the municipalities take care of everything above the surface. Even though it is divided like this, collaboration is still embedded in the planning, also because the municipalities often own the utilities. However, good examples on close collaboration between the municipality and water utility with creative, far-reaching solutions is for example Albertslund Municipality. Here, the responsibility of the water utility is to ensure a robust rainwater system, but together with the municipality, this is revolving around creating synergies within the climate adaptation activities such as including the water environment, biodiversity and recreational value in the projects. (Albertslund Municipality, 2012). Another is in Dragør, where the municipality is working together with Hofor in order to analyse how the edge of the town can be utilised for recreational rainwater buffer zones. (Dragør Municipality, 2014). Frederikssund Municipality is also in close collaboration with the local water utility, which is analysing the sewers for problems and possible solutions as well as initiating new drainage systems for roads in order to minimise the flood problem from the extreme rain. (Frederikssund Municipality, 2014).

4.2.2.2 Dialogue

When looking closer at the indicator dialogue with citizens and housing associations, it is clear that most municipalities are doing a great job. The survey looks into to what extent the climate adaptation actions of the citizens are essential for a climate-adapted municipality, 72 % of the municipalities answered *to a large extend* while 28 % answered *to some extent*. No one answered *not at all*. Thus, it seems that the initiatives of the local citizens play a general important role in the climate adaptation development within the municipalities. This also fits well with the results from the evaluation of the climate adaptation actions, where the municipalities in general do a great job in planning actions, which are intended to inform and motivate the citizens to climate adapt their own property. 83 % of the municipal climate adaptation plans fully include the dialogue with citizens and housing associations as an indicator, while 10 % partially include it. Finally, only 7 % do not include it at all. Both the survey and the evaluation thus show a similar positive attitude and willingness to include and engage the citizens and housing association in relation to climate adaptation.

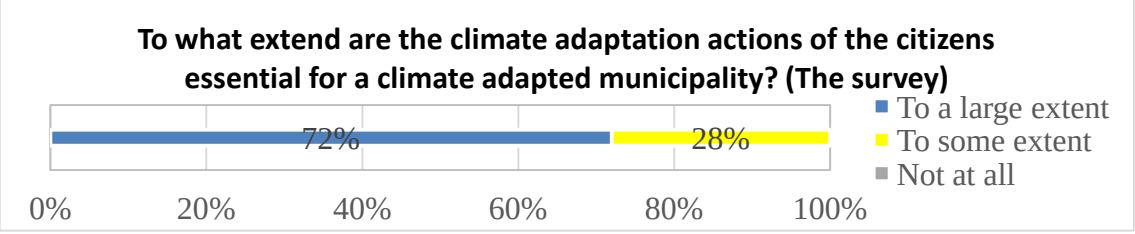


Figure 25: To what extend are the climate adaptation actions of the citizens essential for a climate adapted municipality? (The survey)

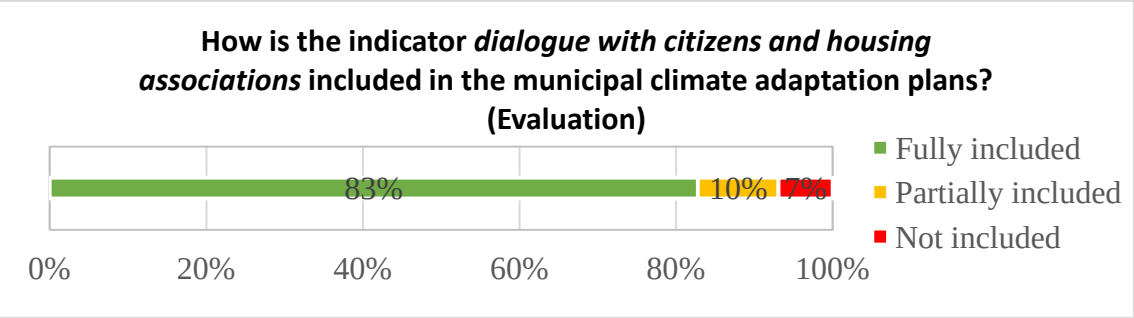


Figure 26: How is the indicator dialogue with citizens and housing associations included in the municipal climate adaptation plans? (Evaluation)

In relation to companies, which sometimes own larger impermeable properties, the survey shows that 50 % of the municipalities answered that it to *a large extend* is essential that companies implement climate adaptation in order for the municipality to become fully climate adapted. The other 50 % answered that they agreed *to some extent* with this. Again, no municipality answers *not at all*. Thus, it seems that municipalities in general rely less on companies than on citizens when climate adapting. This is also reflected in the climate adaptation plans, where 59 % of the municipal climate adaptation plans fully include the indicator *dialogue with companies*, while 10 % partially include it. Finally, 31 % do not include it at all. Although the majority do include this indicator fully, the result shows a significantly less municipal focus on actions which include and engage the companies in climate adapting their own property, when compared to the citizens.

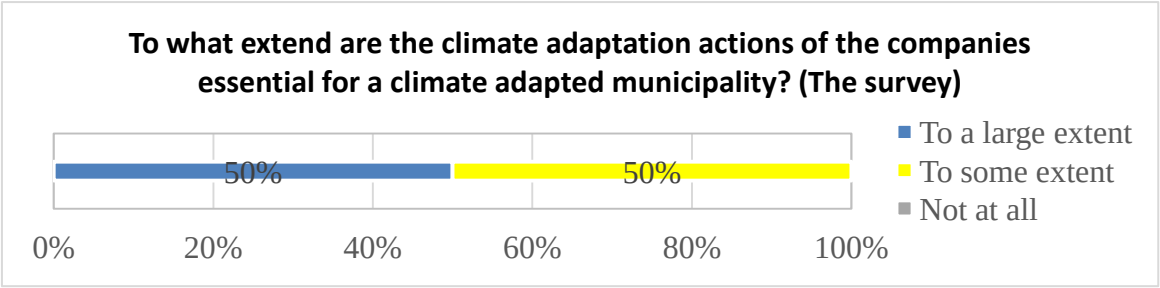


Figure 27: To what extend are the climate adaptation actions of the companies essential for a climate adapted municipality? (The survey)

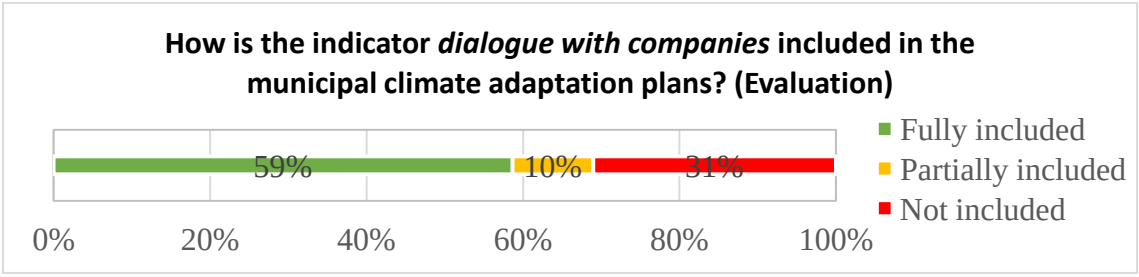


Figure 28: How is the indicator dialogue with companies included in the municipal climate adaptation plans? (Evaluation)

The many recent experiences of floods have definitely motivated some citizens and companies to act and adapt. Furthermore, the municipalities use varies of methods to motivate and engage

both citizens, housing associations and companies to climate adapt. The amount of implemented climate adapted solutions might be a result of both factors.

The survey shows that 61 % of the municipalities use information material, 50 % use information meetings, while 17 % use workshops. However, some municipalities have through the answer 'other methods' further explained the use of fairs, demonstration projects about sustainable urban drainage systems, and information campaigns. Some are even experiencing citizens, who ask the municipality for meetings about climate adaptation. Other municipalities are supporting sketching projects for dikes created by the citizens themselves. This mutual interest could indicate that the methods of motivating and engaging the citizens and companies are working.

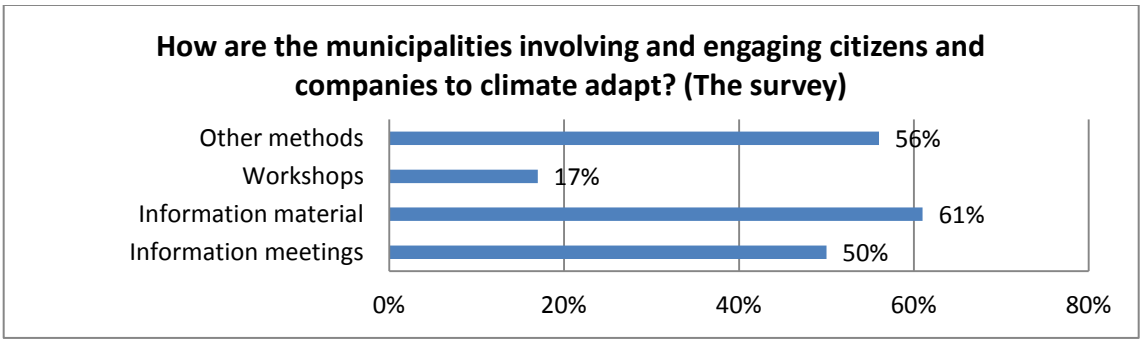


Figure 29: How are the municipalities involving and engaging citizens and companies to climate adapt? (The survey)

According to the survey, 72 % of the municipalities answer that they are experiencing a great interest from the citizens in relation to climate adapt their own property, while 44 % answer that they are experiencing a great interest from the companies. The fact that a significantly bigger percentage of the municipalities are experiencing a great interest from citizens compared to companies is interesting, because it correlates with the significantly bigger focus that municipalities have towards citizens compared to companies in relation to climate adaptation. This raises some questions. For instance, is it the significant bigger interest that is caused by the significant bigger municipal focus, or is it the municipal focus that is caused by the interest? Alternatively, is the citizens easier to inspire and reach out to than the companies or is it an economical reason? It could be somewhere in between. Why the citizens might have a bigger focus from the municipalities and show a bigger interest is being touch upon in the case study later on.

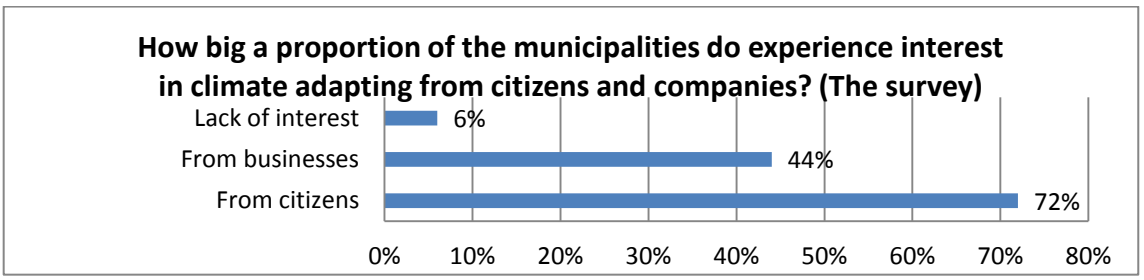


Figure 30: How big a proportion of the municipalities do experience interest in climate adapting from citizens and companies? (The survey)

An example on how citizens and housing associations and/or companies are being involved in the planning of climate adaptation is Egedal Municipality, where the citizens are being engaged to report flood events, in order for the municipality to collect data for later planning. (Egedal Municipality, 2015). Frederiksberg Municipality has also initiated several projects, where the local solutions have to be completed with the involvement of citizens and companies. They also state that it is important to inform the companies and citizens about what they can do in relation to minimising flood risks. For instance, they would like to initiate a sustainable urban drainage system project, where it is possible to establish a dialogue with the local citizens about dealing with cloudbursts. (Frederiksberg Municipality, 2013).

4.3 Giving the adaptation score and finding the frontrunner

Below is the table of every given point for each indicator included in every municipal climate adaptation plan in the Capital Region of Denmark, as well as the final adaptation scores. Together, they show how well these municipalities are planning their climate adaptation action as well as which municipality can be considered as a frontrunner in relation to climate adaptation actions.

Indicators	Climate adaptation projects	Added value	Other plans	Economy	Financing	Timeframe	Other municipalities	Water utility	Citizens and housing associations	Companies	
Municipalities	**Expected effects**	**Synergies**		**Time and money**			**Collaborations**		**Dialogue**		**Adaptation score**
København	1	1	1	1	1	1	1	1	1	1	10,0
Brøndby	1	1	1	1	1	1	1	1	1	1	10,0
Frederiksberg	1	1	1	1	1	1	1	1	1	1	10,0
Vallensbæk	1	1	1	1	1	1	1	1	1	1	10,0
Gladsaxe	1	1	1	1	1	1	1	1	1	1	10,0
Fredensborg	1	1	1	1	0	1	1	1	1	1	9,3
Albertslund	1	1	1	0,5	0,5	1	1	1	1	1	9,3
Høje tåstrup	1	1	1	1	1	1	1	1	1	0	9,0
Egedal	1	1	1	1	1	1	1	1	1	0	9,0
Glostrup	1	1	1	0,5	0,5	0	1	1	1	1	8,7
Rødovre	1	1	0,5	0,5	0	1	1	1	1	1	8,5
Hvidovre	1	1	1	0,5	0,5	0,5	1	1	1	0,5	8,5
Helsingør	1	1	1	1	0	1	1	1	1	0	8,3
Rudersdal	1	1	1	0,5	0,5	1	1	1	0,5	0,5	8,3
Herlev	1	1	1	0,5	0	0	1	1	1	1	8,3
lyngby tårbæk	1	1	1	0	0,5	0	1	1	1	1	8,3
Gentofte	1	1	1	0	0	1	0,5	1	1	1	8,2
Hørsholm	1	1	0,5	0	0,5	0,5	1	1	1	1	8,2
Bornholm	1	1	1	0	0,5	1	0	1	1	1	8,0
Gribskov	1	1	1	0	0	0	1	1	1	1	8,0
Halsnæs	1	1	1	0	0	1	0	1	1	1	7,7
Frederikssund	1	1	1	0	0	1	0,5	1	1	0	7,2
Furesø	1	1	0,5	0	0	0	0	1	1	1	6,5
Tårnby	1	1	0,5	0	0	0	1	1	0,5	0,5	6,5
Ishøj	1	1	0,5	0	0,5	0	1	1	0,5	0	6,3
Ballerup	1	1	1	0	0	0	0	1	1	0	6,0
Dragør	0,5	0,5	0	1	0	1	1	1	1	0	5,8
Hillerød	0,5	0,5	1	0	0	1	0	1	0	0	4,2
Allerød	0,5	0,5	0	0	0	0	0	0	0	0	1,5

Figure 31: Score for each indicator included as well as the final adaptation score. Green = fully included = 1 point. Orange = partially included = ½ point. Red = not included = 0 point. For how the indicators are weighted, please see Chapter 3.2.1.1. and Appendix F.

The adaptation scores have been coloured according to their value. Going from green in the top to red in the bottom, these colours give a more clear impression of who is doing well and who is not doing so well. The average adaptation score is 7.9, which is represented by the colour yellow. Furthermore, the horizontal line divides the municipalities, which are above average from those, which are below average.

Through the table, it becomes easier to see the overall performance of how the municipalities in the Capital Region have planned their actions in relation to the different indicators. The table shows that the municipalities are especially good at including the expected effect of climate adaptation actions, as well as synergies with added value and collaboration with the water utility. It also seems that the majority of the municipalities have integrated climate adaptation in other plans than just the climate adaptation plan. Furthermore, the municipalities seem keen on involving and engaging citizens and housing association in order to make them climate adapt their own property. The same can be said about companies, although there is a significant difference. In relation to inter-municipal collaboration, the majority are also doing well, but those who are not, could be due to a lack of shared catchment areas or other risks. Finally, it is within economy, financing, and timeframe that the municipalities are doing least well. However, it is important to mention that these three most likely are being taking into account somewhere else than in the climate adaptation plan.

In relation to the adaptation score, the table clearly shows five municipalities in the top, which all got the top score of 10. These are Copenhagen, Brøndby, Frederiksberg, Vallensbæk and Gladsaxe, and can all be considered as frontrunner municipalities in relation to climate adaptation action planning. Thus, they all fulfil the appropriate conditions for a case study research with the analytical frame of Transition Management. However, only one of these municipalities is being selected for this.

4.3.1 Selecting Gladsaxe Municipality as frontrunner case study

Gladsaxe Municipality has been chosen as frontrunner case for the further study. The municipality has throughout the evaluation shown particular good planning within all of the indicators; it has sometimes even gone a step further than the other four frontrunner municipalities (which has not been visualised in the table above). Especially in relation to the dialogue with the citizens and collaboration with the local water utility, Gladsaxe Municipality has shown an extra willingness and effort to initiate actions together with other actors. This governance approach to climate adaptation planning is also very much in line with the ideas of Transition Management.

In addition, the size and structure of the other four municipalities could potentially make them too complex in a case study. For instance, even though Vallensbæk and Brøndby are two separate frontrunner municipalities, they can be seen as *one* special case because they have developed their climate adaptation more or less together. Copenhagen Municipality can also be seen as a special case because of its population size and unique resources ability, which make it difficult and even inadequate to generalise possible results from the case study. Frederiksberg is also a unique municipality, as it is surrounded by Copenhagen and cannot be taken as an average municipality. Gladsaxe is a more average municipality compared to the other municipalities within the Capital

Region, both in terms of population and resources. A case study of Gladsaxe Municipality is thus both more interesting and suitable.

4.4 Reflections on why some municipalities might plan their actions better

Every municipality in the Capital Region, which have replied to the survey, have experienced flooding within the last ten years. This means that they basically share the same problem and thus have the same starting point. Of course, the damages created by flooding differ from municipality to municipality, but it does not change the fact that they share the goal to manage rain- and seawater more sustainably. Since there is a relative big difference between the best and worst municipal climate adaptation actions in the Capital Region according to the evaluation, it is valid to believe that other drivers or reasons for how/why these municipalities have climate adapted exist. In order to understand the 29 adaptation scores, it is thus relevant to reflect upon possible correlations between the adaptation score and municipal characteristics such as geography and population density. This will make it possible to see what might have an influence on the climate adaptation action planning, and what is typical for a frontrunner municipality.

Figure 33 shows a map including all the municipalities with a colour according to the climate adaptation score. Here, it is possible to find some geographical patterns. First, all frontrunner municipalities are located within a relatively small area within Greater Copenhagen. This might have something to do with the fact that the population density in general are higher closer to the capital. (Danish Economy and Ministry of Interior, 2015). A higher population density means that there is a higher number of people per square kilometre in risk of flooding and thus a bigger incentive to climate adapt. This pattern seem to continue when looking at all 29 municipalities. As Figure 32 shows, the adaptation scores are in general better the higher the population density. In total, the average score of greater Copenhagen is 8.4 while the average score of the remaining area is 7.6. All this strongly indicates that population density could be correlated with the adaptation score.

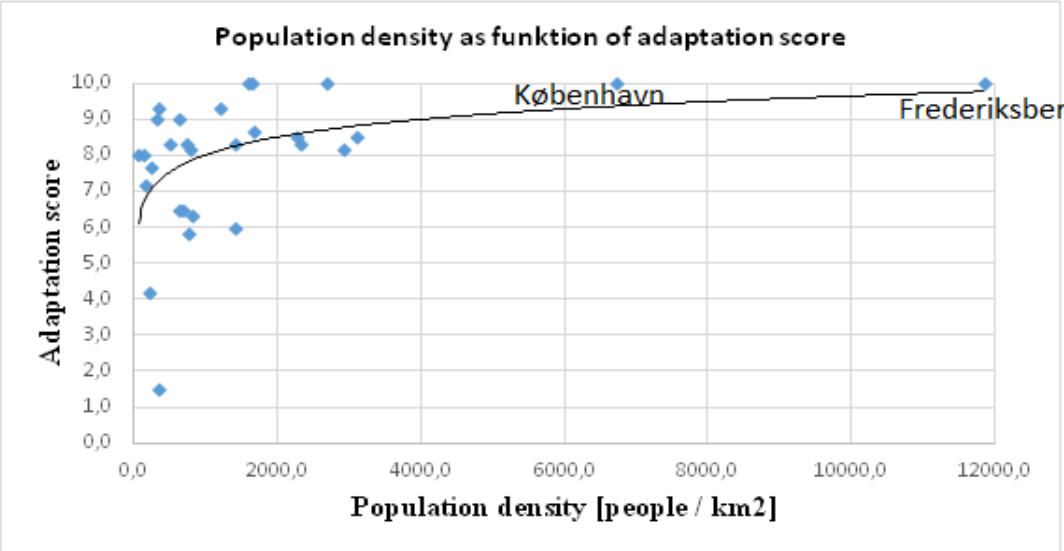
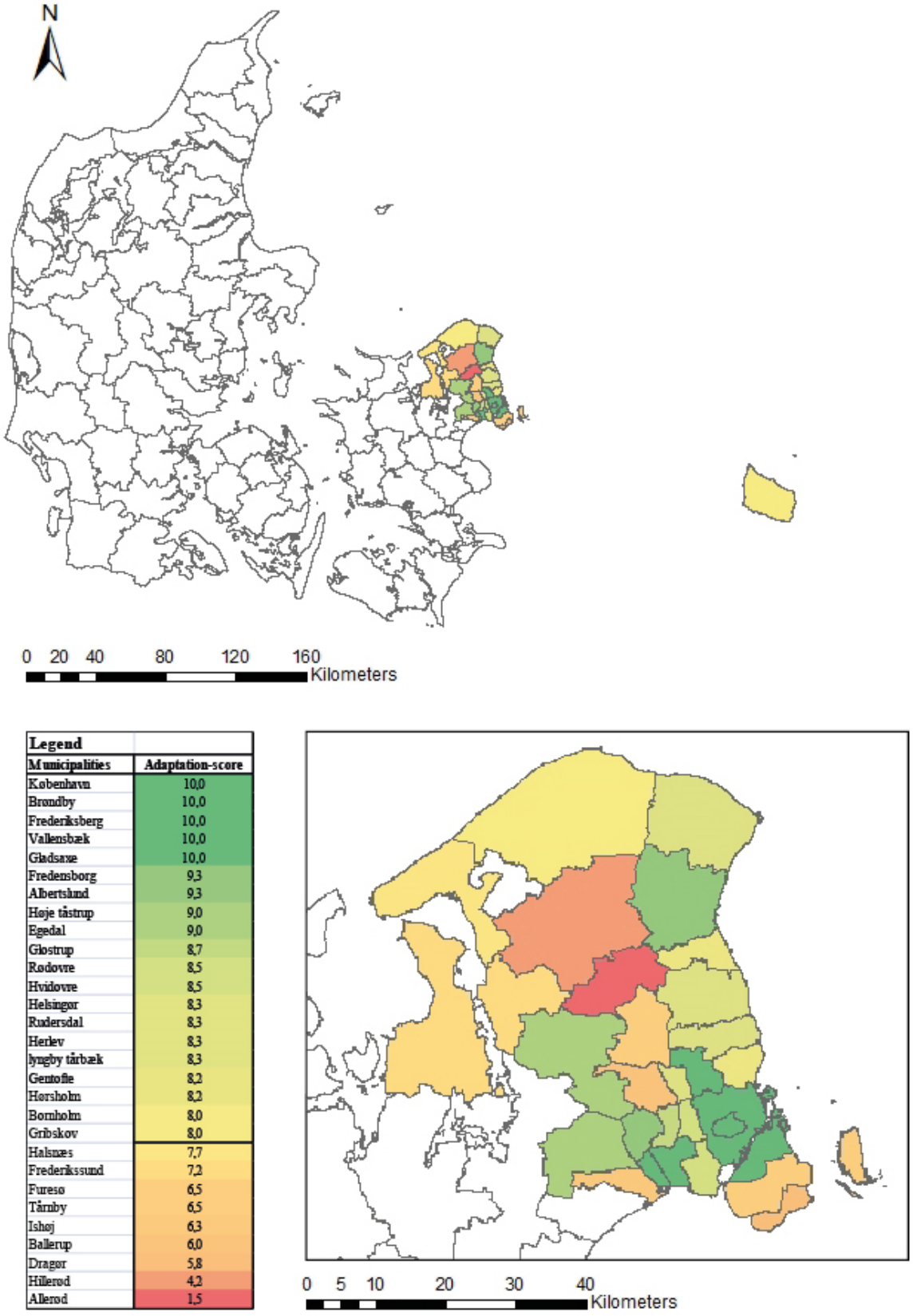


Figure 32: Population density as function of adaptation score.



Legend	
Municipalities	Adaptation-score
København	10,0
Brøndby	10,0
Frederiksberg	10,0
Vallensbæk	10,0
Gladsaxe	10,0
Fredensborg	9,3
Albertslund	9,3
Høje tåstrup	9,0
Egedal	9,0
Glostrup	8,7
Rødovre	8,5
Hvidovre	8,5
Helsingør	8,3
Rudersdal	8,3
Herlev	8,3
lyngby tårbæk	8,3
Gentofte	8,2
Hørsholm	8,2
Bornholm	8,0
Gribskov	8,0
Halsnæs	7,7
Frederikssund	7,2
Furesø	6,5
Tårnby	6,5
Ishøj	6,3
Ballerup	6,0
Dragør	5,8
Hillerød	4,2
Allerød	1,5

z

Figure 33: Map of Capital Region of Denmark, showing municipalities with a colour according to their adaptation score.

Second, with an average score of 8.7, the east coast municipalities all the way from Copenhagen to Helsingør (Elsinore) are doing quite well in general. Here the lowest score is 8.2, given to Hørsholm and Gentofte, but the score is still above average. This could be a result of the fact that all these municipalities are not only threatened by the changing rain patters, but also by the changing sea level. This creates an added incentive to climate adapt. However, some coast municipalities within the Capital Region do have a significant lower adaptation score, which could mean that they are downgrading the potential threats from sea level rise. In total, the average score of coastal municipalities is 8.2 while the average score of inland municipalities is 7.6. This could indicate that the presence of a coast might act as an added thread and thus an added incentive to climate adapt.

There are more factors than those above, which influence the need for climate adaptation actions and how well they are planned. For instance, if a lot of buildings have been build in low-lying areas, they will also be at a greater risk of being flooded, due to the nature of water. Some of these buildings have already experienced floods once or more. Furthermore, events like these put a certain pressure on the local politicians to act via the climate adaptation plans. It is a political decision what the money of the municipality is spent on, however, the decision makers also need to take the support of the citizens and companies in consideration if they would like to get re-elected later. The city council's dominating political orientation may have an impact on how the municipality choose to work with the climate adaptation.

The wealth as well as the population composition of the municipality might also have an influence on climate adaptation. However, within the Capital Region this is difficult to compare since the 29 municipalities resemble each other relatively well, and thus these municipal characteristics might not play such a great role unless the scope was national instead of regional. In the end, the evaluation and survey show that the planning of climate adaption is a complex subject for the municipalities, as it involves many actors both within and outside, as well as it involves many considerations.

5 The actors influencing the climate adaptation

This chapter looks into the role of the different actors and sets the stage for the next four chapters concerning the case study. The climate changes affect a lot of different actors, causing them to have an interest in the implementation of climate adaptations solutions.

5.1 State of the art

The primary focus area of the case study is the different governance activities. It is thus interesting and relevant to carry out a state of the art research on why collaboration and dialogue are important within the field of climate adaptation and how climate adaptation solutions can be created with the help from external actors.

5.1.1 The knowledge of external actors

Seen from a municipal point of view in relation to climate adaptation, "*dialogue, network and collaboration internally […] across sectors, and externally with utility companies, citizens, businesses, insurance companies and neighbouring municipalities are important because these groups have important local knowledge*" (Lund, et al., 2012, p.616). Utilities, entrepreneurs, architects, companies and citizens are an important part of the implementation of climate adaptation and citizens, utilities and insurance companies in particular have important knowledge about damages caused by flooding. Municipalities are obviously depended on initiatives towards external actors. Especially initiatives which motivates citizens and companies are important, because the municipalities cannot climate adapt private property, and is thus depended on the actions of both citizens and companies to adapt their own property. (Lund, et al., 2012).

5.1.2 Increasing the legitimacy

Dialogue with stakeholders is essential for creating awareness of the need for climate change adaptation and for improving related decisions. According to André et al. (2012) there is mainly two reasons for the municipalities to involve stakeholders 1) "*making science more 'socially robust' through direct engagement with the societal context*" (André, et al., 2012, p.244); and 2) "*making planning and decisions more legitimate in terms of both process and outcomes*" (André, et al., 2012, p.244). By increasing the legitimacy of policies and measures, institutional dialogue with stakeholders are contributing to a more effective climate adaptation. Local stakeholders can increase this legitimacy by providing local information and expertise as well as narratives, which cannot be provided through the actual adaptation planning itself. (André, et al., 2012).

5.1.3 A participatory approach and added values

The local-level capacity is also crucial to successful climate adaptation and the society's ability to cope with climate changes, and thus is cooperation between institutions and citizens just as important as cooperation between different institutions on different levels. (Wamsler, 2014). The benefit of having this participatory approach, with not only the citizens but also other actors, is that it creates a shared understanding of both climate change and climate adaptation; including the risks, issues and outcomes. (Cloutier, et al., 2014). This shared understanding is important because it increases the chances of successful climate adaptation. (Webb, et all., 2013). Lund et al. (2012) stress that the involved parties need to listen to each other in the established networks

and they must all accept the others profession and priorities. When establishing networks, which include the relevant public and private stakeholders such as companies, organisations and citizens as well as other actors such as scientists, professionals and decision makers, it is more likely that a shared understanding of solutions and problems can be found and that the final climate adaptation projects will contain an added value. (Lund, et al., 2012). In addition, by understanding how climate adaptation is shaped by local surroundings and social values creates greater depth and legitimacy to climate adaptation (Cloutier, et al., 2014), but it also highlights the need of and opportunities for these added values (Lund, et al., 2012).

5.1.4 Obtaining mutual support

In relation to institutional support, municipalities can help citizens in two different ways. They can either reduce the risk, which the citizens face or they can strengthen the citizens' own ability to reduce the risk themselves. However, mutual support requires following involvement from the municipalities (Wamsler & Brink, 2014, p.86):

1. "*The establishment and enforcement of complementary legal responsibilities for adaptation;*
2. *The provision of information on, or incentives for, individual adaptation measures;*
3. *The active use of information from local people as a basis for adequate institutional assistance;*
4. *Support of intermediaries to facilitate information exchange (and possibly action-taking); and*
5. *Mutual dialogues (two-way information flow and collaboration); and/or*
6. *Complementary action-taking on the basis of people's and institutions' respective capacities*"

Ideally, all these forms of institutional support ought to be combined in order to create mutual support between the municipalities and citizens; however, in practice it depends on the citizens' level of engagement as well as confidence in authorities. In Swedish municipalities where the engagement is low but confidence high (somewhat similar to the Danish municipalities), point 1 and 2 are often prioritised as the municipal focus. In the end, the municipalities' climate adaptation efforts depend on how they reduce risk and vulnerability, and how they involve the citizens and affect their adaptive capacity. (Wamsler & Brink, 2014).

5.1.5 Influence of universities and institutional entrepreneurs

Wejs et al. (2014) and Lund et al. (2012) explain the importance of the municipalities' collaboration with universities and research institutes, as they can provide new knowledge about climate adaptation solutions and update the municipalities on the possible climate change effects. Wejs et al. (2014) further explain how the use of the triple helix method has supported the municipalities in becoming frontrunner climate adaptation municipalities.

Institutional entrepreneurs can have a big influence on the climate adaptation development. These entrepreneurs are known for going against the bureaucratic barriers, which are often found in municipalities. An analysis shows (Wejs, et al., 2014) how one municipal employee with a climate adaptation passion truly can influence a municipality's status as a frontrunner within climate adaptation. Wejs et al. (2014) analysed two municipalities, each with a passionate employee: an environmental officer and an employee in the development and business unit, who spotted a business opportunity. In both cases, these employees acted "*on external signals and*

bringing climate-change knowledge to the organisation". (Wejs et al., 2014, p.505) They strived for cross-sectorial relations within the municipality and played a big role in the processes of building the local legitimacy for climate-adaptation, and further initiated the partnerships with external actors as universities and businesses. (Wejs, et al., 2014)

5.1.6 Contributions of the thesis

There have been some research within the field of dialogue and collaboration in relation to municipal climate adaptation. Understanding this need for interaction between municipalities and external actors is important for securing a successful future development and implementation of climate adaptation solutions. However, the research is far from complete. *Why* involvement and engagement of stakeholders and other actors are important, seem to be covered quite well by existing literature, while *how* they are involved and engaged by the municipalities are not yet analysed as well. The strength of this thesis is that it contributes to both the why and how. The thesis actively analyses how some of these actors are successfully involved and engaged in the municipal work, and thus contributes with relevant new research to a relatively new field of study. This thesis also contributes with a new and alternative use of Transition Management as an analytical framework in order to analyse and organise the municipal governance activities. (see Chapter 2). Thus, the thesis contributes with new knowledge on more than one level.

5.2 The climate adaptation actors' role in the four clusters

There has been found ten kinds of actors, who directly can influence the municipal climate adaptation work to reach their vision. The municipality should therefore include or be aware of these actors in relation to the right governance activity to strengthen the transition. The ten actors are shown in the matrix below. These ten actors are identified through the state of the art and the carried out interviews.

Strategic	**Tactical**	**Operational**	**Reflexive**
Municipality	**Municipality**	**Municipality**	**Municipality**
Water utility	**Water utility**	**Water utility**	**Water utility**
		(*)Citizens	Citizens
		(*)Companies	Companies
		(*)Housing associations	**Housing associations**
	Consultant	Consultant	Consultant
		Contractor	Contractor
		Producer	
Universities	Universities	Universities	Universities
	Insurance company (damage data)	Insurance company (investor)	
* Independent project, based on their own visions.			

When establishing the vision through the strategic governance activity the municipality should ideally include themselves across departments, the water utility and universities in the process. The municipality and the water utility have the overall responsibility to develop the needed climate adaption and hold the power to push for this development. The municipality is responsible for the urban development, the functionality, its appearance and how the water is managed on the surface in conjunction with the city's function. The municipality is the authority for everything that is established in the urban space. It is the water utility's responsibility that the sewer system can manage the rain and wastewater and comply with the service level from the Wastewater plan. The municipality and utility have shared climate adaptation interests and it is often beneficial for them to collaborate about the adaptation, as they depend on each other. (Krawack, 2014). Furthermore, the municipality, utility and universities possess important knowledge and the university can further provide a theoretical approach to improve the transition.

In order to create the transition agenda (the climate adaptation plan), images (creation and assessment of risk areas in the climate adaptation plan) and paths (descriptions of changes necessary to reach the image) the municipality should ideally include the water utility, consultants, the insurance company and universities. The municipality and water utility should work close together incorporating the expert data from the consultant(s) and the damage data from the insurance company to produce optimal risk maps, and again improve the transition through the universities theoretical insight.

In the operational cluster the municipality would benefit from including a lot of different actors to achieve the transition. The municipality can itself perform climate adaptation solutions collaborating with the water utility, consultants, contractors and producers. It is however important that the owners of the private owned land (citizens, companies and housing associations) also climate adapt which the municipality should strive to achieve either by collaborating with them or making them aware of the possibility. This is why the asterisk is set in the parenthesis in the matrix above. When a house has experienced multiple flooding episodes, it is also a possibility that an insurance company can participate and use the compensation sum to invest in a long-term solution. The universities theoretical and practical insight should furthermore be used. (Forsikring&Pension, 2015).

Finally, the municipality can further develop the climate adaptation transition by exchanging and discussing the implemention and collaboration experiences of the others actors (water utility, citizens, companies, housing associations, universities, consultants, contractor and the universities). In that way the municipality can insure the further development of the adaptation transition.

5.2.1 Gladsaxe Municipality as a case study

The next four chapters are looking into how Gladsaxe Municipality is working and collaborating to achieve their climate adaptation vision, which is analysed by looking at their performance using the Transition Management theory. The case study therefore go through the four clusters: strategic, tactical, operational and reflexive. The five kinds of actors highlighted with bold letters

in the matrix above have been interviewed and are used in the analysis. The interviewed actors are bold in the clusters they actually have played a role in Gladsaxe's climate adaptation work.

The performance of the partnerships, coalitions and networks and how they are formed, are crucial for all four clusters. (Loorbach, 2010) However, in reality the interviews have shown that the personal chemistry, the economy and dialogue are crucial factors as well, why these factors also are included in the case study.

The case study analysis takes points of departure in Gladsaxe Municipality, Nordvand (water utility), citizens, companies and housing associations. As these are some of the key actors, who hold the direct power to implement the climate adaptation solutions on their land.

Gladsaxe Municipality is a north-westerly suburb municipality to Copenhagen and is included in the Capital Region. Gladsaxe Municipality is Denmark's 20th largest municipality of 98. There live just under 67,400 inhabitants and the area of Gladsaxe measures 25 km^2. The municipality has a social democratic mayor. (Gladsaxe Municipality, 2015a). Gladsaxe Municipality has been working with climate adaptation for a longer time than some other municipalities, as they started to work with the climate adaptation plan before the Economy agreement 2012 was created, which agreed that all municipalities had to develop a climate adaptation plan before the end of 2013. (Danish Ministry of Finance, 2012)

Figure 34:Gladsaxe Municipality's location in the Capital Region of Denmark.

The water utility Nordvand has existed since 2008, when it was separated from the municipalities Gentofte and Gladsaxe. Nordvand is responsible for the water supply and wastewater management in Gentofte Municipality and Gladsaxe Municipality, which includes a total of 140,000 consumers. Nordvand is owned by Gentofte and Gladsaxe Municipalities, and has 110 employees. It is located in Gentofte. (Nordvand, 2015f).

6 The strategic work with climate adaptation

This chapter will analyse Gladsaxe Municipality's and the water utility Nordvand's strategy and vision for climate adaptation. The strategic activities entail the processes of the vision development, which include strategic discussions and long-term goal formulation. The long-term perspective is essential for Transition Management in order to achieve a sustainable development. The awareness and the use of the transition arena is necessary for the development of the vision. An initiating core group must debate the problems and form the visions in an open-minded network of innovation. (Loorbach, 2010).

6.1 Gladsaxe Municipality's climate adaptation vision

The municipality has incorporated the climate adaptation work in their municipal plan. The municipality's climate adaptation vision states that "*it is the Council's objective to climate adapt to prevent and reduce the damage of cloudbursts and separate rainwater from wastewater.*" (Gladsaxe Municipality, 2015b). This should be done in such a way to ensure that the rainwater is used as a resource to increase the quality of the city or in green solutions, which simultaneously increases the quality of nature. The municipal plan stresses that the rainwater should be handled locally and when possible be visible in the urban landscape and nature. In the vision it is further stated that the climate adaptation action should be implemented in collaboration by many stakeholders, such as the local water utility, neighbouring communities and landowners (citizens, housing associations and companies). Gladsaxe Municipality will inspire the stakeholders to take action in many different ways (further elaborated upon in the operational cluster chapter, see Chapter 8). (Gladsaxe Municipality, 2015b).

Gladsaxe Municipality has not given much thought about the branding value of the climate adaptation projects. The flooding was a problem, which the municipality felt they had to solve, but Kathrine Stefansen stresses that the branding of their adaptation to the climate change is something they would like to work on in the long term, as it can be a way to distinguish themselves and attract citizens and companies. (Stefansen K., 2015).

6.2 The creation of the vision

In the interview, Kathrine Stefansen made it clear that this vision has been created due to many reasons. First of all, Gladsaxe has experienced flooding the last couple of years for instance in 2007, 2009 and July 2nd 2011 (Jangmark L. and Kolte-Olsen A., 2015), which have led to the conclusion that something special needed to be done. (Stefansen K., 2015). Many citizens, housing associations and companies with water in their basement have contacted the municipality and Nordvand complaining, which have pressured the politicians to act and do something more. At the same time as the heavy rain event July 2nd 2011 occurred Gladsaxe's Wastewater-plan was in hearing, and the municipal Environment Committee had coincidentally planned to meet and finally decide on the plan just after the event. At that time, there was political pressure, because it was right after the event and suddenly the plan was not ambitious enough and a budget for the climate adaptation planning and campaigns was agreed upon by the politicians. (Stefansen K., 2015).

Another factor that has had an influence on Gladsaxe's vision is that the municipality was one of the first municipalities in Denmark to adopt the "repayment scheme", where citizens and companies can receive up to 24.070 DKK if they manage the rainwater on their own property. (Stefansen K., 2015) Kathrine Stefansen explains that:

"*the thoughts begin to emerge that the challenge* [the cloudburst events] *is probably greater than just the traditional solutions we used to establish beneath the ground, and we have to do something else and we also want the citizens to participate and help us with the challenge*." (Stefansen K., 2015, 04:08).

The actual work with the climate adaptation and the vision is started by the municipality through a core group called the climate adaptation group, which is established in 2011 after the heavy rain event. The group looks into what kind of flooding-challenges Gladsaxe face and how they need to plan. Initially the climate adaptation group wanted to pick out the exact right solution for each risk area. However, the group found that it was not possible. Instead, the group has outlined what the challenges are and what type of solutions that can be used. (Stefansen K., 2015). Gladsaxe Municipality does in fact start to work with the climate adaptation plan before the Economy agreement 2013 (Danish Ministry of Finance, 2012) was made by the Danish Ministry of Finance and the Local Government Denmark (KL), which agreed that all municipalities had to develop a climate adaptation plan before the end of 2013. (Stefansen K., 2015). Gladsaxe has therefore had a longer time to experience and learn how to plan for climate adaptation than most other Danish municipalities.

The climate adaptation group does in the beginning consist of Kathrine Stefansen as project leader, another employee from the municipal Water and climate team, one from the Environment department, a park-employee and a road-employee and two employees from Nordvand are as well part of the group from the beginning: a planner (Annette Kolte-Olsen) and Nordvand's head manager of drains. The town planning department is represented in the group a bit later when the Economy agreement in 2012 was adopted. Even more recently, some new members, as the municipal property department (Ejendomscenteret) has become part of the group. The composition of the group secures conversations that are more direct across the departments and the "silo effect" is reduced. The various departments' concerns and working methods has become more clear by working in this kind of group. Each person gives inputs based on their background, which sometimes can cause a debate, which leads to further inside. The group members act as ambassadors in their own departments for how they can promote the municipal vision and how it should be managed. The working group are now continued, as they work with the actual concretisation projects (will be further elaborated upon in the operational cluster chapter, see Chapter 8). (Stefansen K., 2015).

Gladsaxe's climate adaptation group contains in many ways what Transition Management defines as the initiating core group, which must debate the problems and form the visions in an open-minded network of innovation. The group members are for instance chosen based on their competencies, interests and backgrounds. More members are added to the group when needed and is part of a continuous development. The group creates a sufficient space and favourable

conditions for the creation of the vision, which helps Gladsaxe to become a climate adaptation frontrunner. It is however controversial, because the creation of a group also can shield for an even more innovative approach. The group is represented well by the existing regime: the municipal employees and employees from Nordvand, it can however be debated whether it truly can be defined as a societal network of innovation, as no NGOs, universities, companies etc. are included to further develop the vision.

6.3 Nordvand's climate adaptation approach

The vision of Nordvand is to be the preferred water utility. Their overall mission is to provide high quality of drinking water, divert rainwater and wastewater reliably and offer an overall consumer price as low as possible. (Nordvand, 2015b). Nordvand does also mention the needed climate adaptation work on their homepage, where they make it clear that it is important to secure the drainage system for the future and think in new ways to manage the increasing quantity of rainwater that needs to be diverted either below or above ground. (Nordvand, 2015b).

The Danish water utilities have been accustomed to manage the rain under the ground. Nordvand has worked with climate adaptation beneath ground for a long time, but with the Direction 27 created by the Wastewater Committee[1] in 2005, the utilities' water basins must fit the rain that will fall in 100 years, so the utilities have to make them larger to guarantee the future. (Jangmark L. and Kolte-Olsen A., 2015). The cloudburst events gains the public focus on the work the utilities always have had, often causing the politicians to act and support the utilities work further, why Nordvand has nicknamed this type of rain the "grant-giving-rain". Many of the projects Nordvand is carrying out, is caused by rain events that mainly hit a very limited area, showing a problem as it gets visible by flooding. (Jangmark L. and Kolte-Olsen A., 2015).

Nordvand and other Danish utilities are challenged due to the increased precipitation that falls over a short amount of time, but also due to the historical building expansion. The amount of new houses being build close to old houses have been expanding and the degree of impermeable area is growing, but the pipes under the ground are not always updated to fit with the added amount of houses, which may even have taken over a green area that previously absorbed the rain. The problem has only started to show recently, why the utilities in Denmark have not yet solved the issue. (Jangmark L. and Kolte-Olsen A., 2015). Lise Jangmark furthermore adds:

"*And then suddenly, the problems are passed down, while there has been less capacity, and pipes are older and need more maintenance, renovation and replacement. It costs a lot of money. Moreover, the increased rainfall on top*." (Jangmark L., 2015, 19:50).

Previously, Nordvand had to separate the sewage system to manage the extra amount of water; it was the only alternative in order to comply with the Direction 27. However, the problem then is that the water runs along further down the system, so often it actually only moves the issue. It

[1] Since the late 1940s the Water Pollution Committee of The Society of Danish Engineers (the Wastewater Committee) has played a significant role for the drainage and wastewater technology development in Denmark. The Wastewater Committee examines the water management issues and publishes the results in Directions and Reports, which set the norm for the future water management. (IDA, 2015).

was therefore not a long-term solution, only if the entire sewage system was separated. The separation sewage work needs to start downstream, but if the problems are higher located, they are not so easy to solve. Gladsaxe and Gentofte Municipalities had with their previous wastewater plans introduced that the rain and wastewater from the roads must be separated in the sewage system. (Jangmark L. and Kolte-Olsen A., 2015).

To solve the issue, Nordvand is beginning to look at how they can manage rainwater in more innovative ways. The best solution for each project will be different because it depends on the area and what opportunities it entails. Nordvand does not have a percentage of the amount of rainwater projects that should be managed above ground, as it will be assessed on each project whether it makes economic sense. (Jangmark L. and Kolte-Olsen A., 2015). Annette Kolte-Olsen adds:

"*The goal is not to make it* [the project solution] *on the surface. It is simply the economy that primarily counts. The economy and that we must meet the requirements we have. We will never establish a climate adaptation project on the surface just because it looks more beautiful, because beautiful is not our job*." (Kolte-Olsen A., 2015, 27:35).

6.4 The key points

The climate adaptation vision of Gladsaxe is achieved through a collaboration between Gladsaxe Municipality and Nordvand. It describes a long-term goal, which is reached through a sustainable development. Both have the same desire to avoid flooding and are open-minded to find innovative solutions, which cause them to collaborate well in the climate adaptation group, leading to the expansion and use of the transition arena.

However, Gladsaxe Municipality is mainly used to manage the areas above ground and incorporate the aesthetic and recreational effect. Nordvand is used to operate beneath ground and does therefore not need to think about an aesthetic solution. Both think about the economy, but they normally have been used to include different parameters in their equation, especially Nordvand needs to include new parameters when collaborating above ground. The collaboration is forcing both parts to be accommodating to new ideas and think more innovative.

7 The tactical work with climate adaptation

According to Transition Management, the tactical cluster contains the transition agenda, transition images, and transition paths. These governance activities are in this thesis identified as the climate adaptation plan, the risk areas, and the action plan respectively. This chapter thus contains the majority of the content of Gladsaxe Municipality's climate adaptation plan (including some of the wastewater plan), as well as the collaboration between the actors, which have shaped the content of these plans. According to Transition Management, these actors represent certain interests and are dealing with developing programmes as well as financial and institutional regulations on a daily basis in relation to climate adaptation, and can thus be identified as Gladsaxe Municipality, neighbouring municipalities and Nordvand.

7.1 The climate adaptation plan as the transition agenda

The transition agenda is formed by the vision, images and paths and is thus the *compass*, which the developers follow through research and learning. In this case study, the transition agenda is identified as the Climate adaptation plan itself, because it does act as the municipal compass in relation to climate adaptation and because it is shaped by the municipal vision in relation to climate adaptation as well as the risk areas, their possibilities and the action plan. The following sections, present the content of the climate adaptation plan as well as the process behind. Content of the wastewater plan will also be included since it contains more concrete guideline on the municipal approach to climate adaptation.

7.1.1 Risk areas as the future transition images

The transition images are different scenarios, which accompany the long-term vision. The images breaks down the vision into more practical sub-goals and display what should be achieved in the end. Within this case study, the transition images have been identified as the thirteen risk areas within the climate adaptation plan as well as the assessment of the different opportunities for and the prioritisation of these different risk areas. In order for the municipality to fulfil their vision fully, they need to climate adapt each of the different areas.

7.1.1.1 Finding the risk areas

In their climate adaptation plan, Gladsaxe Municipality presents the overall strategies for working towards the vision. The first step has been to point out the thirteen risk areas, which are areas with high risk of flooding. It is within these areas that climate adaptation should be focused. The risks have been calculated by COWI and are based on how often the areas are flooded, and how great the damages are. The flooding risk are thus measured in damage per year as seen in Figure 35.

Flooding Risk = probability (of flooding) x consequence (damage costs)

The thirteen chosen risk areas are then based on larger connected areas with high risk of flooding, so they each represent a catchment area. This also means that in practise flooding do not actually occur in every part of a risk area but primarily in the low-lying parts. Around half of Gladsaxe

Municipality is not covered by a risk area. Although, floods do occur in these areas, the risk is still low due to either a small probability, small consequences or both.

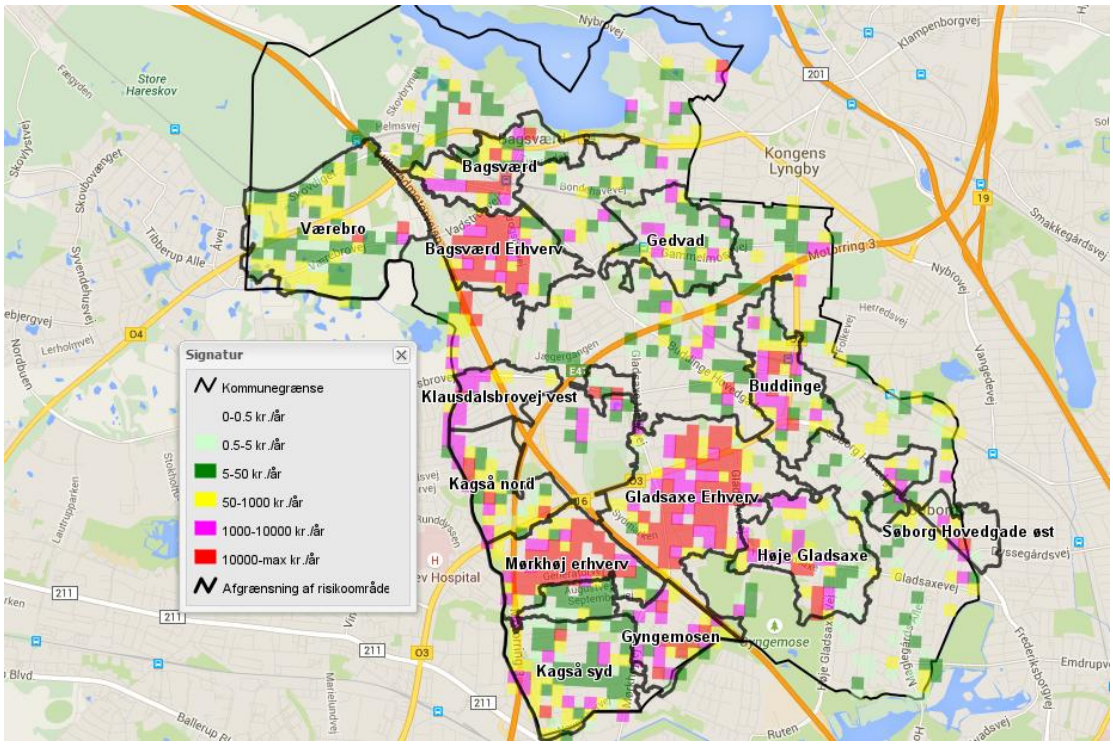


Figure 35: Risk map of Gladsaxe Municipality, showing the thirteen risk areas and the risk of flooding measured in damage cost / year.

Each risk area has been tested with a digital simulation of a 100-year rain event in order to see, where the real problems are in relation to flooding. These areas have been named 'problem areas' and are typically covering areas with buildings and roads because flooding of these areas, compared to parks and other green areas, tend to cause bigger social and economic problems. (Gladsaxe Municipality, 2014b)

7.1.1.2 Assessing the opportunities

Within each of the thirteen risk areas, the municipality has performed an assessment of the climate adaptation opportunities. The assessment process was taking place within the climate adaptation group, which includes employees of both the municipality and Nordvand. The assessment had two purposes: to make general suggestions for possible solutions for each risk area for later use, when concrete actions are being planned; and to make a prioritisation of when the municipality is going to climate adapt each of the thirteen areas. (Gladsaxe Municipality, 2014b).

For making general suggestions for possible solutions, three levels of possibilities were in focus: First, a cadastre level, which covers the possibilities for climate adaptation of buildings and private gardens (rain beds, permeable surfaces, green roofs etc.), initiated by private people or housing associations. Second a local level, which covers the possibilities for percolation, delay and management of water on green areas, parks and roads. Finally, a risk area level, which covers the

possibilities for control and delay of water within larger solutions throughout a risk area. According to Kathrine Stefansen, team coordinator and member of the climate adaptation group, this process was not without complications. This was mainly because the risk areas were spread around among the different professional backgrounds of the climate adaptation group, creating discussion. (Planners, engineers and landscape architects from Nordvand and different departments in the municipality). However, Kathrine also states that the group in the end handled the discussions and the assessment process in general quite well: "*it is a matter of having willingness to take risks in relation to these types of projects, and I think that this has been shown in the process*" (Stefansen K., 2015, 13:03). Thus, risk-taking seems to be an important capability in the process of suggesting successful solutions.

7.1.1.3 Prioritising the risk areas

In relation to the prioritisation of the thirteen risk areas, seven criteria were included. These were cost efficiency, natural conditions, shared sewerage, flooded traffic hubs, green areas, existing plans for physical change of the area, and already planned projects of water utility Nordvand. Based on these criteria, the prioritisation is as seen on figure below.

Område	Kriterier							Summeret værdi
	Størst costeffektivitet	Forbedring af naturkvaliteter	Fælleskloakerede før separatkloakerede	Trafikale knudepunkter	Grønne arealer	plan for fysisk ændring	Nordvand har planlagt projekter	
Vægtning	35%	5%	10%	20%	12%	10%	8%	Prioritet
Gladsaxe Erhverv	3	1	3	3	1	2	1	2,40
Bagsværd	2	3	3	3	3	2	1	2,39
Bagsværd Erhverv	3	2	1	2	2	2	1	2,17
Mørkhøj erhverv	3	2	1	1	1	1	3	1,91
Buddinge	1	1	3	3	2	2	2	1,90
Kagså nord	1	3	3	1	3	3	3	1,90
Kagså syd	1	3	3	1	3	3	3	1,90
Gyngemosen	2	2	2	1	2	2	2	1,80
Klausdalsbrovej vest	1	2	2	2	2	3	2	1,75
Gedvad	1	1	3	1	3	1	3	1,60
Høje Gladsaxe	1	2	2	1	3	3	1	1,59
Søborg Hovedgade øst	1	3	3	1	2	1	2	1,50
Værebro	1	2	1	1	3	2	1	1,39

Figure 36: Prioritisation of the thirteen risk areas based on the seven criteria

It is worth noticing that the three business areas of Gladsaxe Municipality are all within the top in relation to prioritisation. This I partly because of the areas' cost-efficiency, which has a large weighting compared to the other criteria. The three areas are the only ones that have a fully positive cost-efficiency. This is not because the cost of climate adapting these areas are cheaper compared to the other areas, but more because the estimated damage cost is significantly higher. (Gladsaxe Municipality, 2014d). This difference stems from the fact that the general value of business areas is higher than regular residential areas, which characterise the other ten areas. Based on professional experiences, the climate adaptation plan states that the average damage cost of flooding in industry and business areas is 5.500 DKK per m^2, while the same cost for residential areas is 1480 DKK per m^2, which is 3.7 times lower. (Gladsaxe Municipality, 2014b). However, even though these business areas are prioritised higher, it seems that the municipality plan to separate business areas from residential areas when it comes to the action plan.

Criteria for the prioritisation of the thirteen risk areas - Explanation and weighting

- Cost efficiency counts for 35 % of the assessment and is the estimated damage cost the next 50 to 75 years subtracted the cost of climate adapting the risk area.
- Natural conditions count for 5 % and include the potential for improvement of the quality of the nature through climate adaptation solutions.
- Shared sewerage counts for 10 % and is whether the sewerage is shared or separated. Shared is prioritised higher, because floods is a mix of rainwater and wastewater.
- Traffic hubs count for 20 % and include important traffic hubs in risk of flooding.
- Green areas count for 12 % and include green parks and private gardens, which have the potential to be climate adapted.
- Plan for physical change counts for 10 % and includes existing plans and strategies, which purpose are to change or transform the risk area. Climate adaptation solution can advantageously be integrated in the realisation of such plans and strategies.
- Finally, planned projects of Nordvand count for the last 8 % and include already planned projects by Nordvand within the risk area. If Nordvand has already planned a project, but not yet started to implement it, climate adaptation solutions are more able to be integrated in these projects.
  (Gladsaxe Municipality, 2014d).

7.1.2 The action plan and wastewater plan as the transition paths

The transition paths are the routes to the transition images and show more concretely how to fulfil the vision. In relation to this case study, the transition paths can therefore be identified as the different actions and initiatives in the action plan of the climate adaptation plan. These actions are not concrete projects, where actors such as citizens and companies have been mobilised yet. Therefore, they cannot be identified as experiments in the operational cluster, although they are project related. Instead they show the paths, which the experiments should follow. (Gladsaxe Municipality, 2014b).

The transition paths also include the climate adaptation parts of the municipal wastewater plan since it is connected to the climate adaptation plan, and describes the municipality's plan to adapt Gladsaxe in relation to the changing rain pattern in terms of guidelines and projects. In the following section both the relevant content of the action plan as well as the wastewater plan will be explained.

7.1.2.1 The action plan

Based on the assessment of the thirteen risk areas, the climate adaptation plan presents five different tracks of actions: Business areas, residential areas, other construction projects, campaigns and guidance, and development and research projects. It was the content of these five tracks, which were the base of the evaluation of Gladsaxe Municipality in the comparative evaluation analysis in this thesis. In the following, these tracks and their content will be presented. (Gladsaxe Municipality, 2014b).

7.1.2.1.1 Business areas

In relation to the three business areas of Gladsaxe Municipality, the goals are to integrate climate adaptation in the already planned urban transforming of the areas as well as develop a strategy for collaborations with the companies. To reach these goals, three main actions are presented. The municipality has already (in 2014) investigated to what degree the different companies were climate adapting their own property. Based on this investigation, the municipality will then, from 2014 and onward, develop strategies for collaborations and partnerships in relation to climate adaption. In addition, from 2014 and onward, they will also make climate adaptation demands in relation to the urban transformation processes, through the development of climate local plans. (Gladsaxe Municipality, 2014b)

7.1.2.1.2 Residential areas

In relation to the ten risk areas that are mainly residential, the goal is to develop climate adaptation solution according to the prioritisation created earlier (see Figure 35). From 2014 until 2017, concrete actions for Bagsværd and Buddinge, which are the highest prioritised residential areas, will be planned. This includes the development of a cloudburst plan that describes the concrete solutions as well as the subsequent implementation of these solutions. The planning of Bagsværd is first being initiated when the planning of Buddinge is well into progress, in order to gain experiences from the first area and be able to use them on the second. Furthermore, the planning of Buddinge has to be coordinated with the planning of the upcoming light rail, which is supposed to run through the area. The solutions also have to fit together with the general expansion and renovation of the sewerage system within the area. (Gladsaxe Municipality, 2014b).

Finally, from 2018 until 2040, the climate adaptation planning of the remaining eight risk areas are scheduled. (Gladsaxe Municipality, 2014b).

7.1.2.1.3 Other construction projects

In relation to all that is not directly related to neither residential areas nor business, the goal is to climate adapt, where it is relevant and possible. In order to get a more optimal use of resources,

climate adaptation has to be able to be planned when needed and when the opportunities suddenly occur. Thus, an assessment of possible climate adaptation integration ought to take place whenever construction or renovation of bigger projects is in progress. From 2014 and onward, this include possible integration of climate adaptation in renovation and transformation of roads and paths, municipal institutions, green areas, expansion of district heating on private property and the previously mentioned light rail. Furthermore, in relation to these urban renewal projects, climate local plans will be developed in order to insure the regulations and implementation for climate adaptation. (Gladsaxe Municipality, 2014b).

7.1.2.1.4 Campaigns and guidance

In relation to engage and involve companies and citizens, the goal is to support their own climate adaptation initiatives through campaigns and guidance in order to make them manage rainwater on own property. From 2014 to 2017, the municipality plans to focus on spreading out the message about the importance of climate adaptation, through the municipal web side, leaflets and activity days. In addition, the municipality wishes to get into dialogue with companies in relation to climate adaptation solutions as well as communicate out their demonstration project through signage, excursions, press coverage and more in order to gain interest from the public and private. (Gladsaxe Municipality, 2014b).

From 2014 and onward, the municipality wishes to collaborate more with professionals such as sewer contractors and landscapers in order to make them climate adaptation *ambassadors*. They will also like to collaborate more with housing associations. Often these housing associations include hundreds of residents and many green areas, which creates a great potential for a noticeably effect on the sewer system. Finally, the municipality wishes to use the flood risk analysis of the thirteen areas when dealing with private building projects in order to prevent damages. (Gladsaxe Municipality, 2014b).

7.1.2.1.5 Development and research projects

Finally, the municipality has a goal to create projects, which gives them more knowledge in relation to choosing the most optimal solutions, mainly for *residential areas* and *other construction projects*. This includes research on water quality, possible water paths and local seepage conditions. Since they are the base of other tracks, many of these research projects were already initiated back in 2013. Furthermore, from 2014 an onward, the municipality wishes to coordinate actions and share knowledge with the rest of the region as well as collaborate with neighbouring municipalities.

7.1.2.2 The wastewater plan

Gladsaxe Municipality's new wastewater plan from 2015 states that climate adaptation has to be integrated in the implementation of its actions. When for instance Nordvand is developing and implementing wastewater solutions, the municipality would like to make sure that these solutions are well connected with the goals of the climate adaptation plan to minimise the risk of damage during heavy rain events. (Gladsaxe Municipality, 2015c).

Nordvand are expanding the wastewater system so flooding on terrain statistically only should occur in shared sewer areas once every ten years and in separate sewer areas once every five years. The majority of Gladsaxe is shared sewer areas. The climate adaptation plan deals with what happens when these floods do occur. This is why the climate adaptation plan and wastewater plan need to be coordinated. (Gladsaxe Municipality, 2015c).

To take further precautions, Nordvand is integrating a safety factor when expanding the sewer systems. This factor is 1.43 and is integrated because it is necessary to take into account the fact that a 10-year rain event today is properly not as extreme as a 10-year rain event in 100 years. By dimensioning the sewer system to be able to cope more than necessary, the system is prepared for future climate changes. (Gladsaxe Municipality, 2015c).

One of the focuses of the action plan in the climate adaptation plan is to involve citizens, housing associations and companies to climate adapt their own property. The wastewater plan states that these can get 40 % of the connection fee back through the repayment scheme. If 100 % of the rainwater is being managed on own property this payback amount is about 24.000 DKK. Partially repayment is also possible if the rainwater management is between 50-100 %. (Gladsaxe Municipality, 2015c).

The wastewater plan also contains five guidelines for climate adaptation and rainwater (Gladsaxe Municipality, 2015c):

- Climate adaptation must be integrated in the municipal planning, especially in the thirteen risk areas.
- Rainwater has to be integrated in the natural cycle and in green solutions.
- Rainwater has to be visible in the urban areas as well in the nature in order to enhance the recreational and natural value.
- Sustainable urban drainage systems have to lead rainwater to the big green areas during a cloudburst.
- Planning of new urban areas and houses has to consider as minimum green roofs, rain water beds, level of permeability, plinth height, terrain regulations, location of building plots and support the natural surface runoff.

Furthermore, the wastewater plan states that within 2014-2017, climate adaptation actions in veBuddinge and Bagsværd has to be initiated. These two areas are the highest prioritised risk areas according to the climate adaptation plan. (see Figure 35). The plan also states that within 2018-2040, the rest of the risk areas are going to be climate adapted. (Gladsaxe Municipality, 2015c).

Finally, the wastewater plan from 2011 states that Nordvand at that time had planned these projects (Gladsaxe Municipality, 2011a)

- Separation of rainwater from waste water in Grønnemose Neighbourhood
- Separation of rainwater in Høje Gladsaxe Sports Park
- Separation of rainwater from waste water in Marielyst
- Purification of rainwater in Høje Gladsaxe Park

As it is seen in the chapter about the operational cluster, all these four projects are already in the middle of or finished with the implementation.

7.2 Collaboration in the tactical cluster

Gladsaxe Municipality (together with other municipalities) and Nordvand are the main actors in the tactical cluster. It is the collaboration and dialogue between these actors that have been the base for the climate adaptation plan as well as waste water plan, although it is the municipality, who has the primary responsibility. The following sections present the collaboration between the Gladsaxe Municipality and other municipalities, as well as Nordvand in the context of the strategies behind the climate adaptation plan.

7.2.1 Collaboration with other municipalities

In their climate adaptation plan, Gladsaxe Municipality states that they will prioritise to participate in the development and coordination work already established within the Capital Region as well as in the collaboration with neighbouring municipalities. The municipality would like to continue to participate actively in the project management and working groups of the KLIKOVAND network together with the other municipalities and water utilities of the region. They would also like to continue to participate in the rainwater forum (Regnvandsforum) together with the municipalities within the capital area. (Gladsaxe Municipality, 2014b). The Climate adaptation plan furthermore states that:

"*It is important to find the best solutions across the municipal borders, and it is therefore highly prioritised to develop solutions in collaboration and dialogue with neighbouring municipalities and other utilities*" (Gladsaxe Municipality, 2014e, p.1).

Kathrine Stefansen explains that the municipality has been in dialogue with Herlev Municipality (as well as Herlev water utility) in relation to Kagså. Kagså is a shared water catchment area, which has caused floods of the low-lying areas in both municipalities. Here the dialogues have mainly focused on the load of wastewater in the catchment area, but no concrete actions seem to have been initiated in relation to this. Furthermore, she explains that if many of the flooding problems in Gladsaxe are going to be solved, it is necessary to collaborate with Lyngby-Taarbæk Municipality because much of their water, streams downs to Gladsaxe. Gladsaxe Municipality has already a dialogue with Lyngby-Taarbæk about concrete projects and challenges. (Stefansen K., 2015). Thus, it seems that the inter-municipal actions of Gladsaxe (or at least the intentions) are in line with the climate adaptation plan.

7.2.2 Collaboration between the Gladsaxe Municipality and Nordvand

The development of the strategies for the climate adaptation plan as well as the wastewater plan has been the responsibility of the Gladsaxe Municipality. However, the municipality has also been in close collaboration with Nordvand in this process. While the municipality was developing the climate adaptation plan, Nordvand had just started to focus more on surface solutions. According to Kathrine Stefansen, this change has had I big influence on the planning as well as the projects later on. (Stefansen K., 2015).

According to Annette Kolte-Olsen from Nordvand, a solid base for collaboration was important to begin with: "*With Gladsaxe, Nordvand made sure from the beginning to have meetings regularly in order to create a solid base collaboration later*" (Kolte-Olsen A., 2015, 43:34). She furthermore adds that these meetings have led to good collaboration during projects, exchange of knowledge and thus a similar level of knowledge. (Kolte-Olsen A., 2015).

Through the collaboration, Nordvand and Gladsaxe have among other things agreed on how to deal with the repayment scheme, and what strategies should be used when developing projects. This refers to both the climate adaptation plan and the wastewater plan. However, according to Annette Kolte-Olsen, the collaboration on this level has mainly revolved around the wastewater plan because it sets the regulations for what Nordvand as a utility company can do and have to do. For instance, the repayment and connection fees as well as the required level of service are all regulated by the wastewater plan (see Chapter The wastewater plan7.1.2.2). In relation to the reason for why there has been a collaboration with the municipality, Lise Jangmark from Nordvand explains:

"*Of course we also have to deal with what we actually are allowed and not allowed to do, and we have to live up to that. We cannot just do something that we are not allowed to. This is why there have been a collaboration [with the municipality].*" (Jangmark L., 2015, 38:33).

From Nordvand's point of view, setting and understanding the common regulations in relation to wastewater thus seem as the prime motivator for collaborating with the municipality. Annette Kolte-Olsen adds that the municipality has been flexible in relation to the regulations and has for instance not given Nordvand any demands on how big a percentage of rainwater should be managed on the surface, which she is quite satisfied with. In relation to actually setting such a percentage of rainwater managed on the surface, she furthermore adds:

"*[…] it is not appropriate to do. The economy is more important, it has to make sense. You cannot just set a criterion that management on the surface is the only right thing to do […] There have to be space and opportunity so it all relates in the end.*" (Kolte-Olsen A., 2015, 38:50).

Even though the municipality did in fact not put up such a regulation, this statement strongly indicates that Nordvand is less focused on managing water on the surface compared to the municipality and is thus less focused on synergies like added value such as combining solution with green areas or playgrounds. This is understandable since such solutions started to interest them quite late compared to the municipality. It seems that Nordvand is more practical minded, with a tradition for focusing on economy and making sensible solutions. This is also indicated by the monthly internal meetings in Nordvand, which according to Annette are mostly focused on the economy of projects. However, it seems that they are aware of this since they do try more to include a more creative approach when dealing with climate adaptation projects. Annette points out that it is a work in progress as they are growing in size and employees, and an important thing to remember is that Nordvand as a separate company is quite new: "*It is only seven years ago we became Nordvand, so we are still growing as a company, which also requires restructuring*". (Kolte-Olsen A., 2015, 55:16).

The fact that Nordvand was separated from the municipality in 2008 has caused some barriers in relation to developing climate adaptation strategies. Before the separation, the utility department was a part of the municipality and was located in the same municipal building. Back then, it was easy for the utility people to just go down the hallway if they had any inquiries or questions to their planning colleagues. However, now things seem to be different:

"*Now we have to go to the town hall for meetings, and we need to write, e-mail and communicate together much more. […] Because of ongoing replacements within the municipality, […] we suddenly have to communicate with some completely new people*" (Jangmark L., 2015, 01:11:22).

Despite the separation causing this communication barrier, Nordvand and Gladsaxe Municipality have still managed to retain the same level of knowledge in relation to the water utility area. Some of the employees at Gladsaxe Municipality, who were qualified for moving from the municipality to Nordvand when the separation happened (primarily employees from the utility department), stayed in the municipality. This meant that the municipality from the beginning of the separation still had solid knowledge about water utility. As a contrast, Annette mentions Gentofte Municipality, which Nordvand also covers as utility company. She explains that Gentofte did not have the same knowledge to begin with as Gladsaxe, and therefore spend longer time gaining this expertise. She then concludes that this has created a huge difference between how Gentofte and Gladsaxe deal with climate adaptation, and how Nordvand works with them respectively. (Kolte-Olsen A., 2015). In the comparative evaluation of the thesis, Gentofte came on a 17th place with an adaptation score of 8.2 (see Figure 31) despite having the same water utility company as the frontrunner municipality, Gladsaxe. This indicates the importance of having the same level of knowledge between municipality and utility, especially from the very beginning. Knowledge take time to build up. Utilities will always be *the experts*, but a deep knowledge about water utilisation within the municipality itself must be seen as an important capability.

7.3 The key points

Derived from the transition vision, thirteen transition images have been created, which show the desired future state of a climate adapted Gladsaxe Municipality. These images are the thirteen risk areas within the climate adaptation plan, which have been located based on data on geography and potential damage by COWI; assessed in relation to different climate adaptation opportunities; and been prioritised according to seven criteria. The assessment and prioritisation have been performed by the same diverse climate adaptation group (properly with some replacements), which also created the vision.

Furthermore a number of transition paths have been created, which show the routes to the transition images. These are the actions within the action plan, which have been divided into five different tracks. Together with the transition images, the paths form the transition agenda, which is the climate adaptation plan itself. This agenda functions as the compass for the transition. The content of the climate adaptation plan has also been influenced by the different inter-municipal networks that Gladsaxe is participating in, and especially by the close collaboration between Gladsaxe Municipality and Nordvand.

8 The operational work with climate adaptation

According to Transition Management, the operational cluster contains short-term concrete experiments that are in line with the long-term vision, transition images and transition paths. These experiments are in this thesis being identified as the different climate adaptation actions initiated by Gladsaxe Municipality and developed through collaboration and dialogue with Nordvand, citizens, housing associations and companies. This chapter thus contains the development of these projects and how the actors of these projects have been mobilised by the municipality (or Nordvand in some cases). Furthermore, it explores the influence of project managers and economy as well as the collaboration and dialogue between the municipality, Nordvand, citizens, housing associations and companies.

8.1 Initiated and implemented climate adaptation actions in Gladsaxe Municipality

The municipality has initiated the climate adaptation concretisation of Buddinge, which is the highest prioritised risk area in Gladsaxe. No concretisation plans have been published yet, but a working group, consisting of the same people as the climate adaptation group that developed the vision, has been attached to the project. (Stefansen K., 2015). However, three concrete projects in Gladsaxe Municipality are implemented, currently being implemented, or very close to start the implementation. These three are Gedvad, which includes climate adaptation of eleven private roads and five private gardens in a smaller residential area; Høje Gladsaxe Climate District , which includes climate adaptation of five larger areas; and Kildevængen/KildeParken, which is the climate adaptation of two neighbouring housing associations.

It is worth mentioning that the two first projects are within risk areas that are only prioritised as tenth and eleventh respectively, while the latter is not even within a risk area. (see Figure 35). This means that they should be less important to climate adapt compared to many other risk areas. However, the fact that these projects are still being realised, is more or less a result of coincidence and the interest of the property owners.

The following sections explain these three projects as well as minor demonstration projects, including how they came about and who was involved.

8.1.1 Climate adaptation of Gedvad

Gedvad area is primarily residential neighbourhoods. The purpose of the project in Gedvad is to explore the possibilities and implement sustainable urban drainage systems locally within an area that includes about 300 residents. These drainage systems include green ditches and rain beds, which are able to delay and percolate rainwater from roads and roofs. Eleven roads and five gardens have been chosen to be climate adapted. (Nordvand, 2015e).

Figure 37: The eleven selected roads in Gedvad

The area is low on the prioritisation list in the climate adaptation plan. However, Nordvand already made the initial plans to separate the road water in the area, before the climate adaptation plan was published. At the same time, the municipality had tried to find private gardens, which they could use as *try-out rainwater gardens* for climate adaptation. When Nordvand in August 2014 started the dialogue meetings with the local residents, the municipality joined in order to find residents, who could be interested in the rainwater garden project:

"*We were looking for five gardens to be rainwater gardens. They would get their 24.000 DKK back of course (repayment scheme), as well as a sketch of the new garden and the work labour itself. However, the materials such as stones and plants, the residents had to pay for themselves. In that sense they really get a lot from us, but they also have to be willing to have a sign in front of their house as well as accept that people are able to visit the gardens.*" (Stefansen K., 2015, 31:21).

Some of the residents were interested, and the municipality eventually found their five gardens. (Stefansen K., 2015). In general, one of the key elements in both the garden and the road project has been involvement of the local residents. This have of course been necessary since it takes place on private property, but another important reason was furthermore so the residents could join in and provide with good ideas and local experiences. The three dialogue meetings held in 2014 by Nordvand as project manager, have been the base for creative exchange of information, qualities and possibilities between residents, Nordvand and Gladsaxe Municipality, which concreteness have increased through the meetings. (Nordvand, 2015e).

At the first dialogue meeting in August 2014, where 97 residents participated, the focus was to introduce the residents to the projects. This happened through presentation of slides, where Nordvand introduced the road project, while the municipality introduced the garden project. In addition, the first meeting also included a workshop, where the citizens had the opportunity to tell about the area (in relation to the road project). (Nordvand, 2014g). Gedvad was divided into three smaller areas with a workshop group attached to each area. The residents answered questions such as: "*What are you happy about in your area?* […] *Why do you live here?* […] *What characterises your area? […] How is the composition of residents? What things are you less happy*

about? […] *What could be changed?* […] "What actions / green measures do you need? […] *What could supplement your area well?"* (Nordvand, 2014h, pp. 1-7). Through the answers of these questions, Nordvand got an idea of the challenges and possibilities of the area.

Figure 38: Workshop with the residents of Gedvad

A special group of interested resident was also created. The purpose of this group was to meet and discuss climate adaptation in between the dialogue meetings, while walking around in Gedvad or in areas, where climate adaptation already was initiated. Knowledge and inspiration from these excursions were then integrated later in the following dialogue meeting. In addition, in between these meetings, Nordvand had meetings with the three consulting engineers EnviDan, Alectia and Rambøll, which had been attached to each of the three smaller areas in Gedvad. (Nordvand, 2014e).

At the second dialogue meeting in October 2014, where 110 residents participated, possibilities for Gedvad in relation to the road project were discussed. Based on the previous workshop, EnviDan, Alectia and Rambøll had made suggestions for the areas of Gedvad. These professional consultants were also participating the meeting in order to answer specific questions from the residents. The second meeting included a workshop as well, where residents could discuss and come with feedback to the proposed suggestions. (Nordvand, 2014e).

Finally, at the third and final dialogue meeting in November 2014, a sketch project were presented to the resident for each of the three areas of Gedvad. These were based on the previous two workshops. A final workshop was held in order for the residents to come with their last feedback. (Nordvand, 2014f). After subsequent meetings between Nordvand and the consulting engineers, the climate adaptation implementation of Gedvad is scheduled to start mid-2015. (Nordvand, 2015e) Furthermore, the rainwater gardens were also included in this final meeting since all five gardens had been identified. (Gladsaxe Municipality, 2014h). The climate adaptation implementation of these gardens is scheduled to be finished in June 2015. (Gladsaxe Municipality, 2014h).

8.1.2 Høje Gladsaxe Climate District

Within a major area of Høje Gladsaxe, a comprehensive climate adaptation project is currently being implemented. This major project has been named Høje Gladsaxe Climate District and includes climate adaptation of five connected subareas: Høje Gladsaxe Sports Park, Marielyst Neighbourhood, Grønnemose Neighbourhood, the Water Conduit Path (Vandledningsstien), and Høje Gladsaxe Park. The idea is to transform and adapt this huge area, so rainwater from all the subareas ends up in Høje Gladsaxe Park, where rainwater lakes have been implemented. (Nordvand, 2015c).

Gladsaxe Municipality and Nordvand finance the overall project, while Real Dania co-finances Gladsaxe Sports Park. (Nordvand, 2015c).

Figure 39: Høje Gladsaxe Climate District and its five different climate adaptation areas.

Nordvand has been the project manager and the main driver since the Climate District was initiated. Even though, the municipality does have an economic part in the project, they have only had people attached to different meetings along the process. The reason for this is mainly that the project is very sewer-technically complex:

"*If it had been [...] a project with a small and simple sewer technical part, it could have the municipality in charge, and we [Nordvand] would then only had been a smaller part of the financing and participated in the meetings. However, this has been really complex, so Nordvand has been in charge.*" (Jangmark L., 2015, 58:34).

Many of the areas were already included in the wastewater plan from 2011 as projects that Nordvand had planned to implement. In 2011, when a massive cloudburst hit the majority of the Capital area, Grønnemose Neighbourhood was greatly damaged. Shortly after, Nordvand did a wastewater project at a school area close to Grønnemose, and in order to accommodate both areas, Nordvand chose to implement a big tube with a diameter of 1.400 millimetre; more than capable to separate wastewater and rainwater from both areas. This subsequently opened up for other climate adaptation plans nearby. Plans fostered other plans further away until Nordvand suddenly had five large connected areas with a big and realistic potential for climate adaptation. However, without the initiating of the big tube, it would not have been possible. (Kolte-Olsen A., 2015). Thus, the overall Climate District is a result of coincidence and unstructured planning with the simple strategy to separate rainwater and wastewater.

All five projects within the Climate District are either currently being implemented or are finished. The following sections focus on the Høje Gladsaxe Sports Park and Marielyst, because these exemplifies the municipal collaboration with Nordvand and a housing association respectively.

8.1.2.1 Høje Gladsaxe Sports Park

As part of the Climate District, Nordvand is in charge of separating rainwater from wastewater in Gladsaxe Sport Park. Via ponds and ditches all over the area, the rainwater is intended to also be of recreational value. From these ponds and ditches, the rainwater will either percolate or run on the surface down through the Water Conduit Path to Høje Gladsaxe Park. (Nordvand, 2015d).

Figure 40: Construction of one of the ditches in Høje Gladsaxe Sports Park.

The sports park did receive supporting funds from Real Dania through the *VANDPLUS* fund, because it "*shows that it is possible to complete a climate adaptation project and in the same time create new values for the citizens and the city.*" (Klimatilpasning, 2015a, p.1). *New values* includes among other things the recreational values gained through many of the double functioned rainwater basins of the area. These basins also contain certain activities, for instance a water playground. (Krawack, 2014) Furthermore, Nordvand mainly finances the project, with a minor contribution from Gladsaxe Municipality. (Klimatilpasning, 2015b). The money from the municipality as well as from Real Dania has mainly been used for the recreational parts of the sports park, because it is not Nordvand's area of business. (Jangmark L., 2015).

One of the benefits with the implementation of Gladsaxe Sports Park is the fact that there is almost no one who lives right next to the construction side. It is mostly green areas. This has resulted in a relatively easy implementation so far, with few complains to delay the process. Lise Jangmark adds:

"*We have been a bit lucky with this project, that is has been so gentle for the nearby residents. There has not been that much negative feedback on the project*" (Jangmark L., 2015, 1:17:04).

Nordvand has been the main project manager, while the municipality has been involved in different ways, depending on what type of project was implemented in the sports park. The representative from Centre of Property (Ejendomscenteret) within the climate adaptation group has especially been active because the sports park is municipal property. (Stefansen K., 2015). The collaboration has worked very well and both Gladsaxe Municipality and Nordvand seem to recognise each other's strengths. The municipality recognises Nordvand's greater capacity to assume the role of project manager and contract holder, while Nordvand recognises the municipality's expertise within recreational values and creative planting. However, even though the shared ownership and project management of the project have worked well, it can cause a problem to have such an approach if conflicts should occur. Such a process is challenging. (Krawack, 2014).

Figure 41: Ditch around football field in Gladsaxe Sports Park.

8.1.2.2 Marielyst Neighbourhood

Marielyst is a 180.000 m^2 residential area and is a part of *Gladsaxe Social Housing Cooperative Association* (Gladsaxe Almennyttige Andelsforening – GAA). Together with Nordvand and Gladsaxe Municipality, they have separated rainwater from wastewater through the implementation of different sustainable urban drainage systems in order to minimise the flood risk. These systems include rainwater beds, ditches and hollows in the terrain, which collect rainwater from roofs and other impermeable surfaces, and turn it into a recreational value. The area is also connected to the Water Conduit Path, which ensures that excess water eventually will end up in Høje Gladsaxe Park.

Figure 42: Ditch along the inner facade of Rundgården, Marielyst.

The Marielyst Neighbourhood is owned privately by GAA. However, the project originally started because a municipal employee saw a potential in Marielyst in relation to climate adaptation. He first consulted Nordvand with his ideas, which agreed to join the project, if the road water in the area was integrated in the plans. The municipality thus contacted Dennis Schultz, the operating manager in GAA, in 2011 with the idea to climate adapt Marielyst in order to fully manage rainwater.

"*Their [the municipality] question to us, was if we would like to separate on our own land, and thus get the fee back from Nordvand through the repayment scheme. Overall, this would give us about 13 million DKK, which we could use to pay the project.*" (Schultz D., 2014, p.1)

These 13 million was based on the about 550 resident in Marielyst, which each would get close to 24.000 DKK back from Nordvand if they could separate rainwater 100 %. This meant that the residents in reality did not have to pay anything for the project, if they agreed to pay through the repayment scheme.

From the municipality contacted GAA to the final approval, one and a half year went. In this period, the municipality provided sketches and participated in meetings with GAA and Nordvand. However, after the approval, the municipality became more absent in the process and reduced their role to be an authority unit:

"*We [the municipality] left the project a bit. They have run their own process in the housing association. There is also a democracy out there in the form of an official board. Also the fact that people need to vote for this project. It is a very elongated process to do anything in social housing associations.*" (Stefansen K., 2015, 36:35).

Thus, it seems that one of the reasons for the municipal absence was to give room for these democratic processes. When approved by the different boards, residents was introduced to the project, which was then put to a vote at a general meeting. Dennis Schultz estimates that around 80 % of the residents was positive towards the project, and thus the actual planning could begin. In the planning process as well as the construction phase, it were mainly GAA, Nordvand and the

contractors, which were involved. In order to enhance the collaboration between the actors, a number of teambuilding workshops suggested by one of the contractors was held in the beginning. According to Dennis Schultz, these workshops, which focused a lot on internal and external communication, brought them closer together. Furthermore, throughout the construction phase, GAA, Nordvand and contractors made sure to maintain a good communication with the residents. This was done through information that was being send out to the residents before each new construction site started. In addition, monthly meetings were held in order to take care of the problems of the residents in relation to the construction as well as answer regular questions about the project. (Schultz D., 2015). According to Dennis Schultz, the workshops and the good communication with the residents have been the key elements, when creating climate adaptation solutions in a housing association. (Schultz D., 2014).

Even though Gladsaxe Municipality has not been a part of the initial workshop as well as an active part in the planning and construction phase, Dennis Shultz is very satisfied with their role as authority unit:

"[…] *they [the municipality] have made it a little easier for us in the regulatory approval.* […] *In addition, they have given us many dispensations. Things that would be impossible to do before, suddenly became possible to realise within no time. This includes relocating a kindergarten as well as a playground, cutting down protected trees, changing the building envelope and the local plan, and giving the residents the possibility to expand their gardens. Therefore, they [the municipality] have truly done a lot.*" (Schultz D., 2015, 51:46).

Figure 43: View from the curvature of the ditch in Rundgården, Marielyst.

Dennis Schultz furthermore agrees that Gladsaxe Municipality, through the regulatory approvals and dispensations, has been a big part of the reason for a relatively quick completion of the Marielyst project. He also adds that he has noticed a transition within the municipality themselves:

"*They [the municipality] have gone from being these heavy government officials, who had very easy to say no, or easy to come up with legal obstacles, to be some, who are willing to work together on the same level, participate in discussions and challenge the barriers. In this way, they have delivered a new form of local government thinking, which we can be truly happy about.*" (Schultz D., 2015, 51:46).

From Dennis Schultz's point of view, this transition also includes a top management within the municipality, which had started to make climate adaptation projects highly profiled. (Schultz D., 2015). From a municipal point of view, climate adaptation governance is thus more than just engaging and involving local residents; it also includes sending out the right signals such as interest and prioritisation. Furthermore, the municipal initiative to contact GAA and Marielyst in the beginning should be acknowledged, since Dennis Schultz did not know about climate adaptation and sustainable urban drainage systems before the municipality approached. It is thus valid to believe that Marielyst would not be climate adapted and be a part of Høje Gladsaxe Climate District if it was not for the municipality. The climate adaptation of Marielyst was finished in December 2014, with minor adjustments during spring 2015.

8.1.3 Kildevænget/Kildeparken

On April 29th, 2015, the preparations to the climate adaptation of Kildevænget and Kildeparken Neighbourhoods began. Kildevænget is a housing association, which is also a part of GAA just as Marielyst, while Kildeparken is a separate housing association right next to Kildevænget. From GAA's point of view, the project is a continuation of their long-term vision to Climate adapt most of their housing associations in Gladsaxe. However, it was the municipality that approached GAA about the opportunities just as they did with Marielyst.

Dennis Schultz, who is also operation manager of Kildevænget, explains that the goal is more or less the same as with Marielyst, but it includes the experiences and learnings from Marielyst. He furthermore adds, "*We are taking all the bad things we experienced with Marielyst, and are turning them into good things in Kildevænget.*" (Schultz D., 2015, 32:29). He furthermore adds that they of course need to collaborate with Kildeparken (Schultz D., 2015).

Just as it was in Marielyst, an important focus in Kildevænget is the involvement of the residents. Although it is relatively early in the process, residents have already had the opportunities to point out where they would like to have activities such as barbecues spots. GAA also plans to send out information about the future implementation process in order to prepare the residents as much as possible. (Schultz D., 2015).

Dennis Shultz also points out (2015) that Gladsaxe Municipality is going to be much more involved in the Kildevænget project compared to Marielyst. The municipality has already done a lot in terms of informing the residents of Kildevænget. Dennis especially highlights Anne Stougaard from the municipality, who has been good at managing the initial process and seeing the opportunities. Furthermore, it is also the plan that the municipality this time is going to participate in the workshop about teambuilding together with GAA, Nordvand and the contractors. Dennis Shultz adds:

"*They [the municipality] have received the invitation (to the workshop), and I am sure they will come. They seemed sad that they did not include themselves more in Marielyst. […] For many actors, the workshop in Marielyst was a revelation. I think the municipality need that feeling*." (Schultz D., 2015, 1:04:31). The implementation of the project started mid-May 2015 and is scheduled to be finished mid-May 2016. (Schultz D., 2015).

8.1.4 The smaller demonstration projects

Gladsaxe Municipality has also initiated other projects, which are smaller in scale but manage to demonstrate the possibilities of climate adaptation locally. One of these is a demonstration project in a housing association similar to Marielyst, where the parking area are renewed with permeable surfaces. Another project is just in front of the city hall, where a small rain bed has been implemented in relation to an open house event about climate adaptation. Besides the actual climate adaptation function, these projects also serve as a base for learning. They also acts as practical examples, which the municipality can refer interested residents to. For future demonstration projects, Kathrine Stefansen adds:

"*We have had some plans to make demonstration projects in relation to schools and schoolyards, because new things have to happen, and parents and their kids are coming and going. In general, it is about thinking what type of needs the municipality has and what type of projects are currently going one, where we can integrate climate adaptation.*" (Stefansen K., 2015, 32,32).

8.2 The importance of good project managers and personal relationship

The significance of when specific actors and employees are being replaced because they quit or are being moved to another department, should not be ignored when it comes to climate adaptation projects. Annette Kolte-Olsen points out that successful projects often are the result of a good personal relationship or chemistry between the different people in charge. Where it in the planning process is several people from Nordvand, Gladsaxe Municipality, and a possible third and fourth actor that create the collaboration, the individual project manager creates the collaboration, when it comes to concrete projects. Thus, it is often the project manager, who shapes the process of the project. (Kolte-Olsen A., 2015). Dennis Schultz agrees with this and explains that projects often are very depended on one single person. During the climate adaptation of Marielyst, his collaboration with Nordvand mostly went through the project manager, Bo Brøndum Pedersen. (Schultz D., 2015). Through the implementation process, it turned out that Dennis and Bo Brøndum Pedersen were a perfect match in terms of personal and professional ambitions (Schultz D., 2014). According to Dennis, Bo was not hampered by a certain culture of Nordvand in relation to climate adaptation solutions. In order to compare, Dennis mentions the new project manager from Nordvand, who replaced Bo on the new climate adaptation project in Kildevænget:

"*I sense that that the new project manager will like to do something, but he is hampered by the culture. […] He is burdened by forces, which are influenced by people in Nordvand thinking this [climate adaptation on the surface] is irrelevant.*" (Schultz D., 2015, 1:00:51).

It is important to mention that this statement is just speculations from Dennis Schultz, and is merely based on his immediate impression. However, this suggested *culture*, which Dennis refers to, is somewhat in line with the economical and practical take that Nordvand has on climate adaptation.

Dennis Schultz furthermore thinks that the Marielyst project properly would have been significantly different if Bo had not been a part of the project. Kathrine Stefansen also mentions Bo Brøndum Pedersen, and calls him a progressive project leader that have managed many projects within the Climate District. She furthermore adds:

"*Bo was very innovative, he was good at creating contacts, for instance in relation to the Gladsaxe Sports Park. […] In that sense, I think it depends on the individual, in relation to whether a lot suddenly starts to happen.*" (Stefansen K., 2015, 15:19).

According to Lise Jangmark, it was Bo, who approached the municipal chief of sports, Holger Kortbek, about the suggestion for the Sports Park. Holger Kortbek quickly agreed and has since then participated in the process wholeheartedly together with Bo. Lise concludes that the process of Gladsaxe Sports Park has very much been influenced by the relationship and collaboration between Bo Brøndum Pedersen and Holger Kortbek, and that the general willingness and ability to accommodate have been a key capabilities in this. (Jangmark L., 2015).

Both Nordvand, Gladsaxe Municipality and GAA agree on the importance of close collaboration and a good relationship on an individual level in relation to concrete projects. It is especially the relationship between the project manager and the developer, which seems to be essential for a good and effective process. Furthermore, Bo Brøndum Pedersen can be identified as an institutional entrepreneur because of his alternative mindset and approach, which have proved to be important and successful elements through different climate adaptation projects.

8.3 Collaboration and dialogue in the operational cluster

The climate adaptation projects are heavy influenced by collaboration and dialogue between different actors. The following sections present the municipal campaigns for citizens, housing associations and companies as well as some of the challenges that occur in the collaboration between Nordvand and Gladsaxe Municipality.

8.3.1 Dialogue with citizens and housing associations through campaigns and guidance

In relation to involving citizens, Nordvand has not been working together with the citizens besides in the climate adaptation of Gedvad (see Climate adaptation of Gedvad 8.1.1), as the management of roadwater is a criterion for Nordvand to get involved (just like Marielyst, see Chapter 8.1.2.2). Usually, Gladsaxe Municipality makes the contact to citizens and housing associations in order to make them climate adapt. If these then wish to climate adapt their gardens themselves, Nordvand will pay back the connection fee through the repayment scheme. (Kolte-Olsen A., 2015).

The repayment scheme initiated the municipal focus on citizens in relation to climate adaptation in 2010, when it was introduced in Gladsaxe. The municipality was one of the first in the country to do so. The scheme became relevant when the citizens showed interest in it through a survey send out by the municipality. This interest started a political focus, and many politicians became aware of the potential of the scheme. Since the scheme's start, campaigns focusing on involving citizens have mainly revolved around the scheme, because it is the driving force for citizens to become interested. A goal for how many should join the repayment scheme each year has also been included in the municipal strategy, so it has a lot of political attention. (Stefansen K., 2015).

As support for the repayment scheme, Gladsaxe Municipality also optimised their climate adaptation homepage in terms of usability, as well as created flyers and leaflets. In addition, an idea catalogue was included on the homepage, which contained several different solutions for the citizens to become inspired by. This catalogue later became a part of the climate adaptation plan. The municipality has also held meetings with homeowner associations, as well as arranged climate adaptation fairs, where the citizens could come and talk to craftsmen and small contractors. Finally, the municipality is currently in the middle of the implementation of five try-out rainwater gardens as mentioned earlier. (See Chapter 8.1.1). These gardens are to experiment and create interest from other citizens. Kathrine Stefansen concludes that all these campaigns have been a success: "*The number of citizens managing their own rainwater today would not have been this big without the campaigns.*" (Stefansen K., 2015, 19:25). However, certain types of citizens have shown to be difficult to engage in climate adaptation. This includes citizens living higher up in a catchment area. They are not affected by flooding, and are, according to Kathrine, thus not able to see the problem as clear as people, which live in the lower parts a catchment area. (Stefansen K., 2015).

In relation to campaigns specific towards housing associations (such as Marielyst), Kathrine Stefansen explains:

"*The fact that we are creating the initial sketches for the housing company in relation to what solutions are possible in the area, is also a part of what we call campaigns. We have to help them on the way in all sorts of different ways*" (Stefansen K., 2015, 19:25).

Through the last couple of years, there has also happened a shift in focus in relation to the target group of the campaigns. In the beginning, the focus was on the single-family homes, but now the energy is being put more into involving the housing associations. According to Kathrine Stefansen, there is a bigger potential in climate adaptation of housing associations:

"*[Housing association] is bigger units and it is thus possible to move more water. In relation to water management, it is more beneficial for the utility company to include the big units, which have a significant impact. Then they do not need to make other measures. Therefore, that is where we try to channel our work resources.*" (Stefansen K., 2015, 21:31).

This enhanced focus on housing associations has had an impact. Kathrine tells that citizens and housing associations regularly contact the municipality because they are interested in climate

adaptation. Many of them have also seen the Marielyst project. However, it is not because the municipality has lost its interest in engaging single house owners to climate adapt, just because they are focusing more on housing associations. It is simply because these single-house owners usually are able to climate adapt their own property, and all necessary information is online through the climate adaptation website, such as the idea catalogue as mentioned earlier. Furthermore the total amount of paid back money from the repayment scheme is considerably larger for an entire housing association, than a private single-house owner, causing a greater amount of the climate adaptation project to be financed by the repayment scheme for a housing associations, making it easier for the municipality to engage them. (Stefansen K., 2015). According to Kathrine, the municipality has had a bigger success in involving citizens compared to companies. (Stefansen K., 2015).

8.3.2 Involvement of companies

Compared to campaigns for citizens and housing associations, it is limited how much Gladsaxe Municipality has actually done to engage companies. One of the reasons for this is that climate adaptation of the companies' properties can be a bit more problematic. For instance, some of these properties are polluted, which means that percolation of water is prohibited. However, with the climate adaptation plan, the municipality has stated the intention to integrate climate adaptation in the urban renewal of two of the three existing business areas (See Chapter 7.1.2.1.1). Kathrine Stefansen adds:

"*We would like to include climate adaptation actions in some of these processes behind the urban renewal. It is in these processes that plans and dialogues with companies, that partnerships have to be made.*" (Stefansen K., 2015, 24:05).

In relation to the renewal of the business areas, the municipality has made some basic sketches on how the companies could manage rainwater on their own property. This is something the municipality in the future will like to do to an even greater extent as the renewals move forward.

In the end, it seems that the municipality approaches the citizens and companies very differently and with different strategies. This is also in line with the comparative evaluation.

8.3.2.1 Novo Nordisk and the climate adaptation of their new headquarter

According to Kathrine Stefansen, it is limited how many companies have climate adapted their own property in Gladsaxe Municipality. She does mention Novo Nordisk, which has built a completely new headquarter in Bagsværd business area with climate adaptation solutions in the surrounding area. However, this project has been built privately and with no added help from the municipality other than authority approvals. Elsebeth Dahl Pedersen, project manager from Novo Nordisk elaborates:

"*Gladsaxe Municipality has not helped us with the project. However, they have been pleased that we would do it this way. […] Of course the municipality is happily welcoming companies, which are willing to create a big park on their property. The municipality also has a strategy about*

minimising parking garages, so in that sense we are in line with what they want." (Pedersen E.D., 2015, 06:43).

Some of the property of Novo Nordisk was polluted but has been purified before the climate adaptation implementation. In addition, Novo Nordisk did not receive any financial support for the project. However, as Elsebeth also points out, Novo Nordisk is a big organisation with a lot of money, which means they can manage big projects themselves. (Pedersen E.D., 2015).

Novo Nordisk is of course just one out of many companies in Gladsaxe Municipality; however, the fact that companies usually do have a lot of money, could be one of the reasons why municipalities in general experience less collaboration interest in climate adaptation, compared to the citizens as found out in the comparative evaluation. Novo Nordisk chose to collaborate with SLA Architects in order to climate adapt their property. Maybe it is simply because companies such as Novo Nordisk are more interesting in collaborating with professional architects than collaborating with the municipality, because they think it is worth the extra money.

Figure 44:The new headquarter of Novo Nordisk as well as the climate adapted surroundings.

8.3.3 Challenges in the collaboration between Nordvand and the municipality

Nordvand and Gladsaxe Municipality do of course collaborate a lot during the project processes, and take turns to have the leading role according to the type of project and place in the process. However, they do also have some opposing interests, which have created challenges in the process.

In the Gladsaxe Sports Park project, the municipality requested a manhole cover to be made out of oak tree for a project. Such a manhole cover would weight about 75 kilos, which Nordvand pointed out as inappropriate in relation to the working conditions; workers would not be able to lift it properly when needed to operate the sewer underneath. Høje Gladsaxe Climate District is a

large project with many actors involved, making the collaboration very important. There are many actors with different details on their mind, such as architects who look at the aesthetic, park employees who look at the maintenance and Nordvand who primarily look at the dimensioning of the adaptation solution. Lise Jangmark adds

"*There have been some conflicting thoughts and ideas, which we (everyone) have not fully thought through all around with every actor, when there are so many of them. It is difficult to relate to all aspects of such a big projects for everyone.*" (Jangmark L., 2015, 41:07).

Working with landscape architects is quite new for Nordvand, since it is not the type of consultant they have used before. As mentioned above, this new collaboration has caused some challenges. Lise Jangmark thinks that the reason for this is mainly that landscape architects and utility engineers think very differently. Landscape architects are more esthetical focused rather than practical. (Jangmark L., 2015).

Another challenge has been for Nordvand to operate on a private cadastre. The municipality owns Høje Gladsaxe Sports Park but is technically a private cadastre compared to for instance road areas. Lise Jangmark explains that when operating on public roads, Nordvand uses a detailed map of the utility grid, where each well has its own number. However, on a private cadastre, these maps are typically not that detailed or up to date in relation to any changes. This is not only for wastewater, but usually also the case for electricity, district heating and gas. It can make the implementation process extra complicated and expensive, when the contractors suddenly encounter an unforeseen pipe for district heating, which they then have to redirect before they can continue. In the end, the municipality and Nordvand share these extra expenses, when a situation like this occurs.

8.4 The influence of economy and its challenges

Gladsaxe Municipality is initiating a lot of projects, which they then leave to Nordvand. It is up to Nordvand to find the economy for these projects. This basically means that even though it is mainly Nordvand that finances the projects, it is the municipality that more or less influence *what* projects should be financed. Although it is the citizens, which pay in the end, Nordvand would prefer to control 'their' own money. (Kolte-Olsen A., 2015).

It is according to Kathrine Stefansen often the economy, which is the big challenge when it comes to climate adaptation projects. Nordvand is in charge of the projects and the projects are paid through the tariff. This means that it in the end, it is the citizens who are paying for the projects; however, there is of course no political wish to raise the water bill to much. Although, Nordvand's level of investment is much higher than three years ago, Kathrine Stefansen still thinks that the economy will drag the climate adaptation of Gladsaxe Municipality out time wise. (Stefansen K., 2015).

Kathrine Stefansen also mentions economic underestimations of projects as a problem. This is partly because flooding models change regularly: "*a 100-year rain event today is not the same 100-year rain event as we used to calculate with two years ago.*" (Stefansen K., 2015, 52:37). An

example is the concretisation of the climate adaptation of Buddinge. Here a new and updated calculation showed that in order to ensure ten centimetre on terrain at a 100-year rain event, the overall project suddenly got ten times more expensive than previously estimated. (Stefansen K., 2015).

While the municipality often plans the climate adaptation, it is Nordvand, who is in charge of the economy. Annette Kolte-Olsen explains that it is the economy together with fulfilling the service requirement, which are most important to a project. Furthermore, in relation to climate adaptation on the surface versus in the underground, she adds, "*We will never implement a climate adaptation project on the surface just because it looks more beautiful. Beauty is not out job*". (Kolte-Olsen A., 2015, 27:35). This indicates once again that Nordvand properly is less interested in the recreational value of climate adaptation compared to the municipality and is instead focused more on the cost-efficient solution. This is also in line with Nordvand being more practical minded, with a tradition for focusing on economy and making sensible solutions as concluded in the tactical cluster. (see Chapter 7.2).

Even though Nordvand is more focused on the economy, they are not interested in the co-financing scheme, simply because projects with co-financing often get too complicated. Currently no climate adaptation implementations in Gladsaxe Municipality done by Nordvand have included this scheme. Annette mentions that by including the scheme, it will add more difficulties and complex *joints* to an already long and complex process with many partners. Annette points out that the risk of including the co-financing scheme is when a project gets too expensive, because the scheme is based on financial limits, which the cost of the project may not exceed. If the project costs do exceed, the entire project needs to be reapproved by the Utility Secretariat, which according to Annette has a completely different approval procedure. If it is approved again, a new limit is then being set. (Kolte-Olsen A., 2015). Annette concludes:

"*We are aware that our projects must be financially responsible. It is also difficult to work with many partners and the timetable may slip, but the co-financing does not help because you are just going to have the same discussions with the partners and the Utility Secretariat.*" (Kolte-Olsen A., 2015, 31:07).

Lise Jangmark adds that the already complex process with many different actors and collaboration across, have resulted in completely new issues in the middle of the implementation phase compared to those Nordvand is used to. For instance, cars that chalk a football field may only be cleaned at certain wells. Although this only takes minor measures, Lise Jangmark points out that bigger things also occur from time to time, which have quite big economic consequences for the projects. When such things suddenly occur in the middle of a project, they usually exceed the cost overruns that you initially planned. (Jangmark L., 2015).

Co-financing of climate adaptation projects

Utility companies have since the beginning of 2013 had the opportunity to co-finance both private and municipal alternative climate adaptation projects on roads, water paths and recreational areas through the wastewater tariffs. The co-financing makes it possible for municipalities and utility companies to enter into a new form of collaboration. The Water Sector Reform Act, which separated water and wastewater companies into independent units, resulted in the operation of utility companies becoming independent of the municipalities. The municipality does, however set the framework for managing water through service targets and ownership of the utility companies. Tax funds and tariff funded project initiatives were separated from each other with the Water Sector Act. With co-financing of climate adaptation projects, municipalities and utilities have come in closer collaboration, since the rules suggests that there can be two sources of funding for different parts of the same project. (Krawack S., 2014).

In order to have the rights to co-financing, the utility company musts submit an application to the Utility Secretariat (Forsyningssekretariatet). The application must include among other things the agreement on the alternative project as agreed between the utility company and the project owner, as well as the budget for both the cheapest possible *regular* solution as well as the alternative solution. Both solutions must have the level of service. (Ministry of Environment, 2014)

The rules for co-financing has been a big mouthful for utilities and municipalities to understand properly. It has also been difficult to find they correct way to develop the first applications for the Utility Secretariat. According to Helena Berg Forchhammer, clerk at Competition and Consumer Protection Agency (Konkurrence- og Forbrugerstyrelsen), The development of these applications has been very positive, and are currently very adequate. It seems that the rules is now well implemented and that utility companies have found a good way to make their applications. There has so far mostly been applied for financing in relation to road and watercourse projects. (Forchhammer H. B., 2014).

8.5 The key points

Gladsaxe Municipality has both initiated big development projects such as the Høje Gladsaxe Climate District and small demonstration project such as the five rainwater gardens in Gedvad. The Climate District is five connected areas, where the intention is to lead all rainwater down to Høje Gladsaxe Park. All projects have been developed in a collaboration between the municipality and Nordvand, although Nordvand has functioned as project manager. Høje Gladsaxe Sports Park and Marielyst have been two examples on how the municipality has successfully collaborated with Nordvand and a housing association in relation to climate adaptation. Furthermore, the climate adaptation project of eleven roads in Gedvad is a good example on how Nordvand has used workshops to collect local knowledge and integrate it in the project.

Although many actors are involved in the process, it is often the project manager, who shapes the project. The personal and professional relationship between the project manager and the private developer is a key element in a successful process. Economy is of course also a key aspect in the operational phase and is seen as a big challenge, because of unforeseen expenses, outdated climate models and other reasons.

Finally, the municipality are very keen on involving and engaging citizens, housing associations and companies in order to make them climate adapt their own property. This has happened through different sorts of campaigns, which have had a great influence. However, the biggest driver has been the repayment scheme, where people can get around 24.000 DKK back from the connection fee, if they separate rainwater from wastewater 100 %. It is however also possible to separate less than a 100 % and then receive a smaller percentage of the money.

9 The reflexive work with climate adaptation

This chapter analyses to what extent Gladsaxe Municipality, Nordvand and the housing association of Marielyst have been reflecting or monitoring the climate adaptation work according to the Transition Management. It is important to reflect on the carried out climate adaptation work, so the development keeps taking place, and the procedure does not become locked-in. The reflection of the work must happen as an integrated part of the governance processes in both the strategic, tactical and operational cluster.

9.1 The reflexive thoughts on the work procedure

The climate adaptation group has been created as something new to secure a better climate adaptation vision, plan and end-product through collaboration. The different group members have brought up different options and problems based on their academic field, and they have together found the satisfying solutions through self-evaluation. (Stefansen K., 2015).

Kathrine Stefansen points out that Gladsaxe Municipality does not have an evaluating meeting per se after a project is ended. However, they use their checklist when developing a project and they keep on adding to this list as they find something important to be aware of while creating a project. In that way the list keeps on being updated as an ongoing evaluation. (Stefansen K., 2015).

Nordvand does not have a true Transition Management evaluating culture either. They do have a monthly meeting that normally has been very fixed on economy, but now also entails experience and knowledge sharing. The evaluation of the collaboration process is not something they necessarily need to do, as it is up to the individual employee to decide how it is suitable to end each project. But Nordvand is now starting to think about creating a more structured, framed management evaluation of the experiences. (Jangmark L. and Kolte-Olsen A., 2015).

9.2 The reflexive thoughts on the strategic and tactical work

The work within the strategic and tactical clusters both concern the work prior to the physical projects. The reflection of the transition work within the two clusters are often intertwined, as they share reflections on the collaboration.

9.2.1 The vision and the branding effect

Kathrine Stefansen is very pleased about the collaboration within the climate adaptation group and cannot see a particular thing or procedure which should be changed. She is very pleased about Nordvand as a collaboration partner. The climate adaptation group has from the beginning evaluated the need for new members and adopted them to the group when needed. It is the job of the group members to spread the understanding and importance of the vision in their respective departments, resulting in getting closer to the achievement of the vision. They are aware of carrying out continuous self-evaluation of their work in the group, so the collaboration progresses. (Stefansen K., 2015).

Gladsaxe Municipality would on the long term like to take advantage of their position as a climate adapted oriented municipality and brand themselves as such. Kathrine Stefansen thinks there is a lot of opportunities the municipality can benefit from when doing this, such as attracting more citizens and companies. Kathrine further points out that some municipalities as Middelfart has already taken advantage of this method, as they are branding themselves as "Middelfart climate city", even though they at that time did not even have a climate adaptation solution implemented. Gladsaxe Municipality solely looked at the cloudburst events as challenges that needed to be dealt with from the beginning, and later the idea of branding has started to appear. (Stefansen K., 2015).

Nordvand has only existed since 2008, and has used a lot of time to brand the company, so the citizens know what Nordvand is. They brand the good stories of Nordvand whether it is on the surface or below ground. The Høje Gladsaxe Climate District has been used as the good story in the last couple of years, as something new and innovative. (Jangmark L. and Kolte-Olsen A., 2015). Nordvand is aware of their innovative position and propagate their experiences to the professional world. They have for instance had a presentation at a DANVA meeting, about how they are working, and from time to time present and show their projects to engineering companies and other utilities who ask about it. (Jangmark L. and Kolte-Olsen A., 2015). Likewise has Gladsaxe Municipalities given lectures at DANVA, KLIKOVAND, Danish Byplanlaboratorium and thus shown their projects to the local area and the professional world. (Stefansen K., 2015).

Both Gladsaxe Municipality and Nordvand are becoming aware of the benefits the climate adaptation work may results in if exploited properly.

9.2.2 The collaboration

Gladsaxe Municipality and Nordvand are both aware of the fact, that they need to collaborate to achieve the best climate adaptation solutions, and they both benefit from it.

Lise Jangmark points out in the interview how Nordvand's mindset is changing. In order to manage the great amount of water from the cloudburst, it is necessary to think outside the box. She expresses how Danish utilities 10 years ago had a tendency to think very traditional solution bound, narrowed to underground basins and larger pipes, but now the mindset has become more nuanced in Nordvand, and the solutions depend on the practicalities of each location. (Jangmark L. and Kolte-Olsen A., 2015).

It is Lise Jangmark's believe that other utilities like HOFOR also are quite far with the transition of managing the climate adaptation solutions above ground. She further elaborates, that maybe the size of the utility and their resources influence how far they are in this transition process. As Nordvand manages the water in the two municipalities (Gladsaxe and Gentofte), they employ more managers and wastewater engineers than if they only had to manage the water from one municipality. This causes Nordvand to contain more dynamic, more academic competences and energy to engage, which makes it more manageable to participate in this type of task. It has also been a benefit that Gladsaxe Municipality chose to have some of the wastewater employees to stay in the municipality when Nordvand was established in 2008, as it caused a more collaborative

and direct link between them. Nordvand and Gladsaxe were then able to speak the same "work language" and were familiar with each other. (Jangmark L. and Kolte-Olsen A., 2015).

Kathrine Stefansen also thinks the collaboration-culture between the municipal employees and the utility employees plays a role. The Gladsaxe municipal planners and other employees did before 2008 work together with their wastewater engineer colleagues in the municipality, and this kind of recognition of collaboration has continued after the establishment of Nordvand. (Stefansen K., 2015). She further elaborates the importance of the good friendship between the urban and environmental director of Gladsaxe and the director of Nordvand. This has created a basis of trust between the two actors, and leads to an openness to each other's agendas which is reflected all the way down in the system. (Stefansen K., 2015). Lise Jangmark also mentions the close bond between Nordvand and Gladsaxe Municipality, as an important element for the advanced status of climate adaptation actions in the municipality. Annette Kolte-Olsen further stresses the importance of the mutual respect for each other. Despite the differences, Nordvand and Gladsaxe Municipality share a common understanding of the issues in their own way. Annette mentions the "operating agreement" between Nordvand and Gladsaxe containing what Nordvand each year must do and deliver. It could easily just have been Gladsaxe dictating what they expect. Instead, it has from the beginning been characterized as something they do together. Annette mentions that the cooperation between them can be smooth and sometimes difficult, but it is just a part of it. (Jangmark L. and Kolte-Olsen A., 2015).

The importance of the positive approach Nordvand has towards the municipalities (Gladsaxe and Gentofte) and their project ideas is an important factor for Nordvand being quite far with the transition of managing climate adaptation solutions above ground, according to Annette Kolte-Olsen. She also expresses that "*We* [Nordvand] *see the possibilities instead of the limitations*". (Kolte-Olsen A., 2015, 1:31:30). When Gladsaxe introduced the "repayment option", as one of the first municipalities, many utilities called Nordvand and asked how can you manage that? Annette explains how Nordvand replied: let us try it and then we will evaluate. It is not necessarily the final decision. Nordvand has very rarely initially announced that they think a project could not be done, because of its innovative approach. (Jangmark L. and Kolte-Olsen A., 2015). The approach of the utility is therefore extremely important for how projects can be solved and mutual respect for each other is key.

Finally, it is very essential that there is a political attention and willingness to achieve the necessary water management as well as climate adaptation. The local politicians play a big role for Nordvand, since their choices influence the framework the utility has to work within. The two municipalities (Gladsaxe and Gentofte) are quite different, but fortunately the two municipalities have relatively common service goals. It has been an alignment process through the years of Nordvand's existents, which now makes it easier for Nordvand to operate across the municipal borders. (Jangmark L. and Kolte-Olsen A., 2015).

The factors above have all been vital for the successful collaboration between Gladsaxe Municipality and Nordvand and have a big influence on the climate adaptation vision and all of

the plans (the climate adaptation plan, the wastewater plan etc.) contributing to Gladsaxe Municipality being a frontrunner within the climate adaptation work.

9.3 The reflexive thoughts on the operational work

The work within the operational cluster concerns the physical implementation of the adaptation projects.

9.3.1 The experiences with Høje Gladsaxe Climate District

The projects within the Høje Gladsaxe Climate District area has received a lot of attention, and through the collaboration between Gladsaxe Municipality, Nordvand and other actors it has been possible to come quite far with the climate adaptation actions. It is however important to be aware, that the land used for the climate adaptation solutions in the future will be saved for this purpose and cannot be changed and used to build houses on. Established climate adaptation solutions on the ground ties the area to this purpose and cannot easily be changed. (Jangmark L. and Kolte-Olsen A., 2015); (Stefansen K., 2015).

9.3.1.1 The experiences with Marielyst

Kathrine Stefansen (2015) specifies that "*Marielyst has been where we have taken our childhood steps to see how we can make those processes with large housing companies.*" Kathrine recognises that they have made some smaller mistakes that they had to correct subsequently. In the beginning, they experienced that too much water was withheld in Marielyst's Rundgården and they had to change it. They also discovered later that the fire ladder suddenly could not reach the upper windows in Rundgården, due to the lowered circular basin, which also was adjusted later. Gladsaxe Municipality has a checklist they use for larger projects; this has been expanded with the experience of Marielyst. Kathrine stresses that they get wiser and wiser from each project and they strive to improve the procedure in order to avoid the same mistakes in the future. (Stefansen K., 2015).

Figure 45: View from the curvature of the ditch in Rundgården, Marielyst.

The municipality strives to reach a good dialogue, as it helps to create a good experience for the housing association and people living in the building. If it is a larger housing association they might want to participate in another climate adaptation project at another location, if the cooperation with the municipality was a pleasant experience. (Stefansen K., 2015).

There are several more actors involved in the Marielyst project than what previously has been the norm, causing some to believe that the process is made more difficult and takes longer time. Kathrine Stefansen points out that it is extremely important to organise the process so the right actors are involved at the right time. But there are a rising amount of respect for this kind of process and the fact that it takes a long time, as the necessity of more involved actors now becomes more recognised. (Stefansen K., 2015).

Figure 46: Rundgården, Marielyst.

The municipality contacted Marielyst about the possibility of creating a climate adaptation project. Dennis Schultz thinks this contact was crucial to the realisation of the project. He does not think this project had been established without it. Maybe a similar project could have been developed later, if the information had been presented to them, as they needed to get the knowledge that it was a possibility. Dennis recommends the municipality to be more proactive in the future. It is Dennis' wish that more of the Gladsaxe housing association's locations should become climate adapted, as he likes the climate adaptation perks (branding-effect, more green areas etc.).. (Schultz D., 2015). Marielyst is therefore a prime example of the importance and value Gladsaxe's campaigns do have.

The project in Marielyst is now finished, but Dennis Schultz believes that the residents of the area still need to fully discover and take advantage of the new opportunities such as use the barbecue places and lie down by the lake. Dennis is convinced that the residents will utilise the opportunities, but it might take a small period of time. (Schultz D., 2015).

Høje Gladsaxe Climate District was nominated for the Nordic Council Nature and Environment Prize but did not win. Several EU-politicians and many municipalities have shown an interest in the project and have visited Marielyst. It is remarkable "*that a small settlement in Gladsaxe, who has been sleeping for so long, suddenly become this 'hyped'.*" (Schultz D., 2015, 30:25). It is the Gladsaxe housing association's plan to take advantage of this PR and embrace the possibility of making this site more popular. Dennis Schultz wishes to promote Marielyst further as the place to live if you are a global citizen who cares for the society. (Schultz D., 2015). It is important to take advantage of the opportunities that comes with being a frontrunner, and Gladsaxe housing association is the most certainly aware of this.

Dennis Schultz has noticed a difference in the collaboration process with the municipality, as they are more flexible and solution focused when the project concerns climate adaptation than a regular project. Adaptation to climate change has been the key to get the needed permits to this project, and the effort of Gladsaxe housing association has been supported, as it has the shared interest of Nordvand and the municipality. (Schultz D., 2015).

Figure 47: Rundgården, Marielyst.

9.3.2 The reflexive thoughts about Kildevænget

Gladsaxe Municipality wishes to be a part of the entire process of the newly initiated climate adaptation project at Kildevænget. Previous experiences with Marielyst has made the municipality/Kathrine Stefansen aware of the importance of following a project closely, as they then better can manage the coordinating when the need for a permit or a contact to a specific municipal department for instance is needed. This intensified dialogue procedure will help streamline and speed up the project. (Stefansen K., 2015). The municipality clearly is aware of learning from the past experiences and improving from them.

Dennis Schultz wishes to utilize all the past experiences in Marielyst and ensure the changing of all the bad things that they experienced in Marielyst to good things in Kildevænget. Dennis thinks, that Marielyst has been a kind of draft, Kildevænget will also be a draft, but an improved one. The Gladsaxe housing association is aware of informing the residents about the project, there will be an open, staffed trailer where the residents can get answers to their questions, and as something new a time-table of the project's various implementation stages will be distributed. The final

project product of Kildevænget must include both the importance of accommodating the wishes of the residents and at the same time establish the climate adaptation solutions. (Schultz D., 2015)

The Kildevænget project involves two closely located housing association, causing them to work close together and have two different administrator managers on the joint project. They must draw up a contract and a call for tenders together. (Schultz D., 2015). This is different from the Marielyst project, which will probably rise some difficulties, as they cannot just duplicated and improve what they did last time.

Dennis Schultz appreciates only having one municipal contact person, Anne Stougaard, in connection with the Kildevænget project. The municipality has done a lot of work for the Gladsaxe housing association in Kildevænget. According to Dennis, Anne has been fantastic in the municipality, as she has managed to get things done in the municipality and opened many doors. The municipality has made a huge effort to inform Kildevænget, their reference group and the residents about everything that has happened. However, Dennis expresses that the municipality should be even more involved. He further states that it will be a learning process for the municipality to see how the reality unfolds via the Kildevænget project. Dennis further wishes that the municipality will like to participate in the start-up team-building process between the actors involved (Dennis, the entrepreneurs, the municipality etc.), as it will lead them to gain a bigger understanding of the actual conditions. (Schultz D., 2015).

9.3.3 Gladsaxe Municipality's experiences with the collaboration

Kathrine expresses that Gladsaxe Municipality has the evaluation culture in their backbone, and it is incorporated in the way the water and climate team is working. However, the team does not set special time aside to an evaluation, but as the experiences from the previous projects are included in the checklist, describing the initiating project process, they use this knowledge for the new projects. As it typically is the same people or the same team, who are working with the climate adaptation projects, they achieve an understanding of the collaboration process they can keep on adding to. This approach secures the growth of the climate adaptation procedure. (Stefansen K., 2015).

Kathrine Stefansen believes that the good collaboration with Nordvand, has had a key impact on the fact that the municipality has come so far with their climate adaptation projects. Kathrine points out that one important reason probably is that the municipality and Nordvand just have dared to do it - even without seeking the co-financing. Both parties want to act on the climate issue and they wish to do it now. And the timing has also been essential, while Gladsaxe Municipality has worked theoretically with the preparation of the climate adaptation plan, Nordvand has parallelly moved towards accepting working with surface solutions. This timing of both parts development has been completely crucial. (Stefansen K., 2015).

9.3.4 Nordvand's experiences with the collaboration

Lise Jangmark explains that the collaboration between Nordvand and Gladsaxe Municipality has been good. However, there have also been some cooperation challenges at the Høje Gladsaxe

Climate District, as Nordvand and Gladsaxe are used to take different things into account. An example is the choice of materials for a manhole cover, where the aesthetics (Gladsaxe) is being challenges by the practicality (Nordvand). Nordvand and Gladsaxe have gained more experience and have improved their collaboration through Høje Gladsaxe Climate District, as they have achieved a better understanding of each other's responsibilities. (Jangmark L. and Kolte-Olsen A., 2015). Which they can continue to benefit from and develop it further, and thus achieve an even better collaboration process.

Nordvand does not have an exact method for their evaluation and knowledge sharing, but it is something they are working on achieving in different ways, so they can benefit from previous project experiences. Annette Kolte-Olsen points out that Nordvand has become more conscious about it, but the projects also take a long time before it is implemented, so the development does not happen that fast. Nordvand has improved small things along the way in the Høje Gladsaxe Climate District project, when they have seen a need for it. But there has not been held an overall evaluation session for the Høje Gladsaxe Climate District. Lise Jangmark explains the difficulties of having an evaluation meeting for all the stakeholders, since it is difficult to determine when the total project actually is finished. Lise likes the idea of gathering the municipality and all the different partners in the end and evaluate what has been a good and bad collaboration procedure. She mentions that an evaluation meeting has been held for the Høje Gladsaxe Park's new rainwaterlake and basins, which was finished last year. An evaluation meeting was recently held for this project with the consultants and the two contractors to close the project. Similarly, Lise imagines having a meeting for the Høje Gladsaxe Sports Park. They are now in the process of going through the defects and missing parts, but after the grand opening in June, Lise would like to have a meeting with the municipality, contractors and consultants and look at the process of cooperation, and further have an evaluation of the project process with all of the decision makers. It is just important to find the proper time to have these evaluation meetings. However, Lise also mentions that she has taken over the project from a former employee, Bo Brøndum Pedersen, making it difficult for her to evaluate other parts of the project than the implementation phase. (Jangmark L. and Kolte-Olsen A., 2015). This will might cause Nordvand to lose some lessons on working and collaborating above ground, but they will surely build on to this knowledge through new projects.

Annette Kolte-Olsen explains about the development of a new Nordvand project model for all projects. It will be used after a completed conceptual design and detailed design. This model will make the knowledge available to all employees, and ensure the right things are incorporated along the way. However it should not be standardised too much, as each project has its challenges and its own lessons, that easily can be missed if the model is too restrictive. Right now Nordvand's employees mostly exchange knowledge by asking the persons they know knows something about a specific topic. And as something new they sometimes work two on a project and therefore share experiences and knowledge directly. (Jangmark L. and Kolte-Olsen A., 2015).

9.3.5 The personal relationships

Kathrine Stefansen points out the importance of the personal relationship between the project leader and the person who sits on the other side of the table in a project. Their chemistry and

respect for each other's background often creates the framework for the project. Kathrine points out that there are some who collaborates better than others. And it is important to create the constellations, where the potential for cooperation is best utilised and put those people together in a particular project. The importance of the personal connection is for instance clearly shown in the collaboration between Bo Brøndum Pedersen, Nordvand, and the municipal chief of sports Holger Kortbek, who collaborated very well on the Høje Gladsaxe Sports Park in the Climate District, and managed to make the project what it has become. (Stefansen K., 2015). Had it been two other persons collaborating from Gladsaxe and Nordvand, had the project probably turned out different and less innovative.

9.3.6 The experiences with municipal campaign methods

Gladsaxe Municipality has used many methods (for instance fairs, flyers, a inspiration catalogue and information via the website and sketches of rainwater solutions on private land) to involve the citizens, housing associations and the companies in the climate adaptation work. Gladsaxe has kept a very reflective approach to this involvement work and examined the approaches that have had the best effect and further developed these, and left the methods behind that have not had the most powerful effect. At the first fair almost 500 people turned up, it was held close after a cloudburst event, but at the next fair only few people showed up, causing the municipality to find other methods to get in contact with the citizens and companies. Kathrine Stefansen is really pleased about the effects of the campaigns, and she thinks that the number of private persons managing the rainwater on their own property would not be as high today, if the municipality had not done something extra. But the climate adaptation projects takes a long time from the idea to the implementation, so the fruit of the municipality's efforts will often first be possible to measure later. (Stefansen K., 2015).

9.3.7 Gladsaxe Municipality's experiences in relation to the water table

When Gladsaxe Municipality started the repayment scheme, the municipality decided that the private landowners always could get the permission to percolate rainwater on their own ground as long as it was not registered as polluted. Later, the municipal Environmental department expressed their concern, that the water table in some places were too high, causing the municipality to develop a detailed groundwater model showing the water table throughout the municipality. This knowledge is now used to allow the correct climate adaptation solutions that fit each location. This allows the gabion solution to only be used in areas where the water table is not elevated, and surface solutions (with a large evaporation) is an option at elevated water table locations. Kathrine Stefansen characterises this as a paradigm shift from earlier when it was desired to achieve as much percolation as possible. This experience illustrates how a municipal department, or personal complaints for that matter, may cause the need to go back and change the tactical level and incorporate new reflections in the climate adaptation plan even when they are operating in the operational cluster. (Stefansen K., 2015).

9.3.8 Economy

Kathrine Stefansen points out that the municipality and Nordvand keep on improving the conditions for climate adaption. It is now possible for a landowner to choose to manage their

rainwater and receive the amount of the percentage of the connection fee that the owner withhold. Today the rules state that the owner must withhold between 50 to 100 percent of his rainwater in order to receive the refund. This interval provides a greater degree of flexibility, and more actors may be interested in participating in climate adaptation. The procedure keeps on being developed, as it is an area, where there are constantly new knowledge and thus new ideas to deal with the problems and make it more attractive to climate adapt. (Stefansen K., 2015).

9.4 The key points

Gladsaxe Municipality and Nordvand have both to some degree developed a reflexive approach towards their climate adaption collaboration work, which insure the strength of the transition. It has been a vital part of Gladsaxe being a frontrunner that both parties wanted to act on the climate issue and dared to do it. There is however still a need for more innovative and structured improvements of the evaluation process of a project.

10 What characterises a frontrunner climate adaptation municipality?

This chapter discusses the content of the case study in relation to Transition Management and the Transition Management Framework. First, strengths and weaknesses of the Gladsaxe Municipality's transition will be discussed on a theoretical level. Second, nine goals and their necessities will then be derived as a framework for what characterises a frontrunner climate adaptation municipality. The comparative evaluation analysis is integrated in the nine goals.

10.1 Discussion on strengths and weaknesses of the transition process

The strengths and weaknesses of Gladsaxe Municipality's climate adaptation transition are in the following sections being discussed, with the point of departure in the theoretical concepts of the transition vision, arena, images, paths, experiments and projects, and the reflexive approach.

10.1.1 The transition vision and arena

Gladsaxe Municipality's climate adaptation vision focuses on two main things. First, the objective is to adapt to prevent and reduce damage of cloudbursts and second, rainwater must be separated from the wastewater. Although, the vision is not especially innovative in its approach, the goals underneath the vision include that rainwater should be seen as a resource for the quality of both life and nature as well as be handled locally and be visible. Making the vision a bit more interesting, but still not a complete innovation. Many of the municipalities within the Capital Region of Denmark have been exposed to the same cloudburst events through the last couple of years, and thus have the same initial problems to fight and the same goals to reach. Therefore, it is valid to believe that it is Gladsaxe's processes behind the vision rather than the vision itself, which has played a big role in the transition towards successful climate adaptation actions in a frontrunner municipality as Gladsaxe. There is no doubt in the importance of the vision as a direction for the future planning, but the real strength lies within the group of people that collectively created it and how they created it.

This group, which Kathrine Stefansen from Gladsaxe Municipality refers to as the climate adaptation group, is the initiating core group and are in many ways similar to what Transition Management identifies as the transition arena. Similar to the purpose of the theoretical concept of a transition arena, the climate adaptation group has in this case been the platform for discussing the problems of floods (especially the one that occurred in July 2011, see Chapter 1.1.3), and a platform for envisioning. The climate adaptation group has been an open-minded network of innovation consisting of people with different competencies, interests, and backgrounds. For instance, people from different municipal departments and teams such as *Planning*, *Water and Climate*, *Environment*, *Road and Park* and *property* as well as representatives from Nordvand have participated in this group. In addition, from time to time the people in the climate adaptation group has changed according to the necessity of knowledge and resources through the process. Although it also has caused its challenges, this diversity seems to have been an important part of the later success, since it has made it possible to discuss and envision climate adaptation on many different levels and aspects, which is a key element in relation to the

theoretical concept of the transition arena. This shows that, although simple in its final form, the vision is created through a strong and solid process of collaboration, which according to Kathrine Stefansen has contributed to a reduced silo-effect within the municipality. (see Chapter 6.2).

In order to improve Gladsaxe Municipality's strategic procedure even more, they could had gained knowledge from an university or another knowledge institution and therefore obtained practical and theoretical knowledge about the climate adaptation transition.

10.1.2 The transition images

The climate adaptation group has translated the vision into transition images, which is the thirteen risk areas, as well as their assessment in terms of opportunities and their prioritisation in terms of importance. Identifying and prioritising the risk areas are the mandatory elements in the climate adaptation plan for every municipality, according to the agreement between the Ministry of Finance and Local Government Denmark in 2012 (see Chapter 1). While COWI has simulated and calculated, where the risk areas are located, the climate adaptation group has assessed and prioritised the areas based on certain criteria. The climate adaptation group has mapped the type of housing; special problem areas in relation to floods; important traffic hubs in the risk of flood; green areas, where rainwater can be managed; type of sewerage; potential for quality of nature; and already planned projects within each of risk areas. Furthermore, possible actions have been pointed out as well. The work of both COWI and the municipal climate adaptation group make the thirteen risk areas stand out as thirteen strong transition images, because they, through the assessment, manage to describe the current state of the urgency to act, and the desired future state of each risk area. According to Transition Management, these descriptions are all key elements in transition images. (Loorbach, 2007).

Another strength is that the transition images have been assessed and prioritised by the same climate adaptation group, which created the transition vision. This means that they have been assessed by more or less the same diversity of professionals from both Nordvand and the municipality. It is thus valid to believe that this has created a broad ownership and commitment from both Nordvand and the municipality. This will especially have influence on the operational level.

10.1.3 The transition paths

With the transition images in mind, Gladsaxe Municipality has developed five different tracks of actions: Business areas, Residential areas, Other construction projects, Campaigns and guidance and finally Development and research projects. Thus, it seems that the municipality is aware of the importance of approaching climate adaptation in many different ways. Within the five tracts of the action plan, Gladsaxe has managed to create a diverse and broad set of transition paths that show the route towards climate adaption in the thirteen areas. The majority of the five tracks presented in the climate adaptation plan, focus on obtaining synergies with other planning in some way. This focus mainly includes the integration of climate adaptation in already existing plans in order to optimise the use of resources. This shows that Gladsaxe Municipality is able to plan in a clever way and thus optimise their time and economy.

Another strength is that many of these transition paths is mid to long-term. Although some is scheduled to end in 2017, the majority is scheduled to continue onward with no actual end. While some municipalities within the region have made climate adaptation action plans for the next three or ten years (Appendix F), Gladsaxe and a couple of others have a much longer time scale, covering the next 25 years. This shows that Gladsaxe Municipality is ambitious and thinks ahead.

In relation to the transition images, the two tracks, *business areas* and *residential areas,* are especially well connected, because they take point of departure in the prioritisation of the thirteen areas (see Figure 35). The remaining tracks, *other construction projects*, *campaigns and guidance*, *development and research projects*, are more general, but still focus on important parts of climate adaptation development.

Worth mentioning is the focus on dialogue and collaboration with citizens, housing associations and companies. Transition Management emphasises the importance of collaborating in all clusters, but in the operational cluster the key is to mobilise the local actors in favour of the transition. (Loorbach, 2010). Gladsaxe Municipality seems to be keen on engaging and involving other actors in order to make them more interested in climate adaptation and thus climate adapt their own property. In the comparative evaluation analysis, Gladsaxe was actually the very best among the municipalities in the Capital Region, which fully included the indicators *dialogue with citizens* and *dialogue with companies* (although, this is not shown). This was the result of the many diverse and interesting campaigns and guidance presented in the climate adaptation plan.

An interesting thing in relation to *business areas* is that the municipality has stated in the climate adaptation plan that they "*suspect that the high damage costs for companies means that they already have climate secured their own property more than the citizens have*. (Gladsaxe Municipality, 2014g, p.1). This is an interesting assumption because it could be one of the reasons why the municipalities in general feels that companies show less interest in the municipality compared to citizens in relation to climate adaptation, as discovered in the comparative evaluation analysis. Maybe many of them have already climate adapted their property.

10.1.4 The transition experiments

It is within the operational cluster that actors such as citizens, housing associations and companies have been mobilised by the municipality. The goal of these mobilisations have been to involve and engage them in the importance of climate adaptation in order to make them climate adapt their own property. The municipality has initiated several campaigns towards citizens and housing associations especially, which indeed have produced a lot of attention. The climate adaptation fairs have for instance been a good opportunity for citizens, contractors and producers to create new contacts and inspiration. However, the real driver in terms of climate adaptation of private property seems to have been the repayment scheme. This scheme, where people are able to get up to 24.000 DKK back if they separate 100 % of the rainwater from the wastewater or at least 50 % separation, has been a key political strategy for a couple of years. The fact that Gladsaxe Municipality was one of the first municipalities in Denmark to implement the scheme, has undoubtedly given Gladsaxe a head start in relation to climate adaptation of private property. The repayment fee has made many projects possible economically. For instance, the repayment

fee will cover a significant proportion of the climate adaptation of the Marielyst housing association. This climate adaptation might not had happened without the existence of the repayment scheme.

Besides mobilising citizens and housing associations through campaigns and guidance, there is also the companies and universities as actors to be aware of. The municipality still needs to utilise the potential of these. In order to make the companies climate adapt the municipalities should make campaigns specially targeting them. Furthermore, Gladsaxe Municipality could benefit from the university's insight on a more attractive procedure, which improves the transition further as well as new technical solutions such as hydraulics.

Gladsaxe Municipality focuses on two different types of projects: the small-scale innovation projects in the form of demonstration projects such as the five rainwater gardens in Gedvad; and the big scale development projects in the form of for instance Høje Gladsaxe Climate District including Marielyst.

In the case of the rainwater gardens, the municipality utilised Nordvand, which already had planned to climate adapt eleven roads in Gedvad. By entering the dialogue meetings for the citizens, arranged by Nordvand, the municipality was also entering a forum, where climate adaptation already was on the agenda. This has properly made it easier to gain the interest of the citizens in the demonstration project. The rainwater gardens as a demonstration project can be seen as an incremental adaptation. Although, it does change the dominant system locally through separation of the rainwater, it focuses on creating small local changes stepwise. The demonstration project does not have a significant influence on the surroundings and the overall dominant system. However, the strength of this type of project is its ability to act as a testing ground for experimenting with new climate adaptation solution. Gladsaxe Municipality has created this project in order to try out new innovative ideas and learn more about the possibilities of climate adaptation on a local level. In addition, the fact that the private owners of these rainwater gardens have to accept that other people can come and see their climate adapted garden, also demonstrates that the municipality is keen on showing the general public some of the possibilities of climate adaptation. This is also an important point in relation to mobilisation because it educates and inspires other citizens to do the same. The demonstration projects thus become some sort of transparent and open research laboratory.

The big development projects such as Høje Gladsaxe Climate District can be identified as transformational adaptation, because the dominant system here is being changed much more comprehensively. Compared to the demonstration project, the implementation of these developments are crucial for the overall adaptation of Gladsaxe Municipality. However, the resources it takes to develop and implement them are significantly bigger than with a demonstration project. Nevertheless, Gladsaxe Municipality seems to have dealt with this quite well, especially through the collaboration with Nordvand, who has been in charge of most of the concrete projects. This close collaboration between municipality and utility has been important for the climate adaptation in Gladsaxe, especially in the operational phase. Both actors recognise each other’s expertise. Although the sensible, practical and economic approach of Nordvand and

the political, recreational and more esthetical approach of Gladsaxe Municipality have caused some discussions in-between, they also make the climate adaptation projects in Gladsaxe seem more thought through in terms of sustainability. Another important point is also that Nordvand and the municipality have collaborated well since the creation of the climate adaptation vision. The fact that Nordvand and different departments in the municipality have had a collaborative approach to the envisioning has properly created a broad sense of ownership, support and commitment from all sides in relation to the projects. It is valid to believe that this could ease the implementation of projects significantly.

One of the good expertise of Nordvand is their ability to manage projects. It seems that there is an agreement from all sides that projects are very much shaped by the project manager in charge, and especially by the relationship between the project manager and the private developer. In order to achieve a successful implementation process, there has to be a professional and personal chemistry between these two individuals. Especially one project manager from Nordvand has made a significant difference. Besides having several good relationships with different developers on different projects in Gladsaxe, Bo Brøndum Pedersen has also had an innovative and progressive approach and has been able to overcome certain institutional barriers and cultures in relation to climate adaptation. Thus, he can be identified as an institutional entrepreneur, as described in the state of the art section (see Chapter 5.1). An institutional entrepreneur is characterised by being a frontrunner in relation to destroying or challenging existing bureaucratic barriers. It is project managers like him, which are essential for achieving successful innovative climate adaptation project procedures. However, the fact that projects depend so much on the individual can also be seen as a bit worrying. Quite often, these projects cost several millions and a whole team of planners, engineers, contractors and providers are involved, but whether the implementation process itself is going to be successful or not is influenced by the relationship between few people.

All this shows that Gladsaxe Municipality cannot make as successful climate adaptation actions all alone without the knowledge and expertise of Nordvand. Thus, an important point is that the municipality's utilisation of Nordvand's expertise (and vice versa) is a key element in the development of successful climate adaptation actions. However, Gladsaxe Municipality themselves is good at initiating the projects. Although, they are not as visible in the implementation as Nordvand might is, the municipality has shown to be really good at approaching private developers if they see a need and potential for climate adaptation. A good example is Marielyst, where the climate adaptation properly would not have happened without a municipal initiative. It is however important that the municipality is more involved in the collaboration with the private developer so the project proceeds smoothly, which they learned through Marielyst and now are very much aware of in the Kildevænget project. In addition, it is furthermore important that the private developer knows, who to contact in the municipality and therefore ideally only have one municipal contact person, who will contact the needed municipal employees.

10.1.5 The reflexive approach

The transition toward successful climate adaptation actions in Gladsaxe Municipality has been through both the strategic, tactical and operational cluster. Transition Management emphasises the importance of being reflexive within all these clusters. However, in relation to this, Gladsaxe Municipality could do better. Neither Gladsaxe Municipality nor Nordvand have a true evaluating culture compared to how the reflexive cluster is described in the Transition Management. None of them is for instance having actual evaluating meetings during or after projects. However, both the municipality and Nordvand do have some kind of reflexive thinking. For instance, the municipality has a checklist, which they run through doing projects, while Nordvand has monthly meetings, although mainly about the economy of projects, and some involving experiences and knowledge sharing. Thus, it seems that they are more evaluating as they go. Gladsaxe Municipality has for instance learned during the Marielyst project in terms of how much they should have involved themselves in the process. This is an important learning, which has made them determent to participate more in the similar project in Kildevænget/Kildeparken (see Chapter 8.1.4). Furthermore, they have added some points to the checklist during the process of Marielyst. For instance, in the future they now need to check the length of the rescue ladder after a rainwater basin has been dug. However, no actual evaluation mechanisms have been involved in this learning. It thus seems that they are evaluating but not systematically.

Both Gladsaxe Municipality and Nordvand seem to have a reflexive thinking and are aware of the actors that they should include in the evaluation, but they also lack in having a proper reflexive culture and attitude. The whole idea with the reflexive cluster is to be able to evaluate in order to find improvements in the other three clusters. In a long transition as this is, it is important to optimise the process if it becomes necessary. This especially becomes important when dealing with climate adaptation because it is a relatively new planning method, and approaches and technologies are still in development. Current transition images, transition paths, or implementations might turn out later on to be insufficient in order to truly fulfil the transition vision. Having a proper reflexive approach with both reflexive thinking and attitude are crucial in such scenarios. However, Gladsaxe is keen on learning. The fact that they deliberately wait to initiate the implementation of a second project in order to be able to use the experiences from the first (in Buddinge), show a willingness to optimise their learning in order to optimise the projects and thus a good example on reflexive thinking. It also shows that they are aware of the uncertainties, which lies in climate adaptation development. New technologies and approaches are still being developed, but Gladsaxe seems to have incorporated this in the process. They are also involved in this research themselves, which can be seen in their many planned research projects. Overall, they do have some reflexive thinking, but the municipality and Nordvand need to integrate the mechanisms and start evaluating systematically.

10.2 The nine goals of the transition towards successful climate adaptation actions

By structuring the strengths and weaknesses of Gladsaxe Municipality's transition towards successful climate adaptation actions according to the Transition Management Framework (see Chapter 2.3.1) (Loorbach, 2007) as well as using the comparative evaluation analysis, nine essential goals have been identified. These goals have been crucial for the success of the transition and are based on what Gladsaxe Municipality are doing really well and what they could do better. Furthermore, for each goal a number of governance activities, transition instruments and actor capabilities have also been identified, which are necessary to fulfil the goals. (Loorbach, 2007).

The nine goals are explained below, but are subsequently showed on a table together with their necessities and the actors that should be included in each cluster. Although based on Gladsaxe Municipality, they are generalised through Transition Management, and should thus be seen as a general framework for what characterises a frontrunner climate adaptation municipality. Thus, it can be used as a framework of inspiration for other municipalities.

The nine goals **of the transition towards successful climate adaptation actions**

Strategic

Goal 1) Giving direction to future planning – A municipality must give a direction for the future planning in order to accommodate the changing rain pattern and avoid floods. This is done through the process of envisioning, where a long-term transition vision can be created within the transition arena. This arena should consist of people from different places (preferable from different departments of the municipality as well as the water utility, but could also include universities) in order to have a diverse set of approaches towards climate adaptation. The vision often strives towards preventing and reducing the damage of cloudbursts as well as separate rainwater from wastewater.

Goal 2) Reframing rain as a resource – A municipality must reframe how rain is perceived and utilised. With sustainable urban drainage systems and other solutions implemented more on the surface instead of in the underground, rainwater suddenly becomes a possible resource that can be used for recreational and functional reuse purposes. Reframing is done through the development of a new discourse and the exchange of perspectives within the transition arena. The many different professional backgrounds within the transition arena properly see rainwater differently, but they all must agree on how to work towards rain as a resource. Here, the arena could especially benefit from the universities, which can bring in new knowledge, approaches and perceptions on climate adaptation and rainwater. In the end, the reframing should contribute in shaping the transition vision.

Tactical

Goal 3) Translating the vision into content for the climate adaptation plan – A municipality must translate the long-term vision into more tangible goals and content for the climate adaptation plan (and wastewater plan). This is done through the development of strategies and inspiring images for the future. This includes the development of transition images, which are the identification, assessment and prioritisation of the different risk areas. In total, these images should reflect the current state of each risk area, its level of urgency to act, and its desired future state. Furthermore, the municipality also has to develop transition paths, which are the different actions included in the climate adaptation plan. These paths should reflect changes necessary to achieve the target transition images, including which changes should be taking place when, how and with whom; also, concrete short and mid-term goals and ambitions should be formulated in relation to these paths. It is possible to develop several paths for one image and one path for several images, but the important thing is that there is a general connection between paths and images – between actions and the desired future state of the risk area. Within the climate adaptation plan, these actions could furthermore benefit from including their expected effects, synergies with added value, synergies with other planning, economy, financing and timeframe. They could also benefit from including actions created through collaborations with the water utility and other municipalities as well as through the dialogue with citizens, housing associations and companies.

Goal 4) Building the agenda – A municipality must build up a transition agenda, which is the climate adaptation plan containing the transition images and paths. The agenda is the compass of the transition and decides in what direction the climate adaptation is going. Through a transition coalition, which consist of mainly the municipality and water utility (although, universities and consultants could also further advise), the agenda is built through negotiations, exchange of goals and shared goal formulation.

Goal 5) Networking with other actors – A municipality must network with other actors in order to share knowledge and experiences in relation to climate adaptation. Formal networks like KLIKOVAND or Regnvandsforum are a great opportunity to learn new innovative ideas and approaches from other municipalities and water utilities. However, networking with universities could also be beneficial since these have a knowledge in relation to for instance optimisation of processes. Networking is especially important to transition paths because it is in relation to these that many municipalities have a very different approach. By creating a platform where these different approaches becomes sharable, networking are thus able to improve how actions are included in the climate adaptation plans.

Operational

Goal 6) Innovate new solutions – A municipality must be innovative and be able to create new creative ideas and knowledge themselves. This is done through experimenting with small-scale projects such as demonstration projects, where only a small area is included as a testing ground. Here, new solutions and approaches can be tried out and evolved. This could for instance happen in close collaboration with a couple of private house owners. Thus, such experiments are not only about innovating new solutions, but also about innovating new ways of interacting and collaborating with the residents in relation to projects. Furthermore, the municipality could benefit from other actors such as universities in relation to research on the latest solutions. In the end, the important thing about the experiments are that they should be able to be scaled up. This means that the new solutions and approaches learned through the experiments must be somewhat applicable on a more general level. Otherwise, the innovation is more or less useless.

Goal 7) Develop transformational projects – A municipality must continue to develop the up-scaled projects that transform the physical landscape in order to minimise the risk of floods. These projects are essential to the overall climate adaptation, since they are designed to manage cloudbursts. This is done through experiment portfolios, which are the knowledge and experienced gained from all experiments, innovations, and other projects they (or others) previously have created. From the beginning, these transformational projects must be in line with both the transition vision and the transition paths, in order to ensure their relevance. They are often co-developed with the water utility. Together, the municipality and utility have different strengths and approaches in relation to project implementation, which is important for both to acknowledge and utilise. A good project manager is a key element in the implementation of these projects. However, since the projects are comprehensive in scale and often takes place on private property or public space that is being used by the civil society, it is crucial for the municipality also to collaborate with citizens, housing associations and companies that relates to the area. The collaboration with these actors can add important local knowledge and ideas for the project and it can make the process and outcome more legitimate.

Goal 8) Involve and engage other actors – A municipality must involve and engage citizens, housing associations and companies to make them climate adapt. This is important because the municipality does not have the rights or responsibility to climate adapt private property. Thus, they (and the water utility) will benefit greatly from engaging the private landowners to manage the climate adaptation themselves. This is done through mobilisation of these actors, where the municipality with campaigns, workshops, fairs, and information material can reach the citizens, housing associations and companies in order to start a dialogue and inform them about the risk of floods as well as the opportunities of climate adaptation. However the most important mobilisation strategy here, is the repayment scheme, which creates a significant economic incentive to climate adapt.

Reflexive

Goal 9) Adjustment of the transition – A municipality must be reflexive throughout the transition in order to optimise the process. This is done through a continuing participatory evaluation, where the transition arena, transition agenda, and transition projects are being evaluated and adjusted accordingly. It is important that this is done systematically in order to actually gain new knowledge and successfully adjust hereafter. It is also important that the different actor groups are not only evaluating individually, but also across. This ensures that knowledge and experiences are being shared, and it is possible to optimise the transition even better.

This intention of these nine goals is to guide municipalities to a better transition towards successful climate adaptation actions. Here it is important to remember that Gladsaxe Municipality in the beginning was pointed out as a frontrunner in the comparative evaluation of this thesis because they were good at including the ten indicators in the actions within the climate adaptation plan. (see Chapter 4). Furthermore, it was assumed in the beginning that a frontrunner municipality with well planned actions (like Gladsaxe) are mobilising and utilising different actors through governance activities better (or at least significantly different) in the transition, compared to municipalities with less well-planned actions. These municipalities can thus gain a lot by adopting the nine goals, such as improving their transition towards successful climate adaptation actions.

In relation to Transition Management, every municipality (at least in the Capital Region) seems to be focusing on the operational cluster (and presumably the reflexive) at the moment. It is assumed that they are focusing less on the strategic and tactical cluster since they all have created a transition vision, transition images and transition paths, which collectively forms the climate adaptation plan. This also fits well with the fact that many climate adaptation project all around the region are either finished or being implemented. One might think that this obviates the need for goal one to five, because these are part of the strategic and tactical cluster. However, one of the key ideas of the Transition Management Cycle is that it is recursive, meaning that a transition is not about going from the strategic to the tactical to the operational cluster, but going back and forth between them through the reflexive cluster. The municipalities are thus able to go back and revise the climate adaptation plan including the underlying processes according to the goals of the framework. Since the climate adaptation plan is a part of or an appendix to the municipal plan, which must be fully or partially revised within every election term (every four years) (Danish Ministry of Environment, 2007), it still possible for the municipality to develop the climate adaptation plan and the climate adaptation vision further.

In total, the nine goals represents the entire transition towards successful climate adaptation actions, which other municipalities can follow. However, some municipalities might only need to adapt to some of the goals, depending on where they already are doing a great job in the transition. According to the comparative evaluation of the actions within the climate adaptation

plans, a significant amount of the municipalities in the Capital Region could especially benefit from adopting the third goal, which is about translating the vision into content for the climate adaptation plan. This goal contains the development of transition paths as well as when, how and with whom actions should be taking place. Thus, the goal is directly linked to the evaluation and how the different municipalities have planned their actions in the climate adaptation plan, which is also why the ten indicators have been integrated in it. However, in the end the majority of the municipalities, at least within the Capital Region, but properly also in the rest of Denmark, would benefit from integrating most of the goals. The important thing to remember when adopting the goals and its necessities is that every transition is different. (Loorbach, 2010). Thus, it is not appropriate for a municipality to just adopt the framework without discussing it and adjusting it to their transition.

On the following pages, the general framework for the characteristics of a frontrunner climate adaptation municipality is presented. This framework consists of the nine goals, as well the necessary governance activities, transition instruments and actor capabilities, inspired by Loorbach (2007). Many of the elements within the framework, have been modified to this specific type of transition compared to Loorbach's matrix, which shows the typical elements of successful transition through the four clusters. (see Chapter 2.3.1). However, they are still somewhat similar, since many of the same goals, governance activities, transition instruments and actor capabilities have been identified in Gladsaxe Municipality's transition towards successful climate adaptation actions. This determines the transition as successful even more. Finally, the necessary actors to involve in each cluster has also been added to the framework even though it is not part of the original theory. This is to underline the importance of collaboration and dialogue through the entire transition.

The following framework is divided into elements, which is directly applied from the theory (black) and additions or modifications from the authors of this thesis (blue). Also, elements, which are related to some of the few weaknesses of the transition of Gladsaxe Municipality, are italic.

The nine goals of the transition towards successful climate adaptation actions – Characteristics of a frontrunner municipality					
Type of governance activity	**Goals**	**Activities**	**Transition Instruments**	**Capabilities**	**Actors**
Strategic	**Giving direction to future planning**	Envisioning	Transition Arena, Transition Vision	Creativity, Innovative, Risk-taking, Open-minded, Respect towards other actors, Mutual knowledge	Municipality Utility *Universities*
	Reframing rain as a resource	Exchange of perspectives Developing new discourse	Transition Arena, Transition vision	Communication and network skills Integrative capabilities Open-minded Knowledge of SUDS	

Tactical	**Translating the vision into content for the climate adaptation plan**	Developing inspiring images, Strategies	Transition Images, Transition Paths	Creativity, Risk-taking in relation to suggest opportunities, Similar knowledge between municipality and utility, Thinking mid to long-term in terms of Paths, Aware of uncertainties of climate adaptation	Municipality Utility Consultant *Universities* *Insurance company (damage data)*
	Building the agenda	Exchange of goals, Negotiations, Shared goal-formulation	Transition agenda, Transition Coalitions	Thinking in terms of co-production Negotiation skills Understanding the regulatory framework	
	Networking with other actors	Coalition building	Transition paths, Innovation networks	Communication Consensus building Sharing knowledge Acknowledge the importance of network	

Operational	**Innovate new solutions**	Experimenting	Transition experiments, Testing grounds	Learning and communication Personal relationship Challenging best-practise Technical knowledge Be able to engage citizens Think outside the box Creative	Municipality Utility (*) Citizens (*) *Companies* (*) Housing associations Consultant
	Develop transforma-tional projects	Implementation	Experiment portfolios	Project management Personal relationship Think out-side the box The presence of a “institutional entrepreneur” Integrating/inspire the citizens and companies Be able to integrate feedback from residents Send out the right signals	Contractor Producer *Universities* *(*)Insurance companies (investor)*

	Involve and engage other actors	Campaigns, Workshops, Fairs, Information material	Transition coalitions (Municipality, Water utility, citizens, housing associations, companies), Mobilisation	Personal relationships Integrating/ inspire the citizens and companies Sharing knowledge Be able to integrate feedback from residents Willingness to take risk Open-minded	
Reflexive	**Adjustment of the transition**	Adjustment of vision and agenda, New experiments	Participatory evaluation	*Reflexive thinking* *Reflexive attitude* *An evaluation culture*	Municipality Utility Citizens *Companies* Housing associations Consultant Contractor *Universities*

* = Independent project, based on their own visions.
Italic = What Gladsaxe Municipality should work on improving.
Black words = Directly applied theory
Blue words = Additions to the theory

10.3 The end of transition

According to the survey from the comparative evaluation, the biggest challenge for the municipalities in relation to developing the actions in the climate adaptation plan, was the coordination with external actors. The second biggest challenge was coordination within the municipality. (see Chapter 4,) (Appendix E). These issues appear to have been a consistent theme throughout the thesis, but Gladsaxe Municipality seems to have challenged these issues well.

Gladsaxe Municipality's innovative process of the three first Transition Management clusters: strategic, tactical and operational, has heavily influenced their position as a frontrunner climate adaptation municipality. The close collaboration between Nordvand and Gladsaxe Municipality has also been key to this position. In order to optimise the transition even more, both actors need to improve the reflexive evaluating work and include more actors in the process when needed. Gladsaxe has had a great start with the transition work, but there is still some work ahead until the vision has been achieved, which is to be fully adapted to future cloudburst events and to have fully separated rainwater from wastewater.

The future transition development can be affected by many factors. A key factor will be the future cloudbursts leading to floods. A sudden higher frequency of these events could intensify the transition because both civil and political interest and support will be increased even more. However, the opposite could also happen, if no cloudburst events occurred at all. Climate adaptation could then lose interest and support. The transition is thus a long and dynamic process that takes place as long as there is a determination among the actors who can implement the adaptation solutions. Particularly a determination among the municipality and water utility are important, and the municipality must utilise the right capabilities and involve the right actors at the right time.

11 Conclusion

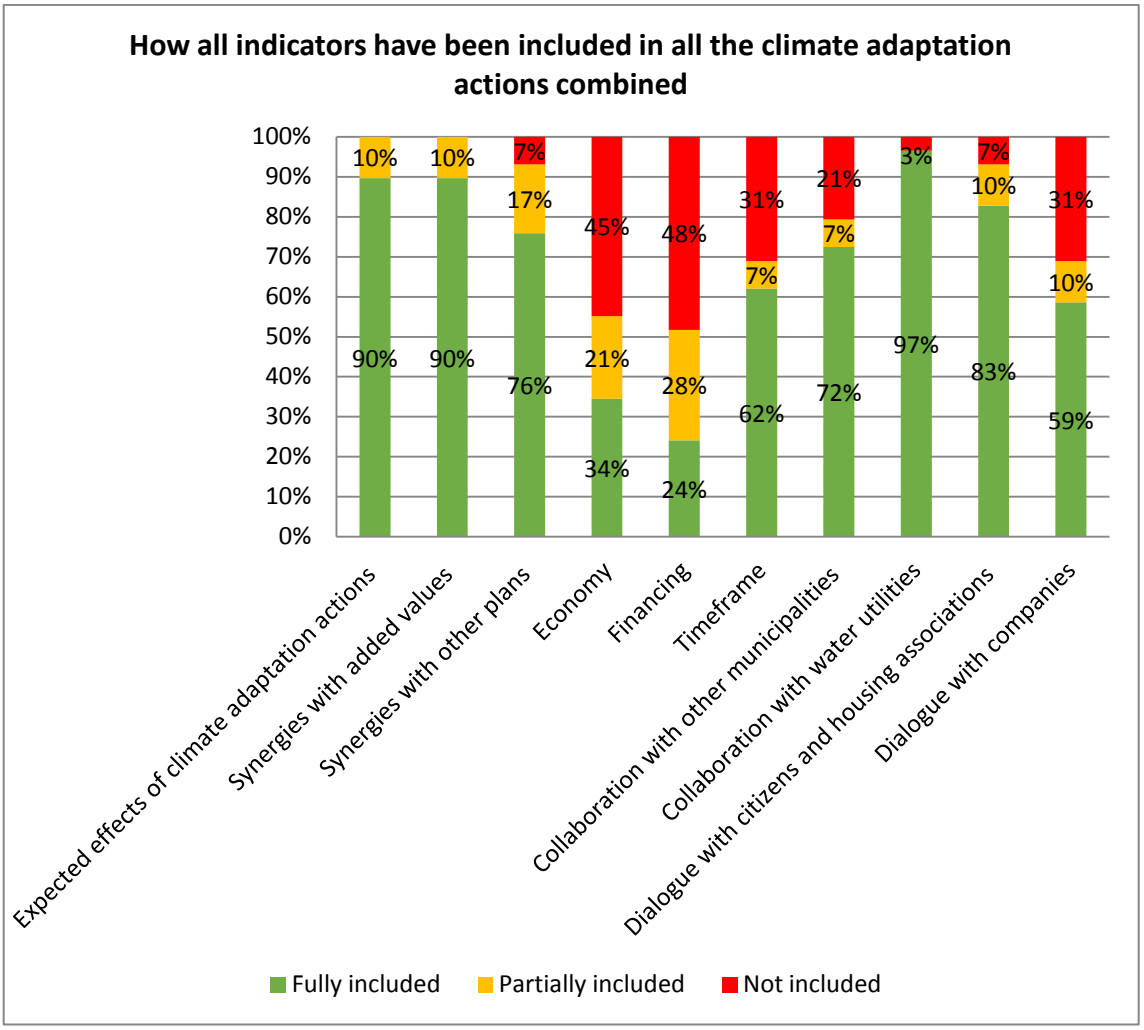
This chapter entails the main points of the thesis and includes the summarised answers to the research questions below:

How well are the municipalities within the Capital Region of Denmark planning their actions in the climate adaptation plan; and how have the water utility, companies, citizens, and housing associations been mobilised and utilised through governance activities by a frontrunner municipality in the transition towards successful climate adaptation actions? Finally, what characterises a frontrunner municipality in relation to climate adaptation actions?

The climate changes are causing many challenges in Denmark. More Danish citizens are experiencing floods due to the rising sea level and the changing precipitation pattern (increased amount of rain during cloudburst events and they happen more frequently). When taming the challenge of climate change through implementing climate adaptation solution, it is key to have a comprehensive plan, so the water does not flood another unplanned place. It is the Danish municipalities' responsibility to each have had developed a climate adaptation plan by the end of 2013. However, the actual transitioning to be a climate adapted municipality takes a long time.

Loorbach's Transition Management theory explains, how a goal can be reached through an innovative transition consisting of four clusters: strategic, tactical, operational and reflexive. It is important to look at the transition as a dynamic development, where a change in one cluster can influence and create the need for a change in another cluster. Collaboration with other actors is key in order to go through the transition. The municipality should therefore be aware of motivating and engaging other actors in the climate adaptation work.

The comparative evaluation analysis explores how well the municipalities within the Capital Region of Denmark are planning their actions in the climate adaptation plan. The five categories with ten indicators (*expected effects of climate adaptation actions, synergies with added values, synergies with other plans, economy, financing, timeframe, collaboration with other municipalities, collaboration with water utilities, dialogue with citizens and housing associations and dialogue with companies*) are produced to analyse how well each municipal climate adaptation action plan did. The overall result of how the ten indicators were included is illustrated in the graph below. The inclusion of the economy, financing, timeframe and having a dialogue with the companies are the indicators which some of the municipalities in the Capital Region seem to have left (partly) out of their climate adaptation action plan.



Level of inclusion	Definition of level
Fully included indicator	Actions contain an explanation on how the indicator is included
Partially included indicator	Actions include the indicator but it is not explained how it is included
Not included indicator	Actions do not included the indicator in any way

The final adaptation score of each municipal climate adaptation action plan is given based on their performance in each of the ten indicators - see the score below for the 29 municipalities. The mean score is 7,9 and five municipalities succeeded in achieving a perfect 10 as a score: Copenhagen, Brøndby, Frederiksberg, Vallensbæk and Gladsaxe.

København	Brøndby	Frederiksberg	Vallensbæk	Gladsaxe	Fredensborg	Albertslund	Høje tåstrup	Egedal	Glostrup	Rødovre	Hvidovre	Helsingør	Rudersdal	Herlev	lyngby tårbæk	Gentofte	Hørsholm	Bornholm	Gribskov
10,0	10,0	10,0	10,0	10,0	9,3	9,3	9,0	9,0	8,7	8,5	8,5	8,3	8,3	8,3	8,3	8,2	8,2	8,0	8,0

Halsnæs	Frederikssund	Furesø	Tårnby	Ishøj	Ballerup	Dragør	Hillerød	Allerød
7,7	7,2	6,5	6,5	6,3	6,0	5,8	4,2	1,5

Gladsaxe Municipality is the chosen transition case study, as they are a more average municipality compared to the other municipalities within the Capital Region of Denmark. The case study analysis of Gladsaxe Municipality is conducted through the use of Transition Management theory. It shows that they often are aware of collaborating with other actors (water utility, companies, citizens and housing associations), which is a key element in the transition process, according to Transition Management. The working process in the three first clusters (strategic, tactical and operational) have been innovative and Gladsaxe Municipality is doing very well. They could however, beneficially had included and collaborated with more actors in these clusters from time to time. And a more innovative process is still needed in the reflexive cluster.

Specifying the findings in the strategic cluster:

The climate adaptation vision of Gladsaxe is achieved through a collaboration between Gladsaxe Municipality and Nordvand in a climate adaptation group. The vision describes the long-term goal to climate adapt to prevent and reduce the damage of cloudbursts and also separate rainwater from wastewater. Both Gladsaxe Municipality and Nordvand have the same desire to avoid flooding and are open-minded to find innovative solutions, which cause them to collaborate well in the climate adaptation group, leading to the expansion and use of the transition arena. The collaboration is forcing both parts to be accommodating towards new ideas and think more innovative. When establishing the climate adaptation vision they could have included more knowledge about managing the transition from an university or another knowledge institution and further made the vision itself more original. But their processes behind the creation of the vision has been really constructive and innovative, due to the climate adaptation group, which consist of employees from different departments.

Specifying the findings in the tactical cluster:

Derived from the transition vision, thirteen transition images have been created, which show the desired future state of a climate adapted Gladsaxe Municipality. These images are the thirteen risk areas within the climate adaptation plan, which have been located based on data on geography and potential damage by COWI; assessed in relation to different climate adaptation opportunities; and been prioritised according to seven criteria. The assessment and prioritisation have been performed by the same diverse climate adaptation group.

Furthermore a number of transition paths have been created, which show the routes to the transition images. These are the actions within the action plan, which have been divided into five different tracks. Together with the transition images, the paths form the transition agenda, which is the climate adaptation plan itself. This agenda functions as the compass for the transition. The content of the climate adaptation plan has also been influenced by the different inter-municipal networks that Gladsaxe is participating in, and especially by the close collaboration between Gladsaxe Municipality and Nordvand.

Also in this cluster Gladsaxe is managing the transition really well through the climate adaption group. In order to improve their work they could benefited from including the knowledge of an

university or another knowledge institution and maybe even utilise the damage data of insurance companies.

Specifying the findings in the operational cluster:

Gladsaxe Municipality has both initiated big development projects such as the Høje Gladsaxe Climate District and small demonstration projects such as the five rainwater gardens in Gedvad. The Climate District consists of five connected areas and have been developed in a collaboration between the municipality and Nordvand, although Nordvand has functioned as project manager. Høje Gladsaxe Sports Park and Marielyst have been two examples on how the municipality has successfully collaborated with Nordvand and a housing association respectively in relation to climate adaptation. Furthermore, the climate adaptation of eleven roads in Gedvad is a good example on how Nordvand has used workshops to collect local knowledge and integrate it in the project.

Although many actors are involved in the process, it is often the project manager who shapes the project. The personal and professional relationship between the project manager and the private developer is a key element in a successful process. Economy is of course also a key aspect in the operational phase and is seen as a big challenge, because of unforeseen expenses, outdated climate models and other reasons.

Finally, the municipality are very keen on involving and engaging citizens, housing associations and companies in order to make them climate adapt their own property. This has happened through different sorts of campaigns, which have helped significantly. However, the biggest driver has been the repayment scheme, where people can get around 24.000 DKK back, if they separate all the rainwater on their property from the wastewater.

Gladsaxe Municipality and Nordvand have in many aspect strived to innovate the process of creating projects and have been aware of collaborating with other actors. In order to strengthen their transition, they could benefit from incorporating the knowledge and experiences of a knowledge institution as an university.

Specifying the findings in the reflexive cluster:

Gladsaxe Municipality and Nordvand have both to some degree developed a reflexive approach towards their climate adaption collaboration work, which insure the future growth of their climate adapted transition. It has been a vital part of Gladsaxe being a frontrunner that both parties wanted to act on the climate issue and dared to do it. There is however still a need for more innovative improvements of the evaluation process. Especially creating a strict evaluating culture would be beneficial for them, so they continue to challenge the norm and reflect on the experiences with the innovative approach.

The nine transition goals

In order to become a true climate adapted municipality it is important to achieve the found nine goals towards successful climate adaptation actions. The nine goals being:

1. Giving direction to future planning
2. Reframing rain as a resource
3. Translating the vision into content for the climate adaptation plan
4. Building the agenda
5. Networking with other actors
6. Innovate new solutions
7. Develop transformational projects
8. Involve and engage other actors
9. Adjustment of the transition

In order to achieve the goals, the municipalities must include and utilise the suitable governance activities, transition instruments and actor capabilities, as the applied Transition Management recommends. It is also necessary that the appropriate actors are involved at the right time to make the needed climate adaptation happen. All goals and their necessities needed in order to manage the transition, are to be found in the matrix below. This framework can be applied to other municipalities' climate adaptation transition, after adjusting the goals etc. to make it fit with their conditions, as each transition is unique.

The nine goals of the transition towards successful climate adaptation actions					
Type of governance activity	**Goals**	**Activities**	**Transition Instruments**	**Capabilities**	**Actors**
Strategic	**Giving direction to future planning**	Envisioning	Transition Arena, Transition Vision	Creativity, Innovative, Risk-taking, Open-minded, Respect towards other actors, Mutual knowledge	Municipality Utility Universities
	Reframing rain as a resource	Exchange of perspectives Developing new discourse	Transition Arena, Transition vision	Communication and network skills Integrative capabilities Open-minded Knowledge of SUDS	

Tactical	**Translating the vision into content for the climate adaptation plan**	Developing inspiring images, Strategies	Transition Images, Transition Paths	Creativity, Risk-taking in relation to suggest opportunities, Similar knowledge between municipality and utility, Thinking mid to long-term in terms of Paths, Aware of uncertainties of climate adaptation	Municipality Utility Consultant Universities Insurance company (damage data)
	Building the agenda	Exchange of goals, Negotiations, Shared goal-formulation	Transition agenda, Transition Coalitions	Thinking in terms of co-production Negotiation skills Understanding the regulatory framework	
	Networking with other actors	Coalition building	Transition paths, Innovation networks	Communication Consensus building Sharing knowledge Acknowledge the importance of network	

Operational	**Innovate new solutions**	Experimenting	Transition experiments, Testing grounds	Learning and communication Personal relationship Challenging best-practise Technical knowledge Be able to engage citizens Think outside the box Creative	Municipality Utility (*) Citizens (*) Companies (*) Housing associations Consultant
	Develop transformational projects	Implementation	Experiment portfolios	Project management Personal relationship Think out-side the box The presence of a “institutional entrepreneur” Integrating/inspire the citizens and companies Be able to integrate feedback from residents Send out the right signals	Contractor Producer Universities (*)Insurance companies (investor)

	Involve and engage other actors	Campaigns, Workshops, Fairs, Information material	Transition coalitions (Gladsaxe Municipality, Nordvand, citizens, housing associations, companies), Mobilisation	Personal relationships Integrating/ inspire the citizens and companies Sharing knowledge Be able to integrate feedback from residents Willingness to take risk Open-minded	
Reflexive	**Adjustment of the transition**	Adjustment of vision and agenda, New experiments	Participatory evaluation	Reflexive thinking Reflexive attitude An evaluation culture	Municipality Utility Citizens Companies Housing associations Consultant Contractor Universities

* = Independent project, based on their own visions.

12 Suggestions for future research

Working with the thesis has created the awareness of the following possible future projects, but there are of course many other interesting approaches to look into as well.

A case study of all the actors involved and their role in the climate adaptation transition is another possible study. This thesis has been limited to investigate a municipality's transition work through its collaboration with a water utility, companies, citizens and housing associations to achieve their vision. The reality is however more complex, and through analysing the collaboration between all the involved actors (municipality, water utility, citizens, companies, housing associations, consultant, contractor, producer, universities and insurance companies) and discuss the municipalities' utilisation and mobilisation of these actors and their work in all the four clusters (strategic, tactical, operational and reflexive), it would become rather interesting to see if some actors could be better utilised by the municipality or their capabilities could be better used. This knowledge would make it possible for the municipality to make the climate adaptation transition stronger.

A case study of all the five found frontrunner municipalities in the comparative evaluation analysis could be another study. It would be rather interesting to analyse the five frontrunner municipalities and compare their goals, activities, their use of the transition instruments, capabilities and their involvement of actors through the four clusters (strategic, tactical, operational and reflexive). It could provide a more nuanced picture of how a frontrunner climate adaptive municipality actually works and what it takes to become one.

Another possible case study is an analysis of a frontrunner municipality and a low scoring municipality. A comparative analysis of the differences of their work in all four clusters (strategic, tactical, operational and reflexive) would be carried out, resulting in a more clear idea of what a frontrunner municipality does extra, causing them to be in the top.

A fourth possibility is a study of Denmark's climate adaptation work compared to the work of for example Sweden, England or Holland. A comparison of the different countries' experiences with climate adaptation and how it is ensured implemented at the local level, would lead to the findings of ways that Denmark can improve their climate adaptation work.

Finally, a case study of the co-financing scheme's opportunities and challenges when using it, would be interesting. How many Danish climate adaptation projects does actually utilise this opportunity and what is the barriers? Through analysing this, it will be possible to setup possible improvement possibilities, it could for instance be: regulative changes, change of the work process etc.

13 List of references

Andersen, I., 2010. *Den skinbarlige virkelighed - vidensproduktion inden for samfundsvidenskaberne*. 4th ed. Samfundslitteratur

André K., Simonsson L., Swartling Å.G. and Linnér B, 2012. *Method Development for Identifying and Analysing Stakeholders in Climate Change Adaptation Processes*. Journal of Environmental Policy & Planning, 14:3, pp.243-261.

Anglia Ruskin University, 2015. *Harvard system*. [online]. Available at: http://libweb.anglia.ac.uk/referencing/harvard.htm [Accessed 30-05 2015]

Astrup S., 2014. *Forsker: Københavns indsats mod ekstremt vejr er for ensidig*. [online]. Available at: http://politiken.dk/indland/ECE2382682/forsker-koebenhavns-indsats-mod-ekstremt-vejr-er-for-ensidig/ [Accessed 27.05.2015]

Capital Region, 2015. *Fælles klimastrategi for Region Hovedstaden.* [online]. Available at: https://www.regionh.dk/til-fagfolk/miljoe/en-gr%C3%B8nnere-region/klimastrategi-for-hovedstadsregionen/Sider/Klimastrategien.aspx [Accessed 20.03.2015]

Climate-ADAPT, 2015a. *About CLIMATE-ADAPT*. [online]. Available at: http://climate-adapt.eea.europa.eu/about [Accessed 20.03.15]

Climate-ADAPT, 2015b. *Denmark.* [online]. Available at: http://climate-adapt.eea.europa.eu/countries/denmark [Accessed 20.03.15]

Cloutier G., Joerin F., Dubois C., Labarthe M., Legay C. and Viens D., 2014. *Planning adaptation based on local actors' knowledge and participation: a climate governance experiment*. Climate Policy, pp.1-17.

Danish Economy and Ministry of Interior, 2015. *Nøgletal.* [online]. Available at: http://noegletal.dk/ [Accessed 20.04.15]

Danish Ministry of Environment, 2015a. *Oversvømmelsesdirektivet*. [online]. Available at: http://naturstyrelsen.dk/vandmiljoe/klima/oversvoemmelser/oversvoemmelsesdirektivet/ [Accessed 27.05.15]

Danish Ministry of the Environment, 2014. *Bekendtgørelse om spildevandsforsyningsselskabers medfinansiering af kommunale og private projekter vedrørende tag- og overfladevand*. [online]. Available at: https://www.retsinformation.dk/Forms/R0710.aspx?id=166842 [Accessed 19.05. 2015]

Danish Ministry of Environment, 2013. *Klimatilpasningsplaner og klimalokalplaner, Vejl*edning. [online]. Available at: http://www.klimatilpasning.dk/media/598918/klimatilpasningsvejledning_web.pdf [Accessed 20.03.2015]

Danish Ministry of Environment, 2012. *Sådan håndterer vi skybrud og regnvand. Handlingsplan for klimasikring af Danmark.* [online]. Available at: http://klimatilpasning.dk/media/566642/klimahandlingsplan.pdf [Accessed 20.03.2015]

Danish Ministry of Environment, 2007. *Planloven i praksis*. [online]. Available at: http://naturstyrelsen.dk/media/nst/attachments/81089/planloven_011007.pdf [Accessed 20.05.15]

Danish Ministry of Finance, 2012. *Aftale om kommunernes økonomi for 2013*. [online]. Available at: http://www.fm.dk/publikationer/2012/aftaler-om-den-kommunale-og-regionale-oekonomi-for-2013 [Accessed 20.03.15]

Danish Nature Agency, 2015. *Rejseholdet om Vandforsyning*. [online]. Available at: http://naturstyrelsen.dk/vandmiljoe/vand-i-hverdagen/drikkevand/rejsehold-om-vandforsyning/ [Accessed 20.05.15]

Danish Nature Agency, 2014. *Analyse af IPCC delrapport 2 – Effekter, klimatilpasning og sårbarhed.* [online]. Available at: http://www.dmi.dk/fileadmin/user_upload/Rapporter/DKC/2014/Analyse_af_IPCC_delrapport_2__Effekter_klimatilpasning_og_saarbarhed.final.pdf [Accessed 20.03.15]

The Danish Regions, 2010. *Statistik*. [online]. Available at: http://www.regioner.dk/om+regionerne/statistik+opdateret+dec+2014 [Accessed 20.03.2015]

DMI, 2014. *Fremtidige klimaforandringer i Danmark*. [online]. Available at: http://www.dmi.dk/fileadmin/user_upload/Rapporter/DKC/2014/Klimaforandringer_dmi.pdf [Accessed 20.03.15]

Emergency Management Agency, 2012. *Redegørelse vedrørende skybruddet i Storkøbenhavn lørdag den 2. juli 2011*. [online]. Available at: http://brs.dk/beredskab/Documents/Redeg%C3%B8relse%20om%20skybruddet%20i%20Stork%C3%B8benhavn%202.%20juli%202011.pdf [Accessed 20.03.15]

Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.), 2014. *Summary for policymakers. In: Climate Change 2014: Impacts,Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* [online]. IPCC. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf [Accessed 20.03.2015]

Forchhammer H.B., 2014. *Tre prisloftsår med ansøgninger om klimatilpasningsprojekter. Klikovand*. [online]. Available at: http://www.klikovand.dk/tre-prisloftsar-med-ansogninger-om…/ [Accessed 19.05.2015]

Forsikring&Pension, 2015. *Behov for løsning til de ekstremt oversvømmelsestruede husejere*. [online]. Available at:

http://www.forsikringogpension.dk/temaer/klima/klimapolitik/Sider/behov-for-loesning-til-de-ekstremt-oversvoemmelsestruede-husejere.aspx [Accessed 25.05.2015]

Forsikring&Pension, 2014. *Klimaviden. [online]. Available at:* http://www.forsikringogpension.dk/temaer/klima/klimaviden/Sider/statistikker.aspx [Accessed 20.03.15]

Gladsaxe Municipality, 2015a. *Fakta og historie*. [online] Available at: http://www.Gladsaxe.dk/kommunen/servicemenu/om_kommunen/fakta_og_historie [Accessed 10.05.2015]

Gladsaxe Municipality, 2015b. *Klimatilpasning*. [online]. Available at: http://Gladsaxe.cowi.webhouse.dk/dk/kommuneplan_2013/hovedstruktur/klimatilpasning/klimatilpasning.htm [Accessed 09.05. 2015]

Gladsaxe Municipality, 2015c. *Spildevandsplan 2015*. [online]. Available at: http://planer.Gladsaxe.dk/dk/vand/spildevandsplan_2015/ [Accessed 20-05-2015]

Gladsaxe Municipality, 2014b. *Klimatilpasningsplan*. [online]. Available at: http://Gladsaxe-sp.cowi.webhouse.dk/dk/vand/klimatilpasningsplan/ [Accessed 15.05.2015]

Gladsaxe Municipality, 2014d. *Notat vedrørende prioritering af områder i Klimatilpasningsplan 2014.* [online]. Available at: http://planer.Gladsaxe.dk/download/klimatilpasningsplan/prioriteringsnotat.pdf [Accessed 09.05.2015]

Gladsaxe Municipality, 2014e. *Udviklings og undersøgelsesprojekter*. [online]. Available at: http://Gladsaxe-sp.cowi.webhouse.dk/dk/vand/klimatilpasningsplan/handlinger/udviklings-_og_undersoegelsesprojekter/ [Accessed 10.05.2015]

Gladsaxe Municipality, 2014f. *Risikokort*. [online] Available at: http://Gladsaxe-sp.cowi.webhouse.dk/dk/vand/klimatilpasningsplan/kortlaegning/risikokort/risikokort.htm [Accessed the 15-05-2015]

Gladsaxe Municipality, 2014g. *Erhvervsområder*. [online] Available at: http://Gladsaxe-sp.cowi.webhouse.dk/dk/vand/klimatilpasningsplan/handlinger/erhvervsomraader/erhvervsomraader.htm [Accessed 13.05.2015]

Gladsaxe Municipality, 2014h. *Demonstrationshaver*. [online]. Available at: http://nordvand.dk/klimatilpasning/bagsvaerd/dialogmoeder/Documents/dialogmoede_3_Demonstrationshaver_JG.pdf [Accessed 16.05.2015]

Geels, F.W., 2002. *Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study*. Research Policy, 31, pp. 257-273

Hansen J .M., 2011. *Hvor meget stiger havet?.* [online]. Aktuel Naturvidenskab, 5. Available at: http://aktuelnaturvidenskab.dk/fileadmin/Aktuel_Naturvidenskab/nr-5/an5_laesoe_hav.pdf [Accessed 20.03.2015]

HOFOR, 2015. *HOFORs forslag til skabelon for Klimatilpasningens implementering i kommuneplanen.* [online]. Available at: http://www.klimatilpasning.dk/media/650754/hofors_forslag_til_skabelon_for_kommuneplan.pdf [Accessed 27.05.2015]

IDA, 2015. *Spildevandskomiteen*. [online]. Available at: https://ida.dk/content/spildevandskomiteen [Accessed 24.05.2015]

Kates, R.W. et al., 2012. *Transformational adaptation when incremental adaptations to climate change are insufficient*. PNAS vol. 109, 19, pp. 7156-7161

Klimatilpasning, 2015a. *Kan klimatilpasning skabe sjovere byer?.* [online]. Available at: http://www.klimatilpasning.dk/vandplus [Accessed 20.05.2015]

Klimatilpasning, 2015b. *Gladsaxe: Vand på sidelinjen.* Klimatilpasning.dk [online]. Available at: http://www.klimatilpasning.dk/vandplus/Gladsaxe-vand-paa-sidelinjen.aspx [Accessed 20.05.2015]

Klimatilpasning, 2013. *Teknologier og metoder til klimatilpasning.* [online]. Available at: http://www.klimatilpasning.dk/teknologi.aspx [Accessed 20.03.15]

Krawack S., 2014. *Evaluering af regelsættet for klimatilpasning.* Concito. [online]. Available at: http://concito.dk/…/klimatilpasning_lovgivning_-_m_rettelse… [Accessed 19.05. 2015]

Kvale S. and Brinkmann S., 2009. *Interview, introduktion til et håndværk*. 2nd ed. Hans Reitzels Forlag

Loorbach, D., 2010. *Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework. Governance: An International Journal of Policy, Administration and Institutions.* Vol 23, 1, pp. 161-183

Loorbach, D. & Rotmans, J., 2010. *The practice of Transition Management: Examples and lessons from four distinct cases.* Futures Vol 42, pp. 237-246

Loorbach, D. et al., 2008. *Governance in the energy transition: Practice of Transition Management in the Netherlands.* Int. J. Environmental Technology and Management Vol. 9, No 2/3, pp. 1-22

Loorbach, D., 2007. *Transition Management – New mode of governance for sustainable development.* Erasmus Universty Rotterdam

Lund D.H., Sehested K., Hellesen T. and Nellemann V., 2012. *Climate change adaptation in Denmark: enhancement through collaboration and meta-governance?.* Local Environment: The international journal of Justice and Sustainability, Vol. 17, Nos. 6–7, pp. 613-628.

Nordvand, 2015a. *Vi gør plads til regnvandet.* [online]. Available at: http://www.nordvand.dk/klimatilpasning/Sider/default.aspx [Accessed 10.05. 2015]

Nordvand, 2015b. *Mission og vision.* [online]. Available at: http://www.nordvand.dk/OmNordvand/Mission_og_vision/Sider/default.aspx [Accessed 10.05. 2015]

Nordvand, 2015c. *Klimakvarter ved Høje Gladsaxe*. [online]. Available at: http://nordvand.dk/klimatilpasning/hojeGladsaxe/Sider/default.aspx [Accessed 16.05.2015]

Nordvand, 2015d. *Gladsaxe Stadion*. [online]. Available at: http://nordvand.dk/klimatilpasning/Gladsaxestadion/Sider/default.aspx [Accessed 16.05.2015]

Nordvand, 2015e. *Regnvand I Bagsværd*. [online]. Available at: http://nordvand.dk/klimatilpasning/bagsvaerd/Sider/default.aspx [Accessed 16.05.2015]

Nordvand, 2015f. *Om Nordvand*. [online]. Available at: http://www.nordvand.dk/OmNordvand/Sider/default.aspx [Accessed 23.05.2015]

Nordvand, 2014e. *Dialogmøde 2 – Velkomst og program*. [online]. Available at: http://nordvand.dk/klimatilpasning/bagsvaerd/dialogmoeder/Documents/PP_dialogm%C3%B8de%202.pdf [Accessed 16.05.2015]

Nordvand, 2014f. *Dialogmøde 3 – Velkomst og program*. [online]. Available at: http://nordvand.dk/klimatilpasning/bagsvaerd/dialogmoeder/Documents/dialogmoede_3_Indledning_Nordvand_Orbicon.pdf [Accessed 16.05.2015]

Nordvand, 2014g. *Dialogmøde 1 – Introduktion ved projektleder Per Lorentzen*. [online]. Available at: http://nordvand.dk/klimatilpasning/bagsvaerd/Documents/dialogmoede_1_pel_intro.pdf [Accessed 16.05.2015]

Nordvand , 2014h. *Referat af dialogmøde 1*. [online]. Available at: http://nordvand.dk/klimatilpasning/bagsvaerd/Documents/Dialogmoede1_omraade1.pdf [Accessed 16.05.2015]

Olsen L. & Rieper O., 2004. *Evalueringsbegreber, modeller og paradigmer* in Olaf R. ed. 2004. *Håndbog i evaluering – Metoder til at dokumentere og vurdere proces og effekt af offentlige indsatser*. AKF Forlaget. pp. 13-33

Park, S.E. et al., 2012. *Informing adaptation responses to climate change through theories of transformation.* Global Environmental Change Vol. 22, pp. 115-126

Schultz D., 2014. *Godt samarbejde og gennemtænkt kommunikation. Klikovand*. [online] Available at: http://www.klikovand.dk/godt-samarbejde-og-gennemtaenkt-kommunikation/ [Accessed 17.05.2015]

Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.), 2013. *Summary for Policymakers. In: Climate Change 2013: The Physical*

Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [online]. IPCC. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WGIAR5_SPM_brochure_en.pdf [Accessed 20.03.2015]

Wamsler C. and Brink E., 2014. *Interfacing citizens' and institutions' practice and responsibilities for climate change adaptation*. Urban Climate, pp. 64-91.

Wejs A., Harvold K., Larsen S.V. and Saglie I.L., 2014. *Legitimacy building in weak institutional settings: climate change adaptation at local level in Denmark and Norway.* Environmental Politics, Vol. 23, No. 3, pp. 490-508.

Webb R.J., McKeller R. and Kay R., 2013. *Climate change adaptation in Australia: experience, challenges and capability development*. Australian Journal of Environmental Management, Vol. 20, No. 4, pp. 320-337.

Yin R. K., 2014. *Case Study Research, Design and Methods*. 5th ed. SAGE Publications

Interviews and conferences

Jangmark L. and Kolte-Olsen A., 2015. *The transcription of the interview with Annette Kolte-Olsen and Lise Jangmark, Nordvand.* Interviewed by Christensen S.K. and Fels M. Nordvand headquarter, April 27th 2015

Louise Grøndal, 2015. Presentation: *Klimatilpasning i Danmark*. The CRES Conference, about critical climate impact, adaptation and vulnerability in Denmark. Odense congress center, April 20th 2015

Pedersen E. D., 2015. *The transcription of the interview with Elsebeth Dahl Pedersen, Novo Nordisk*. Interviewed by Christensen S.K. and Fels M. Telephone interview, April 23th 2015

Resident at Marielyst Rundgård, 2015. C*onversation with a local resident.* Interviewed by Christensen S.K. and Fels M., Fieldtrip to Marielyst. May 11th 2015

Schultz D., 2015. *The transcription of the interview with Dennis Schultz, Gladsaxe Almennyttige Andelsboligforening*. Interviewed by Christensen S.K. and Fels M. GAA headquarter, April 24th 2015

Stefansen K., 2015. *The transcription of the interview with Kathrine Stefansen, Gladsaxe Municipality.* Interviewed by Christensen S.K. and Fels M. Gladsaxe Municipality City Hall, April 14th 2015

The 29 municipal climate adaptation action plans in the Capital Region

Albertslund Municipality, 2012. *Klimatilpasning Albertslund 2012, Strategi og handlinger*. [online]. Available at: http://www.klimatilpasning.dk/media/889385/albertslund_klimastrategi_2012.pdf [Accessed 20.05. 2015]

Allerød Municipality, 2013. *Klimatilpasning*. [online]. Available at: http://alleroed-kp13.cowi.webhouse.dk/dk/6_tekniske_anlaeg/66_klimatilpasning/ [Accessed 20.05. 2015]

Ballerup Municipality, 2014. *Klimatilpasningsplan 2014.* [online]. Available at: http://ballerup.viewer.dkplan.niras.dk/DKplan/dkplan.aspx?pageId=756 [Accessed 20.05. 2015]

Bornholm Municipality, 2013. *Klimatilpasningsplan vand.* [online]. Available at: http://www.klimatilpasning.dk/media/889403/bornholm_klimatilpasningsplan_2013.pdf [Accessed 20.05. 2015]

Brøndby Municipality, 2014. *Klimatilpasningsplan.* [online]. Available at: http://brondby.viewer.dkplan.niras.dk/dkplan/dkplan.aspx?pageId=582 [Accessed 20.05. 2015]

Dragør Municipality, 2014. *Klimatilpasningsplan.* [online]. Available at: http://www.klimatilpasning.dk/media/895744/dragoer_klimatilspasningsplan_2014.pdf [Accessed 20.05. 2015]

Egedal Municipality, 2015. *Vand og Klimatilpasning, Tillæg til Kommuneplan 2013*. [online]. Available at: http://soap.plansystem.dk/jsp/getdoklink.jsp?planid=2962925&plantype=12&status=V [Accessed 20.05. 2015]

Fredensborg Municipality, 2014. *Forslag til Klimatilpasningsplan 2014-2017*. [online]. Available at: http://fredensborg.planweb.dk/klima/Rapporter/Rapport_2.pdf [Accessed 20.05. 2015]

Frederiksberg Municipality, 2013. *Klimatilpasningsplan 2012*. [online]. Available at: http://klimatilpasning.dk/media/801152/klimatilpasningsplan_2012_frederiksberg.pdf [Accessed 20.05. 2015]

Frederikssund Municipality, 2014. *Kommuneplantillæg nr. 007 , Klimatilpasningsplan*. [online]. Available at: http://www.klimatilpasning.dk/media/889427/frederikssund_klimatilpasningsplan_2013_2025.pdf [Accessed 20.05. 2015]

Furesø Municipality, 2013. *Tillæg nr. 1 til Furesø Kommuneplan 2013 Klimatilpasning*. [online]. Available at: http://www.furesoe.dk/kommunen/politikkerogplaner/lokalplanerkommuneplan/~/media/www/kommunen/politikker%20og%20planer/lokalplanogkommuneplan/kommuneplan2013/till%C3%A6g%201%20til%20fures%C3%B8%20kommuneplan%202013%20-%20klimatilpasning.ashx [Accessed 20.05. 2015]

Gentofte Municipality, 2014. *Tillæg 2 til kommuneplan 2013, klimatilpasning*. [online]. Available at: http://www.Gentofte.dk/da/Borger/By-og-milj%C3%B8/Byplanl%C3%A6gning/Nyt-om-lokalplaner-og-Kommuneplan/Vedtagne-kommuneplantill%C3%A6g-2013/Kommuneplantill%C3%A6g-02-2013-Klimatilpasning [Accessed 20.05. 2015]

Gladsaxe Municipality, 2014. *Klimatilpasningsplan.* [online]. Available at: http://planer.Gladsaxe.dk/dk/vand/klimatilpasningsplan/ [Accessed 20.05. 2015]

Glostrup Municipality, 2014. *Klimatilpasningsplan 2013*. [online]. Available at: http://www.klimatilpasning.dk/media/890304/glostrup_klimatilpasningsplan_2013.pdf [Accessed 20.05. 2015]

Gribskov Municipality, 2014. *Klimatilpasning Tillæg nr. 1 til Kommuneplan 2013-25.* [online]. Available at: http://klimatilpasning.dk/media/852314/gribskov_kommune_-_klimatilpasningsplan_forslag.pdf [Accessed 20.05. 2015]

Halsnæs Municipality, 2014. *Kommuneplantillæg nr. 3 til Kommuneplan 2013-2025*. [online]. Available at: http://www.klimatilpasning.dk/media/809175/halsn%C3%A6s%202013%20till%C3%A6g.pdf [Accessed 20.05. 2015]

Helsingør Municipality, 2014. *Kommuneplantillæg nr. 11 til kommuneplan 2013-25, Klimatilpasningsplan 2014*. [online]. Available at: http://www.klimatilpasning.dk/media/889501/helsingoer_klimatilpasningsplan_2014.pdf [Accessed 20.05. 2015]

Herlev Municipality, 2014. *Kommuneplan 2013-2025*. [online]. Available at: http://klimatilpasning.dk/media/861790/herlev_kommuneplan.pdf [Accessed 20.05. 2015]

Hillerød Municipality, 2013. *Kommuneplantillæg om klimatilpasning - tillæg nr. 3 til Kommuneplan 2013, klimatilpasning.* [online]. Available at: http://www.klimatilpasning.dk/media/889513/hilleroed_klimatilpasningsplan_2013.pdf [Accessed 20.05. 2015]

Hvidovre Municipality, 2014. *Strategi for Klimatilpasning 2014*. [online]. Available at: http://klimatilpasning.dk/media/861802/hvidovre_forslag_til_strategi_for_klimatilpasning_2014.pdf [Accessed 20.05. 2015]

Høje Tåstrup Municipality, 2014. *Kommuneplantillæg*. [online]. Available at: http://klimatilpasning.dk/media/869906/h_je_taastrup.pdf [Accessed 20.05. 2015]

Hørsholm Municipality, 2014. *Klimatilpasningsplan.* [online]. Available at: http://www.klimatilpasning.dk/media/889521/hoersholm_klimatilpasningsplan%202014.pdf [Accessed 20.05. 2015]

Ishøj Municipality, 2013. *Klimatilpasningsplan*. [online]. Available at: http://ishojforsyning.dk/fileadmin/Dokumenter/Spildevand_-

_Klimatilpasningsplan/Ishoej_Forsyning_Klimatilpasningsplan_2013_ny.pdf [Accessed 20.05. 2015]

København Municipality, 2011. *Københavns Klimatilpasningsplan*. [online]. Available at: http://klimatilpasning.dk/media/576854/k_benhavns_klimatilpasningsplan.pdf [Accessed 20.05. 2015]

Lyngby Tårbæk Municipality, 2014. *Lyngby-Taarbæk kommune klimatilpasningsplan*. [online]. Available at: http://www.klimatilpasning.dk/media/889541/lyngby_taarbaek_klimatilpasningsplan_2014.pdf [Accessed 20.05. 2015]

Rudersdal Municipality, 2014. *Rudersdal en klimaberedt kommune, Klimatilpasningsplan - Strategi og indsatser.* [online]. Available at: http://www.klimatilpasning.dk/media/889549/rudersdal_klimatilpasningsplan_2014.pdf [Accessed 20.05. 2015]

Rødovre Municipality, 2014. *Tillæg 2 til Kommuneplan 2010 - 2022, Klimatilpasningsplan.* [online]. Available at: http://www.klimatilpasning.dk/media/889545/roedovre_klimatilpasningsplan_2014_2018.pdf [Accessed 20.05. 2015]

Tårnby Municipality, 2014. *Forslag til Tårnby Kommune Kommuneplan 2014 – 2026.* [online]. Available at: http://soap.plansystem.dk/pdfarchive/11_2280340_1417178508734.pdf [Accessed 20.05. 2015]

Vallensbæk Municipality, 2014. *Tillæg nr 1. KOMMUNEPLAN 2013 - 2025, Klimatilpasningsplan.* [online]. Available at: http://www.klimatilpasning.dk/media/889561/vallensbaek_klimatilpasningsplan_2013-2025.pdf [Accessed 20.05. 2015]

Figures

Figure 1: DMI, 2014. *Fremtidige klimaforandringer i Danmark*. [online]. Available at: http://www.dmi.dk/fileadmin/user_upload/Rapporter/DKC/2014/Klimaforandringer_dmi.pdf [Accessed 20.03.15] p. 8

Figure 2: DMI, 2014. *Fremtidige klimaforandringer i Danmark*. [online]. Available at: http://www.dmi.dk/fileadmin/user_upload/Rapporter/DKC/2014/Klimaforandringer_dmi.pdf [Accessed 20.03.15] p. 16

Figure 3: Created by the authors

Figure 4: Louise Grøndal, 2015. Presentation: *Klimatilpasning i Danmark*. The CRES Conference, about critical climate impact, adaptation and vulnerability in Denmark. Odense congress center, April 20th 2015

Figure 5: Danish Ministry of Environment, 2013. *Klimatilpasningsplaner og klimalokalplaner, Vejl*edning. [online]. Available at: http://www.klimatilpasning.dk/media/598918/klimatilpasningsvejledning_web.pdf [Accessed 20.03.2015] p.6

Figure 6: Loorbach, D., 2010. *Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework. Governance: An International Journal of Policy, Administration and Institutions.* Vol 23, 1, pp. 161-183

Figure 7: Loorbach, D., 2010. *Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework. Governance: An International Journal of Policy, Administration and Institutions.* Vol 23, 1, pp. 161-183

Figure 8: Loorbach, D., 2007. *Transition Management – New mode of governance for sustainable development.* Erasmus Universty Rotterdam

Figures 9-16: Created by the authors

Figure 17: Albertslund Municipality, 2012. *Klimatilpasning Albertslund 2012, Strategi og handlinger*. [online]. Available at: http://www.klimatilpasning.dk/media/889385/albertslund_klimastrategi_2012.pdf [Accessed 20.05. 2015]

Figures 18-20: Created by the authors

Figure 21: Egedal Municipality, 2015. *Vand og Klimatilpasning, Tillæg til Kommuneplan 2013*. [online]. Available at: http://soap.plansystem.dk/jsp/getdoklink.jsp?planid=2962925&plantype=12&status=V [Accessed 20.05. 2015]

Figures 22-33: Created by the authors

Figure 34: Jobnet, 2015. *Hovedstaden og Bornholm*. [online]. Available at: https://info.jobnet.dk/mit+jobcenter/sj%C3%A6lland+og+hovedstaden/hovedstaden [Accessed 20.05. 2015]

Figure 35: Gladsaxe Municipality, 2014f. *Risikokort*. [online]. Available at: http://Gladsaxe-sp.cowi.webhouse.dk/dk/vand/klimatilpasningsplan/kortlaegning/risikokort/risikokort.htm [Accessed the 15-05-2015]

Figure 36: Gladsaxe Municipality, 2014d. *Notat vedrørende prioritering af områder i Klimatilpasningsplan 2014.* [online]. Available at: http://planer.Gladsaxe.dk/download/klimatilpasningsplan/prioriteringsnotat.pdf [Accessed 09.05.2015]

Figures 37-40: Nordvand, 2015a. *Vi gør plads til regnvandet.* [online]. Available at: http://www.nordvand.dk/klimatilpasning/Sider/default.aspx [Accessed 10.05. 2015]

Figure 41: Created by the authors

Figure 42: Nordvand, 2015a. *Vi gør plads til regnvandet.* [online]. Available at: http://www.nordvand.dk/klimatilpasning/Sider/default.aspx [Accessed 10.05. 2015]

Figure 43: Created by the authors

Figure 44: Novo Nordisk, 2015. *Contact us*. [online]. Available at: http://www.novonordisk.com/contact-us.html [Accessed 10.05. 2015]

Figures 45-47: Created by the authors