Capacity to plan for climate change adaptation in the municipality of Svalöv

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Abstract

The changing climate caused by anthropogenic factors has an increasing effect on natural and human systems. There is therefore an increasing need for society to adapt to the effects of climate change (IPCC, 2012; Rescalvo et al., 2013) This is vital since the effects of climate change are already being noticed in many parts of the world (Rescalvo et al., 2013). However, municipalities in Sweden generally lack tools for climate change adaptation. This is a case study focusing on the municipality of Svalöv (Sweden). Svalöv is (like many other municipalities in Sweden) faced with risks associated with climate extreme and climate variability (SOU, 2007a; Wamsler 2011; Lundberg, 2013). In fact, the municipality has already been affected by extreme events such as storms and flooding (Svalövs kommun, 2014a). The study focuses on the capacity for the municipality of Svalöv to plan for climate change, and thereby analyses adaptation measures that have been taken in the municipality, as well as the usefulness of existing adaptation tools. The study counts with data from literature reviews as well as conducted interviews.

The results show that measures have been taken in the municipality in both the pre-phases and the post-phases of extreme weather events. The conducted analysis also showed the gaps that exist in the municipality along with unused capacities for climate change adaptation. It can be stated that the measures taken (along with the gaps and unused capacities) can be further enhanced by the use of existing adaptation tools (i.e. Climate Adaptation Tool, Climatools and citizen dialogues). By using these tools, both institutional and individual adaptation capacities can be taken into account when planning for adaptation strategies in the municipality.

Key words: Climate change, Extreme events, Climate change adaptation, Municipality, Svalöv, Adaptation measures, Adaptation tools, Climate Adaptation Tool, Climatools, Citizen dialogue.

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Introduction

Climate change results in increased vulnerability and stress on both natural and human systems. The changing climate caused by the anthropogenic factors such as the burning of fossil fuel, deforestation and cement production can be identified by changes in mean and/or variability of the climate that persist for extended period of time (such as for decades or longer periods) (IPCC, 2012). With climate change comes an alteration of the duration, frequency and intensity of climatic extreme events such as drought, tropical cyclones, heavy precipitation as well as floods, winds and heat waves (SOU, 2007a; IPCC 2012). On human systems, consequences such as the loss of life, loss of property and increased economic losses caused by extreme events are shown around the world, from the local scale to the national and international scale (Easterling et al., 2000). It is hereby important to note that although the effects of climate change are to increase considerably in the future, the effects of the global change in the climate are already being noticed in many parts of the world (Rescalvo et al., 2013).

There is a growing need for communities to adapt to changed climate conditions (Rescalvo et al., 2013). These climatic changes are requiring newer and improved processes for dealing with their adverse impacts around the world. Even though many advancements have been made in the field, e.g. developing early warning systems for extreme events, the progress of these actions has still not kept up with other factors such as the increased economic losses and social disruptions that are occurring globally (IPCC, 2012; Rescalvo et al., 2013).

In Sweden, municipalities generally lack tools for climate change adaptation (CCA) strategies, and the municipality of Svalöv is not an exception to this. Like many municipalities in Sweden, Svalöv is faced with greater risk in association with climate extreme and climate variability, such as heat waves, floods due to intense precipitation and perhaps higher average wind speed (although this last highly depends on the model used) (SOU, 2007a; Wamsler 2011; Lundberg, 2013; Rescalvo et al, 2013). This is resulting in reduced capacity for the local institutions and government to deal with effects caused by climate change (Wamsler 2014). In the case of Svalöv, work on adaptation strategies has not yet begun (SKL, 2011; Lundberg, 2013). With that in mind, there is a need to find ways to take the changing climate and its effects into account in municipal planning, and include climate change adaptation strategies in the work of local institutions and local government (Rydell et al., 2010; Wamsler, 2011).

Furthermore, municipalities that do have adaptation strategies for climate change usually focus on the physical aspects and apply more of a top-down planning. This means that there is often little or no involvement of citizens. Correspondingly, there is an insufficient knowledge of individual and household adaptation capacities (Wamsler, 2011).

The aim of the study

The study will be focusing on capacity (to plan) for climate change adaptation. The geographical focus will be on the municipality of Svalöv in Sweden. In the view of this, the municipal, institutional and individual capacities to adapt to climate change will be examined. The overall objective is to contribute to knowledge development about measures, strategies and tools that can foster climate change adaptation in the municipality.

Research questions

In order to reach the aim of the study, the following questions are to be analyzed:

- What adaptation measures/strategies have been taken in the municipality so far, and based on this, what used and unused capacities for adaptation exists in the local institutions and government?

- What adaptation measures have been taken by inhabitants so far, and based on this, what used and unused capacities for adaptation exists amongst the individuals and households?

- Are existing tools (such as the Climate Adaptation Tool, Climatools and citizen dialogues) suitable for the municipality to use when planning for adaptation?

Background

Importance of adapting to climate change

It is important to start with the question of why adaptation is an important area to analyze. Climate change could occur very rapidly or very slowly and the effects of it may very well be irreversible (Adger et al., 2009). The effects that are most likely to be noticed by people are extreme events such as floods, winds and heat waves (mentioned above) (Russell, 2012). Adapting to the changing climate might include relocating individual homes and sometimes moving entire cities, as well as seeking compensations for economic damages caused by extreme events, to mention a few measures that could be costly. However, it is important to point out that cost of the consequence of not adapting to the changing climate will indeed be more serious (Adger et al., 2009).

Additionally, it is important to consider the aspect of climate change and adaptation when planning for buildings and facilities, since these are generally built to last for many decades (Wamsler 2014). It is, for instance, already reflected in planning and building laws that building and facilities should be located on appropriate land with regard to the risk of accidents such as floods and erosion. The time perspective should be considered in both short term and in long term, meaning that the effects of climate change should also be considered (Länsstyrelsen, 2013).

The municipality of Svalöv and extreme events

Svalöv municipality is located in the south of Sweden, surrounded by larger municipalities such as Landskrona and Helsingborg and close to cities such as Malmö and Copenhagen in the growing Öresund region. Svalöv municipality includes both urban areas such as Svalöv (the urban centre), Kågeröd, Röstånga, Teckomatorp, Billeberga and Tågarp, as well as natural surroundings such as Söderåsen National Park and lake Odensjön (Svalövs kommun, 2014; Svalövs kommun, 2013a). The area also contains one of the largest connected hardwood (broadleaf) forest areas in Europe. Many different types of services and industries exist in the municipality, including care and service support to the residents, engineering and food industry and tourism. The agricultural industry in the municipality has contributed to the historical and current growth, and the company of Svalöf Weibull is one of the leading companies in plant breeding (Svalövs kommun, 2013a). All of these areas can come to be affected by climate change (Svalövs kommun, 2010a).

As explained in the municipal '*Energy Strategy*' document, the region of Skåne (where the municipality is located) can be affected by climate change through milder winters and heavy precipitation causing flooding in many areas (SOU, 2007b; Svalövs kommun, 2010a; Svalövs kommun 2013a). Furthermore, the area where the municipality is located will be affected during the next hundred years by increasing temperature levels and increasing levels of precipitation mostly during the autumn and winter months (due to climate change). The projected sea-level rise of approximately one meter in coastal Skåne does not concern the municipality in a direct way, but might concern the municipality in indirect ways instead (i.e. by people moving away from the municipalities near coastal areas). Amongst the problem areas that the region needs to work with and adapt to the future changes of climate are flooding, erosion, drinking water, sewage and drainage systems. It is important to note that many municipalities already have issues within these areas, and these issues will worsen if no adaptation measures are taken. Another area which is important for the municipalities to focus on as well is heat waves (Länsstyrelsen, 2013).

The municipality has been affected by extreme events in the past, the most recent being storms such as Simone (October 2013) and Sven (December 2013). The storm Sven, which was categorized with a class 3-warning by SMHI (Swedish Meteorological and Hydrological Institute), caused the

regional train services to be cancelled in many areas due to strong winds and heavy precipitation (SMHI,Varning, n.d.; Sunesson, 2013b; Svalövs kommun, 2013b). The storm also caused the local politicians in Svalöv municipality to postpone their meeting and decision-making for one month due to the fact that local residents and staff members were urged to stay indoors during the storm. In Svalöv, the storm led to the closing of the main library, as well as to cancelled school buses in different areas of the municipality (Sunesson, 2013a; Svalövs kommun, 2013c; Svalövs kommun, 2013d). The effects of the storm Sven left the urban area of Billeberga in the municipality without electricity for two days, and caused disturbances to the electricity supply in the urban area of Röstånga. The electricity supplier Eon encountered much work in areas where the storm had ruined the overhead lines for electricity, especially in rural areas. Critical infrastructure affected by the storm also included the municipal wastewater treatment plant (due to power failure) and roads blocked by fallen trees (Sunesson, 2013b).

Prior to the two most recent storms, the municipality had been affected by other weather-related events. For instance, in 2002, three flooding events took place in Svalöv, Billeberga and Källs Nöbbelöv. The reports on these cases were the results of a media analysis conducted by the County Administrative Board (Länsstyrelsen) of Skåne regarding flooding events in the region. Further on, in 2005, heavy rainfall caused damages in basements in Källs Nöbbelöv and Billeberga when the municipal pump station broke down and the water level continued to rise (Leijnse, 2005; Länsstyrelsen, 2013). Furthermore, two flooding events took place during the summer of 2007 in the municipality, which led to economic losses of many millions for the parties involved (Söderquist, 2010). These events show, on one hand, the need for further understanding of how the region will be affected by the changing climate and, on the other, the need for the municipality to foster adaptation strategies, which includes institutional capacities as well as individual capacities amongst the citizens (Wamsler, 2011).

Theoretical framework

This section will introduce and define concepts that are necessary when aiming to reach the goal of this study. These concepts are all related to climate change adaptation and include subjects such as risks of extreme events (disaster risks), adaptive capacity and mainstreaming.

Introducing necessary concepts for CCA

Adaptation

Several definitions of the adaptation concept are found in the climate change literature, amongst those are those mentioned by Smit and Wandel (2006). Here adaptation is mentioned in the context of adaptive capacity and vulnerability of human systems to climate change. Furthermore Smit and Wandel (2006) refers to adaptation as an action, a process or an outcome in a system (e.g. household, community, region or country) to better cope, manage or adjust to changing conditions, stress, risk or hazard. One definition of the adaptation concept in the context of climate change is "*adjustments in individual groups and institutional behavior in order to reduce society's vulnerability to climate*" (Pielke, 1998, p. 159). This definition which will work well with this particular thesis since it is in the context of both individual groups and also institutional behavior. Also, in Godden et al., (2013, p. 225) the concept is defined as "*action to manage the consequences of a changed climate*" which works as a summary of the adaptation concept for this thesis.

Disasters and extreme events

IPCC's Special Report (2012, p. 36) describes adaptation as "*a goal to be advanced and extreme event and disaster risk management are methods for supporting and advancing that goal*" showing the need for the integration of risk reduction (RR) and adaptation (CCA) in the sectorial work of the local government and institutions. However, it is important to take into account the fact that there have been independent developments of the interpretations of concepts, institutional framework, methods and strategies in the two fields of (disaster) risk reduction and climate change adaptation. This background is especially important when considering ways of integrating these measures into urban planning and other sectorial work (IPCC, 2012). In disaster risk research, disasters are the interaction between natural hazards (e.g. storms) and vulnerable conditions. It should thus be noted that a natural hazard without the interaction with vulnerable conditions (e.g. people or a community) would not cause disasters (Wamsler, 2014). UNISDR (United Nations Office for Disaster Risk Reduction) (2009 p. 9) defines a disaster as "*a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources*". Disaster risk is further conceptualized by Wisner et al. (2004) and by Wamsler (2014) as R = H * V, where R stands for (disaster) risk, H stands for (natural) hazards and V stands for vulnerable conditions. In this context, the vulnerable conditions are not determined by natural components but by the society's social systems (Wisner et al., 2004).

Furthermore, there are many descriptions of the concept of extreme events, some refer only to the meteorological phenomena while other include physical aspects such as flooding and finally some descriptions include the impacts on humans and society systems and ecosystems (IPCC, 2012). The IPCC's Special Report (2012) considers the spectrum of the human, society and ecosystem as impacts of the events rather than a part of the definition of extreme event itself. In this thesis the term extreme events is used instead of disaster. This because a disaster implies a certain magnitude of damages or losses, and this thesis focuses on both small and large scale events.

Measures

Since risk reduction and adaptation share the aim of reducing the frequency and the impact of extreme events related to climate, similar measures are often required (Wamsler, 2014). In fact, one single extreme event, such as a flood or a storm, generally cannot be attributed to climate change caused by anthropogenic factors (e.g. burning of fossil fuel) (IPCC, 2012). This means that in this context it may not be possible to tell the difference between adaptation measures and other risk management measures. There is generally a considerable overlap (Wamsler, 2014). Furthermore, five main measures are needed in order to reach the goal of risk reduction and adaptation. They can be taken on an institutional or organizational level or on an individual level. They are:

1. Hazard reduction and avoidance
2. Vulnerability reduction
3. Preparedness for response
4. Preparedness for recovery
5. Risk assessment (Wamsler et al., 2013; Wamsler, 2014).

Of these, hazard reduction and avoidance are measures that aim to (increase the capacity to) reduce or avoid existing or future hazards that would threat municipalities or citizens. (These measures can also be seen as climate change mitigation, but such measures are out of the scope of this thesis.) Vulnerability reduction, on the other hand, can be identified as measures aiming to (increase the capacity to) better withstand the impacts of potential disasters. Preparedness for response regards measures that aim to (increase the capacity to) establish effective responses to hazards, this during or in the immediate aftermath of a disaster occurrence. Measures that fall under the concept of preparedness for recovery aim to increase the capacity to ensure recovery mechanisms and structures after a potential disaster/hazard occurs (Wamsler, 2014). Importantly, risk assessment is not a risk reduction measure itself since it provides knowledge (e.g. through risk analysis) for the first four mentioned measures (Wamsler, 2014). This thesis will use these concepts in order to find which measures have been taken in the municipality.

Adaptive capacity and drivers

The concept of adaptation is naturally linked with adaptive capacity (Smit & Wandel, 2006). The adaptive capacity of an individual to adapt to changing conditions can be described as features that have been developed to ensure the survival of an individual (although this is a more natural science based definition of the concept of individual adaptive capacities) (Smit & Wandel, 2006). Another understanding of an individual's adaptive capacity is conceptualized in two terms, first by the fact that an individual assesses a threat or damaging potential (under the condition of no change in the behavior of the individual) to something that the individual values. Secondly, the individual evaluates his or her ability and the cost to prevent being harmed by the threat or the damaging potential. The first note is related to the individual's risk perception, whereas the second note only occurs after the risk perception process and is individual's judgment to carry out change in order to avoid or prevent damage, the ability to take these adaptive responses and also the potential cost for an individual to carry out adaptive responses (Grothmann & Patt, 2005). In the context of this particular thesis, adaptive capacity can be seen as the ability of institutions or individuals to respond to risk that is related to climate change using the four risk reduction and adaptation measures mentioned above.

The drivers of adaptive capacity are, according to Smit and Wandel (2006), the forces which affect the ability of a system or community to adapt, and these vary from community to community. Factors such as finance, technology, knowledge resources and infrastructure, to mention a few, can affect the ability to undertake adaptation measures. Some drivers of adaptive capacity are more local while others are more general. Example of a local driver of adaptive capacity is the presence

of a strong network that absorbs stress, while more general drivers will reflect socio-economic and political systems (Smit & Wandel, 2006).

Used and unused capacities

Since it is vital for adaptation to build on those measures and strategies that already exist in a community or municipality (meaning not only those measures that fall under adaptation), the terms used and unused capacities are central for this thesis. Used capacities are explained as risk reduction and adaptation measures that have been taken, whereas unused capacities are existing capacities that can form the basis for new risk reduction and adaptation measures. An example of used capacity is the existence of back-up generators and an example of unused capacity is existing church bells that could be used as warning alarms in case of an emergency. Used and unused capacities can be identified in the municipality's own organization and local institutions, as well as for the citizens in the municipality (Wamsler, 2014).

Mainstreaming risk reduction and climate change adaptation

On an important note, the two subject areas of risk reduction and climate change adaptation are cross-cutting issues and should therefore be integrated in urban planning and other work (IPCC, 2012; Wamsler, 2014). This means that local government and its different sectors need to have the knowledge of how to reduce disaster risks in their area, and also which measures that are vital to reach this goal. This also ties in with a principle in the Swedish emergency management system (*Ansvarsprincipen*), stating that the agency responsible for a service under normal conditions is responsible for providing the same service in an emergency situation (Regeringskansliet, 2010). There is thus a need to find ways to mainstream risk reduction and adaptation in order for specific measures to be integrated in the practice of urban planning (Wamsler, 2014).

Before introducing the different mainstreaming strategies it is important to understand the concept of mainstreaming. Mainstreaming adaptation according to Smit and Wandel (2006) occurs gradually and modifies existing plans or strategies. Furthermore, mainstreaming risk reduction and adaptation does not mean to completely change the institutions' core work. Instead, it means to view the core work from a different perspective and then carry out necessary measures or alterations (Wamsler, 2014). Mainstreaming is therefore looking into what already exists and build upon existing structures, mechanisms and procedures. Hence, linking to previously mentioned fact that mainstreaming is about modifying what work that already exists (Smit & Wandel, 2006; Wamsler, 2014).

As mentioned, there are different ways of mainstreaming risk reduction and adaptation into work at the organizational (municipal) level (Wamsler, 2014; Wamsler & Brink, 2014). These strategies are called:

1. Organizational mainstreaming
2. Internal mainstreaming
3. Inter-organizational mainstreaming
4. Educational mainstreaming

Organizational mainstreaming has the purpose of integration risk reduction and adaptation as a standard process of an institutions or municipality's work. Internal mainstreaming aims to modify an institutions or municipality's way of operating and their internal policies. This in order to ensure a continuous functioning of the work even when affected by disasters and climate change. This shows that two strategies focus on organizational functioning (Wamsler, 2014). The last two strategies to be mentioned focus on collaboration and capacity development with other urban stakeholders and citizens. Hence, inter-organizational mainstreaming aims to promote collaboration between existing actors for capacity development and also to implement risk reduction and

adaptation into the management of different organizations. Educational mainstreaming has the purposes to allow risk reduction and adaptation to become incorporated into e.g. planners activities. This is done by shifting sector-specific education (Wamsler, 2014; Wamsler & Brink, 2014).

The focus for mainstreaming is often on the pre-disaster phase (i.e. before an extreme event), which means that measures regarding risk reduction and adaptation should be integrated in the context of development work and everyday planning practice. However, in the response and recovery phases, mainstreaming of risk reduction and adaptation is no less important (IPCC, 2012; Wamsler, 2014). One example of this is that the reconstruction after a disaster should not reinforce the risks that led to this event, but aim to 'build back better'.

Existing tools for climate change adaptation

This section will focus on tools and measures that can be used to adapt to climate change. There are many different tools, methods and guidelines for planning for climate change adaptation, which ranges from local to international scales and scopes. These measures can be used in order to either reduce the damage associated with climate change and realize opportunities for institutions and governments that are associated with climate change (European Commission, 2013; Climate-Adapt, 2014b). This thesis focuses on Climate adaptation tool (CAT), Climatools and citizen dialogues.

Climate adaptation tool (CAT)

One tool that can be used when planning for climate change adaptation is the Climate Adaptation Tool (CAT). Although the tool was originally developed to support organizations in the United Kingdom (UK) by using UK-based climate projections, the tool is applicable for other regions as well. This can be done by replacing the UK-based climate projections with climate projections of other regions (e.g. Sweden or Skåne) (see Appendix I for climate projections in Sweden). The climate projections are used in order to inform climate risk identification (UNFCCC, 2014).

Furthermore, the tool is divided in three parts; the first part is used for identifying and prioritizing climate risks, the second part facilitates identifying and appraising adaptation options, whereas the third part allows users to review the performance of implemented options. Also, the second and the third stages of the CAT are independent from the first stage since risk assessments procedures or measures in organizations or municipalities have often already been conducted. Additionally, the CAT consists of a multi-criteria analysis (MCA) which results in the fact that the tool is able to facilitate sustainable decision making and further on is able to take into account other influential factors rather than only economic factors which would be the case if it was just a cost-benefit analysis (CBA) (Bellamy & Aron, 2010).

The tool has two components where one is a data and manipulation spreadsheet, available in an Excel-format (on the Microsoft Excel platform) and the second component is a guidance document for the tool which is available in a PDF-format.[1] . Furthermore, the CAT does not require specific training or external help and the tool is free to download by organizations and institutions. Also, the scope of CAT is broad, meaning it can be applied on all different levels of an organization or institution and it can also be applied on all climate risks. The key inputs for the tool are user-specific climate risks along with adaptation options. Further, the key outputs of the tool are I) identification of climate risks, II) prioritizing of climate risks, III) identification of adaptation options, IV) evaluation of adaptation options and finally V) review of adaptation option (Figure 1) (Bellamy & Aron, 2010; UNFCCC, 2014).

[1] The tool can be found on the webpages of the UNFCCC (United Nations Framework Convention on Climate Change) in the following link [http://unfccc.int/adaptation/knowledge_resources/databases/items/7723.php].

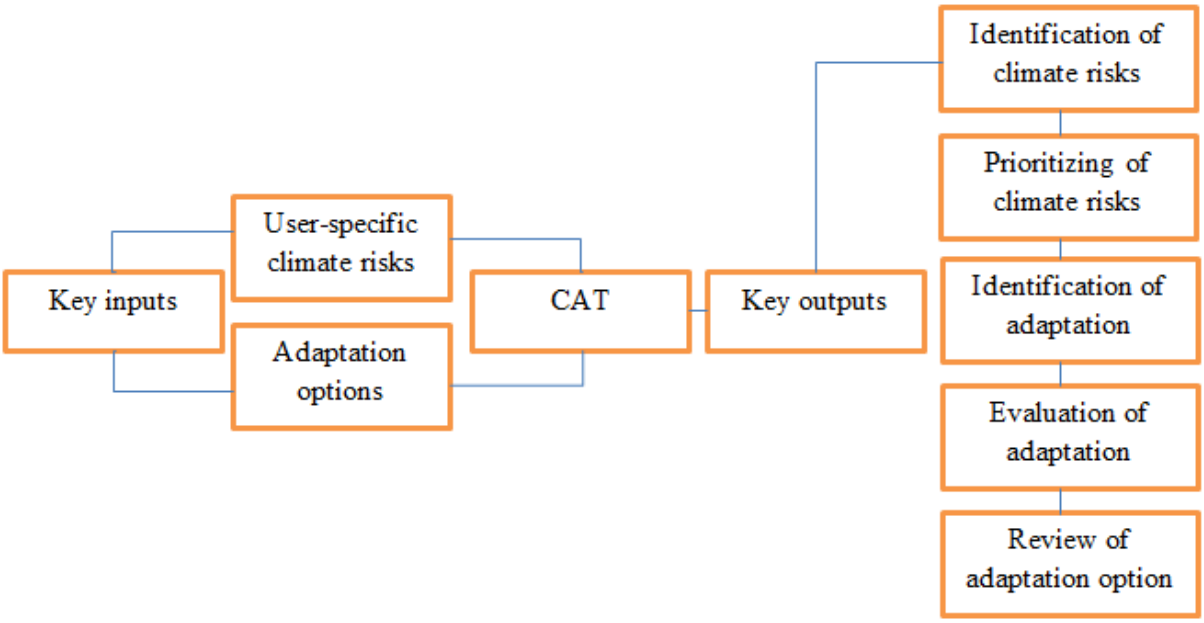

Figure 1. The figure shows the key inputs for the Climate Adaptation Tool (CAT) and the key outputs that the tool provides.

Climatools

Another set of adaptation tools come from the project Climatools which was driven by FOI (*Totalförsvarets forskningsinstitut*) on behalf of the NVV (*Naturvårdsverket*) (SKL, 2011). The project aimed to improve and maintain the capacity of different sectors and regions in the country to provide services that the society will need and require in the future. The project developed eight adaptation tools intended for the municipalities in Sweden (Naturvårdsverket, 2013; FOI, Climatools, n.d.). The tools can be used, individually or in combination, to identify the impacts of climate change as well as to evaluate different adaptation measures (FOI, 2011a). The eight tools that were developed from the project are (FOI, Verktyg, n.d.) (further information found in Appendix II):

1. Local climate impact profile (*Lokal klimateffektprofil*)
2. Integrating climate change adaptation into local risk and vulnerability assessments - a guidance (*Integrera klimatanpassning i kommunala risk-och sårbarhetsanalyser-en vägledning*)
3. Checklist for health and social care (*Checklista för vård och omsorg*)
4. Guidance for the assessment of drinking water risks from a changing climate (*Vägledning för bedömning av dricksvattenrisker vid ett förändrat klimat*)
5. Increase preparedness for heat waves - a guidance (*Höj beredskapen för värmeböljor - en vägledning*)
6. Effects of heat (*Effekter av värme*)
7. Use of socio-economic scenarios in climate adaptation (*Använd socioekonomiska scenarier i klimatanpassningen*)
8. Sustainability analysis (*Hållbarhetsanaly*s)

Citizen dialogues

According to Tahvilzadeh (2013), the 21st century can be seen as a time that challenges and develops the institutions of the democracy established during the 20th century. Although there are different views on how institutions for citizen participation should be designed in order to strengthen the democracy (Tahvilzadeh, 2013). Citizen dialogues (sometimes called public dialogues) are according to Tahvilzadeh (2013) the latest trend in the Swedish democracy. This because there is a need for more participatory democracy in the 21st century (SOU 2000:I). Some

criteria against citizen dialogues are that it is not possible to create free and equal dialogues since individuals are driven by for instance their own interests or emotions. Furthermore, since individuals have different ability and opportunity to get information also affects the dialogues, thus threatening the democracy. Additional criteria against citizen dialogues focus on its practicality. Meaning that the motive behind a citizen dialogue is crutial since it can make the dialogue an "instrument to gain more power" and not to enhance the democracy (Tahvilzadeh, 2013).

With that being said, the knowledge transfer in vertical flows (i.e. from citizens to municipality, or municipality to country) is considered by others to be essential when considering democracy and development strategies in municipalities (Tahvilzadeh, 2013; Wamsler, 2014). Studies also argue that through citizen dialogues, the citizens can provide the municipality with opportunities to further enhance their development work (by giving advices and assistance). The authorities simultaneously provide an opportunity for citizens to participate in the decision making processes. Thus, increases the citizen's sense of connection with their community and opposing the creation of distrust, exclusion and opposition (Båstads kommun, 2011). Currently, many citizen dialogues about climate change focuses mainly on the mitigation aspects of climate change. The focus should move forward to also discuss the consequences of extreme events (i.e. adaptation). This is important in order for the local adaptation strategies to get the support they need for being implemented effectively (Adelsman & Ekrem, 2012).

Methods for conducting citizen dialogues

Different methods are used when conducting citizen dialogues. Examples of two ways of conducting a citizen dialogue are a) through dialogue seminars and b) dialogue groups. The first method occurs at least once or twice a year, which creates opportunity for profitable dialogue and recurrent feedback to those participating. The dialogue seminars can also be perceived as pointless if the subjects arising from the dialogue are not handled in a proper way. The second method is to be used for more specific or focused area of citizens (e.g. a specific residential area). This means that although the dialogue provides with crucial in-depth knowledge about a specific area, the dialogue might not be representative for the whole municipality. Also, those participating in the dialogue group need to represent the specific area which the dialogue focuses on (Båstads kommun, 2011).

Furthermore, one method to fostering the citizen's engagement is called the Wheel of engagement (Community Momentum, n.d.). This process tool is developed by Kindle et al. (2012) and aims to structure engagement processes. The tool can be used by different municipal authorities in order to enhance citizen's engagement. Additionally, it is important to find enabling factors in a municipality which could foster the citizen's engagement (Kindle et al., 2012; Community Momentum, n.d.). More specifically, the method uses four main themes (called Initiate, Internal Capacity, External Capacity and Engage) and a series of enablers that are grouped within these four main themes (Figure 2). This method for engaging the citizens can be used in a linear way, meaning starting with '*Initiate*' and ending with the theme of '*Engage*', but the tool can also be used iteratively. This means that while some of the steps in the enabling process might build of one another naturally, other steps in the process may need to be repeated before continuing (Kindle et al., 2012).

Figure 2. The figure shows the spiral visualization of the process tool called the Wheel of engagement. The method is used for fostering public engagement in municipalities. The process tool starts with the main theme called '*Initiate*' and ends with '*Engage*' (Community Momentum, n.d.).

Methodology

The study is based on case study in the municipality of Svalöv. Furthermore, the study includes data from literature reviews of e.g. journal, articles, books and municipal documents. Information for the analysis was gathered from citizens and local municipal and institutional staff in the form of semi-structured interviews. Additional information was gathered from interviews with three local political parties (mentioned here as political parties A, B and C). Political party A contributed with information through answering interview questions by e-mail, this was also the case of political party B (and also by participating in short meeting). Political party C contributed with a focus group interview. These answers are all analyzed and discussed in this study.

Regarding the interview within the municipality's own organization, four staff members contributed with answers to a semi-structured interview. Regarding institutions, those participating in the interviews (through e-mail) where the municipal emergency center, the municipal health care center and also the inter-municipal company named NSVA (*Nordvästra Skånes Vatten och Avlopp*).

Furthermore, the study also evaluates tools that could foster the planning for adaptation in the municipality. These tools are namely the Climate Adaptation Tool (CAT), Climatools and citizen dialogues. These tools are chosen since they involve both the municipal/institutional and citizen aspects of adaptation. The tools were chosen due to their availability and their relevance in the municipal context. Also the fact that municipalites often have experience with citizen dialogues, as is the case in Svalöv's municipality, which made this particular tool relevant for the study (Svalövs kommun, 2011a). Additional reasons for these tools are (regarding Climatools) the fact that they cover many different areas (if used combined), from water-related to heat wave issues. Lastly, regarding CAT, the fact that the tool is free to download and easy to use made it relevant for further evaluation in this study.

Semi-structured interviews

Regarding conducted interviews with citizens, eleven persons contributed with interviews directly on spot and also through e-mail (by providing with e-mail addresses due to lack of time or type of issue). These were both male and female, ages varied from 20's to 60's, with different occupations. The persons contributing with interviews were all citizens in the municipality, living in both urban and rural areas. Although the citizens were selected randomly (i.e. those who were willing to participate) some of the citizens were particularly chosen by where they lived. This was done in order to get represents from both urban and rural areas, meaning that citizens were divided in categories of accommodation place.

The interview form used for the citizens, the municipal staff, the different institutions and political parties A and B was semi-structured. This means that the same sort of questions were asked for the different informants (even though the same sort of questions were asked, the structure of the questions varied if it was an interview with a citizen or if it was an interview with an institution etc.). The questions for the semi-structured interviews were open-ended, giving the informants equal opportunity to express their own opinions on the same issue (Kvalitativ metod, 2014).

Focus group interview

The method of focus group interviews has been used over many years for the purpose of gathering in-depth opinions and knowledge on different matters from the public/the individuals. This means that focus group interviews/research is used in the areas of market research, policy research and social research to name a few. Additionally, focus groups provide researchers and others with general information but also with more specific information which can be used as data for further

for analysis and research. The blending of different techniques is required when conducting a focus group interview, meaning techniques from the group process theory and also from qualitative research, although focus group interviews are considered to be qualitative research methods (Then et al., 2014)

The process of the focus group interview needs clear outlines with what the focus group interview needs to achieve from the beginning of the session until the end. It should include identifying the topic and conduct a basic introduction of the topic which is to be discussed, clarification of terms if needed, as well as talking about the issue of confidentiality. The issue of confidentiality is important when requesting permission to tape the focus group interview for the purpose of transcriptions (Krueger, 2002; Then et al., 2014) Furthermore, the focus group interview was be transcribed verbatim in order to then use the information in the analysis of the thesis (Then et al., 2014).

Further on, the questions used for the focus group interviews are, as explained by Then et al., (2014), not to be used as questions that are set in stone, but rather as guides for the discussing taking place. Also, it is important to use open-ended questions and avoid dual/dichotomous questions which only can be answered with simple yes or no (Krueger, 2002).

The timing of the focus group interview was approximately one and a half hour (including the short introductory presentation of the topic of climate change adaptation). Eight participants were included in the focus group interview, and the location of the focus group was in the main municipal building in Svalöv. The focus group interview was conducted the 9th of April at 18.30, during the board meeting with political party C.

Limitations

The adaptation tools (i.e. CAT, Climatools and citizen dialogues) are, further on, only theoretically analyzed and discussed in this study. Due to the lack of time, no practical analyze of these tools could be conducted. Citizen dialogues could not be conducted due to the lack of time, as well as the fact that it is election season for new government and political parties in the municipality and country. An additional limitation was the number of political parties who contributed with focus group interviews and semi-structured interviews. More interviews (both regarding political parties and citizens) could have enhanced the results of the study. This was not possible mainly due to the lack of time.

Analysis

Adaptive practices and capacities at the municipal level

Adaptation to what?

When analyzing the aspects of climate change adaptation, it is important to first note which types of events are considered to be the greatest risks in an area (Wamsler, 2014). In the municipality of Svalöv, flooding and storm events where the weather related risks which were considered to be a risk in the area (Table 1) (NSVA, 2014; Political Party C, 2014; Svalövs kommun, 2014a; Vårdcentralen Svalöv, 2014). The health care center, the emergency center and municipal officers also regarded heat waves as one of the extreme event risks that could have an impact within the municipality (Räddningstjänsten Svalöv, 2014; Svalövs kommun, 2014a; Vårdcentralen Svalöv, 2014). Although they claimed that the municipality has not yet been affected by heat waves, this could be a concern for the future (Svalövs kommun, 2014a). The risk of other extreme events such as extreme snow and rainfall was also mentioned as a future concern (NSVA, 2014; Political Party C, 2014; Räddningstjänsten Svalöv, 2014). Some consequences caused by above mentioned hazards were damages in basements, infrastructure and sewage systems due to flooding events (Table 1). Additionally, during extensive flooding events there has been a problem with shortage of water pumps. Regarding risks related to extreme precipitation (rain and snow) the mentioned consequences are erosion and infrastructure damages, trees falling (due to saturated soil and shallow root systems). Damages on infrastructure, power and telephone communication failure are consequences mentioned regarding storm events. No consequences were mentioned regarding heat waves (NSVA, 2014; Political Party A, 2014; Political Party C, 2014; Svalövs kommun, 2014a).

Table 1. Potential hazards and consequences mentioned by interviewed municipal staff, institutions and political parties.

Hazards	Consequence
Flooding	Damages on sewage systems Damages on infrastructure Flooding in basements Problem with shortage of water pumps (during extensive flooding events)
Storms	Damages on infrastructure Power failure Telephone-communication failure
Heat waves	
Extreme precipitation (rain and snow)	Erosion damages Damages on infrastructure Trees falling (due to saturated soil and shallow root systems)

Municipal risk governance structure in Svalöv

Before continuing on to the specific measures which have been taken in the municipality with regard to extreme weather events, it is important to link the measures to the concept of adaptation introduced previously. By taking the different measures mentioned below the municipality's own organization and the different institutions/companies have made adjustments which can be regarded as adaptation measures. This means that in order to reduce the society's vulnerabilities to extreme events caused by the changing climate, institutional and organizational behavior adjustments have been made (Pielke, 1998). What also contribute to adaptation in the municipality are risk reduction, risk and vulnerability analysis, and environmental protection to mention a few. Also, the capacity to

build on existing work (i.e. mainstreaming) contributes to adaptation in the municipality (Smit & Wandel, 2006; Wamsler, 2014).

Institutions

The main departments in the municipality's organization are municipal administrators (Kommunförvaltning), social care (Social omsorg), education (Utbildning) and planning and building (Samhällsbyggnad) (Svalövs kommun, 2014b). The key administrators regarding risk reduction and adaptation are those mentioned in the municipal vulnerability analysis. These are municipal administrators (Kommunförvaltningen myndighet), health and social care (Vård och omsorg), emergency service (Räddningstjänst), IT-department, NSVA, education and childcare (Utbildning och barnomsorg) and the crisis management committee (Krisledningsnämnd) (Svalövs kommun, 2011b). The municipality does not have an environmental administration but rather the environmental covenant of Söderåsen (Söderåsens miljöförbund) is an additional inter-municipal collaboration which regards environmental issues (Svalövs kommun, 2013e). Figure 3 below shows the different departments and institutions and how they are linked in the political structure of the municipality.

To cope with risks caused by the natural hazards (mentioned above such as storms and flooding) in association with vulnerable conditions (of e.g. roads or sewage systems) in the municipality, the municipality has developed a crisis management group (govern by the crisis management committee) (Svalövs kommun, 2014a; Wamsler, 2014). The crisis management group and its panel collaborate with the departments within the municipal organization and institutions in the (mentioned above) in the municipality to reduce the risks associated with extreme weather events (Räddningstjänsten Svalöv 2014; Svalövs kommun, 2014a). There is also a risk and security group that works to reduce the risks of these events (emergency service) (Räddningstjänsten Svalöv, 2014). Furthermore, the health care center on the other hand cooperates on a daily basis with the risk and crisis group of Region Skåne (Vårdcentralen Svalöv, 2014).

Additional organizations which cooperate during extreme events are the POSOM-group (for psychological and social care in the event of a crisis), the DMV (*Vägverket*), Home Guard Unit via Military Region at Revingehed, the electricity company Eon (mentioned), the volunteer fire department in Tågarp and Teckomatorp and NSVA (inter-municipal water and sewage company) (Political Party C, 2014; Räddningstjänst Svalöv, 2014). NSVA is linked to the municipal organization through the environment management department (Figure 3) (Svalövs kommun, 2014b). Other collaboration that occur with different municipalities is through Watercourse management association of Råån (Rååns Vattendragsförbund). This collaboration aims to build wetlands to clean water. This is of interest since it is also mentioned in the political structure in the municipality (Figure 3) (Rååns Vattendragsförbund, n.d.; Svalövs kommun, 2014b).

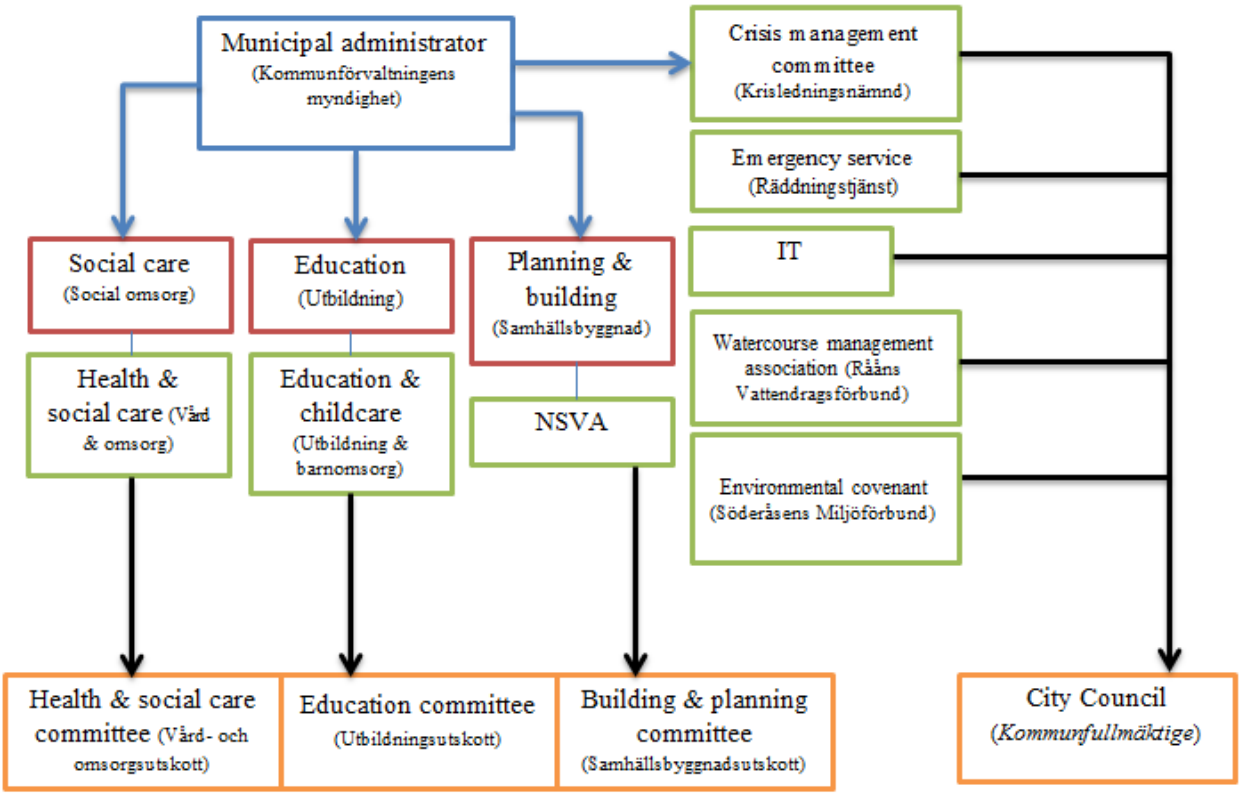

Figure 3. The figure shows the key departments and institutions in the risk governance structure of Svalöv's municipality. The blue box is the municipal administrator department (head department), the red boxes shows the main departments under the head department in the municipality. The green boxes are the different under-departments and institutions and finally the orange boxes illustrate how the departments and institutions are connected to the political structure in the municipality. Note that: 1) NSVA, the Watercourse management association and the Environmental covenant are inter-municipal cooperations. 2) CCA and RR should be integrated throughout the municipal departments. The figure shows some of the most important, but not all, municipal bodies that work or should work with CCA and RR.

Policy documents

The comprehensive plan (*Översiktsplanen*) is another important municipal document that governs the planning work (Svalövs kommun, 2010b; Räddningstjänsten Svalöv, 2014; Svalövs kommun, 2014a). It is connected to another important instrument (the national law for planning and building, i.e. PBL) regarding physical planning in the municipality, which states that municipal plans and building permits must take into account the issue of climate adaptation (Länsstyrelsen, 2013).

Furthermore, the policy documents which that govern the work related to extreme weather events are the risk and vulnerability assessments (*Riskanalys och sårbarhetsanalys*) and the resulted developed documents for protection against accidents and extraordinary events. These programmes focus on all types of accidents which that are common in the municipality (not only those related to natural factors). The comprehensive plan (Översiktsplanen) is another important municipal document that governs the planning work (Svalövs kommun, 2010b; Räddningstjänsten Svalöv, 2014; Svalövs kommun, 2014a).

The risk vulnerability assessments notes that with the changing of the climate and the increased results of extreme weather events, the municipality will more likely be affected by the occurrence of natural disasters (Svalövs kommun, 2011b; Svalövs kommun, 2011c). The vulnerability analysis

was therefore conducted in order to investigate the crisis-management capacities in the municipality in case of extreme weather events. The vulnerability analysis focuses on flooding scenario and present measures which the municipality can implement (Svalövs kommun, 2011b).

Furthermore, in the policy document of NSVA, the risk of flooding caused by heavy precipitation due to climate change is mentioned (although not in the concept of adaptation). But the measures to be taken should according to the policy document consider the effects of climate change. The policy document mentions measures which should be taken such as building infiltration areas, wetlands, ponds and flooding surfaces (in case of extreme rainfall) (NSVA, 2013).

Used adaptive capacity: What measures have been taken?

Risk assessment

The municipal vulnerability analysis resulted in a list of measures to be taken by different responsible bodies in the municipality (Svalövs kommun, 2011b). These involve identifying which roads are vulnerable (which is a part of risk assessment) and how to take decisions to make them less vulnerable to extreme flooding event. What type of risk reduction or adaptation measure this is depends on what measures the municipality decides to take in order to make the roads less vulnerable (Svalövs kommun 2011b; Wamsler, 2014).

Hazard reduction

Additional measures presented in municipal planning documents are the goals of locally handle stormwater, improve sewage systems to prevent water pollution, construct stormwater ponds and wetlands that will manage heavy precipitation levels and also capture the nutrients which reach the watercourses. When it concerns water related issues, the inter-municipal company NSVA becomes involved in taking measures (Länsstyrelsen, 2013; NSVA, 2014). These are relevant goal for an adaptation measures (e.g. hazard reduction and avoidance and/or vulnerability reduction) considering the risk of heavy precipitation due to the changing climate and resulted flooding (SOU, 2007a; Wamsler, 2014).

Vulnerability reduction

Additionally, by cooperating with the company NSVA (mentioned above) the municipality is provided with different measures that can be taken in the different stages of a flooding event. These measures are for instance provided on the webpage of NSVA and some examples are to remove valuable items from the basement and to clean water wells (NSVA, n.d.).

Preparedness for response

Many response measures could be noted during the recent storms Simone and Sven. These included both measures that had been prepared beforehand (i.e. preparedness for response), and measures that were taken in an ad-hoc manner (i.e. response).

Further on regarding the crisis management group, the last time it was active was during the last two storms (the storms Simone and Sven) in the year 2013. The City Council and other staff where in the panel and made sure that there was staff in the reception in order to communicate with the citizens who called in for information (Svalövs kommun, 2014a). Both the staff of the emergency center and the municipal organization worked around-the-clock during the two storms. When the crisis management group was activated, staff members who were taking the public transportation home were sent home earlier from their posts in order to secure their safe return. In addition, the schools in the municipality take measures regarding sending their students home. Further on, the back-up power generators (run on diesel) at the nursing homes were tested the day before and the municipal and emergency center staff worked during the night before the storms and were also provided with information from the provincial government of Skåne (Table 2) (Räddningstjänsten

Svalöv, 2014; Svalövs kommun, 2014a). These measures taken fall under the concepts of vulnerability reduction measures. By sending staff and students home and by testing back-up power generators, the municipality aims to minimize the existing or the future hazards. Hence, the measures result in increased capacity to withstand the occurrence of the extreme weather events (Svalövs kommun, 2014a; Wamsler, 2014). Also, the municipal health care center keeps an emergency call list in order to contact necessary staff when the health center is closed (Vårdcentralen Svalöv, 2014).

Furthermore, it is explained that before an extreme event the measures that are taken regard planning and training, as well as conducting risk and vulnerability assessments. During an extreme event on the other hand, focus lays on the operational aspects on minimizing the adverse effect of an extreme event. Here, the emergency center uses tools developed beforehand and act operationally when taking measures.

Importantly, according to municipal staff, the organization has a planning strategy for water (in collaboration with NSVA) and electricity supply in case of extreme events (*this is also preparedness for recovery*) (Svalövs kommun, 2011b; Svalövs kommun, 2014a). The webpage of NSVA also provides with measures to be taken during and in the immediate aftermath of a flooding event, such as disconnecting all electrical power in the flooded premises (NSVA, n.d.).

Further on regarding the last two storm events, all the municipal nursing homes where opened to the public to attend to hygiene or heat food (Räddningstjänsten Svalöv, 2014). Additionally, the electric company Eon which provides much of the electricity in the municipality created a crisis center for two days after the results of the storms in 2013. The crisis center was there to help those who were affected by the storm and lacked electricity. Amongst those vulnerable where the citizens who live in the rural areas where the electricity air lines where broke down due to the storm (Sunesson, 2013b; Räddningstjänst Svalöv, 2014). These measures fall under the concept of preparedness for response, thus aiming to establish effective responses in the immediate aftermath of the storms (Wamsler, 2014).

The measures recommended by the municipal vulnerability analysis (Svalövs kommun, 2011b) include communicating with citizens and supplying with emergency water, to have reserve stocks of canned food, batteries, and flashlights and so on in the municipality and informing the citizens of their own responsibilities. Thus, aiming to reduce vulnerabilities as a part of response and enable citizens and staff to establish effective response mechanism to an extreme event (Svalövs kommun, 2011b; Wamsler, 2014).

Preparedness for recovery

The measures regarding the aftermath of an extreme event focuses on recovery and evaluating measures on how to prevent a future incident. Meaning that the action becomes sort of a loop for continuous learning and improvement of the work (Political Party A, 2014; Räddningstjänsten Svalöv, 2014). This can be coupled with the different stages of disaster risk management, with the three main processes of reducing risks meaning during the pre-phases (reduction) of an event and the post-phases (response/recovery) (Wamsler, 2014).

The already mentioned webpage of NSVA provides with measures to be taken in the post-phase of a flooding event, e.g. contacting insurance company (*preparedness for recovery*) (NSVA, n.d.). An additional example of preparedness for recovery is the municipal POSOM-group and non-profit organizations that provides with advice and assistance in case of accidents causing personal injury (or if a relative gets injured) (Svalövs kommun, 2011b).

Table 2. Overview of measures for risk reduction and adaptation taken in the municipality (the list of measures is sorted after their status).

Measure	Responsible actor/agency	Objective hazard reduction/avoidance, vulnerability reduction, (preparedness for) response, (preparedness for) recovery, risk assessment	Thematic focus physical, environmental, social, economic, institutional/political	Status
Identifying which roads are vulnerable	Municipality/institutions (mentioned in vulnerability analysis)	Risk assessment	Physical	Vision
Risk and vulnerability assessments	Municipality / institutions	Risk assessment	-	Implemented
Cooperating to construct wetlands in an inter-municipal "watercourse association" (*Rååns Vattendragsförbund*)	Rååns Vattendragsförbund	Hazard reduction/avoidance	Environmental, Institutional	Planned/vision
Examples of measures to be taken on internet webpage of NSVA	NSVA	Vulnerability reduction (as well as examples of preparedness for response and recovery)	Physical, Social	Implemented
Locally handle storm water, improve sewage systems, building infiltration areas, wetlands, ponds and flooding surfaces (in case of extreme rainfall)	NSVA and municipal planning documents	Vulnerability reduction, Preparedness for response	Environmental	Planned/vision
Communicating with citizens, supplying with emergency water, to have reserve stocks of canned food, batteries, and flashlights and so on in the municipality and informing the citizens of their own responsibilities	Vulnerability analysis	Preparedness for response	Social	Implemented
Testing back-up power generators at nursing homes on the day before the storm	Emergency center	Preparedness for response	Social	Implemented
Keeping the municipal reception staffed during storm to answer phone calls from citizens (e.g. communication)	City council/crisis management group	Preparedness for response	Social	Implemented
Crisis center for those affected by power failure	Eon (electricity company)	Preparedness for response	Social	Implemented
Municipal nursing homes where opened to the public to attend to hygiene or heat food	Municipality	Preparedness for response	Social	Implemented
Health care center keeping an emergency call list to reach staff when institution is closed	Health care center	Preparedness for response	Social	Implemented
On the day of the storm, sending school children home earlier	Educational administration	Preparedness for response	Social	Implemented and also planned
On the day of the storm, sending municipal staff members using public transportation home earlier	City council/crisis management group	Preparedness for response (also Internal mainstreaming)	Social	Implemented
Using the webpages of the municipality in order to reach out to citizens about measures which they can take in the event of storm (one-way communicating)	Municipality	Preparedness for response (also inter-organizational mainstreaming)	Social	Implemented
Municipal staff being available in the reception (telephone communication) in order for citizens or those affected to reach out for information	Municipality / reception	Preparedness for response (inter-organizational mainstreaming)	Social	Implemented
Planning strategy for water and electricity supply	Municipality (and collaboration	Preparedness for response and recovery	Environmental, Social	Exists

	NSVA).			
Providing advice and assistance in case of accidents causing personal injury (or if a relative gets injured)	POSOM-group & non-profit organizations	Preparedness for recovery	Social	Implemented

Used adaptive capacity: Mainstreaming risk and adaptation

The mainstreaming strategies found to be implemented in the municipality of Svalöv were organizational mainstreaming, internal mainstreaming and inter-organizational mainstreaming along with educational mainstreaming regarding risk reduction and adaptation (Table 3).

Organizational mainstreaming was done by the creation of a crisis-management group (although the crisis-management group focuses on risk associated with factors other than extreme weather events as well) (Svalövs kommun, 2011b; Svalövs kommun, 2014a). The internal mainstreaming in the municipality is done by sending municipal staff members using public transportation home earlier on the day of the storm (storms Simone and Sven in 2013) (Svalövs kommun, 2014a). Also, by having existing collaborations on an inter-municipal level (with NSVA, Watercourse management association of Råån and the Environmental covenant of Söderåsen) inter-organizational mainstreaming is conducted (NSVA, n.d.; Svalövs kommun, 2013e; Svalövs kommun, 2014b). Additional inter-organizational strategies exist through one way communicating with citizens through the municipal webpages (news section) where measures where recommended during the last storm and by having staff at the reception in order for citizens to call (two way communication), which was the case during the last two storms (Political Party C, 2014; Svalövs kommun, 2014a). These last mentioned measures can also be seen as preparedness for response (as well as the measure mentioned under internal mainstreaming) hence are included in Table 2 above.

Regarding educational mainstreaming, this was done through the usage of a MVA-method (Municipality Vulnerability Analysis) when conducting the municipal vulnerability assessment, developed by LUCRAM (Lund University Center for Risk Analysis and Management) (Svalövs kommun, 2010b). Additional educational mainstreaming in the municipality is having this thesis done, i.e. having a master student writing a thesis about climate change adaptation.

Table 3. Mainstreaming strategies in the municipality of Svalöv.

Type of mainstreaming	Strategies
Organizational mainstreaming	• Creation of crisis-management group and panel (which deals with risks associated with extreme events, but also other risks in the municipality)
Internal mainstreaming	• On the day of the storm, sending municipal staff members using public transportation home earlier (also mentioned as preparedness for response)
Inter-organizational mainstreaming	• Collaboration on an inter-municipal level regarding issues coupled with risk reduction and adaptation to extreme events (with NSVA, Watercourse management association of Råån and the Environmental covenant of Söderåsen) • Using the webpages of the municipality in order to reach out to citizens about measures which they can take in the event of storm (one-way communicating) (also mentioned as preparedness for reponse) • Municipal staff being available in the reception (telephone communication) in order for citizens or those affected to reach out for information
Educational mainstreaming	• When conducting the vulnerability assessment in the municipality a MVA-method (Municipality Vulnerability Analysis) developed by LUCRAM (Lund University Center for Risk Analysis and Management) • Having a master student writing a thesis about climate change adaptation

Adaptive capacities and practices at the individual (citizen) level

Risk perception and previous experience of hazards

The extreme events that the citizens have been affected by, according to the interviews, were mainly the last two storms and flooding (Table 4). Heat waves on the other hand were not something considered as much of a risk, although the citizens showed to be aware of measures that can be taken in case of these events (read below). From the interviews conducted with the citizens, it was shown that they had been affected by storms and flooding through damages on houses, power failure, telecommunications and internet failures, damage to objects in the gardens and glass panes in a greenhouse, roof tails falling off, road blocked by fallen trees, trees and branches falling on property, a fence in the garden that fell down, a streetlight that fell and hit a car in a garden, flooding in the basements and impacts on wells and sewage systems. The events of flooding and storms also resulted in citizens becoming isolated (due to e.g. fallen trees) (Table 4).

Table 4. Experienced hazards and consequences (individuals).

Hazard	Consequence
Flooding	• Damages on houses • Flooding basements • Affecting wells and sewage systems • Causing citizens (both in rural and urban areas) do become isolated
Storm	• Damages on houses • Power and telecommunication/ internet failures • Roof tiles falling off • Streetlight fell on car • Fence in garden fell down • Trees and branches falling on property • Fallen trees from storms could isolate the citizens in rural areas
Heat waves	None experienced

Used adaptive capacity: What measures have been taken?

From the interviews conducted with citizens in the municipality, information about the individual capacities to adapt was gathered. Regarding the used capacities (i.e. adaptation measures which the citizens take) it was shown from the conducted interviews with citizens that measures were taken in the pre-phase of an event and also during and after an event (i.e. post-phase). These measures are all listed in Table 5.

Vulnerability reduction (pre-phase)

Regarding measures in the pre-phases of events, no measures where mentioned in the interviews regarding hazard reduction and avoidance. The examples of measures taken in the pre-phase (in this case vulnerability reduction measures) of an extreme event are cutting down trees which could fall on the property/house, building interlocks to keep gates from breaking down, cleaning and digging out rainwater wells and adding new pipelines to remove the rainwater, nailing down roof tiles and checking the sewage systems more often (Table 5).

Preparedness for response – and responding

Examples of measures taken by citizens in order to respond to extreme events (also Table 5) are buying diesel generators and gas kitchen, buying a cooling fan, taking loose objects in the gardens inside, and also have batteries, flashlights, candles and lighters in the home. Additional measure taken on the individual level in the post-phase of an extreme event is following the weather forecasts (during all different extreme events).

Common response measures for heat waves include drinking a lot of water, turning on the air pump and avoid direct sunlight. In the event of a storm, staying indoors and closing windows and securing doors were the measures citizens would take. Also regarding storms, some citizens would place the car as wind catcher in sensitive areas. When concerning flooding, there were measures such as taking out the sewer pumps and emptying the water wells and rain water pipes in order for the water to drain away.

Preparedness for recovery – and recovering

Only one measure is mentioned by the citizens when regarding measures taken in the recovery-phase of an extreme event (i.e. also in the post-phase). This measure mentioned by the citizens regards insurance for potential or damaged property after an event (Table 5).

Table 5. The table illustrates most mentioned hazards and what type of measures that were taken on an individual level.

Hazard (Flooding, storms, heat waves)	**Measure**	**Objective** Hazard reduction/avoidance, vulnerability reduction, (preparedness for) response, (preparedness for) recovery
Flooding	Checking sewage systems	Vulnerability reduction
	Clean and dug out rainwater wells and adding new pipelines to remove the rainwater	Vulnerability reduction
	Taking out sewer pumps	Preparedness for response
	Empty water wells and rainwater pipes	Preparedness for response
	Following the weather forecast	Preparedness for response
	Insurance for potential damages	Preparedness for recovery
Storm	Staying indoors	Preparedness for response
	Closing/securing doors/windows	Preparedness for response
	Taking in loose objects from the garden	Preparedness for response
	Nailing down roof tiles	Vulnerability reduction
	Place car as a wind catcher in sensitive areas	Vulnerability reduction
	Cutting down trees which could fall on property/house	Vulnerability reduction
	Build interlocks to keep gates from breaking down	Vulnerability reduction
	Buying diesel generators and gas kitchen	Vulnerability reduction
	Have batteries, flashlights, candles and lighters in the home	Preparedness for response
	Following the weather forecast	Preparedness for response
	Insurance for potential damages	Preparedness for recovery
Heat waves	Drinking a lot of water	Preparedness for response
	Turning on air pump	Preparedness for response
	Buying cooling fan	Preparedness for response
	Avoiding direct sunlight	Preparedness for response
	Following the weather forecast	Preparedness for response

Obstacles and "enablers" for citizen action-taking

Furthermore, the citizens who answered the question regarding obstacles that might affect their ability to take adaptation measures showed that there are (according to interviews) no obstacles that affect their ability to take measures. Although the conducted interviews (from citizens, political parties, municipality and institutions) implied that there is a difference in capacity to take measures between those citizens who live in the urban areas and those living in rural areas. In terms of citizens living in rural areas, it was suggested that they need to take independent measures regarding

their own wells and water waste lines. According to Political party B (2014) and Political Party C (2014), the citizens in the rural areas have greater experience and ability to take measures and could cope with the effects of an extreme event for a longer time period (compared with citizens in urban areas with regard to power failure). However, this does not apply to those citizens who are dependent on different types of support (e.g. home care support) (Political Party B, 2014).

Also, some citizens found that less populated areas in the municipality was not as much of a priority as those areas with a larger population, i.e. the urban areas. According to both the interviewed citizens and Svalövs kommun (2014a), the citizens in rural areas were regarded vulnerable due to the fact that e.g. fallen trees from storms could leave the citizens isolated and thereby affect their adaptive capacities (Table 4). Distance was also seen as a factor affecting the ability to take measures or get support (Political Party C, 2014). The problem of power failure and telephone line failure was also considered larger in the rural areas, although some citizens have back up power generators (mentioned above) (Räddningstjänsten Svalöv, 2014; Svalövs kommun, 2014a). Further on, flooding events in both rural and urban areas are seen as obstacles for citizens to take measures, thus causing citizens do become isolated (due to saturated soil and shallow root systems, mentioned above) (Table 4) (Svalövs kommun, 2014a). Although it was shown from conducted interviews that those living in the urban areas can seek out and get support faster than those living in rural areas, there is also a greater coordination of resources in the urban areas. Those living in rural areas had to cope with the effects for a longer time period. This because it can be more difficult to reach out with help on the countryside (Political Party A, 2014; Political Party B, 2014; Political Party C, 2014). Additionally regarding capacity to adapt, neighbors were viewed as a resource to get support from and affect the ability to take measures (Political Party C, 2014).

Usefulness of existing tools

In this section, the usefulness of existing tools to foster adaptation in the municipality will be analyzed. Table 6 illustrates the challenges and benefits regarding the different tools. The tools assessed are CAT (Climate Adaptation Tool), Climatools and citizen dialogues. When interviewing municipal staff, it was shown that analytical tools such as these had not been used in the municipality (Svalövs kommun, 2014a). However, when conducting the vulnerability assessment in the municipality a MVA-method (mentioned above) was used (Svalövs kommun, 2010b). The motivation for using this particular tool was that the tool was relatively simple to implement, easy to understand, that it provides a comprehensive assessments of risks, threats and vulnerabilities and also evaluates the abilities to handle the needs and tasks which are triggered by unwanted events (Svalövs kommun, 2010b).

Climate Adaptation Tool (CAT)

In the UK-developed CAT, the first step of the tool regards risk assessment with focus on the changing climate. This is done to some extend in the municipal risk and vulnerability assessments (Bellamy & Aron, 2010; Svalövs kommun, 2011b; Svalövs kommun, 2011c). Although, a challenge occurs when identifying and prioritizing the specific risks associated with climate change that the municipal organization is exposed to (this is one of the first steps of the tool). This part is not fully developed in the documents. Additionally, finding local climate change scenarios can be seen as a challenge for the municipality (but there exist options such as the predictions found in the webpages of SMHI and those explained by SOU 2007, see Appendix I). Furthermore, regarding the second step of the tool (i.e. identifying and appraising adaptation options) four key factors are to be considered. These key factors for choosing adaptation options are acceptability, economics, effects and delivery. Additionally, the factor of acceptability is divided into two criteria, one being political acceptability (thus meaning if an adaptation option can attract political criticism or praise). The second criteria for acceptability regards the social aspects, thus meaning if an adaptation option can attract praise or criticism of the public (e.g. citizens). (Bellamy & Aron, 2010). Finding and

comparing adaptation options depending on these factors can also be considered a challenge for the municipality. Regarding the last step of CAT (i.e. reviewing the performance of the implemented options) should be done while taking into account the four factors mentioned (acceptability, economics, effects and delivery) (Bellamy & Aron, 2010). This can thus also be a challenge when deciding on whether to continue with a particular option or to replace it.

The key benefits with the tool (Table 6) are (mentioned in the theoretical framework), the consistence of a multi-criteria analysis (MCA) the tools takes into account different sort of factors (e.g. effects and delivery), rather than only the economic factors (which a cost-benefit analysis would do). Another key benefit from the tool is that no specific training or external help is required when using the tool (Bellamy & Aron, 2010; UNFCCC, 2014). Thus, falls well in line with the criteria acquired (e.g. easy to understand and implement) for the MVA-method used for the vulnerability assessment in the municipality (Svalövs kommun, 2010b). Additional benefits with the tool are (as mentioned above) free to download and that the tool has a broad scope allowing it to be applied on all different levels. What also can be considered a benefit is the above mentioned factor of acceptability (concerns governments and the public) Lastly regarding the benefits of this particular tool are the key outputs from using it, meaning the mentioned I) identification of climate risks, II) prioritizing of climate risks, III) identification of adaptation options, IV) evaluation of adaptation options and finally V) review of adaptation option (Bellamy & Aron, 2010; UNFCCC, 2014).

Climatools

Regarding Climatools (as with CAT) there exist challenges concerning the fact that not all the municipal departments or the municipal institutions have experience with using tools such as these (Table 6) (Svalövs kommun, 2014a). It can also be a challenge to find out who is or who should be responsible to conduct these methods when regarding the issue of risk reduction and adaptation. Choosing a suitable tool (since there are eight tools) can also be a challenge for the municipality or an institution. Although a key benefit with Climatools is that the tools (as mentioned) can be used separately or in combination (i.e. using multiple tools) (FOI, 2011a). This produces a benefit since the municipality or an institution can get specific information about an area or a subject (e.g. flooding/drinking water or heat waves) by using one specific tool, or getting information about multiple subjects (both drinking water and heat waves) by using several different tools.

Citizen dialogues

Lastly regarding citizen dialogues (Table 6), the municipality has carried out citizen dialogues in the past, these have focused on other areas than climate change adaptation (e.g. the quality of schools and communication with local politicians) (Svalövs kommun, 2011a). Citizen dialogues are also included in the municipal political organization as a part of increasing influence and development in the municipality (Svalövs kommun, 2014b). Further, having experience with citizen dialogues in the municipality results as a benefit for the tool to be used (but shifting the focus to risk reduction and adaptation). An additional benefit is that the municipality has conducted a handbook for citizen dialogues that also can be used (Svalövs kommun, 2010c). Challenges with conducting a citizen dialogue can be which method to use (e.g. dialogue seminars, dialogue groups or Wheel of engagement). The methods used by the municipality itself when conducting the citizen dialogues are called "World café" and "Open area meeting - citizen meeting". The method of the World café dialogue is conducted in smaller premises with tables and moderators, and the dialogue can be both targeting (specific citizens). The aim of this is to generate ideas and proposals and encourage listening, learning and exchanging of views. The municipality conducts the method in the early stages of a process. The open area meetings are conducted in larger premises, aiming to inform citizens and also finding important questions and issues that matter the most to the citizens. This is conducted in agenda form, through invitations, and can include booking in municipal staff and politicians (Svalövs kommun (2010c). This shows of similarities with the methods mentioned

above. For instance, the method called 'World café' has similarities with dialogue groups since both of them focus on a more specific area of people (i.e. only those affected). However, the method of dialogue groups requires the dialogues to be repeated for best results (Svalövs kommun, 2010c; Båstads kommun, 2011). The method of dialogue seminars is has more in common with the method of "Open area meetings" in Svalöv's municipality since it does not include only a specific group of people, but is rather a more informative gathering (for both parties) (Svalövs kommun, 2010c; Båstads kommun, 2011). The dialogue methods used by the municipality have the overall aim of giving the citizens the opportunity to meet and conduct dialogues and bring forth opinions regarding different subjects, to provide with suggestions on changes and improvements (Svalövs kommun, 2010c). Thus showing to have the common goal as methods mentioned (e.g. the wheel of engagement) in the theoretical framework, e.g. providing with in-depth information and foster the participation of the local citizens in the municipality.

Table 6. Listing challenges and benefits from different adaptation tools (CAT, Climatools and citizen dialogues).

Tool	Challenge	Benefit
CAT (Climate Adaptation Tool)	Not all municipal departments and institutions have experience with using analytical tools	Experiences with analytical tool called the MVA-method
	Need for new or further development of existing risk/vulnerability assessments to find risks of extreme weather events/effects of climate change	Consistence of a multi-criteria analysis (MCA) (including other factors than only economic)
	Need for local climate change scenarios	No specific training or external help is required (hence making it easy to work with and implement)
	Identifying and prioritizing the specific risks associated with climate change that the municipal organization is exposed to	Free to download and has a broad scope
	Finding and comparing adaptation options	The tool has five important key outputs listed in the text.
	Reviewing the performance of the implemented options/deciding on rather to continue with a particular option or to replace it	Including political and social aspects/opinion when regarding adaptation options (i.e. acceptability)
Climatools	Not all municipal departments and institutions have experience with using analytical tools	Experiences with analytical tool called the MVA-method
	Finding responsible actor to conduct these methods	Can tools can used separately or in combination
	Choosing a suitable tool (since there are eight different)	Resulting in information about a specific subject or area (if tool is used separately) or resulting in multiple information if different tools are used combined
Citizen dialogue	Which method to use to carry out the citizen dialogue	Has carried out citizen dialogues in the past (i.e. has experience) and having an existing handbook for dialogues
	Conduct the right way in order for the citizen dialogue not to be pointless (method of dialogue	Providing vital in-depth information

	seminar)	
	Finding representatives for a specific area (method of dialogue group)	Regarding Wheel of engagement, the method can be used in a linear way or in an iterative way
	Finding enablers to enhance citizen's participation (method of Wheel of engagement)	Enhancing the local (or area specific) citizen's engagement (all methods)

Adaptation gaps, missing pieces and unused capacities

The last part of the analysis section focuses on the unused capacities and gaps which exit in the municipality (including institutions and citizens) (Table 7).

Adaptation gaps based on objectives, thematic foci and mainstreaming strategies

Regarding the objectives and thematic foci in the municipality (the own organization and the institutions), most objectives are found to be measures taken under the concept of preparedness for response. Much less is found regarding the pre-phases of extreme events and preparedness for recovery. The thematic focus is mostly on the social aspects and less so on e.g. the environmental and physical aspects. None are found under for instance the thematic foci of economics. However, most of the measures found are in existing or implemented stages. Further, concerning the mainstreaming strategies found, the most representative strategy was shown to be inter-organizational mainstreaming. Thus, less on the three other mainstreaming strategies. However, even though inter-organizational mainstreaming is the most representative one found, it can be recommended that the municipality increases its participation in inter-municipal projects in the topic of CCA.

Additionally most of the objectives are represented by preparedness for response, regarding measures taken on the individual level. Fewer measures are found under the concept of preparedness for recovery and none under hazard reduction and avoidance. An important note here is that these measures found and the existing shortcomings in the municipality are only represented of what this particular study found. There can be other measures which have not been found and thus not included.

Missing pieces in the municipal risk governance structure

In general, the municipal organization is lacking a holistic view of the issue of risk related to extremes events (and climate change adaptation as a whole). There is no one who works with these certain tasks in order to provide a holistic view (Political Party C, 2014; Svalövs kommun, 2014a). Furthermore, there is a need to work with making conclusions from the extreme weather events in order to work with prevention measures and also be prepared in the future in the municipal organization (Svalövs kommun, 2014a). The work that exists within the different municipal departments can be seen as unused capacities for risk reduction and adaptation. This because the only collaboration which occurs amongst the municipal departments (regarding extreme events) is that of the crisis management group. No other collaboration between the departments of municipality regarding these issues occurs (Svalövs kommun, 2014a). The lack of collaboration between the health care center and the crisis management in the municipality (regarding issues associated with extreme events) shows another a gap that exists.

Further on, although the municipality has (as mentioned) planning strategies for water and electricity supply, but they do not have strategies for flooding and heat waves (Svalövs kommun, 2014a). Additionally, not obtaining economic resources for issues regarding risk reduction and adaptation can also be considered a shortcoming in the municipality (Political Party C, 2014).

Further on concerning the citizens in the municipality, there are difficulties of conducting follow-up work regarding the measures which the citizens are able to take in case of extreme events (Svalövs kommun, 2014a). Another factor that the municipality does not have (which could enhance the contact network between departments, institutions and citizens) is that the municipality should have resources to have a key contact person in each department regarding extreme events. Also, the municipality should have resources to include staff training to deal with extreme weather events (Political Party B, 2014). Thus this shows examples of additional gaps.

Existing but unused capacities for adaptation

Since the adaptation work in Svalöv is only just beginning, the existing potential for adaptation can be found under other names and sectors in the municipality. Additionally, this can also be seen as an unused capacity in the municipality, meaning that there exists capacity to plan strategies for flooding and heat waves (since the municipality has developed the mentioned strategies). Other example that is the goal of constructing wetlands (through the collaboration with Watercourse management association of Råån) (Rååns Vattendragsförbund, n.d.). This can be seen as unused capacity for adaptation measures regarding flooding risks.

Also, further collaboration between the municipality's own organization and the municipal institutions and inter-municipal corporations are considered vital (Räddningstjänsten Svalöv, 2014; Political Party A, 2014; Svalövs kommun, 2014a). Since there is an existing contact network with the provincial government and other resources such as the Armed Forces, there is an importance for further information on how this is used (Political Party A, 2014; Svalövs kommun, 2014a).

Also regarding the health care center, there exist contact network with Region Skåne and also with the municipal organization (however, as mentioned, not with the crisis management group) (Vårdcentralen Svalöv, 2014). This is another example of unused capacities regarding risk reduction and adaptation (to extreme events).

These factors can be seen as unused capacities regarding the possibility for further mainstreaming of risk reduction and adaptation within the municipality and amongst the institutions. This also applies for other important resources in the municipality, namely capital/budget (meaning that there is budget but is distributed for other issues rather than those related to RR and CCA), collaboration with the volunteer fire department in Tågarp and Teckomatorp and the communication through telephones and the internet (between municipality's own organization, the different institutions and the citizens) (Political Party C, 2014; Svalövs kommun, 2014a).

Other unused capacities regard the usage of analytical tools for adaptation. The usage of the above mentioned MVA-method for the vulnerability assessment shows that there exist unused capacity in the municipality to use tools with focus on risk reduction and adaptation. The existence of a handbook for citizen dialogues is also an example of unused capacities in the municipality (which can be used to develop citizen dialogues on risk reduction and adaptation). An unused capacity that also affects citizens regards communication. Although (as mentioned) the municipality lists measures that can be taken in case of a storm, this can be seen as unused capacity regarding mentioning other measures related to risk reduction and adaptation (e.g. extreme events other than only storms) that citizens can take. Additional unused capacity (regarding citizens) is the close by neighbors (Political Party C, 2014). It can be seen as an unused capacity through the fact that neighbors capacities to act and take measures are not used in order to help those who are affected and vulnerable to extreme events.

Table 7. List of gaps and unused capacities in the municipality of Svalöv.

		Key actor (The municipal organization, institutions, citizens, volunteers)
Gaps	Lacking a holistic view of the issue of risk related to extremes events (and climate change adaptation as a whole	The municipal organization
	Lacking someone who works with these certain tasks in order to provide a holistic view	The municipal organization
	Need to work with learning from extreme weather events	The municipal organization
	Resources to train staff to deal with issues concerning extreme events	The municipal organization
	Not mentioning climate change adaptation in association with extreme weather events in municipal documents such as vulnerability assessment	The municipal organization, Institutions
	Lacking planning strategies for flooding and heat waves	The municipal organization, Institutions
	Lack of collaboration between crisis management center of which exists in Region Skåne (through the municipal health care center) and the municipality's crisis-management center	The municipal organization, Institutions
	Resources for key contact persons in municipal departments	The municipal organization, institutions and citizens
	Difficulties to carry out follow-up work regarding citizen's capacities to take measures (risk reduction and adaptation)	The municipal organization, Citizens
Unused capacities	Handbook for conducting citizen dialogue	The municipal organization
	Webpage of municipality (news section) used during storms, could be used for further instructions about flooding/heat wave events	The municipal organization
	Capital/budget (can also be considered a gap)	The municipal organization
	The volunteer fire department in Tågarp and Teckomatorp	The municipal organization, Volunteers
	Existing planning strategies for water and electricity supply (that can be used for other risk reduction and adaptation issues)	The municipal organization, Institutions
	Constructing wetlands (regarding adaptation measures coupled with flooding risks)	The municipal organization Institutions
	Existing collaborations with other institutions on an inter-municipal level and also with	The municipal organization,

	provincial government and the Armed forces	Institutions
	Further collaboration with health care center (and Region Skåne) regarding risks associated with extreme events	The municipal organization, Institutions
	Goal to construct wetlands (Watercourse management association of Råån)	The municipal organization, Institutions
	The communication through telephones and the internet	The municipal organization, institutions and citizens
	Usage of analytical tools for adaptation (experience of using MVA-method)	The municipal organization and institutions (also citizens when regarding Climatools, e.g. finding vulnerable individuals)
	Experience with carrying out citizen dialogues	The municipal organization, institutions and citizens
	Neighbors helping out	Citizens

Discussion

Municipal used and unused capacities and practices

It was shown from the conducted analysis that the measures taken on municipal and institutional level result in work that falls under the concepts of risk reduction and adaptation. By having implemented, existing as well as planned measures such as those listed in Table 2, it can be stated that the municipality of Svalöv, has a basis for continuing the work related to risk reduction and adaptation. Furthermore regarding the used capacities in the municipality, the results show that the measures and strategies are taken both in the pre-phases and in the post-phases of extreme events. Hence, resulting in the fact that there are capacities in the municipality to further plan for adaptation measures (in both pre and post-phases of extreme events). In this regard, it was also shown that most measures focus on extreme events in form of storms and flooding, while less (and sometimes none) focus on extreme events in the form of heat waves. The interviewed municipal and institutional staff did not only bring up storms and flooding but also risks associated with heavy precipitation (both snow and rain) as well as heat wave. Still, when discussing the effects and consequences (as well as measures be taken under the different extreme events) it became clear that most of the knowledge was on storms and flooding (associated with heavy precipitation) and less on heat waves. With that being said, the municipal health care center does have knowledge and strategies when concerning heat wave related issues, however, they lack collaboration with for instance the municipal crisis-management group. From these results it can be stated that perhaps the municipality is better prepared with issues related to storms and flooding and less so with issues relating to heat waves. Thus, showing that additional knowledge might be required in this particular field in order to get a fully comprehensive adaptation plan in the municipality.

Further on regarding the measures taken on the municipal and institutional level it was shown that the thematic focus of the measures are on more on the social aspects and less on aspects such as physical and environmental (Table 2). This can be due to the fact that the social aspects (i.e. the citizens in the municipality) are of greater concern to the municipality when regarding the issue of extreme weather events. Also, the found distribution regarding thematic foci could also be a product of the selection of documents and professionals to provide information for this thesis. For instance, an additional interview with someone from the environmental covenant (the inter-municipal association that Svalöv has instead of an environmental administration) might have relieved more environmental measures. In spite of this, it can be argued that including other factors (such as environmental, physical, political as well as economic) can result in more comprehensive adaptation work in the municipality. Regarding the environmental aspects, it can be recommended for the municipality to look into the concept of ecosystem services.

Also, the list in Table 2 illustrates that many of the used capacities are existing or have been implemented, while less are on the planned stages. It can be seen as positive that much of the measures are on the implemented-level, it is important to have additional plans and goals in order to fully combat the issue of adapting to the changing climate in the local level.

Mainstreaming risk reduction and adaptation

Moving on to the risk governance and political structure of the municipal organization, the institutions and collaborations mentioned in figure 3 are only key bodies. It is (as mentioned) important to point out that climate change adaptation and risk reduction should be integrated throughout the municipal departments and institutions/collaborations and its political structure.

This study has found that some aspects of mainstreaming are already applied in the municipal work (Table 3), but a lot is still to be done. For instance, the different existing inter-municipal collaborations shown in the analysis are part of inter-organizational mainstreaming and can be seen as important factors that can benefit the municipal work when planning for climate change adaptation. This because climate change impacts (such as flooding and storms) do not respect municipal borders, and it is thus vital to collaborate with other municipalities and institution for a more comprehensive work basis for adaptation. Also, through further collaboration both within the municipality and on an inter-municipal level, the municipality can overcome some of the identified obstacles currently affecting the ability to take risk reduction and adaptation measures. For instance, increasing participation in existing inter-municipal projects focused on CCA is a way to obtain knowledge from other municipalities that may have come some steps further in their adaptation work.

By further applying the mainstreaming strategies mentioned in the theoretical framework (i.e. organizational mainstreaming, internal mainstreaming, inter-organizational mainstreaming and educational mainstreaming) the integration of risk reduction and adaptation measures would be further enhanced in the sectorial work. In this context, it should be noted that by comprehensively integrating risk reduction and adaptation measures and strategies in the early development phases (before a climate-related hazard strikes), the measures in the post-phase stages of an extreme event (i.e. response and recovery) are then likely be less costly, and some perhaps not even necessary (Wamsler, 2014).

Several existing studies support the finding that Svalöv municipality needs to increase its mainstreaming of climate change adaptation. For instance, municipal planning documents were examined by Länsstyrelsen (2013) to see what measures the municipality has included in their documents regarding climate change adaptation. According to this examination, the current comprehensive plan of the municipality from 2007 does not consider the effects of climate change, although if the goals and the visions that are described in the document regarding water issues are reached then the municipality will be better prepared when facing the changing of the climate in the future (Länsstyrelsen, 2013). Additionally, according to Svenskt Näringsliv (2013), the municipality has not mainstreamed climate change adaptation strategies in their risk and vulnerability assessments.

Although the municipality does not mention the concept of adaptation in words in these documents, it was shown from the analysis on this thesis that the municipal organization and the different institutions do take measures that could be considered as adaptation. For instance, even though the vulnerability assessment does not mention the word adaptation, it does take note on the changing climate and their potential effect (as illustrated by the flooding scenarios in the vulnerability assessment). In this regard, it should be emphasized, as presented in the theoretical framework, that there can exist overlap between the work done under risk reduction and work done under adaptation since they share common goals (Wamsler, 2014). The results from the used capacities in the municipality show (as mentioned) that this is the case in the municipality of Svalöv. Having knowledge of these and other measures is essential for the municipality and should especially be considered in the ongoing renewal of the municipal comprehensive plan (which is to be concluded by the year 2016), in which the municipality aims to take into account the issue of climate change adaptation (Svalövs kommun, 2014a).

Factors affecting institutions' adaptive capacity and practices

Different factors were found to affect the ability (of a municipality or individual) to take adaptation measures (Smit & Wandel, 2006). The collaboration amongst the different municipal departments, the collaboration with institutions in the municipality and the collaborations on an inter-municipal

level are drivers that affect the ability for adaptive measures to be taken. These particular type of drivers are explained by Smit and Wandel (2006) as local driver/factors, i.e. the presence of strong networks which can absorb stress (in the context of risk related to extreme events).

Further analysis of regarding the adaptive capacity of the municipality showed that factors such as lack of budget regarding the subject of RR and CCA and lacking a holistic view of the climate change adaptation issue were considered as obstacles affecting the ability to take measures (Focus Group Interview, 2014; Svalövs kommun, 2014a). An additional example of a factor affecting adaptive capacity is further mainstreaming of adaptation in the political and risk governance structure, which also affects the ability to fulfill municipal goals (e.g. those mentioned in planning documents or comprehensive plan). Fulfilling the municipal goal was seen to be vital for reducing risks associated with extreme events (Political Party A, 2014). These factors are explained by Smit & Wandel (2006) as general drivers that reflect the political and socio-economic systems in a municipality.

Most of the measures taken by the municipality and its different institutions were focused on flooding and storm events (which were found for both municipality/institutions and the local citizens). From the conducted analysis, it was shown that measures were taken in both the pre-phases and the post-phases of an event. Although in this context, a considerably higher number of measures were taken under the concept of preparedness for response, as opposed to preparedness for recovery. Even though this shows that there are capacities to take measures in all different phases, it is to be noted that most measures are focused on preparedness for response and there needs to be more focus on measures that aim for a more long-term reduction of hazards and vulnerability.

Citizens' used and unused capacities and practices

Regarding citizens' used capacities, the fact that the effects of mainly storms (but also flooding) are mentioned can be explained by the events of the two most recent storms (Simone and Sven) and that their effects are most fresh in the thoughts of the citizens. Another explanation can be that the persons which were interviewed randomly happened to be those not particularly affected heat waves. Perhaps with more interviews there would have been greater focus on heat waves as well as flooding. With that said, the citizens interview showed to have knowledge (and also used capacities) on measures concerning extreme heat (even though heat waves were not considered a priority).

Factors affecting citizens' adaptive capacity and practices

The risk reduction and adaptation measures that have been taken by the citizens in the municipality of Svalöv can further on be linked with the individual adaptive capacity explained by Grothmann and Patt (2005). By gaining the knowledge of an extreme weather event such as a storm, citizens have assessed a threat or damaging potential to the object which they consider of values (e.g. loose objects in the gardens and vulnerable trees). This can be coupled to the risk perception of the individuals. Furthermore, by then taking measures such as for instance cutting down trees or removing loose objects from the gardens, citizens have also evaluated their ability and cost to prevent the potential damages. Meaning that this is the individual's evaluation/judgment to carry out a change (e.g. take action/measure) in order to avoid or prevent potential damage. The ability for the individual to take adaptive responses/measures is also linked to the potential cost for the individual to take these adaptive responses. This implies that citizens with more economic resources potentially are more able to take such measures. Other resources, such as time availability and social networks may also be important (in particular the latter since the citizens mentioned their neighbors as a resource). In this context, Smit and Wandel (2006) mention factors such as economics and knowledge. To further link the measures with adaptive capacity, all of these factors

can be something that has affected the ability for citizens to take measures. This regards both citizens in urban and rural areas.

Tools for adaptation planning

Moving on to the evaluation of the existing tools for risk reduction and adaptation, it can be argued that the usage of these tools (CAT, Climatools and citizen dialogues) can foster adaptation planning. This can be done by finding different risks as well as the vulnerable people and areas (through CAT, Climatools and citizen dialogues). Further benefits with the tools are assistance in order to prioritize risks and prioritize adaptation measures (through e.g. CAT) and assistance to evaluate tools and measures and options (through CAT and citizen dialogues).

However, it is vital to also consider the challenges which come with the different tools when planning to use them. Challenges such as the limited (and also lack of) experience with this type of tools can affect the ability to use them. This particular challenge mostly concerns the analytical tools (i.e. CAT and Climatools), since the municipality does have experience in carrying out citizen dialogues (although focusing on other issues than risk reduction and adaptation).

A way of fostering the planning for adaptation measures in the municipality could be to combine or use more than only one of these tools. By using both analytical tools and citizen dialogues (an important note is that CAT also includes the social aspects regarding the mentioned key factor of acceptability), the gap between the municipal/institutional level and the citizen level could addressed. This because the tools would help to take into account both the municipal/institutional and citizen aspects regarding adaptive capacities, resulting in a more holistic view of the issue. The argument for citizen dialogues can be enhanced by the fact that Focus Group Interview (2014) and Svalövs kommun (2014a) mentioned this tool as a potential way of increasing the municipality's knowledge regarding its citizens and their climate change adaptation capacities.

Additionally, by carrying out citizen dialogues and by the usage of the other adaptation tools, citizens can become involved in the sectorial work through identifying and mapping adaptation options. Citizens can then become more aware of the risks that are associated with extreme events and get a better understanding of the issue. Also, this can lead to the adoption of various adaptation and risk reduction strategies amongst the citizens themselves and the municipality/institutions (Wamsler, 2014).

By involving citizens, bottom-up knowledge transfer can be enhanced in Svalöv's municipality. This can create a greater "two-way communication" between the municipality and its citizens, and ultimately be vital for increasing democracy in the municipality (as argued in the theoretical framework).

Bridging the gaps

Further on, regarding the gaps and unused capacities illustrated in Table 7 in the analysis, it can be discussed that risk reduction and adaptation planning in the municipality could be enhanced by closing these gaps and using the capacities which exist. The gaps and the unused capacities are factors which, as exemplified above, affect the ability to take adaptive measures in the municipality.

Conclusions

This study has looked at the adaptation measures that have been taken in Svalöv at the municipal as well as individual levels. It has emphasized some of the existing capacities for (planning for) climate change adaptation in the municipality. The results from the study have also pointed out which capacities are not being used and what type of gaps that exist in the municipality of Svalöv. It is important for the municipality to address these gaps and unused capacities to benefit future adaptation plans. A way of doing this can be by using the different adaptation tools mentioned in the thesis. Evaluating these tools showed that municipal and institutional as well as individual adaptive capacities can be taken into account when planning for adaptation measures, thus providing the municipality with a more holistic view of the issue.

When regarding the used capacities in the municipality, it can be concluded that steps are taken in the right direction regarding adaptation measures and strategies, but more needs yet to be done. The municipality has a basis to continue the work in the field of risk reduction and adaptation. However, it is important for the municipality to further mainstream adaptation work, both within the municipality and on an inter-municipal level. Increased collaboration with municipalities that have come a bit further in their adaptation work would also benefit the municipality.

Regarding the measures taken on the individual levels, it can be concluded that citizens in the municipality have capacities to take measures in both the pre-phases and the post-phases of extreme events. However, most of the measures focused on the events of storms and flooding and are conducted in regards to preparedness to response. This means that the objectives should include more of the other measures as well. Also, even though heat waves are not considered a priority, the citizens do have the knowledge of some measures that should be taken in this regard.

As for the citizens, it is essential that the municipality does not only focus on the effects of storms and flooding but include work related to heat waves as well. Another important point is that the municipality in the future needs more continuous work to reduce the occurrence of and vulnerability to extreme events in the longer term, as well as measures that fall under the concept of preparedness for recovery and not mainly on preparedness for response. This would be beneficial to future adaptation plans.

Additionally, the fact that the municipality is currently renewing their comprehensive plan provides them with an opportunity to include the effects of climate change and adaptation work, which is vital for the municipality. This would benefit future risk reduction and adaptation plans in Svalöv municipality. However, risk reduction and climate change adaptation should be further enhanced in other key policy documents (such as risk and vulnerability assessments). This would for instance benefit the usage of analytical adaptation tools (mainly CAT).

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Appendix I

Choosing climate projections for CAT

As mentioned, this particular tool needs local or regional climate projections. The climate projections are needed before continuing with the three main stages of the CAT. Since the projections used in the guidance document of the CAT (the PDF-document) are applicable for the UK only it is important to find national or regional climate projections for Sweden or the region of Skåne (where the municipality of Svalöv is located) (SOU, 2007b; Bellamy & Aron, 2010). One source of information which can be used when finding climate projections is the SOU (2007b). In this document it is explained for instance that when concerning extreme events, the number of cold and frosty winter nights have decreased globally while the number of very warm summer days and warm summer night has increased due to the increasing levels of greenhouse gas emissions and the resulting global warming effect (SOU, 2007b). This document (SOU, 2007b) uses two global climate models, namely HadAM3H and ECHAM4/OPYC3, and the motivation for these two particular climate models was that these are the same climate models that SMHI's Rossby Centre uses when scaling down to their own regional models and also at the time the ECHAM4 model was the only climate model which was scaled down to the region of Sweden for various of timeframes (meaning to the end of the 21st century). A brief description of the two global climate models used are that the ECHAM4/OPYC3 is a coupled atmosphere and ocean model and that HadAM3H is an atmosphere model (SOU, 2007b).

Further on this study uses A2 and B2 scenarios, where the A2 scenario represents a world of different regional development, continued population growth due to uneven development, emissions continue to increase just under 30 GtC (Gigaton Carbon) around the end of the 21st century, the economic growth per capita is a bit slower than other scenarios and finally the temperature increases with 3.4 °C by the year 2100. Whereas the B2 scenario has a local and regional focus, and represents a slower population growth than A2 along with good but not remarkable economic growth. In the B2 scenario emissions increase quite slowly and result between 10 and 15 GtC by the end of the century together with a temperature increase of 2.4 °C, which is less than the A2 scenario (SOU, 2007b).

The results from the study in SOU (2007b) show that there is expected to be a greater warming in Sweden than the global average. This depends primarily on the historical greenhouse gas emissions while the size of the temperature increase at the end of the century will depend on the future levels of greenhouse gas emissions. Furthermore, great changes in the patterns of precipitation are expected, whereas the changes in the wind climate are less certain. The warming of the average temperature by the year 2020 in the country will be around 2 °C, further on by the year 2050 the warming will increase with 2 °C to 3 °C and continuously by the year 2080 the warming is going up to between 3 °C to 5 °C (although mostly in the north-easterly parts of Sweden). In the year 2020, the region of Mälardalen will have the same average temperature previously noticed in the region of Skåne, this means that the gradually increasing levels of the average temperature in the country will result in climate zones shifting towards the north (SOU, 2007b).

Additionally, the average temperatures in the winter will increase between 1.5 °C to 2.5 °C by the year 2020 in greater parts of Sweden. By 2050 the increase will continue to between 2.5 °C to 4 °C. By the end of the century (year 2080) the average winter temperature in the region of Götaland (where Skåne and the municipality of Svalöv is located) will increase with 5 °C to 6 °C. In the same period of time, the more the northern parts of the country (Norrland) will face a warming between 6 °C and 7 °C during winter. These high levels of increased average temperature are explained mostly by the reduced duration and also the reduced thickness of the snow coverage. These predictions are mostly for the month of January and possibly February, whereas the month of December shows a

somewhat smaller increase in warming than the two other winter months (SOU, 2007b). The summer months (June to August) will much like the winter face warmer average temperatures, with an increase of 0.5 °C to 1.5 °C by the year 2020, and an increased warming of 1.5 c to 2.5 C by the year 2050 and finally a warming of 2 °C to 4 °C by the year 2080, with the increase being generally higher along the coasts (SOU, 2007b).

When it comes to precipitation during the winter, by the year 2020 the precipitation which falls as rain will double up in Götaland (where Skåne and the municpality of Svalöv are located) whereas the precipitation which falls as snow in these areas will be reduced. Additionally, by the year 2080 the precipitation which falls as snow will have decreased the majority parts of Sweden and snow will furthermore become rare in the coastal parts of Götaland (with only the inland of northern Norrland which might experience a slight increase of precipitation which falls as snow during winter). At the same time, the amount of rain will increase significantly in most parts of the country. When it comes to precipitation in the summer, climate scenarios shows a decrease of precipitation in the southern parts of Sweden, causing drier conditions. But this is less certain since some models shows that even some parts of southern Sweden might face rather wetter weather during the summer months, also the average temperature warming differs between models being used. As mentioned, the changes of wind climate are more uncertain and they also vary between the models used, some models show an increase in wind speed whereas some models show small changes in most parts of the country. Although results from a model used for regional information about wind gusts shows a certain increase, largely in the coastal regions of Götaland (SOU, 2007b). These climate projections can be used when using the CAT in order to extract the key findings in the predictions, before continuing with the three main steps of the tool mentioned above.

Another source for climate projections to be used to extract key findings/factors, which can be used with regards to CAT, can be found on the webpages of SMHI[2]. Here one can choose a particular region, e.g. Skåne, along with a particular climate scenario, season and climate index (e.g. temperature, precipitation, maximal speed of wind gusts of a year). The results are shown in maps, diagrams and information texts.

[2] [www.smhi.se/klimatdata] or [http://www.smhi.se/klimatdata/Framtidens-klimat/Klimatscenarier/Europa?area=lan&var=t&sc=rcp85&seas=ar&dnr=0&sx=0&sy=139#area=lan&dnr=0&sc=rcp45&seas=ar&var=t]

Appendix II

Summation of Climatools

The first tool on the list, the Local climate impact profile, is developed to create a foundation or base for municipal politicians and administrators to analyze future climate change. The results from this tool can be used as input or a base in an adaptation plan, municipal overview plans and in risk and vulnerability assessments (with the focus on weather or climate) (FOI, 2011a).

The aim of guidance tool (Integrating climate adaptation into local risk and vulnerability assessments) is, as the name explains it, to help municipalities which aspects of adaptation can be included in municipal risk and vulnerability assessments and which aspects of adaptation should not be included in these assessments. The tool also guides the municipal staff to choose which future weather scenarios and climate change impacts that are important for the particular municipality to include in their risk and vulnerability assessments. The tool is to be used by those who develop the assessments and also by those who have the overall responsibilities within the area of climate change adaptation (FOI, 2011b).

Furthermore, the tool for creating checklists for health and social care (the third tool on the list above) has the purpose to help these institutions adapt to the changing climate, especially concerning the impacts of heat waves amongst vulnerable citizens. This tool uses a form in order to determine which measures have been taken by the different health and social care institutions (e.g. retirement homes, nursery schools and day care centers) in the municipality and which measures have not been taken, where the results will show which measures are needed to consider/be taken within the municipality (FOI, 2011c).

The forth tool on the list above, Guidance for the assessment of drinking water risks from a changing climate, considers extreme precipitations in a changing climate and the guidance tool is aimed for politicians and officials who are responsible for the municipal waterworks and sewage systems, climate adaptation, environmental and health protection, physical planning or preparedness issues. Furthermore, the guidance is to be used in analysis for how the municipal drinking water supply can be affected by extreme precipitation due to climate change. The results of this tool are to be included when making decisions and prioritizing within the focus of climate change adaptation (FOI, 2011d).

The guidance tool (number five on the list above) for increased preparedness for heat focus on those who are sensitive and vulnerable to the extreme events of heat waves. The purpose is to increase preparedness measures in a particular municipality within the focus of this issue, this in order to prevent vulnerable and sensitive citizens from dying or becoming extremely ill. As with most the tools on this list, this tool is also aimed to the municipal administrators but particularly those within the area of health and care along with concerned politicians and security officials. The results from this tool can be used in maps to locate sensitive and vulnerable citizens within the municipality, the information can be used for a local plan about measures to take before, during and after heat waves and this information used for the municipal staff and also be displayed for public (FOI, 2011e).

Continuing down the list, the tool named Effects of heat also focuses on the extreme events of heat waves. This is a calculation tool which is supposed to be used by staff within the institutions of health and social care. The adaptation tool can also be used by administrators within the area of public and environmental health, urban planning and climate adaptation. The goal of the tool is to prevent death and illness amongst citizens by adaption measures such as action plans and prediction-based warning systems. This calculation tool aims to help quantify the consequences of

severe heat waves in terms of death. The tool also provides opportunities to reduce the consequences (deaths due to heat waves) through adaptation measures (FOI, 2011f).

The penultimate tool on the list of Climatools is named Use of socio-economic scenarios in climate adaptation. This adaptation tool aims to analyze how the changing of a society due to climate change and further on how this development of a society will affect the prospects for adaptation measures. This guidance tool is to be used by consultants or municipalities which will evaluate how the changing socio-economic conditions will affect the impacts that climate change will have on the society. Further on, the tool can then be used to determine how different adaptation measures are depended on the socio-economic conditions of a society. With this, municipalities can identify socio-economic factors which are important and which will have an impact on the vulnerability and the adaptation capacity of the society. Furthermore, the tool can be used to raise awareness amongst administrators and decision makers (FOI, 2011g).

Lastly, the purpose of the Sustainability analysis tool is to be used when planning and choosing climate change adaptation measures. Moreover, the tool is to be used to systematically identifying the economic, environmental and social impacts of implementing the particular adaptation measures which are to be used within a municipality. The tool is primarily aimed to the decision makers in a municipality which takes decisions regarding climate change adaptation, and the tool is also aimed to those administrators who are responsible for preparing these decisions. The tool consists of three main parts which are a basic component along with two parts which are selectable. These selectable parts are namely a cost-benefit analysis and a goal-conflict analysis. The basic component is aimed to help the decision makers in the municipality to systematically identify the potential consequences (mentioned above) due to the adaptation measure in mind. The cost-benefit analysis is a economic based tool which is to be used in order to weigh an adaptation measures benefits against its costs, whereas the goal conflict analysis aims to identify and validate the goal conflicts and the synergies (meaning if the consequences of a measure will counteract or support the abilities to reach other planned goals) (FOI, 2011h).

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