

The application of a monitoring, evaluating and reporting (MER) framework on climate change adaptation measures implemented in cities

An orientation for the case study of Bilbao, Spain



Master thesis

Radboud University Nijmegen

MSc Environment and Society Studies

June 2018

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Colophon

Title: The application of a Monitoring, Evaluating and Reporting (MER) framework on climate change adaptation measures implemented in cities

Subtitle: An orientation for the case study of Bilbao, Spain

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Date: June 2018

Front picture: View on the Nervión river in Bilbao (researcher's own photo)

Keywords: Climate change adaptation measures, cities working on adaptation, monitoring, evaluating, reporting, deliberative decision-making processes.

Words:

Radboud University



bc³

BASQUE CENTRE
FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

Preface and acknowledgements

The last year I have been busy creating, studying and writing this master thesis research. The decision to submit for an international internship position has turned out to be the best decision I have made during the master thesis trajectory. My internship position at the Basque Centre of Climate Change in Bilbao has taught me a lot of valuable things. First of all, it taught me the experience of what it feels like to work as a professional academic researcher for five months. Secondly, and probably even more valuable, it taught me what it feels like to be part of a great research institute where all kind of research projects take place concerning the issue of climate change. Therefore I would like to thank everyone whom I have been working with in The Basque Centre of Climate Change. You all made my stay as a master student so interesting and fun.

In particular I would like to thank my friendly and helpful supervisors. At the Basque Centre of Climate Change in Bilbao, Dr. Marta Olazabal, for putting all your time and effort in helping me out with my research project and conducting the interviews together. Without your help I would not have been able to deliver the research report that is here today. In addition, I would like to express my greatest gratitude to the supervision I have received from Prof. Dr. Pieter Leroy of the Radboud University. Thank you for your patience, your knowledge and all the helpful feedback and support when I needed it.

And last but not least, I would like to express my great gratitude to the people I have met in Bilbao; Ziyad, Michel, Alena, Tanja and Marloes. I would like to thank you guys all for your great companionship, in getting to know the Basque country and in particular your good sense of humour which made me smile every day.

As a last word of gratefulness, I would like to thank my family and friends who have supported me back home and helped me through the scarce moments of homesickness. In particular, I want to thank Dylan van Dijk for his feedback and brainstorm sessions on our research topics. You have made my hours spent in the university library a lot more fun.

Lies Huitema,

June 2018, Nijmegen.

Executive summary

Even if we are able to stabilize our CO₂ emissions very soon, climate change's effects will last for many years. As a response to climate change's effects, adaptation receives significantly more attention lately. An adaptation measure aims to reduce the vulnerability of natural and human systems and increase their resilience to actual or expected climatic effects. This research focusses especially on adaptation measures implemented in areas that are most affected by, and most vulnerable to climate change; cities. There is one important problem with the implementation of climate change adaptation measures in cities. Namely, little evidence exists on what makes adaptation measures effective and efficient in their process, output and outcomes. Where there is a high level of scientific consensus on how to measure the effectiveness of mitigation policies, there is a huge lack of certainty on how to measure the efficiency and effectiveness of adaptation measures. As a result, city's policy-makers can't get a better understanding of what the exact ingredients are for successful, effective and efficient adaptation measures. This absence of knowledge could eventually lead to a situation in which maladaptive measures are implemented in cities, making the climatic situation even worse. For this reason, climate scientists unanimously agree that finding an instrument able to measure adaptation is eminently demanding research.

This research investigates the use of the instrument of a monitoring, evaluating and reporting framework (MER) for measuring what makes adaptation measures successful. Although executing MER tasks is a common and known practice for most policy-makers on which already a lot of research has been done, the development and use of MER explicitly applied for measuring adaptation, is a new and young academic field within climate change science. This research has identified five criteria that are important to meet as a city when developing the framework for adaptation. Nevertheless, a city can never accomplish all these criteria since each criterion is related to its own set of MER choices, indicators, evaluation methods etc. For this reason, every city should decide attentively which criterion/a has their priority to accomplish before starting the MER process. Subsequently, a city should think of its 'system of interest' including the city's adaptation context, main adaptation objectives and the link between the climate change issue at stake and the response of their designed adaptation measure. As a last step, a city should identify its potential financial, organizational, scientific or social challenges when developing and performing MER for adaptation. The better a city is aware of its potential challenges, the better a city is prepared to overcome them in the process of MER.

When starting with the set-up of the monitoring system for adaptation, one should develop four different sorts of indicators, used to assess the (1) process, (2) input, (3) output and (4) outcomes of the adaptation measure. Monitoring of adaptation should be defined as the systematic collection of adaptation measure's data in order to track the progress of the adaptation measure. Ideally monitoring lasts from the measure's design phase till its output and outcomes are visible. Moreover, an adaptation evaluation entails the objective and systematic assessment of the adaptation measure's effectiveness and efficiency, using the monitoring results generated earlier. Lastly, a city should perform the task of reporting by communicating with its selected public on the adaptation measure's monitoring results and processed evaluations in the form of a written formal report.

This research has further analysed the instrument of MER by applying it to the case of Bilbao, Spain. The main research question of this research has been:

‘What are Bilbao’s main opportunities, pitfalls and recommendations when developing a MER framework for measuring adaptation practices, ideally used in the city’s future adaptation strategy?’

The research strategy chosen for answering this main research’s question has been a deductive qualitative research approach, conducted from out a constructivism perspective. Complementary to this strategy, there is chosen for a triangulation of data analysis methods, knowing; documentation analysis, semi-structured interviewing and the conduction of open-participative observations

Before answering this main research’s question, different sub-questions have been analysed and answered first. One sub-question entailed the review of the early-adapter cities of Copenhagen and Rotterdam and their main opportunities and challenges recognized in the process of developing and performing MER for adaptation. From this review, two important lessons for Bilbao have been extracted describing (1) how monitoring indicators for assessing adaptation results should be developed and (2) how a MER-like approach for adaptation in a city should be initiated. Besides both cities have made clear that, defining the adaptation objectives and developing the best set of monitoring indicators and evaluation methods to measure them is for most cities an under-estimated challenge. Additionally, both cities emphasized the urgency of anchoring MER budgets, resources and responsibilities on the long-term in order to safeguard the successful execution of a city’s MER process. The second sub-question entailed the analysis of the City Council’s experience with the tasks of MER, Bilbao’s expected climate change effects and Bilbao’s current climate change practices and ambitions. In particular, this question aimed to answer how the combination of these aspects would support a thorough execution of the proposed MER framework and process.

Based on the recommendations derived from the reviews and the results of the second sub-question, the research has proposed a MER framework for Bilbao, ideally to be included in the city’s future adaptation strategy. The proposed framework features characteristics of a deliberative system and assigns special responsibilities to the Adaptation Committee and the Mayor’s Office. As the last sub-question entailed the testing of the proposed MER process on Bilbao’s first adaptation measure of the opening of the Deusto canal, its results helped to answer the main research question.

Regarding Bilbao’s institutional, climatic and historical context, there has been concluded that Bilbao has a sound basis for conducting and starting the MER process for adaptation how it is proposed in the research. Bilbao’s main opportunities for the development of a MER framework are; the City Council’s great amount of experience with MER tasks, the high level of adaptation mainstreaming within City Council policies and strategies, Bilbao’s signed environmental agreements and climate change commitments and last but not least, Bilbao’s threatening climate change scenarios. Further on, Bilbao’s main pitfalls are; the fact that Bilbao has no signed and binding ‘contract’ for working on adaptation and developing a MER framework in Bilbao, the lack of experience with developing adaptation indicators, evaluation & reporting methods and with the initiation of a double-loop learning process within adaptation and last, the ‘newness’ of the adaptation committee.

Likewise, the main recommendations for Bilbao when developing and using a MER framework for adaptation are; to use the MER framework and process proposed within this research, to educate the Committee’s participants in monitoring according to the principles of MER, including process-, input-, output and outcome-indicators, to strive for a double-loop learning process within adaptation, to promote that Bilbao’s adaptation reports are shared on the international platform and to discuss with the Adaptation Committee and the Mayor’s Office the existence of the Committee on the long-term.

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1. Introduction

1.1 Research context

Our climate is inevitably changing. Even though, nation-wide, we are increasingly committed to mitigation efforts. The already built-up stock of CO₂ in the atmosphere is so large that in the next hundred years, a further warming of our planet cannot be avoided (IPCC, 2014; RESIN, 2015). Adaptation to the changing climate is therefore necessary in any case. Nevertheless, although climate change effects are felt everywhere, they differ locally in their intensity (WRR, 2006).

For example, housing more than 50% of the world's population and creating more than 80% of the global GDP, cities are by far most vulnerable to the risks of climate change (Solecki et al., 2011; GlobalCitiesReport, 2014; IPCC, 2014). From the number of people living in urban areas, the largest share of this number is settled in the even more vulnerable coastal/delta-cities areas (United Nations, n.d.; VanderHeijden, 2014). Driven by the interplay of urbanization and climate change processes, cities are now emerging as a leading force for climate change adaptation. This results in the fact that, developing and implementing adaptation measures that help to diminish citizens' climate vulnerability and make cities more climate resilient¹, is increasingly becoming a common practice for city councils to work on (Araos et al. 2016).

The attention adaptation receives next to mitigation is largely created by climate change discussions held on international levels. For instance, conferences like the UNFCCC (United Nations Framework Convention on Climate Change) are essential instruments for enhancing the adaptation processes initiated within cities worldwide. Explicitly, the Paris Agreement signed in 2015 underlined the importance of developing adaptation initiatives and taking action on different policy-making levels as the disastrous effects of climate change are becoming progressively visible in many countries and cities (EEA, 2017). However, the Paris Agreement was legally binding for mitigation and not for adaptation, still the agreement enhances nowadays non-state actors (e.g. city governments) to reach the ambitions stated on adaptation in the Agreement (UNFCCC, 2015).

The main necessity for cities to work on adaptation is derived from research showing that: well planned and early implementation of adaptation measures saves money and lives for later when predicted climate change scenarios are realized (European Commission, 2017). Adaptation to climate change can be defined as: 'The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities' (IPCC, 2001, WGII). Invented adjustments are often described in an adaptation strategy to be developed at all levels of administration; the local, regional, national, EU and also the international level (Van de Sandt et al., 2013; European Commission, 2017). Nevertheless, little evidence exists on what makes the adaptation measures developed within these strategies successful and effective in their process, output and outcomes (Naswa et al., 2015). This lack of knowledge has several negative consequences on the governmental, economic, ecological and societal level. One main economic consequence of not knowing how to measure the effects of the implemented adaptation measures is

¹ Resilience is here defined as; 'the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions' (UNISDR, 2010, p. 13).

that it will remain unclear if the money and resources appointed for adaptation are used in its best way (Bours, McGinn, and Pringle 2014). Even more important, without this measurement it is impossible to draw any conclusion on the potential increase of adaptive capacity of citizens and increased level of climate resilience of the city's landscape (Dinshaw et al., 2014). Not knowing what makes adaptation successful and how it can be measured makes cities unable to attribute positive nor negative effects to the implemented adaptation measures. This absence of knowledge also causes that cities are in a minimal way exchanging 'good' and 'bad' adaptation practices with other cities on international (adaptation) platforms. All these aspects substantiate the hypothesis that most cities do not know how to measure what works in adaptation and what the ingredients are for successful, effective and efficient adaptation.

City's governments and climate scientists agree that finding an instrument, able to measure the effectiveness and efficiency of adaptation measures implemented in an urban environment, plays a critical role in the evolvement and improvement of adaptation practices over time (Climate Adapt, 2017; Vanderheijden, 2014). As a response to this demand, lately scientists and policy makers have been busy finding an instrument able to measure what is, and what makes adaptation successful (Pringle, 2014). As a result of this investigation, different kind of approaches of a 'Monitoring, Evaluating and Reporting framework' (MER) applied to adaptation practices have been developed. Maybe as one knows, monitoring, evaluating and reporting are well-known and frequently used instruments by policy-makers in all kind of practical fields. For example, the development of monitoring indicators is a common and highly-valued practice, in particular in the environmental policy-making field. For example, the European Environment Agency has created its own package of environmental indicators named the 'EEA's Indicator Management System' covering 22 different environmental topics for which it serves matching indicators (EEA, 2017). Also the tasks of evaluation and reporting are routine practices for policy-makers as they are often obligatory tasks demanded by the money lending institutes.

It should be clear that the individual tasks of MER are all part of existing fields of knowledge and practice, which should not be put aside during this research. Nevertheless, the development and use of a MER framework, explicitly applied for the measurement of adaptation measures, is something new and rare for scientists and policy-makers. Therefore, the *problem analysis* of this research can be described by the fact that there is no well-functioning MER framework especially developed for measuring adaptation yet.

This master thesis research pursues to analyse the purposes, principles and challenges of developing a MER framework used to measure the successfulness of adaptation practices implemented in cities. To see how the theoretical instrument of MER can be used in practice for the city landscape, the city Bilbao is selected as the main case study. As Bilbao has just started its adaptation process, the city has no adaptation data nor experience to develop a reliable MER framework on. For this reason, this research should be treated as an ex-ante evaluation of what Bilbao's main opportunities and pitfalls are when developing and performing a MER framework applied to its future adaptation strategy.

1.2 Research objective

The main objective of this research is to contribute to the currently modest body of academic as well as practical knowledge available on the development of a MER framework functioning for cities implementing adaptation measures. The research objective reads:

*‘Identifying the main set of criteria for developing a Monitoring, Evaluating and Reporting framework (MER) for adaptation measures implemented within cities **and** making an ex-ante evaluation of what Bilbao’s main opportunities and pitfalls are in this MER development process’*

1.3 Research question

For the formulation of the main research question a distinction should be made between descriptive and explanatory research questions. The descriptive question can be best described as a ‘what’ question, seeking to describe situations and/or patterns of behaviour and practices. An explanatory research question tries to answer a ‘why’ question (Farthing, 2016). Within this research there is a descriptive research question established, following:

‘What are Bilbao’s main opportunities, pitfalls and recommendations when developing a MER framework for measuring adaptation practices, ideally used in the city’s future adaptation strategy?’

To answer this main research question, some sub-questions have been formulated that will be answered throughout the research analysis. These questions are:

1. What lessons can Bilbao extract from the opportunities and challenges recognized with using MER for adaptation in the early-adaptor cities of Copenhagen and Rotterdam?
2. How could Bilbao’s environmental-policymaking history and current climate change practices support a thorough execution of the proposed MER framework and process?
3. How does the MER process in practice work for the test case on Bilbao’s first adaptation measure of the opening of the Deusto canal and what can the city learn from this test?

1.4 Societal and scientific relevance

The scientific relevance

The scientific relevance of the research can be found in answering a question that has not been yet answered earlier or been answered in a satisfactorily manner (Farthing, 2016). The scientific relevance of this research can be found in the investigation results whether the MER framework is the most compatible instrument for assessing the successfulness of adaptation measures implemented. Secondly, the scientific relevance of this research is that it adds in knowledge to the current scarce amount of available knowledge on developing a MER framework used for measuring adaptation practices. With the addition of scientific knowledge on how to develop a MER framework for adaptation, other cities gain as well the potential to make their adaptation strategies ideally stronger, its implementation process smoother, and its outcomes more effective. Hopefully this will also stimulate other cities to share their future adaptation reports on international adaptation platforms, thus increasing the ability to learn from each other and simultaneously make each other’s adaptation measures more effective and efficient.

The societal relevance

This research has a great societal effect helping cities and its citizens worldwide becoming better protected and less vulnerable to climate change its disastrous effects. Likewise, with the sharing of knowledge on how to develop an instrument able to measure the successfulness of adaptation measures, cities increase their potential of becoming fully climate adaptive and resilient.

It is assumed that this research's will be of extra societal relevance for policy-makers working on adaptation. As policy-makers would like to know how well their designed adaptation strategy is doing and what is missing in the current strategy, they gain the potential to show the effectiveness of their designed and implemented adaptation measures to their public using the MER framework. When good adaptation results are reported to the public, citizens' trust will assumingly increase as they feel that their authority is protecting them sufficiently against the threatening effects of climate change.

The local relevance

As an increased level of climate resilience in Bilbao ensures that the citizens can stay living and moving in its low-lying areas where infrastructure and housing is situated, the research is regarded as highly local relevant for Bilbao. Besides, the local relevance of this research is reflected in the fact that Bilbao's citizens have the right and urge to know how well their living hood is adjusted to the impacts of climate change. This right also applies when there are still climate change risks that are not sufficiently covered by adaptation measures yet and thus make citizens and their belongings remain vulnerable. With the knowledge produced within this thesis on how to develop a MER report, Bilbao can establish this communication on remaining and solved climate change risks with its public.

1.5 Thesis outline

This master thesis research is divided in chapters presenting the different steps of the research that are necessary for answering the main research question as presented in chapter 1. The following chapter 2 presents and elaborates on the theoretical framework, containing the different theoretical interpretations, perceptions and principles existing within academic literature on the methodological instrument of MER applied to adaptation. Chapter 3 provides an extensive description of the research's methodology. Chapter 4 contains the review of two early-adapting cities, Copenhagen and Rotterdam, reviewed for their MER performance executed during their adaptation process. The recommendations derived from this review are used as a basis of the analysis of the Bilbao Case. Chapter 5 is dedicated to the analysis of the Bilbao case, describing the city's previous experience on tackling climate change issues and its current experience with the execution of MER tasks. As a follow-up, chapter 6 consists of an in-depth analysis of the Bilbao's potential opportunities and pitfalls when developing a MER framework. In chapter 7 the identified opportunities and pitfalls are validated by applying them to Bilbao's first adaptation measure of the Opening of the Deusto Canal. The research's results, conclusions and recommendations for further research are presented in the final chapter 8.

2 Theoretical framework

2.1 Adaptation and MER defined as moving targets

Before the theory behind the instrument of MER can be introduced, the concepts of adaptation and MER demand extra clarification. Although scientists unanimously agree and accept the definition of adaptation constituted by the IPCC in 2001 (WGII). Adaptation is discussed, perceived and tackled in different ways by various countries and local governments. This difference is mainly caused by the fact that people perceive the wicked problem² of climate change differently. In some countries, climate change is rarely discussed and not perceived as a severe danger while other countries perceive it as policy-making priority since climate change's effects increasingly occur in their country (Heimann & Mahlkow, 2012). Besides, it is not a rule that every country/local government working on adaptation, also focusses on the same adaptation topics. The adaptation topic that a country/local government pays attention to depends on the political, geographical and economical context of the country and city (Levin et al., 2007). For example, where adaptation for the Netherlands mainly means, adapting to flooding risks and high water issues by implementing dikes and Delta Works (Van Twist et al., 2013). For a country like Spain it means more often; adapting to increasing desertification's processes and urban heat stress (Reil et al., 2016). Seen this interpretative difference, adaptation should be seen as a social construct. Besides being a social construct, adaptation can be classified as an 'moving target'. A moving target can be described as an object of which the solution's strategies continuously change since the societal and physical context in which the object moves, also continuously changes (Wittrock & De Leon, 1986, p. 3). The only solution to these moving target's conditions is to treat the object dynamically. As climate change knowledge evolves heavily through time, so must the national and local strategies developed to cope with the issue of adaptation (Heimann & Mahlkow, 2012).

As people's ideas on adaptation are subject to change, thus are the instruments used in adaptation (IPCC, 2014). For this reason, the instrument of MER analysed in this research, used to assess adaptation results, should be treated as a moving target as well. This classification means that, one should acknowledge that ideas on MER for adaptation will change through time. Therefore, theories based on this instrument should not be treated as the eternal truth but as dynamically evolving theories (Van den Berg & Feinstein, 2009).

2.2 Introduction to the framework of MER

The theoretical foundation of this study consists of an elaboration on the methodological instrument of a Monitoring, Evaluation and Reporting framework (MER). This methodological instrument is used in a significant amount and variety of scientific and societal fields. For example the use of the MER framework is very popular in fields like ecology/biodiversity (Davies et al., 2009), land-use planning (Theobald & Hobbs 2002) and development studies (United Nations Development Programme, 2009). It must be noted that the interest in using a MER framework is not only coming from researchers, who would like to increase their knowledge on what is successful in policy-making, but also from policy-makers and managers who have significant shared interest in assessing the results, successfulness and

² A wicked problem is here defined as: problems that lack simplistic or straightforward planning responses (Rittel & Webber, 1971).

the overall utility of an intervention that is made (Valadez & Bamberger, 1994). For a policy-maker, the three tasks of MER are favourable to perform in every new research project, management strategy or policy-making direction. In general, all new decisions/regulations/policies implemented in an organization or governmental institute demand assessment of their effectiveness and efficiency. By the results of the MER tasks, there can be determined how the situation has improved during time and thus, how successful the intervention has been eventually. Nevertheless, to what extent, and for what budget the individual MER tasks are performed differs in every policy-making context (Van de Sandt et al., 2013). In the case of funded projects, it can be assumed that a MER-like framework will always be used. Funding always requires that there is communicated on the accountability of the money and that there is reported how much, and for what the funding money is used (Galarraga, 2017). Another option is that the execution of MER tasks is voluntarily demanded and legalized. In these situations, information on efficiency and effectiveness of the implemented interventions is vital for the organization or (governmental) institute.

2.2.1 The MER framework applied to adaptation

As monitoring, evaluating and reporting of adaptation is relatively a new field within climate change science, there is no scientific nor political consensus yet on how 'successful' adaptation can and should be measured (Christiansen et al., 2016). Although there has not been much literature developed on MER for adaptation, policy-makers do have the urge to objectify the effectiveness and efficiency of their adaptation strategies developed. As most countries have so far concentrated their efforts on creating adaptation strategies, frameworks of MER -able to assess the results of these strategies- are in most cases not created by these countries (Hedger et al., 2008).

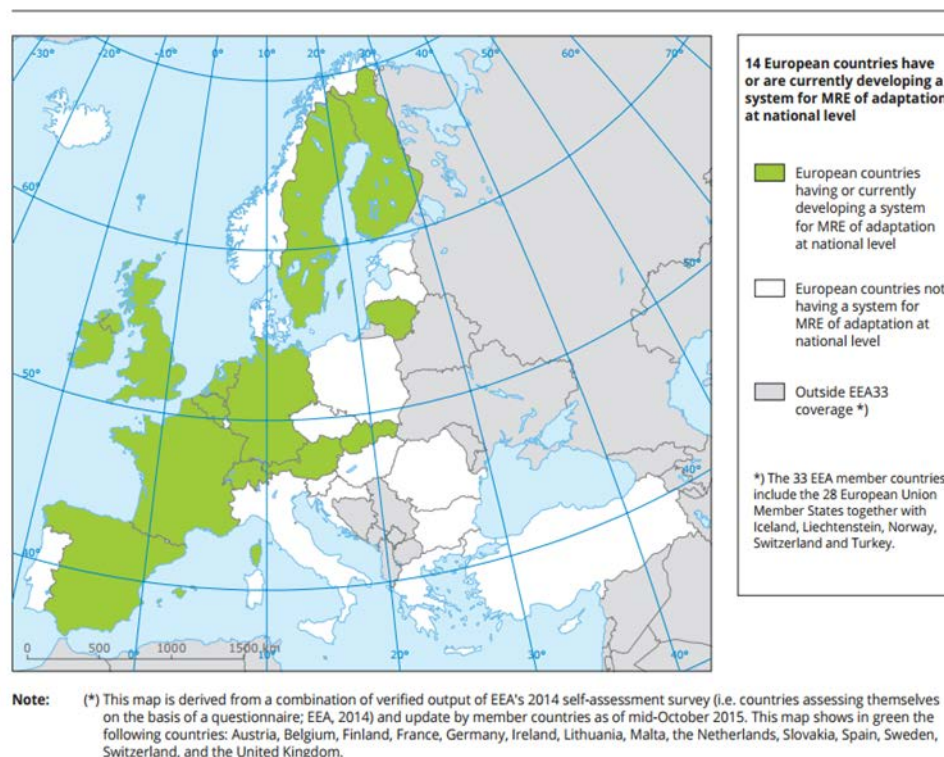


Figure 1: Map visualizing the European Countries that are mid-October 2015 developing a system of MER (here called MRE) at national level for measuring their adaptation results. Source: EEA, 2015.

Nevertheless, an increasing number of countries are now making progress in developing and implementing their own tailor-made MER framework in order to measure the successfulness of their climate change adaptation actions (EEA 2015, 10). Examples of countries that have already adopted MER-like approaches within their national adaptation strategy are; Finland, UK, Germany and France (Klostermann et al., 2015). The European Environmental Agency (EEA, 2015) created a map which visualizes the European countries that stated to be progressing in developing a MER framework for measuring the results of their adaptation actions (see figure 1). The EEA derived these results from a self-assessment survey executed among all European countries in 2014. The green marked countries in the map are in the most early phase of thinking about the development of a certain MER framework, but some of them (note: the earlier named countries of Finland, UK, Germany and France) are in a more progressed stadium of developing their MER framework.

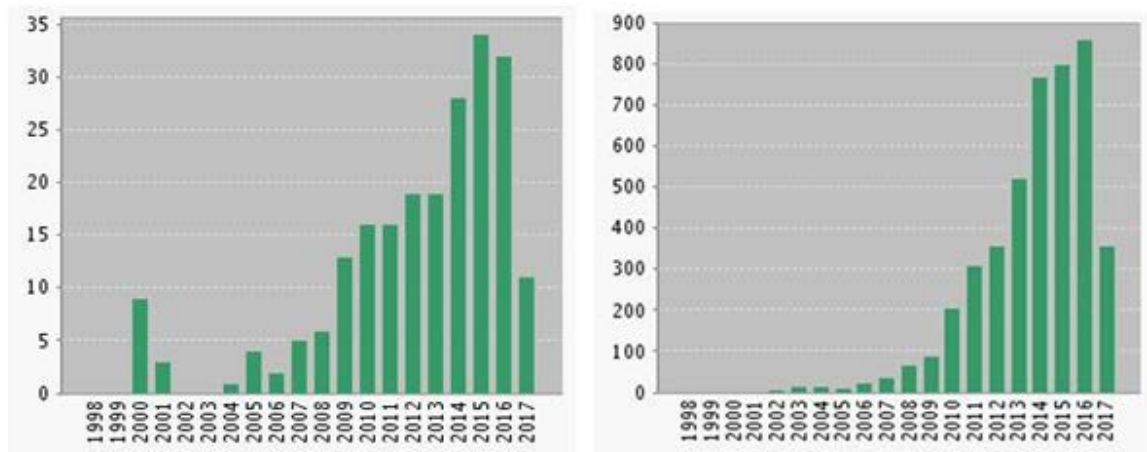


Figure 2: Item left: Published items in every year. Item right: Citations in every year. Source: Thomsom and Reuters Web of Knowledge database. Search criteria applied: Title= (Climate AND Adapt). Topic= (Monitor). Derived on June 14, 2017.

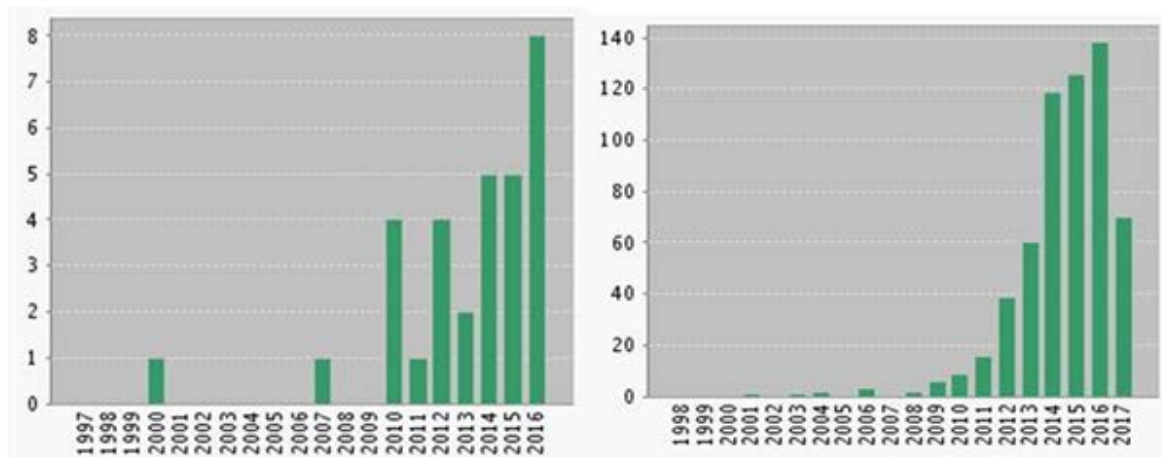


Figure 3: Item left: Published items in every year. Item right: Citations in every year. Source: Thomsom and Reuters Web of Knowledge database. Search criteria applied: Title= (Climate and Adapt). Topic= (Monitor) AND (City OR Cities OR Urban OR Municipal). Derived on June 14, 2017.

In 2014, sixteen papers were published on the instrument of MER applied to adaptation practices (Turner et al., 2014). These publications range from, consisting information of what the tasks of MER basically entail, till descriptions and developments of MER tools, instruments and frameworks. It should be noted that these papers are not only describing adaptation practices implemented within cities, but also adaptation measures implemented within eco-systems and small communities. There has also been searched in the Web of Knowledge, better known as *Web of Science*, for MER papers

published on adaptation practices. There has been searched by the criteria of 'Climate' and 'Adapt' together with the topic of 'Monitor'. Figure 2 shows that, with these terms, the first paper publications were in 2000. In 2016 the number of publications is still very low with 32 paper publications. Applying the extra criteria of 'Cities' in Web of Science provides us with the scarce result of the first paper publication in 2000, and by the year 2016, a total number of 8 paper publications (figure 3). These results visualize that MER for adaptation, especially applied to cities, is a very young and new academic field.

Before there can be continued with the description of the different MER tasks and their individual aspects and instruments, it is important to make one more notion. Within the climate change debate the question often raises why the results of adaptation measures can't be measured in the same way as mitigation efforts. The only right answer to this question is that, in terms of mitigation, the scientific knowledge of how to do monitoring and evaluation is far more advanced and characterized by a high level of agreement (Turner et al., 2014). Within mitigation there is a high level of scientific consensus on the use of quantified indicators measuring the reduction of carbon dioxide gasses emitted (CO₂) in order to measure the effectiveness of the implemented mitigation policy/action. While there is a high level of scientific consensus on the use of these standardized indicators, there is a huge lack of consensus and uncertainty on how to monitor and evaluate adaptation measures (Van de Sandt et al., 2013).

2.3 Defining the concepts of monitoring, evaluating and reporting

The instrument of MER means: monitoring, evaluating and reporting. Although these three concepts are closely interconnected since they complement each other in use. They are also dissimilar from each other in their characteristics and main objective.

Monitoring:

'Monitoring refers to the systematic collection of data during an (adaptation) project to track the progress of adaptation measures and make adjustments to the implementation where necessary' (Lamhauge, Lanzi, & Agrawala, 2011)

Monitoring of adaptation should be described as the continuous process of measuring with indicators the progress of an adaptation measure. From its design phase, till the measure its outcomes and results are visible (Turner et al., 2014). Besides, monitoring can be used to measure the changes in context, surroundings and physical/social environment that has arisen during the adaptation measure's process. To make sure that these changes are tracked as best as possible, monitoring starts in the most early-moment of the adaptation process. For example, ideally one should start monitoring from the moment when the design and location of the adaptation measure is still in discussion. It is important to note that there is no specified moment when one stops monitoring the adaptation measure. Instead, it is recommended that monitoring of adaptation proceeds after the adaptation measure has been implemented, as long as possible. Especially since one wants to monitor if the measure has fulfilled its adaptation objectives and remains in its effects (Naswa et al., 2015).

Monitoring makes use of three different sorts of indicators, used to assess the process (1), output (2) and outcomes (3) of the adaptation measure under implementation (Klostermann et al., 2013). First, a process indicator refers to the organizational conditions and resource management of the

adaptation measure. Secondly, an output indicator refers to what has been implemented in terms of material. And the third and last indicator, the outcome indicator, refers to the level of accomplishment of the pre-set measure's adaptation objectives. For example, if the adaptation measure has reduced the vulnerability and has made the area more climate resilient.

The monitoring data is subsequently processed into statistical models. Often presented in a map, table or a clear schedule, presenting what has changed from the moment of intervention till now. When these monitoring results are processed into evaluations, one can decide if the adaptation measure needs to be adjusted in order to make it more effective and efficient in its process, output and outcomes.

Evaluating:

Back in 1991, an environmental policy evaluation often consisted of a 'goal-achievement' description. Nowadays, the task of evaluating has been evolved into ex-ante, mid-term and ex-post evaluations (Mickwitz, 2003). An adaptation evaluation entails; the objective and systematic assessment of the effectiveness and efficiency of a climate change adaptation measure (Villanueva, 2009). Evaluation is distinctive from monitoring due to the fact that an evaluation is undertaken at a defined moment in the adaptation process. Besides, it uses not only quantitative but also qualitative data to draw conclusions (Turner et al., 2014). There are in fact three types of adaptation evaluations; (1) ex-ante evaluations, (2) mid-term evaluations and (3) ex-post evaluations (EEA, 2015, p. 17). Where an 'ex-ante evaluation' or 'mid-term evaluation' is carried out to identify ways of improving the measure's effectiveness and efficiency, an 'ex-post evaluation' is used to create an estimation on the overall successfulness of the adaptation measure or strategy. In most cases it is fruitful to undertake not only an *ex-post* evaluation but also implement an evaluation moment earlier in the process. (EEA 2015, p. 17)

Reporting:

Reporting is the process of communicating the adaptation measure's monitoring results and processed evaluations in the form of a written formal report (Global Reporting Initiative, 2015). These reports have the main purpose of sharing, with the selected public, all the relevant information regarding the process, output and outcomes of the implemented adaptation measure(s) (Turner et al., 2014). Most of the time these reports provide an overview of where the city 'stands' within its adaptation process (Houwen, 2017).

The publication of reports can be done on two levels; local and internationally (Global Reporting Initiative, 2015). The local level entails that the adaptation report is shared with a city's citizens and internally between its different governmental levels. The international level entails that the adaptation report is shared externally with other countries and or city governments, for example on an international adaptation platform like Climate-ADAPT or C40.

2.4 Main criteria for developing a MER framework for adaptation

Within this research context, a monitoring, evaluating and reporting (MER) framework is used to track the process of, and assess the outputs and outcomes of climate change adaptation measures (Turner et al., 2014). The relevance of developing and using a MER framework for adaptation is recognized by different scientific and city government's reports addressing adaptation strategies and adaptation measures. These reports all emphasize the need and urgency of developing a MER framework when

working on adaptation planning as a city of country. Scientists state that it should not be an option for a city to skip the task of developing and executing a MER when working on adaptation planning (Araos et al., 2016). Instead, they recommend to make the development and execution of MER an obligatory task within the policy-making cycle of adaptation planning. Their argumentation is based on one overall acknowledged reason, following:

‘Monitoring, evaluating and reporting allows one (a city) to assess how well the adaptation measure has contributed effectively and efficiently to the reduction of climate vulnerability and has increased the level of climate resilience in the area of implementation’ (Turner et al., 2014).

As identified in literature, there are five criteria that are important to meet when developing a MER framework for adaptation in order to fulfil MER its purpose. In this paragraph, these criteria are clearly described and explained. This description is carried out by two main reasons: (1) to provide more insight in the different purposes of developing and performing a MER framework for adaptation and (2) to get a better understanding of the processes necessary to initiate when developing a MER framework for adaptation on city-level.

There must be mentioned that these five criteria entail requirements that can be different regarding the content of the tasks of monitoring, evaluating and reporting. Nevertheless, there must be emphasized that it should not be a city’s purpose to fulfil all the criteria from the beginning of the MER process. Instead, selecting one MER criterion as the main starting focus is recommended for cities.

1. Assessing effectiveness and efficiency of the adaptation measure implemented

Assessing the effectiveness and efficiency of implemented adaptation measures is regarded as the most important criterion when developing a MER framework for adaptation (Van de Sandt et al., 2013). This criterion entails that the MER framework is mainly developed to discover whether or not the adaptation measure has achieved effective and efficiently the results and outcomes it originally intended (Pringle, 2011). The intended outcome of an adaptation measure can be described as the ‘objectives’ of the adaptation measure. Effectivity means in this definition; knowing that the adaptation objectives have been fulfilled (Villanueva, 2010). For example, the adaptation measure has increased the adaptive capacity of an area similar to its objective. Efficiency tells something about, whether the adaptation objectives are achieved in an efficient manner. The efficiency of an adaptation measure can be determined making a cost-benefit analysis of the implemented measures or by qualitative measuring the ‘smoothness’ of the implementation process (Pringle, 2011).

2. Communicating on adaptation experiences

This criterion entails that a city develops and uses MER with the main aim to enhance the communication/exchange of adaptation knowledge with other countries/cities. By this exchange of knowledge, stakeholders can help each other globally, to accomplish successful adaptation planning (Klostermann et al., 2013). Since adaptation planning is relatively a new policy-making field, it is important to share all the knowledge there is within cities, on *what* works in adaptation planning and *what* one should try to avoid (Villanueva, 2010). Besides, MER reports can demonstrate countries, that are not yet familiar with adaptation planning, why it is necessary and advantageous to work on adaptation planning. Policy-makers and politicians like to have this kind of evidence of policy-making success before they are willing to spend money and time in a new field (Christiansen et al., 2016).

Without having knowledge of foreign lessons on adaptation, a city or country might increase the chance of making costly mistakes and having unintended outcomes like *maladaptation* (Arts, 2014).

Another reason to emphasize the establishment of good communication within adaptation planning can be found in the context of international climate negotiations, like the ones organized by the UNFCCC. For the existence of these conferences, it is of great importance that countries are communicating on their adaptation progress and identified adaptation barriers. By the informing of the international area, cities and governments mutually inspire each other to raise adaptation ambitions and goals (Pringle, 2011). Last but not least, communicating on adaptation experiences is regarded essential as it is the most important instrument for increasing climate change awareness among citizens and involved stakeholders.

3. Providing accountability of the resources used for adaptation

A MER framework should be developed in a way that it provides perfect accountability of the resources used during the adaptation process. In particular, when public-tax money is used for implementing adaptation measures in a city, providing accountability of this money used is indispensable. In general, in many policy-making field applies that, in order to estimate if intended commitments are meeting the final outcomes and results, there is a contractual requirement to undertake MER-like practices. (Pringle, 2011).

Predictions indicate that in the coming decades the most marginalised groups of our society, will be the greatest victims of climate change induced events (Van der Heijden, 2014). Due to this growing concern, in the Paris Agreement (UNFCCC, 2015), many countries have indicated that they would like to see an increased focus on designing and implementing adaptation strategies and adaptation measures in the most vulnerable areas. Also, several supportive Adaptation Funds have been created the last couple of years to allocate money to countries that are in the most desperately need of adapting to climate change (Christiansen et al., 2016). One example of such a well-known fund is the 'Green Climate Fund' created in 2010. Seen these decisions, the flow of money between donators and recipient countries is expected to increase the coming years (Van de Sandt et al., 2013). To make sure that the allocation of resources and budgets is established as fair and effective as possible, it is important to ensure accountability (Araos et al., 2016). In addition, when accountability is provided, a high level of transparency is also ensured. Ensuring transparency is in particular essential when adaptation is set up in a participatory manner, meaning that different stakeholders are involved and share interest and responsibility (Dinshaw et al., 2014).

4. Facilitating a double-loop learning process for adaptation

The MER framework should facilitate a learning and iterative adaptation process. In an iterative process, choices and decisions of the adaptation process are constantly evaluated and allow adjustments and improvements to be made during the adaptation process. The establishment of such a dynamic working process makes the adaptation process eventually more effective and efficient.

The pursuing of an iterative learning process can be linked to the single- and double loop learning' theory of Argyris and Schön (1974). When pursuing a *single-loop learning process*, one aims to accomplish as many adaptation objectives by the implementation of adaptation measures. During the implementation process, there is checked in the end, one single time, which measures still need to be implemented to accomplish the final objectives. When pursuing a *double loop learning process*,

one is open to change its adaptation perspective and behavioural attitude during the adaptation process. Where necessary, pre-set adaptation objectives are adjusted or replaced by a new better fitting objective. When 'double' checking for mistakes and flaws within the adaptation process, knowledge is generated that helps the adaptation process becoming less costly, time-consuming and risky and instead more efficient and effective (Van de Sandt et al., 2013).

5. Ensuring climate justice within adaptation

Last but not least, the MER framework should ensure a certain level of climate justice. Climate justice reflects on the uneven distribution of consequences of climate change experienced by people in different parts of the world (Robinson, 2011). Not only the consequences can be unevenly distributed spatially, they can also impact communities and individuals internally different (Shi et al., 2016). When one would like to avoid the aggravation of this issue, ensuring climate justice should be an important goal when implementing adaptation measures (Pringle, 2011). One way to ensure climate justice is by developing a MER that entails special monitoring indicators. These indicators should address the measurement of climate (in)justice adaptation outcomes. From these monitoring results, one can evaluate and report whether the adaptation measure has targeted the 'right' people and spread its positive effects equivalent in its area of implementation.

2.5 Important thoughts before developing a MER framework

It is important to be aware of a few aspects and questions one should think about and take into account before creating a MER framework for adaptation. These three aspects and questions are:

1. *When should MER take place within the adaptation policy making process?*
2. *Think about the 'system of interest'. What are the adaptation objectives that you want to measure of the measures you are implementing?*
3. *What challenges can I expect in the tasks of monitoring, evaluating and reporting?*

2.5.1 The place of MER within the adaptation policy-making process

Within the literature of MER, different ideas emerge on where MER best fits within the adaptation policy-making process. Although all agree on the fact that MER should be incorporated as a critical step in the adaptation policy-making process, not all adaptation strategies place the step of MER in the same order (Pringle, 2011). To see these differences, there are two different policy-making cycles of adaptation included in this section to make the different conceptions clear. The first policy-making cycle on adaptation is the 'European Adaptation Support Tool' (2013), published in the 'European Commission's Guidance for National Adaptation Strategies (figure 4). In this adaptation support tool, the step of monitoring and evaluation is included as the final task (step 6). Before reaching this last step, a long process is preceded of assessing risks and vulnerabilities of climate change (step 2), identifying and assessing fitting adaptation options (step 3 and 4) and implementing the selected adaptation measures (step 5). When cities and municipalities have almost finished their adaptation process, step number 6 states that it is time to perform MER. Unfortunately it happens a lot that cities are not prepared for this last step of MER and haven't considered -in an earlier stage of the adaption process- the methods and resources they need in order to perform a good-working monitoring, evaluating and reporting process in the end (EEA, 2015). When cities are non-prepared for these tasks,

Figure 4: European Adaptation Support Tool. Source: European Commission's Guidance for National Adaptation Strategies, 2013.

there is a big chance that the MER tasks will not be performed in an efficient and effective manner (Christiansen et al., 2016). For this reason, this adaptation tool raises a lot of questions whether this order of steps makes up a good adaptation tool to be used by cities that work on adaptation and like to involve MER. The overall notion of scientists is that this tool is too 'simplistic' and lacks the dynamic to tackle the complex aspects of the adaptation process (Turner et al., 2014).

The other policy-making cycle of adaptation planning that is analysed is retrieved from the report of Turner et al. (2014). Although at first sight, the model seems quite similar to the 'European adaptation support tool', there are significant differences between them. As the other tool considers the *now* occurring climate change risks, the model from Turner distinguishes the current and future climate risks. Besides, the model of Turner includes the task of monitoring, reviewing and evaluating and draws a feedback loop from this task towards the steps of assessing current and future climate risks. This feedback loop shows that the model pursues a double-loop learning process within adaptation planning. Due to the inclusion of the feedback loop within this tool, most of the scientists are in favour of this last policy-making tool (Van de Sandt et al., 2013).

Figure 5: The policy-making cycle of adaptation (Turner et al. 2014, 8)

2.5.2 Define the system of interest, what are the objectives you want to measure?

After having considered the place MER takes within the policy-making cycle of adaptation, there will be focussed on the question which adaptation objectives one would like to monitor, evaluate and report on. Although the measurement of all priori stated adaptation objectives would make up a complete assessment of the successfulness of the measure, it is not very realistic and necessary to do

this as a city. Nevertheless , figuring out what is necessary to measure is a quite complex and difficult process.

Defining the ‘*system of interest*’ of the adaptation measure can function as solution to this problem. The system of interest is a tool to structure, simplify and make clear what adaptation objectives are realistic and necessary to be monitored, and what not (Van de Sandt et al., 2013). It should be noted that the defined system of interest can vary, depending on the stakeholder that is responsible for defining the system’s aspects. For example, a system of interest filled in by a policy-maker can differ from when a climate scientist or participative citizen defines it. Being aware of the stakeholder’s perception that influences the definition of the system of interest, one should carefully think of which stakeholder/party is appointed responsible for the definition of the system of interest of the adaptation measure(s) that is/are in case.

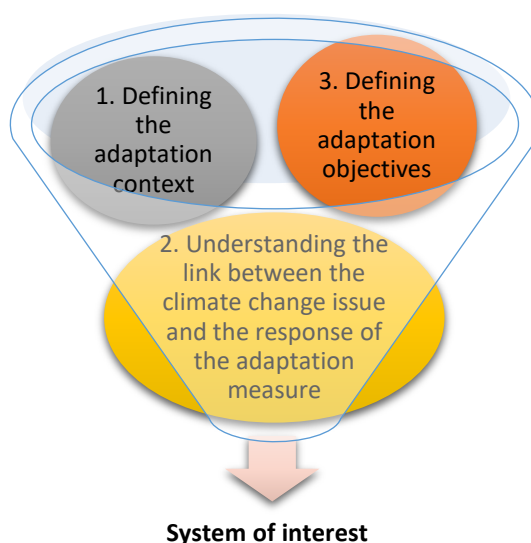


Figure 6: The system of interest of an adaptation measure. Source: Adapted from Van de Sandt et al., 2013

The system of interest is composed of three elements: (1) the adaptation context, (2) the link between the climate change issue and the measure and (3) the adaptation objectives of the measure. These element -in combination with each other- are important to identify when composing a MER framework. These three elements are individually discussed in the following sub-sections of this paragraph.

1. Defining the adaptation context

The concept ‘adaptation context’ is derived of Van de Sandt et al. (2013) stating that:

‘The adaptation context can be seen as a combination of the physical situation, the social-economic conditions, the adaptation objectives and the involved sectors and actors’
(Van de Sandt et al., 2013, p. 14)

MER can never be a ‘one size fits all’ approach for adaptation measures but needs to be developed according to the context specifics of the adaptation measures themselves (Pringle, 2011). The best way to define the adaptation context is to make an overview of the social, economic, physical and institutional factors influencing the measure being implemented. Also relevant temporal and spatial scales and the broader context in which the measure is implemented should be identified and

regarded as important influencers. With the broader context, one should think of *interdisciplinary projects* and *cross-sectoral dependencies* that are/were of influence in the implementation process of the adaptation measure (Van Minnen et al., 2015).

2. Understanding the link between the climate change issue and the response of the adaptation measure

This element is structuring the linkage between the climate change issue at stake and the designed adaptation measure its response. This link is important to analyse so the MER framework can eventually draw conclusions on the effectiveness of solving the climate change problem at stake. For analysing this linkage, the interactions between the current climate situation and the designed adaptation measure. A helpful tool for framing this interaction is the DPSIR framework. This framework sets out the **drivers, pressures, state, impact and responses** of a climate change issue (Kristensen, 2004). In here, response is the adaptation measure designed to solve the climate issue at stake.

3. Defining the adaptation objectives
























The adaptation objectives of the measure(s) being implemented should be as clearly determined and defined as possible. With 'objectives' are meant 'the aspirations and desired outcomes associated with the measure(s)' (Van de Sandt et al., 2013). Two types of objectives should be distinguished; (1) objectives that have the purpose to build adaptive capacity and (2) objectives that aim to deliver practical climate change solutions (Pringle, 2011). With building adaptive capacity is meant; increasing the area's ability to respond to climate changes and to initiate responses to these climate changes (Fenech et al., 2005). Practical adaptation measures are defined as; measures that directly reduce climate vulnerability and risks in the area, but diminish in their effect in the long term (EEA, 2015).

2.6 What are the known challenges in developing and performing a MER

The literature on MER emphasizes that there are a different challenges to be aware and concerned of, when developing and performing a MER framework for adaptation. In contrast of what may be thought by policy-makers and politicians, it is not per se a bad thing that these challenges exist. Instead of trying to avoid the occurrence of certain challenges, MER challenges should be carefully interpreted and used. Only in this way, we can improve our understanding on how we can best adapt to climate change impacts by designing effective and efficient adaptation measures (EEA, 2015).

Table 1 is manually created, giving a clear overview of the challenges that have been identified in the process of developing and performing a MER. For the creation of this table, six important MER reports are collected and analysed for stating MER challenges. Further on, there will be conclusions drawn on the challenges that overlap and the ones that are different in the reports.

Table 1: Overview of the MER challenges found in academic literature. Source: Own work, information derived from the six different MER reports stated in the table.

(Van de Sandt et al., 2013, p. 11)	(Turner et al., 2014, p. 21)	(Dinshaw et al., 2014, p. 10)	(Christiansen et al., 2016, p. 5)	(Arts, 2014, p. 39)	(EEA, 2015)
1. Long timescales	 1. Dealing with different timescales	 1. Assessing effectiveness of long-term adaptation initiatives within short-term evaluation cycles	1. Dealing with different timeframes	 1. Dealing with different timeframes	 1. Dealing with long timeframes
2. Shifting adaptation goals during time	 2. Measuring the impact of an adaptation intervention to a shifting baseline	 2. Difficult to set adaptation baselines and targets within MER	 2. Defining specific baselines	 2. Changing goals and targets over time	 2. Shifting adaptation baselines
3. Attribution of effects to adaptation initiatives	 3. Hard to identify the success of the measure, relying on proxy measures	 3. Attribution of effects of adaptation initiatives	 3. The problem of attributing outcomes to adaptation initiatives	 3. The problem of attributing effects	 3. Attributing outcomes to specific policy actions
4. Need of multiple metrics for multi-sectoral adaptation initiatives	 4. Lack of concrete MER and adaptation definitions, challenging to agree on one		 4. Lack of standard 'best practice' MER methodology and general available indicators and adaptation metrics	 4. Need of different metric systems to monitor context-specific adaptation initiatives	 4. Lack of universal, transparent objective monitoring indicators
5. How to better integrate MER horizontally and vertically in different policy sectors	5. Avoiding maladaptation. Being aware of negative externalities/trade-offs of the implemented adaptation initiative			 5. Integrating MER within different policy sectors and across jurisdictional levels	 5. Diversity of key concepts and definitions
6. How to involve non-state actors with less adaptation capacity	 6. Dealing with climate, social and political uncertainty				 6. Dealing with inevitable adaptation uncertainties
	 7. Diversity in adaptation scales and institutional contexts				7. Availability of suitable data sets necessary for monitoring
					8. Resource constraints

Conclusions derived from the table

In table 1, the challenges that are overlapping because of similar content are marked in the same colour. Only a few challenges are not marked in a colour since they are only stated in one report. For this reason, one can conclude that the reports agree to a large extent in their perception of the most important challenges, potentially occurring in the process of MER.

The challenge of *dealing with different timescales/timeframes* is in all documents described as the most important challenge. This challenge is based on the fact that, as adaptation's effects visualizes only over a long time, it is a complex task for policy-makers to measure these long-term effects. In particular, as it is common for policy-makers to use short-term evaluations right after a measure has been implemented. The challenge of *setting adaptation baselines* is also stated multiple times. This methodological challenge refers to the complexness of finding the right 'baseline' to compare the situation of the area with, when the adaptation measure has been implemented. Another challenge, this time stated in all MER reports, is *attributing outcomes to adaptation initiatives*. Although some reports are referring to the word 'effects' instead of outcomes, we assume that they mean the same. This challenge refers to the complex issue of distinguishing effects initiated by the adaptation measure itself, and the ones initiated by external factors.

One important observation is that the challenge of *avoiding maladaptation* is only mentioned by the report of Turner et al. (2014). This can be worrying as many scientists have discovered that, when maladaptation occurs, the effectiveness and outcomes of adaptation actions is greatly reduced. Instead of increasing climate resilience, maladaptation can adversely increase the vulnerability of systems, social groups and sectors (Juhola et al., 2015). For this reason, when developing and executing MER on adaptation as a policy-maker, it is very much important to recognize the avoidance of maladaptation as an important challenge. As only one report mentioned this challenge, there can be concluded that concept of 'maladaptation' is alarming underexposed within the literature on MER.

What one must learn from this overview of identified challenges is that, the potential occurring challenges are not of the same nature. Some challenges are significant of scientific nature, like; dealing with the uncertainty of climate change scenarios, the lack of monitoring data sets and changing MER definitions. These challenges can be overcome when adaptation knowledge grows and develops itself during time. Nevertheless, the other challenges are of the category methodological and institutional/political challenges. For example, the challenge of finding the right metric systems for every adaptation context, developing objective monitoring indicators and setting adaptation baselines, are all methodological challenges. Solving these methodological issues cost time and a lot of experience. Nevertheless, there is a high probability that these issues will be ultimately solved when expertise on MER for adaptation increases. On the contrary, institutional/political MER challenges are more substantial in nature and less easy to overcome. For example, the challenges of integrating MER within different policy-making sectors (horizontally, vertically), involving non-state stakeholders and coping with resource constraints due to political uncertainty. The only way to work on them is by recognizing that these challenges occur due to the way politics are organized in the city. When a city is committed to work on developing and executing a MER for their adaptation strategy, leadership should be taken to analyse the organizational MER problems that are at stake in order to find a suitable response to them.

2.7 The processes of monitoring, evaluating and reporting

In the previous chapters the main criteria, thoughts and identified challenges of performing a MER for adaptation are discussed. This chapter describes in more detail on how the three tasks of monitoring, evaluating and reporting are organized and set-up separately in their processes. Besides, a subject that finds common ground in all three tasks of MER; stakeholder engagement, will be discussed first.

2.7.1 Stakeholder engagement within MER

‘Stakeholders need to be involved in the monitoring process; from the design of the monitoring program, selection of indicators, data collection, interpretation of the results and follow up’ (Van de Sandt et al. 2013, p. 12).

This quote from the report of Van de Sandt et al. (2013) describes the role stakeholders have in the multiple stages of the process of developing and implementing a MER framework. In here, the term ‘stakeholder’ is considered as a broad term, referring to all parties that ‘are affected by or affect adaptation policies’ (EEA, 2015, p. 34). Potential involved stakeholders in monitoring, evaluating and reporting on adaptation measures could be governmental parties as well as non-governmental parties, on the local level as well as on the national or sub-national level. To give an example of stakeholders that should be considered for involving them in the process of developing and implementing a MER framework in adaptation planning, table 2 is created.

Stakeholder parties	Examples of stakeholders
Public sector	The city mayor Ministries of the City Council
Private sector	Industry companies Water companies Energy sector Finance sector Data providers Consultancy
Interest groups and NGO’s	Environmental NGOs Hospitals Neighbourhood associations
Scientists	Universities Scientific institutes
General public	Inhabitants World media International climate debate platforms

Table 2: Overview of the possible MER stakeholders. Source: Adjusted from (EEA, 2015, p. 35)

Regarding to table 2, it must be mentioned that for every kind of city, type of adaptation strategy and adaptation context, the number of stakeholders involved within MER is different. When many stakeholders are engaged in the decision-making process of designing monitoring indicators, stakeholder engagement will require a significant amount of effort and time (Van de Sandt et al., 2013). In order to create a participatory adaptation process, making use of the best expertise available, a variety of stakeholder parties should be engaged in the decision-making process of developing the MER framework (French Environment & Energy Management Agency, 2011). When stakeholders are selected to be engaged in the MER process, one must question whether this group of stakeholders is inherent to another group of stakeholders that also asks for engagement.

One should define the stakeholder groups that are responsible for performing the separate tasks of monitoring, evaluation and reporting (De Pryck et al., 2014). Besides, it is regarded helpful by some cities working on adaptation to appoint one stakeholder (group) responsible for the supervision of the whole monitoring, evaluation and reporting process. For both cases, it is recommended to select a stakeholder with previous experience in monitoring, evaluating and reporting of other projects/processes. For example a city council department or private organization (Arts, 2014).

2.7.2 The process of monitoring

Developing and selecting the right monitoring indicators is crucial for establishing an efficient and effective monitoring process. Having the right monitoring indicators is also crucial for performing the next steps of evaluating the adaptation measure's process, output and outcomes and writing an informative report. As every adaptation measure is embedded in its own system of interest, multiple monitoring indicators should be developed for a city's adaptation strategy (Van de Sandt et al., 2013). However, as adaptation measures respond to multiple sorts of climate risks and are implemented across different policy sectors, it is impossible to develop a set of indicators that concerns all context-specific factors and measure perfectly all the attributed adaptation objectives. Seen this limitation, the main aim of monitoring should be for a city, to develop a set of monitoring indicators that measures the accomplishment of the most critical and urgent adaptation objectives.

The literature on MER distinguishes three types of monitoring indicators to track and assess the results of adaptation measures; (1) process-based indicators, (2) output-based indicators and (3) outcome-based indicators (Harley et al., 2008). It is likely that a combination of process-based, output-based and outcome-based indicators is needed to monitor the total level of successfulness of the implemented adaptation measures (Klostermann et al., 2015).

1. Process-based indicators

Process-based indicators are developed to measure the efficiency the process of adaptation measure(s), from the design phase till the implementation has been finalized (Klostermann et al., 2015). Process-based indicators can also be developed to measure the *mainstreaming* of climate change adaptation practices within other policy-making fields.

2. Output-based indicators

Output-based indicators are used to monitor the 'state' of the area right after the implementation of the adaptation measure has been realized. There is basically measured if all involved stakeholders have kept word and have implemented what they have said they would (Klostermann et al., 2015). For this reason, an output indicator aims to measure the products, capital goods and services that result from the implementation of an adaptation measure (Van de Sandt et al., 2013).

3. Outcome-based indicators

Outcome-based indicators aim to measure the effectiveness of the adaptation measure, referring to its adaptation objective (Harley et al. 2008). For example, an outcome indicator could measure the reduction of flood risks and vulnerability and the increased level of adaptive capacity of people, institutions and governance structures (Turner et al., 2014; Klostermann et al., 2015).

One important advantage of process-based indicators is that, its use engages very well with establishing a 'double-loop learning' approach within adaptation. The monitoring results of process-based indicators can be used to feed-back into the adaptation process and thereby, adjust the aspects that are identified to be holding back the adaptation process (Arts, 2014). Hence, measuring and upgrading the adaptation process does not guarantee that the adaptation measure becomes in it outcome always more successful (Turner et al., 2014). Outcome-based indicators have the advantage to be very specific on every adaptation objective. They create the potential to be prescriptive of what goals have been reached, they are in neither way allowing flexibility in changing the adaptation process during time. Analysing these advantages and disadvantages of both indicators, there can be concluded that it is wisely to make use of all three indicators when developing a MER framework.

There are also other methods to distinguish monitoring indicators. One of these methods are to distinct indicators on their working sector like transport, building or infrastructure (RESIN, 2017). Another way is to distinguish indicators on basis of being 'quantitative' or 'qualitative' (Bours et al., 2014). Other MER literature, working with the process, output and outcome distinction, sometimes distinguish the 'input' indicator as an extra indicator. This indicator is used to measure what has been invested in terms of resources, time, money for the implementation of the adaptation measure (Jacob & Blake, 2010).

This thesis will not further elaborate on what these indicators must look like and what they should include in their formulation. First, such a description would be too extensive, including a lot of technical details, prescriptions about linkages and sector specific information. Second, is that there is already a lot written about developing monitoring indicators which makes it less necessary to tip the topic again. Examples of these kind of reports are the Guidance note of (Bours et al., 2014), the Universal Metrics report of (Stadelmann et al., 2011) and the ten criteria of a good adaptation indicator developed by Naswa et al (2015, p. 18, 19) that is also included in Appendix B.

Textbox 1: Developing standardized monitoring indicators?

There is a continued discussion on the question, if it is possible to develop a standardized set of adaptation monitoring indicators, universal and objective whether in their application (Bours et al., 2014; Jacob & Blake, 2010). The Adaptation Community (2014) suggests to disregard any repository of indicators as prescriptive of what indicators for adaptation must entail and look like. Rather, in the opinion of the Adaptation Community, adaptation indicators of other cities/reports must be regarded as illustrations of how indicators can be developed in their own country-specific and decision-making context. Nevertheless, the opinion that there can be, and must be some standardized set of adaptation indicators developed is also substantiated by some. The Green Climate Fund (2016) and the project of RESIN (2017) are both busy developing an index of universal standardized adaptation indicators. The Green Climate Fund is developing this set to be used by developing countries receiving climate funding. RESIN is exploring the feasibility of developing a set of standardized adaptation indicators to be used by any city in the world working on adaptation. RESIN is exploring this feasibility by creating an indicator tool, to be filled in with context specific information, resulting in the right monitoring indicator for the right adaptation situation. In order to create this tool, RESIN is developing a database of potential indicators, applied and related to a specific adaptation context (González, 2017). For this project RESIN is working together with The Standardisation Institute of the Netherlands (NEN).

2.7.3 The process of evaluation

Making an evaluation is the second task within the process of MER for adaptation. There are different approaches for evaluating adaptation between one should choose. These multiple approaches have arisen since there are different understandings of what makes adaptation effective and efficient (Biesbroek et al., 2013). Besides, what entails a good evaluation is also very subjective and personal for every adaptation implementing organization (Villanueva, 2010).

In general, stakeholders might not like to evaluate the adaptation actions that have appeared to be less successful from the beginning. Nevertheless, it is very helpful to evaluate on all adaptation actions and decisions made during the whole adaptation process, by all involved stakeholders (Mickwitz, 2013). Only when knowledge is derived from a complete and honest evaluation, a double-loop learning process can be established (Van de Sandt et al., 2013). Traditionally, policy-makers often choose for a 'cost-benefit' analysis as the main evaluation approach. The range of potential evaluation methods for the topic of adaptation is much wider. For example, the paper of (Villanueva, 2010) describes four different approaches within adaptation evaluation methods. The evaluations are split by their focus on either 'effectiveness' or 'efficiency'. Under effectiveness, the paper distinguishes (1) process-based, (2) input-output-outcome or (3) behavioural change evaluations. Under efficiency, the paper describes only the economic evaluation. This economic evaluation is most similar to a traditional cost-benefit analysis. This method assesses the benefits of the adaptation measure by terms of avoided economic loss (Villanueva, 2010).

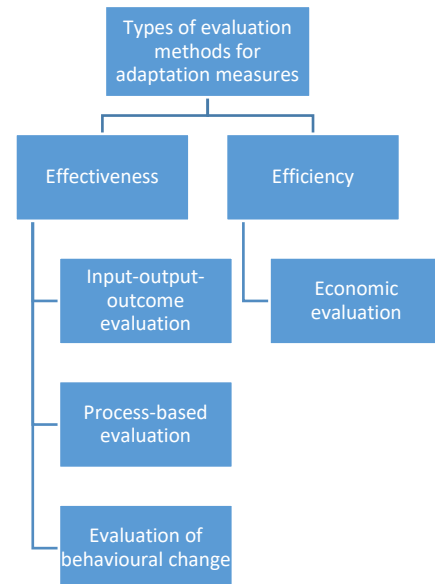


Figure 7: Different methods of evaluating adaptation measures. Adjusted by researcher from: Villanueva, 2010

The paper of Villanueva recommends to perform more than one sort of evaluation. These approaches are non-mutually exclusive and can be combined in any given MER process to assess a full comprehensive picture of the adaptation measure's results.

2.7.4 The process of reporting

When monitoring results are assessed and the evaluation is carried out, the last task left within MER is that of communicating the adaptation measure's results with the public (Global Reporting Initiative, 2015). This method of communication is called reporting within MER. With reporting, a city informs the public on the pitfalls and/or opportunities it has recognized during the adaptation process (Pringle, 2011). It is important to note that it depends on the country or city regulation whether the task of reporting is a legal requirement or a voluntary task to execute. In some countries reporting becomes a legal requirement due to the specific governmental context of a city. Another option is that reporting is demanded by a supranational organization that funds the specific adaptation project (EEA, 2015).

Since the task of reporting seems easier on paper than it is in practice, the main principles for cities reporting on their adaptation measures are described.

1. Think about the purpose of your report and the targeted audience

Reporting should not only be about disseminating evaluation conclusions. Ideally a report reflects on the whole adaptation process, in all its positive and negative aspects (Pringle, 2011). Besides reflecting on the whole adaptation process in the report one must define what the exact purpose is of the information that is shared with the report (Global Reporting Initiative, 2015). Is it to learn the audience more about adaptation? Is it to communicate how policy-making goals are accomplished and funding is allocated and used? The selected purpose of the report is thereafter linked to the audience that is targeted with the written reports. The adaptation results need to be understood easily by the intended target group and must be of high relevance to them (EEA, 2015).

2. Think about how to bring your message

When reporting one must consider a varying level of adaptation knowledge available with the targeted groups. For every targeted group there is reported to, the information should be readable and understandable (Galarraga, 2017). Besides, it is a great challenge when a city wants to provide a 'headline' message without over-simplifying the details of the report and losing contextual information required for understanding (Galarraga, 2017). As scientists or policymakers are not explicitly trained in writing reports and having the best communication techniques, it can create extra value to involve a communication expert in the process of reporting (EEA).

3. Think about the moment and frequency of reporting

The moment and frequency of reporting is something that needs to be very-well thought through in order to make the reporting as effective and efficient as possible (Turner et al., 2014). Sometimes it seems logical to report when the implementation phase of the adaptation measures has been finalized although it can also be wise to publish reports during the implementation process. The ideal frequency of reporting is depending on two factors. One factor is, is the amount of existent resources to report frequently (time, information and competent people for writing etc.). Another factor is the attitude and perception of the targeted audience towards the adaptation process. When there seems to be a tension and feeling of dissatisfaction on this process coming from your audience, it can be wise to report more frequently in order to reassure them.

4. Communication that goes both ways

'Communication and informing goes both-ways' (Global Reporting Initiative, 2015). This quote describes that there is not only information flowing from the reporter to the recipient. Instead, there is also (unwanted) information send back to the reporter including feedback and remarks on the information (Pringle, 2011). Although policy-makers are in tradition not always used to designing a mechanism for gathering feedback, it is a must to organize such a system in order to develop successful adaptation measures.

2.8 Remarks on the theoretical framework

When talking about MER functioning for adaptation, one must be aware of the contradiction in knowledge that is available on this subject. Where the research field of MER applied to adaptation on

city-level is very young, the execution of MER tasks in general is nothing new for (environmental) policy-makers and city councils. On the contrary, these tasks are routine and often obligatory when developing and implementing policy. The question is therefore, if cities can advantage from this grounded experience when developing a MER approach for adaptation.

The theoretical framework has addressed and described various aspects of the instrument of MER, used for measuring adaptation practices in cities. For a few of these aspects applies that they might bring up questions for cities working on the topic. One example are the different criteria for developing MER for adaptation, brought up by adaptation literature. As these criteria are complying with different set-ups of MER in terms of indicators, evaluation methods etc., one can expect that adaptation stakeholders will get easily confused on the question which criterion of MER should get priority. For example, as the criterion of *double-loop learning* coherent with a different set-up of monitoring indicators as the criterion of *assuring accountability*. The question arises how often a city accomplishes to meet more than one criterion.

The second aspect that must receive attention are the questions a city must think of when developing MER for adaptation. Two questions raise for this description. First, how willing will an adapting city be to develop and fill in the *system of interest* including all its three components for the adaptation measure that is in case? The assumption is that as cities want to perform any policy-making task as efficient as possible, making a full-detail description of (to be) implemented measures' system of interest is not cities' main interest. Especially when adaptation measures are in a hurry to be implemented as time passes. The second question raises for feasibility of cities to deal with the MER challenges as identified in adaptation literature. Although it is highly recommended that cities do their homework of informing themselves on the MER challenges that might occur during their adaptation process. There is no assurance that cities will monitor their own 'political climate' to know what the chance is that they need to deal with some of the political/institutional challenges literature poses and don't have solutions for. The last remark considers the MER criterion of achieving a 'double-loop learning' and 'flexible' adaptation process. From a practical perspective, there should be asked what level of flexibility policy-makers can afford themselves within adaptation planning seen the scope of available resources, limited adaptation expertise and a city's political and institutional power.

Overall, there can be concluded that, the thing that seems to be missing in MER literature, is the response to the question of what is exactly *feasible and realistic* to realize within cities, given their policy-making structure and societal context. It is realistic to remark that the complexness of the MER instrument might lead to the situation that some cities question if developing a full MER instrument for adaptation is the most efficient choice. Nevertheless, as the instrument contains numerous of positive aspects, there should be respected and supported that MER for adaptation is still 'under construction'. For this reason, MER must benefit from the different bodies of knowledge that are available now on the criteria of the MER framework and its processes of monitoring, evaluation and reporting. From this point of view, scientists, policy-makers and society must mobilize and re-assemble this current knowledge together in order to lift MER for adaptation to a higher 'practical' city- level.

3 Methodology

This chapter describes the methodology of this research. First, the philosophical assumptions of constructivism that underlie this research will be described, followed by the research design of qualitative research, the choice for a single case research method and last but not least, the data collection methods used. Finally, several comments on the reliability and validity of this research will be given.

3.1 Philosophy of the research; Constructivism

Before to engage in research, one needs to explain its – often silent - philosophical assumptions. The identification of these philosophical assumptions is important as they shape the formulation of the main research question and the way one gathers the information necessary for answering the question at stake (Creswell, 2013). Philosophical assumptions are best to identify by looking at the epistemological framework which the research is embedded in (Farthing, 2016).

Within research, two opposing types of epistemological frameworks can be distinguished; naturalism and constructivism. In an academic context, ‘naturalism’ is also known by names such as ‘positivism’ and ‘empiricism’ (Moses & Knutsen, 2012). Naturalism seeks to find regularities and patterns within nature that are independent of the observer. Naturalist thinkers believe that these patterns can be objectified by employing logic and reason (Moses & Knutsen, 2012, p.7). In general, this epistemological position is more common in the natural sciences, using quantitative research methods, than within social science. Constructivism, can be seen as the opposite of ‘naturalism’ (Horsten et al., 2007). Constructivists see facts as ‘social constructs’ and seek constantly for understanding of the world they live and work in. They study the meaning people attach to objects and phenomena they come across. As these meanings are multiple and various, they lead to a complex variety of meanings given to a certain object, making every object into a social construct (Creswell, 2003). It should be recognized that social constructs are not only formed by imprinted meanings of individuals, but even more through interaction between individuals and through historical and cultural aspects occurring in individuals’ lives (Creswell, 2003).

This research deliberately opts for a ‘social constructivist’ approach. Since there are many ways to understand climate change (scientific, political, etc.), the concept of Climate Change can be considered as a social construct. Mike Hulme describes climate change as a social construct by the following quote:

‘Climate change is not a ‘problem’ waiting for a solution. It is an environmental, cultural and political phenomenon that is reshaping the way we think about ourselves, about our societies and about humanity’s place on earth’ (Hulme, 2009, p. 1).

As climate change can be considered as a social construct, the objects of ‘adaptation’ and ‘MER framework assessing adaptation results’ accordingly can be considered as social constructs as well.

3.2 Research design; qualitative research

The research opts for an in-depth approach instead of a generalized approach (Verschuren & Doorewaard, 2007). The research is focused on gaining in-depth knowledge of a specific situation in the present: 'climate change adaptation practices within cities' and the conduction of a 'MER framework' for assessing adaptation results in Bilbao, Spain. Seen this specified in-depth approach, the researcher's belief is that a qualitative research method is the best fitting method for the execution of this research.

Qualitative research is regarded as considerate and interpretative, trying to understand the meaning people assign to certain things (Vennix, 2006). A qualitative research method suits better with a constructivist approach than quantitative ways of research. Quantitative research aims to quantify opinions, behaviour and underlying reasons of phenomena. In contrast, qualitative research tries to capture the different meanings assigned to a social construct (Verschuren & Doorewaard, 2007). For this reason, the social constructs of 'adaptation' and the process of conducting a 'MER framework' are best to be investigated using qualitative research methods (Denzin et al., 2000).

3.3 Research approach: deductive research

The aim of the research is to find out, by the use of the analytical instrument of a MER framework, how adaptation results can be best assessed in the city Bilbao. As this instrument applied to adaptation is highly valued by climate change experts and little research has been done on the instrument yet, there has been decided to devote more research to this instrument with this master thesis research. For this reason, there is chosen not to establish a new theory in this research. Rather there is chosen for a deductive research approach. Where an inductive approach conducts its own theory, a deductive approach starts from a certain theory or analytical instrument which the research is based and conducted on (Creswell, 2013). The theoretical framework of the research elaborates on the analytical instrument of a MER framework before it is applied on the situation of Bilbao.

3.4 Research method; single case study

Within literature, there are different research methods described for conducting research. The most important ones are; doing surveys, experiments, a case study, founded theoretical research and desk research (Verschuren & Doorewaard, 2007, p. 161). Seen the main goal of this research is gaining in-depth information of the adaptation situation in Bilbao, a case study has been chosen as the main method of research. A case study research can be explained as being concerned with the complexity and particular nature of a specific setting, the case that is in question (Bryman, 2012).

Case studies can be distinguished between single and multiple case study methods. There is chosen for the single case study of Bilbao, for multiple reasons. One important reason for this choice is the fact that the city of Bilbao is included as one out of the four European participative cities in the Horizon 2020 RESIN research project, called 'Resilience Within Cities' (RESIN, 2015). The main purpose of this project is to stimulate Bilbao in its process of delivering an adaptation strategy before the year 2019 (RESIN, 2015). The fact that the city Bilbao is in an early stage of adaptation, makes Bilbao – compared to the other cities - a perfect case for investigating its chances for developing a MER framework functioning for adaptation. Moreover, it is predicted that Bilbao is increasingly threatened by climate change consequences like sea-level rise and extreme weather events in the coming years (Reil et al.,

2016). As climate change issues are becoming harsher every day in Bilbao, this city is the ideal case for conducting this MER research. Finally, the practical aspect of being able to work as a research intern at the 'Basque Centre for Climate Change' in Bilbao for six months gave me the opportunity to conduct this research. This position gave me access to a great network of people with adaptation expertise and local climate change knowledge. It also created the opportunity to investigate the main research question with the best resources at hand and within the ideal circumstances.

3.5 The research strategy; more than a single case study

Although the research method chosen for this research has been described as a single case study, this research goes far beyond the analyzation of this single case study. This research may be distinguished in two phases: the explorative and the elaborative phase. These research phases provide the base and more importantly, the structure of this research. From these two phases, different research chapters have risen. All of this is visualized in figure 8.

The explorative phase

The explorative phase of the research consist of two important research sections. The first is a '*state-of-the-art*' literature review of current MER and urban climate change adaptation. This literature review comprehends previous research findings, academic documents, (non-)governmental papers and reports on MER and adaptation. As a result of this literature review, hopefully a broader understanding is created in the field of the research object (Verschuren & Doorewaard, 2007).

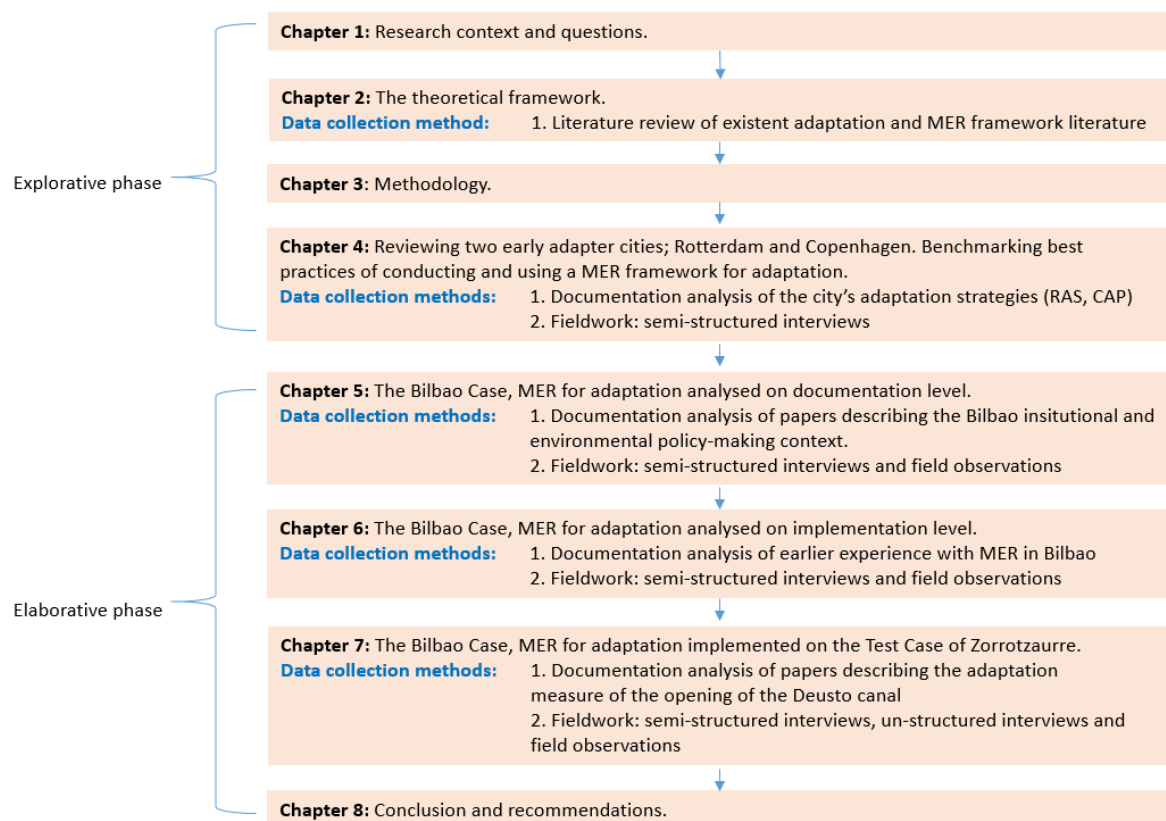


Figure 8: visualization of the research process. Indicates which data collection methods are used in the different phases of the research. Source: Own work.

The second important research section of the explorative phase is the review of two other ‘early-adapter’ cities: Rotterdam and Copenhagen. The reviewing of these two cities has the purpose of *benchmarking* what are the best practices in the field of MER used for adaptation. Benchmarking can be described and understood as an important method utilised to create a ‘point of reference’ with which individual cities’ climate adaptation practices can be compared and assessed (Kuzemko, 2015) (Hoppe, 2013).

To be more specific, the ‘early adapter’ review focuses on the cities’ experiences with the development and use of a MER-like framework for adaptation. Explicit attention will be given to the cities’ good and bad experiences with the framework.

The selection of the cities of Copenhagen and Rotterdam has been based on similarities that can be found between them, in terms of their size, their geography, economy and climate adaptation strategies. Looking at the cities their size, the population number of both cities is almost conform as Copenhagen has 606 057 inhabitants (Statbank, 2017) and Rotterdam counts 634.264 inhabitants (Rotterdam Buurt Monitor, 2017). In comparison, the population of Bilbao consists of 342,481 citizens (Eustat, 2016). From a geographical point of view, both cities are directly situated at the sea and positioned in low-lying areas, making them cope with the same kind of climate change initiated problems like flooding and extreme weather events (Klimaatinfo, 2017). Due to their comparable geographical position, both cities have a flourishing shipping economy. As adapting to climate change issues is a crucial and necessary task when having a shipping economy, the last resemblance can be found in the cities’ creation of an adaptation strategy. Copenhagen delivered its adaptation strategy in 2011 and Rotterdam published its adaptation strategy only two years later, in 2013. The conclusion of the review provides the reader with information on the cities’ good and bad experiences using a MER-like-framework for measuring the successfulness of their adaptation practices.

The elaborative phase

The elaborative phase of the research consists of three important research sections. One research section represents the Bilbao Case, analysed on documentation level. It investigates the institutional and environmental policy making context of Bilbao. In addition, it describes what Bilbao has done with climate change issues till now, and what its current climate change ambitions and efforts are. Working on adaptation practices can be eminently typed as a complex organizational challenge for cities’ governments. This challenge arises from the fact that climate change is also framed as a ‘wicked problem’; an intractable problem for which governance has no clear rational solution (Rittel & Weber, 1973). In order to make the institutions clear that are focused on the tackling of climate change issues in Bilbao, the Bilbao Case visualizes the policy-making structure of the ‘city council of Bilbao’ working on these issues. Within this visualized structure, the departments responsible for implementing the developed climate change adaptation measures within the city, are highlighted. In conclusion, this first section of the Bilbao Case can be seen as the documental foundation representing the ‘starting position’ of Bilbao working on adaptation and conducting a MER framework for assessing its adaptation results.

The Bilbao Case has been analysed on implementation level as well. In this second part of the analysis of the Bilbao Case, Bilbao’s experiences with individual MER tasks, earlier and nowadays, are described. These experiences are found by performing a content analysis of environmental policy-making documents. Based on these experiences, the section provides a pre-evaluation of how a MER

framework for adaptation can be ideally established for Bilbao, and workout in its implementation process.

Subsequently, the last research sections zooms in on a specific part of Bilbao; Zorrotzaurre. The opening of the Deusto Canal, crossing the area of Zorrotzaurre, is representing the first adaptation measure currently being implemented in Bilbao. The MER framework criteria and recommendations drawn in the previous section, will be tested in this section on this first adaptation measure implemented in Zorrotzaurre. The assumption is that, if it works for the case of Zorrotzaurre, there is a high chance that the framework can be used for other adaptation measures implemented in Bilbao.

3.6 Data collection methods; triangulation of methods

Before starting the research, one needs to think about how to extract the required and relevant information from the sources that are selected (Verschuren & Doorewaard, 2007). For the purpose of obtaining the right information about the research object, data collection methods need to be chosen. As the research has a qualitative research approach, qualitative data collection methods are used. By these methods, the various interpretations and beliefs on how a MER framework could be ideally established in Bilbao - for assessing its adaptation results - are tried to be captured through different ways of data collection.

In this section, the triangulation of data collection methods used within the research will be discussed briefly. These methods are; documentation analysis, conducting observations and conducting interviews.

Documentation analysis

The method of analysing documents is regarded as an essential task to be executed within research (Creswell, 2013). This method is used for exploring what has been written on the subject of MER, and in general on adaptation from different perspectives and within different context. It is important to note that there are documents on MER and adaptation of different sorts, depending on their author/organization, the scale they focus on and the perspective they write from (scientific or political). During the documentation analysis, this differentiation has to be taken into account by the researcher.

The data collection method of document analysis is applied in the early-adaptor review where both adaptation strategies of the cities were analysed. For the Bilbao Case and the Test Case of Zorrotzaurre, documentation analysis has as well been used as a primary data collection method. Here, (non-) governmental documents, local policy papers and project informing documents are used as the main source of information.

Conducting observations

Observation is a technique of collecting data that involves (prolonged) engagement of the researcher in a social setting or natural environment (Verschuren & Doorewaard, 2007). One can choose between participative and non-participative observations, depending on the researcher taking part in the situation under study or not (Saunders et al., 2009). Within participatory observation, one should be aware that, the people that are observed, might question and change their behaviour when they know about the presence of a researcher. For this reason, Saunders et al. (2009) makes the difference between being a secret or full participant. The researcher can opt for the 'secret' position when he/she wants to make sure that the observed behaviour is as intuitive and pure as possible. As a last aspect,

observations can be open or closed, depending on the question if there is a structured observation scheme used for observing or not (Bryman, 2012).

Observing is an important data collection method within the elaborative phase of this research. For the Bilbao Case (chapter 6), open participative observations have been made at the policy-making institution of the City Council of Bilbao. There has been observed here how environmental policy-makers were discussing the project of RESIN, concerning the development of an adaptation strategy for Bilbao. Within this situation, others were informed about my status of being a researcher. For this reason, during these observations I was a full participant. Secondly, as a secret participant, open participative observations have been made on the location of Zorrotzaurre for the sake of the Zorrotzaurre Test Case. While walking around in the residential area of Zorrotzaurre, observations have been made of how the residents act in their daily lives living in this risky flood-prone area. In addition, I've attempted to observe the implementation progress of the adaptation measure of the opening of the Deusto Canal as frequent as possible.

Conducting interviews

Within both the explorative and elaborative phase, data has been collected by conducting semi-structured interviews with a select sample of respondents. Semi-structured interviews provide a flexible question guidance that allows the researcher to gain in-depth knowledge about new ideas to be brought up during the interview (Edwards & Holland, 2013). In this research 14 interviews have been conducted. Four of these interviews are done in the scope of the 'early-adapter' review with selected representatives of the adaptation strategy of Copenhagen and Rotterdam. The representatives were asked three main questions: how the city's MER process is structured for adaptation, how its process is organized in its tasks and responsibilities between stakeholders, and, last but not least, what the main recognized opportunities and challenges are within the MER process.

For the Bilbao Case, research respondents have strategically been selected in consultation with the team I interned in, consisting of junior and senior staff members at the Climate Change research institute in Bilbao (BC3). Based on these conversations, five experts in the field of environmental policy making and climate change adaptation (science) have strategically been selected. All five respondents are highly involved with the adaptation process of Bilbao but have a different background. Three of these respondents are working as environmental policy-makers. The other two of the respondents are working in the scientific climate change field. Due to the limited time to conduct this research and the scope of this research, the senior staff members and my supervisor strongly advised not to focus on stakeholders like NGOs, companies, citizen groups etc. Furthermore, they stated that it might be too ambitious to include more than two types of stakeholders, because the adaptation process of Bilbao is still in its start-up phase. This means that stakeholder groups like NGO's and citizens are very likely less involved and concerned with adaptation issues in Bilbao (Olazabal, 2017). For these reasons, these stakeholders will not be included in this research. Nevertheless, it is strongly recommended to involve these stakeholders as interview respondents in further research in the coming years, when the adaptation process and development of MER in Bilbao is more evolved and practically implemented.

For the test case of Zorrotzaurre, respondents have been chosen in both selective and non-selective ways. Based on talks with a scientific expert in the field of adaptation measure implemented in Zorrotzaurre, respondents for the Test Case of Zorrotzaurre have been chosen in a selective way. Furthermore, Citizen Groups and inhabitants of Zorrotzaurre have been chosen in a non-selective way. These respondents have been selected due to an informal meeting during fieldwork in Zorrotzaurre.

The interviews with these non-selected respondents count as exploratory interviews, aiming to capture a 'lay' vision on the Zorrotzaurre adaptation measure. The purpose of creating this lay vision is to capture the inhabitants' feelings and ideas on the adaptation process in Bilbao in general, and more specific, on the implementation of the adaptation measure in their living area. For this reason, the interviews held with these respondents can be best characterized as 'open interviews', aiming to establish a *narrative* character. The data collected with these interviews is used for the description of the society-policy interface of the adaptation measure (Chapter 7.3). The interview guide and list of respondents can be found in Appendix A and B.

3.7 Reliability and validity of the research

Reliability

Reliability is defined as 'the extent to which results are consistent over time and form an accurate representation of the total population under study' (Creswell, 2013). If the same research results could be produced under a similar methodology, the research can be considered as reliable (Verschuren and Doorewaard, 2007). This research pursues that the data collection methods used and the generated data, are clearly tracked, in order to comply with a high level of reliability.

Nevertheless, it should be noted that there are always factors influencing the reliability of the research that could not be avoided. One factor is the language barrier affecting the reliability of the research. The interviews were conducted in English, while the native language of the respondents was Spanish, Danish or Dutch. Therefore, potential wrong expressions and interpretations should be taken into account. Another influencing factor is the context and timeframe in which the research is conducted. Although the research methodology is as clear as possible described, the research will certainly not create the same results in another country over a long time. The generated results in this research are intertwined with the political, social and scientific context of the city Bilbao where the research has been performed. Besides, adaptation needs to be handled as a 'moving target' that is constantly in motion in the policy-making and scientific world. The last factor influencing the reliability of this research is the aspect of 'human judgement'. Qualitative research is always affected by the perception and ideas of the respondents and the researcher itself (Bryman, 2012). For this reason, it is likely that not exactly the same results will be generated when executed by a another researcher and applied to other respondents.

Validity

The validity of the research is explained as the extent to which the researcher is truly measuring the phenomena he/she intended to measure (Golafshani, 2003). There are two types of validity, external and internal validity. A study has a high level of internal validity when all the concepts and instruments used throughout the research are defined in the same way by all respondents, within all cases. Besides, internal validity is about having instruments of measurement that are accurate and point out as good as possible what they are determined to point out (Verschuren & Doorewaard, 2007).

As we know from Hulme (2009), there are multiple interpretations and conceptions of the phenomena 'climate change' and 'adaptation to climate change'. In order to assure a high level internal validity, all respondents have been asked how they define the concepts of adaptation and MER during interviewing. As well within documentation analysis, the similarity of the use of the concept of adaptation and MER is determined. The more methods of data collection methods are used within

research, the more the occurrence of any bias will be avoided (Bryman, 2012). As the research methodology is set-up and executed as a triangulation of methods, containing observation, interviewing and document analysis methods. There has been strived as much as possible for the generation of internally valid research results.

External validity means that the results of research can be generalized to other cases (Creswell, 2013). The determination of the external validity of the research is a complex issue. The results generated with this research are in particular applicable to the Bilbao Case. Nevertheless, they also have the function of being a 'foreign lesson' for other countries dealing with the same issue and working on adaptation. For this reason, the conclusions of this research can be adopted by a larger group than the case under scrutiny.

4 Reviewing two different early-adapter cities

This chapter reviews the feasibility of applying a MER-like approach, for assessing adaptation practices at city-level, on the two cities of Rotterdam and Copenhagen. This review should be seen as an exploration of how MER, or a MER-like approach, is developed and currently used for assessing adaptation results within these two cities.

This review consists of two mini-case research studies. The choice for reviewing Rotterdam and Copenhagen is described in the methodology chapter of this research. This chapter elaborates on the choice to perform documentation analysis and interviews as the main data collection methods for this review. For both mini-cases, interviews have been conducted with two representatives of the adaptation strategies that are published in each city. The following topics were addressed in these interviews: What are the main reasons for performing a MER-like approach according to Rotterdam/Copenhagen (1), What does the process of MER look like for Rotterdam/Copenhagen (2) and what are the main challenges of MER identified in Rotterdam/Copenhagen (3).

With the data extracted from documents and respondents, two goals are set. First, to find out what the main differences are between MER as described in theory versus its use in practice. Second, to find out what lessons Bilbao may draw from this information.

4.1 Review of the early-adapter city Rotterdam

4.1.1 The ‘Rotterdam Adaptatie Strategie’ (RAS)

Located as a low-lying delta city, Rotterdam is heavily confronted with the consequences of climate change. Climate predictions for Rotterdam indicate that the city will be increasingly challenged by more extreme weather conditions, heavier rainstorms, longer periods of drought, intensive heat waves and changing river discharges due to climate change (Rotterdam Climate initiative, 2013) (see figure 11). As a response to the climate change threat, Rotterdam launched its climate change adaptation strategy called ‘De Rotterdamse Adaptatie Strategie (RAS)’ in 2013. This strategy not only focusses on the problems that climate change poses for the city, but also on the benefits and opportunities that it brings along. Besides being a safe and resilient city to climate change, Rotterdam also aims to evolve as an attractive and economically strong port city.



Figure 9: Flooding in the area of the Noordereiland, Rotterdam. Source: RAS, 2013

The main message of RAS entails that the existent robust water protection system should be maintained at its best and should be strengthened by tailor-made climate adaptive measures. RAS has

chosen to gradually create and implement in particular *no-regret*³ adaptation measures in the city. In Rotterdam, these are small-scale adaptation measures with direct benefits and solutions for the most vulnerable areas of the city (Rotterdam Climate initiative 2013, 24). These no-regret adaptation measures are regarded as a method within adaptation to avoid the occurrence of maladaptive practices. RAS also emphasizes the principle of reserving enough time and money to experiment with innovative adaptation measures. Eventually this will help adaptation planners to find out which adaptation measures are successful to implement on a large-scale. Finally, it should be mentioned that Rotterdam aims to export all its generated knowhow on adaptation internationally.

4.1.2 Monitoring, evaluating and reporting described in RAS; documentation analysis

RAS is a set of ambitious plans and principles on adaptation, Rotterdam wants to implement in the years to come. Unfortunately, it lacks the provision of a monitoring, evaluating and reporting approach, necessary to assess its effectiveness. The only MER-like reference in RAS is its mentioning that it is important to monitor and evaluate its adaptation performance. Besides this, the strategy states that the tools for monitoring, evaluating and reporting on adaptation are still under construction and that these will be included as a part of the (still to be developed) implementation of RAS (Rotterdam Climate initiative 2013, 130). There is no announcement, however, when this implementation approach will be released by RAS. The latter is striking, as already seventeen adaptation measures have been implemented in Rotterdam since 2010 (Deltacities, C40, derived 24-07-2017).

4.1.3 Results of the interviews

Although the strategy of RAS envisages to develop a monitoring framework, a set-up of a MER-like framework was not to be found in the strategy, nor in other documents. Informational wise, there can be stated that there is a lack of information on what Rotterdam is exactly doing in the context of MER tasks. By the method of interviewing, data is collected on this topic as well. This sections shows the results of the interviews that have been conducted with the representatives of RAS.

Main reasons for performing a MER-like approach according to RAS

The main reason for Rotterdam to perform monitoring, evaluation and reporting is the purpose of *providing accountability*. This purpose is constituted by the argument; '*When community tax money is being used, you want to know how the money is spent*' (Van der Burgt, 2017). Besides it is essential for Rotterdam to assess the *effectiveness and efficiency* of the adaptation measures implemented (Houwen, 2017). The city would like to know where it stands in the process of becoming a climate-proof city in 2025. Executing MER tasks provide insight on which topics need more attention and which topics are doing well. Especially, when dealing with *uncertain climate scenarios*, the execution of MER tasks is regarded necessary. The last reason for Rotterdam to develop and perform a MER-like approach is to *communicate* with its audience the adaptation measures that are being realized in the city. In here, with the word audience is meant; all stakeholders that are affected by climate change issues in Rotterdam like citizens, businesses, NGO's and the municipal and national government.

³ No regret options are defined as: options that have negative net costs, because they generate direct or indirect benefits that are large enough to offset the costs of implementing the options (IPCC, WorkingGroupIII, n.d.)

Rotterdam also aims to share as many MER reports on an international scale, especially with other cities and countries coping with climate change issues. When sharing its experience, Rotterdam may benefit from potential requests for buying their expertise (Van der Burgt, 2017). Rotterdam has experienced earlier that foreign cities were interested in buying their adaptation expertise, for example on building climate adaptive parking squares, used to store excessive rainfall (Van der Burgt, 2017).

What does the process of MER look like for RAS

Rotterdam has chosen to develop a tailor-made MER-like framework that is able to measure what level of climate resilience the city has accomplished by its implemented adaptation projects (Houwen, 2017). The respondents state that developing a MER-like framework for adaptation is not something that could be done by one person, but asks for cooperation with experts and stakeholders involved within the adaptation process. Rotterdam has started its process of developing indicators by organizing consecutive rounds of discussion in order to hear different opinions on how monitoring should be performed and which adaptation objectives should be prioritized. Policy makers from the municipality of Rotterdam stated that some stakeholders involved in this process find it hard to make time for the quite technical job of developing indicators and are not aware of the urgency of developing these indicators.

From the discussion rounds, five principles have been developed guiding the development of Rotterdam's MER-like approach: 1. The earlier to start organizing MER with stakeholders, the better. 2. The adaptation objectives should be clear and defined before developing monitoring indicators. 3. Monitoring indicators developed should not be too technical and unnecessary complex. 4. A monitoring indicator should be measurable over time and therefore be clearly substantiated in its way of measurement. 5. Research projects necessary for the monitoring of indicators should be connected with research that is already on the agenda for Rotterdam.

The occurrence of any type of negative effect or *maladaptive practice* is not discussed nor monitored in the adaptation strategy of Rotterdam. The representatives of RAS state that they are more than sure that maladaptation will not occur during the implementation of adaptation measures as they are designed with great accuracy (Van der Burgt, 2017). In addition, representatives of RAS stated that they regret not having a priority list of adaptation measures that are implemented and monitored. When they could start over again, this plan would have been made.

Challenges within MER identified in Rotterdam

The RAS representatives we spoke with identified three challenges with MER. First, monitoring can be a really technical and time consuming job for stakeholders to work on. Secondly, implementation and monitoring are directly influenced by the current political situation. In the worst case, the implementation and MER process might get cleared from the agenda or decreases in budget. The third challenge is based on developing indicators that measure at best, whether Rotterdam has genuinely become more adaptive and climate resilient as its adaptation strategy claims.

4.2 Review of the early-adaptor city Copenhagen

4.2.1 The Copenhagen Climate Adaptation Plan (CCAP)

For the investigation of the mini-case of Copenhagen, the adaptation strategy of 'Copenhagen Climate Adaptation Plan' (CCAP) delivered in 2011, is analysed. The CCAP names the most severe climate change challenges Copenhagen is facing. Next, it presents the adaptation solutions identified to be the most effective in keeping Copenhagen a safe and attractive city to live and invest in under the circumstances of increased climate change risks, for now and in the future.

The biggest climate change challenge posed upon Copenhagen is that of increased and intensified precipitation and increased frequency of heavy cloudbursts potentially leading to a frequent overflow of the city's sewage system (see figure 12). The second biggest challenge consists of the risk of an increase of the urban heat island effect in Copenhagen (City of Copenhagen, 2011). The CCAP emphasizes that, although climate change will happen over a long period of time, it definitely makes sense for Copenhagen to start now working



Figure 10: Flooding in Copenhagen. Source: Asla.org, 2016. Derived on 01-08-2017

intensively on the design and implementation of adaptation measures that will build adaptive capacity in the city. In October 2015, Copenhagen launched the 'Climate Change Adaptation and Investment Statement'. This latter report urges for a prioritization in the implementation of the +/- 300 adaptation measures that are designed and proposed in the CCAP. In order to further the implementation phase of CCAP, one made an adaptation implementation framework while a budget estimated what is needed for the implementation of all these adaptation projects. According to the prognosis in CCAP, the projects' implementation may take a period of at least thirty years.

4.2.2 Monitoring, evaluating and reporting described in CCAP; documentation analysis

When searching for the word 'monitoring' in CCAP (2011) and its Investment Statement (2015), references are found in descriptions stating that, aspects like 'ground-water level' and 'the temperature rise in the city' must be monitored before and during the implementation of adaptation measures. Monitoring is also mentioned in the reports when it comes to monitoring new scientific climate change information. Although these are all monitoring tasks, within the reports there is no mentioning of monitoring tasks used in the context of MER. When searching for the mentioning of the tasks of evaluating and reporting in the reports, unfortunately no references could be found. This outcome could mean that there is no MER-like approach developed and integrated in the adaptation strategy of CCAP. In order to validate this statement, interview results need to be analysed.

4.2.3 Results of the interviews

According to the documentation analysis, conclusions seem to be that Copenhagen has no MER-like approach developed at this moment. By using the results of the interviews, Copenhagen's MER-like practices on adaptation are investigated as well.

Main reasons for performing a MER-like approach according to CCAP

Copenhagen is not prioritizing the design of a MER-like framework that is able to measure the effectiveness of the whole adaptation strategy, the CCAP. Instead, the city emphasizes to monitor and evaluate its adaptation measures one by one, right after a measure has been implemented (Lauesen, 2017). In this way, the tasks of monitoring, evaluating and implementing adaptation measures, designed in the context of CCAP, all happen at the same time. The following quote explains this process:

'For example, the academic world would say -now we are in the evaluation phase and now in the monitoring phase-, whereas in the practical world these phases are most of the time intertwined.' (Sanderson, 24-04-2017).

The main reason to monitor and evaluate right after an adaptation measure has been implemented, is to make sure whether Copenhagen is actually gaining resilience towards climate change effects. Another important reason is to prevent maladaptation to occur. Copenhagen is aware of the fact that the implementation of green measures can make the situation worse in some areas when precipitation is hindered to be discharged effectively (Lauesen, 2017). Creating a MER-like framework functioning for the whole adaptation plan will take Copenhagen at least 10 -20 years (Sanderson, 2017). Besides, as the executors of the CCAP might not have the financial resources to implement all of the +/- 300 adaptation measures designed and proposed in the CCAP, it is not effective and efficient to develop a MER-like framework functioning for the whole adaptation strategy. Nevertheless, the representatives of CCAP recognize the value of developing a MER-like framework, functioning for the whole adaptation strategy, in the coming years. According to the representatives, using such a framework would be most effective right after the city has experienced a climate change induced event. They state that the working of adaptation measures can be measured only after experiencing a real climate change event:

'As we have only finished very few adaptation projects, monitoring the whole adaptation strategy is something that is more relevant in 5-20 years from now. Then we have actually experienced them working. For example, when a cloudburst event has hit Copenhagen'. (Bovbjerg, 18-04-2017)

How the process of MER looks like for CCAP

Although there is no MER-like framework developed for the CCAP strategy as a whole, adaptation measures are being monitored and evaluated individually. The monitoring indicators used for these measures are tailor-made and not copied from other frameworks. Most monitoring indicators in Copenhagen are developed to measure rainfall intensity and sewage capacity. Evaluation and reporting tasks are currently not organized nor demanded by the management of CCAP. Some measures are evaluated and reported on, while others are implemented but not evaluated nor reported on. The reports currently delivered aim to show to the city's municipality council (from whom

the CCAP receives budget) the adaptation results obtained. In this way, the municipality can check whether Copenhagen avoids making costly mistakes within adaptation.

Adaptation policy-makers tell that they have identified an urgent lack of climate change awareness among Copenhagen's citizens (Lauesen, 2017). The last time Copenhagen experienced a heavy cloudburst event was in 2011. For this reason, citizens and the city government don't feel a great sense of urgency to work on climate change adaptation measures. This makes it hard for CCAP to implement all the designed adaptation measures and to monitor and evaluate them one by one as their strategy is now. When CCAP will be monitored and evaluated in its full scope in the future, it would be explicitly reported to the city's municipality council and the citizens of Copenhagen to increase climate change awareness among them (Lauesen, 2017).

There are several flaws identified within the management of the CCAP that hinder the process towards effective and efficient monitoring and evaluating in Copenhagen. These flaws are, long-term consultation procedures, shifting executing responsibilities and moving adaptation priorities and budgets (Lauesen, 2017). Representatives state that there is a lack of leadership noticeable which makes it hard to execute all the different tasks belonging to CCAP. This is worrying seen the tasks of MER demand coordination and consultation to execute them at best (Pringle, 2011). Although the existence of these flaws are no exception within policy-making fields, their occurrence is alarming within a relatively 'new' policy-making field like adaptation to climate change.

Challenges within MER identified in Copenhagen

Two important challenges are identified within Copenhagen for the tasks of monitoring and evaluating CCAP. The first challenge is to be found in the bureaucratic flaws occurring within the management of CCAP. These flaws hinder the establishment of an effective and efficient monitoring and evaluating process within Copenhagen. These flaws need to be overcome if Copenhagen wants to realize an effective adaptation process in which adaptation measures results are assessed successfully.

The second challenge is based on raising awareness about climate change among citizens and the local government of Copenhagen. Since it is a long time ago that Copenhagen had to deal with a devastating cloudburst event (July 2011), people have to be reminded time and time again that Copenhagen is being threatened by climate change and a disastrous event can happen soon again. As there is a lack of urgency, it is hard for the executors of CCAP to work on, and prioritize the execution of MER tasks.

4.2 Conclusions derived from the reviews

Theory vs. Practice

In both cities there has been analysed how monitoring indicators are developed and selected for assessing adaptation results. Copenhagen states to have no technical issues in the development of the right monitoring indicators. Although there are flaws occurring within the management of CCAP that hinder the development of the indicators, they argue on the technical side to be doing 'fine'. The indicators developed for CCAP cover mostly the topic of cloudburst management. For this reason, these indicators are quite unambiguously in content. As the adaptation strategy of Rotterdam covers a wide range of topics, Rotterdam experiences more trouble with the development of the best set of indicators. Rotterdam does identify, following the academic literature, barriers like the 'attribution of

effects to adaptation measures’ and ‘uncertainty of climate change effects’ in the development of suitable monitoring indicators. To overcome these barriers, Rotterdam has developed five principles that helps them conducting monitoring tasks at best.

One important difference with the literature on developing adaptation indicators and these two practical experiences is that, neither Copenhagen nor Rotterdam, develops indicators according to the distinction between process, output and outcome-indicators. Instead, both cities are focusing on the measurement of adaptation objectives (outcome), thereby forgetting the monitoring of the implementation process and output.

In addition, there has been analysed how adaptation is addressed in both cities and how a MER-like process is initiated. Just like in other policy-making fields, the adaptation process is in practice not as step-wise as it is described in theory. For both cities holds that steps like design, implementation, monitoring etc. are intertwined. It is striking that Copenhagen does not aspire developing a MER-like approach functioning for the whole adaptation strategy at this moment. In contrast, Rotterdam strives for a small set of indicators that, with the least amount of resources, can say the most about all adaptation objectives developed. Furthermore, practical adaptation challenges identified in these cities, that can’t be found in any academic source, are; the challenge of coping in the MER process with an unstable political agenda and financial budgets (Rotterdam), bureaucratic flaws (Copenhagen) and a lack of climate change awareness (Copenhagen).

An important agreement between theory and practice on the MER process, is the fact that both cities strongly demand coordination and leadership over the execution of monitoring, evaluation and reporting tasks. Both cities indicate that they recommend to anchor beforehand which stakeholder pays what and who is responsible for what MER tasks. Nevertheless, in practice we see that Copenhagen struggles with this coordination and regrets not having leadership functions while Rotterdam delegated responsibilities for all MER tasks.

Recommendations for Bilbao according to the researcher

The information generated from the review above leads to the development of two main recommendations for when Bilbao starts developing and organizing a MER-like approach for adaptation. These recommendations are based on the questions (1) How should monitoring indicators for assessing adaptation results be developed. And (2) How should a MER-like approach for adaptation in a city be initiated.

1. While developing monitoring indicators, it is best to strive for a small set of indicators that has the function to prescribe with the least amount of resources, the most about the adaptation objectives. Besides, it is important to make the monitoring indicators as specific as possible so they are repeatable and understandable for all users. Monitoring is all about knowing what the main adaptation objective is and which indicators can measure this objective’s accomplishment, how and when. The adaptation objectives should form the basis for the development of monitoring indicators. Although, nothing has been shared by the cities on the three functions of indicators; process, output and outcome, it is still recommend to discuss this division as policy-makers. For monitoring it seems best to select one person responsible for developing the monitoring structure and indicators. This person has the leadership role to work and communicate with relevant experts for the development of monitoring indicators

(as Rotterdam is currently doing). Besides, it is recommend for cities to make a priority list of the adaptation measures that are implemented and monitored first.

2. Regarding the way adaptation should be addressed in cities, it is recommend to discuss as early as possible how a MER-like approach should be set-up. Although performing MER for adaptation is a 'new' process for policy-makers, cities should use their experienced institutions and experts to embed and initiate the new MER process. Furthermore, it seems effective and efficient to identify as soon as possible the resources/budget necessary to execute all MER tasks. Subsequently the right persons and departments should be appointed responsible for the execution of the identified MER task. Only in this way the MER process gets structured and organized, which is a necessity for getting stakeholders, policy-makers and politicians dedicated for performing MER. We have learnt from this review also that an unstable political situation influences the process of MER. When MER budgets change and adaptation priorities (potentially) shift, policy-makers are challenged to continue the adaptation process and the execution of MER tasks. Furthermore, Copenhagen shows that a lack of climate change awareness makes working on adaptation and assessing results difficult. Recommend for every city that is hard working on implementing its adaptation strategy, is to secure the adaptation process on a top-down level. Budgets and resources should be anchored on the long-term as far as this is possible, just like responsibilities for the execution of the different adaptation and MER tasks.

5. The Bilbao Case

5.1 Introduction to Bilbao

Bilbao is a medium-sized city situated in the Autonomous Community of the Basque Country in northern Spain. As the capital city of the province of Bizkaia, Bilbao has 342,481 inhabitants and is populated densely with 8438 inhabitants per km² (Eustat, 2016). For the last two decades, Bilbao has to deal with a declining and an aging population. Although the number of people is declining within the city, there is still a high demand for housing space as most people from the metropolitan area wish to live in the city (RESIN, 2015). This expected population growth ensures that Bilbao will expand in its size in the coming years.

Bilbao has an oceanic/Atlantic maritime climate, (Cfb). This climate is typed by precipitation throughout the year and mild summers and winters. Bilbao is part of the so-called, 'green Spain' zone, characterized by a higher amount of rainfall and precipitation days in comparison to the rest of Spain (KLIMA 2050, 2015).

The centre of Bilbao is located only 10 km away from the Atlantic coast. Bilbao is located within the estuary of the tidal river named the Nervión. Since this river is flowing throughout Bilbao's city centre, the city is under high risk of flooding. This flooding risk is enhanced by the fact that Bilbao is built in a low-lying valley, characterized by strong and steep slopes (Scussolini et al. 2013). Within this low-lying valley, due to the proximity of the Atlantic Ocean, sea and valley breezes are developed. These breezes bring strong winds and frequent rains to the city of Bilbao and its surroundings. The city's rain make up an average precipitation of 1195 mm a year. Flooding risks within the city are even more enhanced when frequent and intense rains are combined with a high tide level of the Nervión river (Ramses, 2017).

Bilbao has suffered from several flooding events in the past and in its recent history. The August 1983 flooding event is standing as the worse and most destructive flood Bilbao has ever suffered, taking 37 inhabitants their lives and causing infrastructural damage for €1,2 million (Ibiate et al., 2000). The Nervión river was flooded due to extreme weather conditions combined with high tide, causing the river reaching 6 meters in the old quarter of Bilbao (figure 12).

Flooding risks are increasingly triggered in Bilbao by one other factor: climate change induced by human activity (Mendez, 2014). Climate change increases the current flooding risk in Bilbao. Reports predict that, due to climate change, more dangerous flooding events are likely to happen, now and in



Figure 11: Picture above: Location of Bilbao within Europe. Source: G. Trisca, 2014) Picture below: Bilbao located in the Nervión estuary. Source: Google Maps, 2017.

the future (Reil et al., 2016). Chapter 5.3 will elaborate further on the risks and consequences of climate change for Bilbao.



Figure 12: The flooding event of August 1983, Bilbao. Source: <http://servicios.elcorreo.com>

The historical transformation of the city

Going back in the history of Bilbao leads us to interesting and important facts that have made Bilbao the city as we know it today. One of the most interesting things is the city's historical transformation from an industrial to a post-industrial city. As an industrial city, Bilbao was known for its flourishing steel and iron industry (Olazabal, 2015). Unfortunately like in many other places, the economic crisis of 1980's hit the area very hard which led to a phase of industrial decline. One of the most striking memories of this period is the decay of the river Nervión which became extremely polluted, smelly and brown. The Nervión eventually became an ecologically dead river. Because of the extreme environmental degradation, Bilbao was in this time seen as one of the most polluted and unattractive cities to live in (Plöger, 2008). Bilbao was committed to transform the old, dirty and polluted industry areas as soon as possible into new attractive urban areas full of opportunities (Plöger 2008, p. 15). As a result, Bilbao established the 'Strategic Plan for the Revitalisation of Metropolitan Bilbao' in 1991 (Olazabal, 2015). The most risky investment derived from the plan is the development of the world-famous landmark 'Guggenheim Museum', built along the riverbanks of Nervión (1997). As a solution for the contaminated image, there was a sanitation system installed, costing 1 billion euro, to improve the water quality of the Nervión River and make it ecologically liveable again (see figure 13).

One of the most important results of the urban transformation of Bilbao is the image it gained of a city that shows progress, liveability and hope for the future (Areso, 2017). Although the urban



Figure 13: The urban transformation of the riverbanks of Bilbao. Photo left; Bilbao nowadays including the Guggenheim Museum, 2017. Photo right; Bilbao in the mid-1980s. Source: Areso, 2017.

transformation process of Metropolitan Bilbao is widely seen as an enormous success, there are still challenges in the field of urban transformation ahead for the city.

One of these challenges is not to enter again a phase of stagnation. Rather, Bilbao wants to keep reinventing itself continuously (Areso, 2017). This means, also responding to new societal challenges like the impact of climate change, the main subject of the Bilbao case.

5.2 The governmental and institutional structure of Bilbao

There are four levels of governance to be identified for Bilbao: the Spanish Central Government, the government of the autonomous community of the Basque Country, the provincial government of Bizkaia and the municipal government of the City Council of Bilbao (figure 14).



Figure 14: Governmental and institutional structure of Bilbao. Source: Own work, adjusted from: Ayuntamiento de Bilbao, 2017.

The Basque Regional Government is the main legislative and policy-making institution responsible for regional land-use strategies. The provincial level institution functions mostly as a financial institution, providing budgets for different supra-municipal master plans (González, 2006). On the lowest institutional scale, the institutional power is with the City Council. The City Council, also called *Ayuntamiento*, is responsible for preparing and implementing municipal plans in the area of Bilbao. At the head of the City Council is the Mayor's Office which is currently empowered by the mayor Juan Mari Aburto (Ayuntamiento de Bilbao, 2017).

The coastal and water/flood management institutions are two exceptions of institutions that are not governed by the City Council of Bilbao. First one has the management of coastal areas, which is a shared responsibility of the Spanish Ministry of Environment and the Basque Government. The other institute with shared responsibilities is the institute of water management. The Basque Country is divided by three river basin districts; the West Cantabric river basin, the East Cantabric river basin and the Ebro river basin. From these three basins, the East Cantabric river basin is the only one that is of complete responsibility of the Basque regional water agency called URA. The other two water basins are shared responsibility of the central Spanish government and the Basque Government (Scussolini et al., 2013). In the context of adapting to flooding risks, it is important to be aware of this institutional construction that is of influence in the implementation of flooding policies and regulations.

The structure of the City Council

The structure of the City Council of Bilbao is visualized in figure 15 on page 45. The organization body shows that the City Council is divided into six different departments, all having their own topic and field of policy action. The six departments are further divided into policy action 'areas' and 'sub-areas' in which the department workers are accommodated. All the departments, areas and sub-areas ultimately depend on the 'top-down' power of the Mayor's Office which is at the head of the City

Council. The Mayor's Office is the most powerful stakeholder in all the projects/plans and strategies, developed and implemented by the different departments (Galaragga, 2017). The Mayor's office is able to demand information, appoint budgets and allocate (human) resources of the different departments and their (sub) areas. Nevertheless, this has to be in agreement with the 'General secretary', 'Public and Institutional Relations Office' and the threefold 'Supportive units' (Gogeaskoetxea, 2017). Although the figure shows that the organization is being separated by administrative barriers, in practice the different departments have a high level of transdisciplinarity and often work together in the development of city master plans.

The departments, areas and sub-areas marked bold in figure 15 are regarded as relevant for the research.

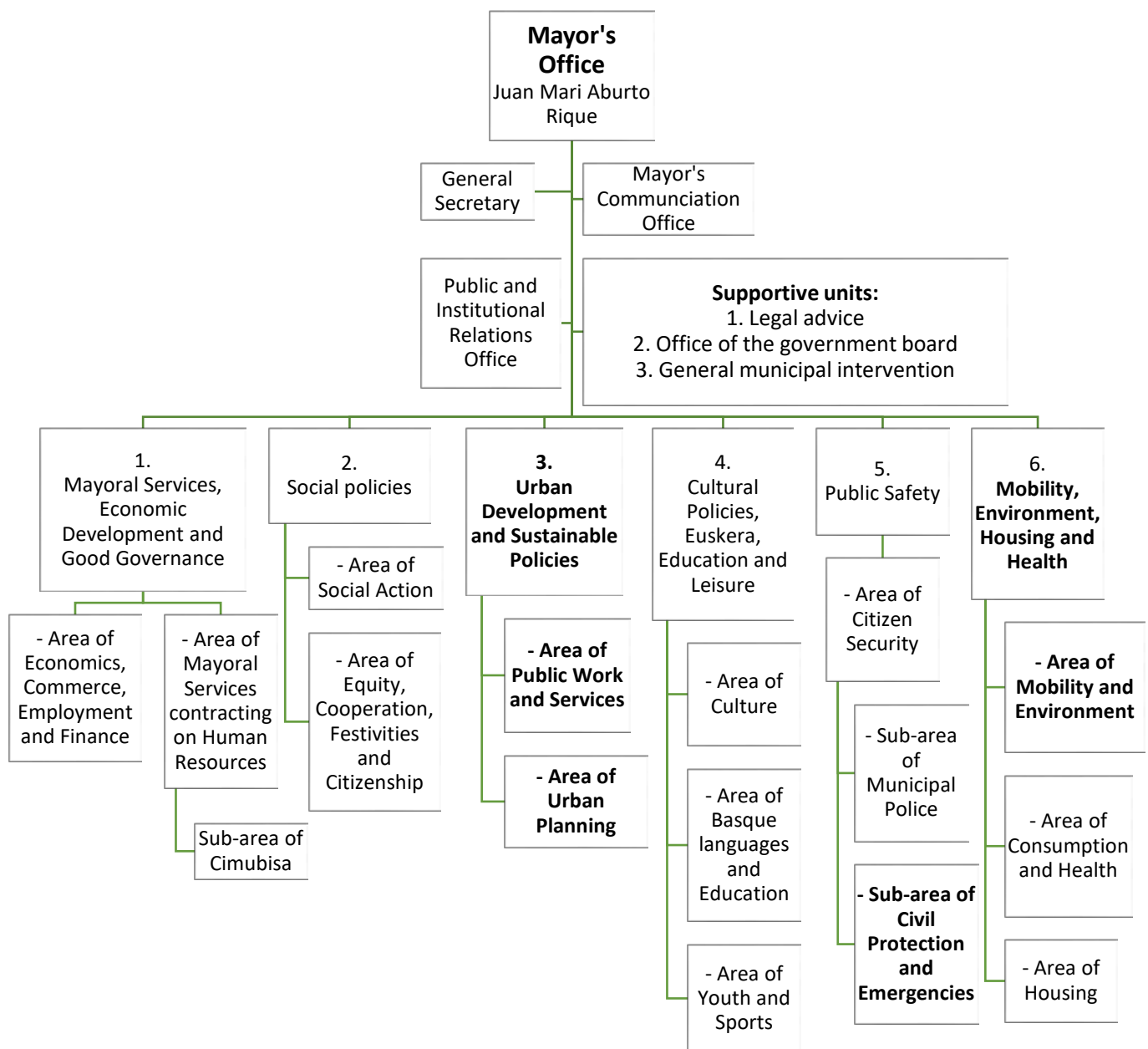


Figure 15: The institutional and governmental context of Bilbao. Source: Adjusted from (Ayuntamiento de Bilbao, 2017)

5.3 Climate change and Bilbao

Since the earth population emits over a long time an increasing amount of heat-trapping greenhouse-gasses, the earth temperature has simultaneously been increasing (Eisenack & Stecker, 2012). This warming of the planet is known by the words of 'climate change' (UNFCCC, 2017).

For Bilbao, climatic models suggests that climate change will lead to an increase in air temperature of + 0.7°C in 2020-2050 and + 1.6 °C in 2070-2100 (Ramses, 2017). These predictions are all in comparison to the baseline of the present temperature (2017). Besides, climatic models suggests a 10% rise in extreme precipitations in the Basque Country caused by climate change. According to the estimated climate change effects, the main local climate risks for Bilbao will be: (1) sea-level rise, (2) increase of extreme weather events like intense rainfall, (3) heat-waves and (4) air pollution (Ramses, 2017; Gonzalez & Aparicio, 2013).

The prediction of a 10% rise in extreme precipitations in Bilbao, combined with the risk of sea-level rise, makes flooding risk the most severe and dangerous threat for Bilbao. It is estimated that the water level of the Nervión river (flowing through Bilbao) could rise by 22% by 2050. This accession subsequently increases flooding risks within Bilbao (Ramses, 2017; Mendizabal et al., 2013). Scientists state that this flooding risk can be enhanced when erosion intensifying factors increment in the area of the Nervión Estuary. Example of these factors are inadequate forest management, intensive cattle raising and urban sprawl (RESIN, 2015).

A flooding event of the Nervión River will have disastrous effects for Bilbao's housing, infrastructure and economy that is located in the city. As Bilbao has to deal with natural and climate change enhanced flooding risks, the need of adapting to climate change and its consequences is really high. When Bilbao will not adapt to the increased risks of flooding, costs incurred to a disastrous flooding event will rise steeply and will damage the living conditions within the city dramatically (IHOBE, 2007).

To know how Bilbao is working on the subject of climate change adaptation, past and present adaptation practices of the city will be analysed below. This analysis is made on different governmental levels. First, climate change adaptation will be analysed on the Basque Country level. Second, the City Council level will be discussed.

5.3.1 Climate change in the Basque Country context

'The changing of the climate is forming one of the most pressing and complex environmental challenges the Basque Country is facing nowadays'.

(KLIMA 2050 Basque Country 2015, p. 7)

The quote that is mentioned above is from the KLIMA 2050 strategy; the climate change strategy for The Basque Country released in the beginning of 2015. This strategy addresses both the topics of climate change mitigation and adaptation. Although the Basque country only contributes 0.5% of the total emissions emitted by the European Union, the strategy states that tackling climate change should be led by the principle of shared responsibility. This means that the Basque Country is working on developing mitigation policies as well as adaptation policies and measures.

The KLIMA 2050 strategy does not set out any adaptation commitment for the individual Basque Provinces and their cities. Rather, this strategy functions as a regional 'tool' helping the provinces to develop their personal strategies and measures for adaptation (Gogeaskoetxea, 2017). For this reason, the Basque strategy of KLIMA 2050 cannot be used to describe Bilbao's work on developing adaptation measures to analyse the city's adaptation efforts, one needs to analyse the city's documents.

5.3.2 Bilbao working on climate change, from past to present

The Local Action Agenda 21

When analysing Bilbao's climate change adaptation efforts, it is important to understand the city's history of working on environmental issues. In 1994, the Mayor of Bilbao signed the Aalborg Charter (Olazabal, 2015). The signing of this charter involved the declaration of Bilbao to develop a Local Agenda 21 Plan, thus contributing to the European Union's Environmental Action Programme 'Towards Sustainability' at that time (ICLEI, 2018). With the establishment of a Local Action Agenda 21, Bilbao commits to develop sustainability criteria that will be integrated in the City Council's action fields in the coming years.

Bilbao's most recent Local Action Agenda 21 plan is launched at the end of 2017 (Ayuntamiento Bilbao, 2017). This plan covers the years of 2018-2021 and includes an up-to-date diagnosis of the current environmental situation in Bilbao, sketching the challenges that are still existent for the city and should be tackled with the new plan.

Bilbao's first climate change plan

The first plan Bilbao has developed for tackling climate change related issues is the 'Plan Local de Acción Contra el Cambio Climático de Bilbao'. This plan has been released in 2010 by the City Council of Bilbao. Although adaptation to climate change is included as a strategic area in the action plan, the action plan its main focus is climate change mitigation. The plan presents an overview of the potential climate change impacts in Bilbao. In addition, it discusses the ongoing local initiatives related to climate change mitigation and energy efficiency. Although, the plan states that adapting to climate change should emerge as one of Bilbao's priorities in the coming years, the plan draws only some guidelines of what Bilbao should work on in the context of adaptation. These guidelines are as follow:

1. Carry out a study of Bilbao's most climate vulnerable areas in the city.
2. Improve the flooding response of Bilbao for the Nervión river.
3. Make predictions of predicted climate change effects like; heat and cold waves, extreme precipitation, droughts etc.
4. Increase the explanation and diffusion of climate change information through public information systems.
5. Establish objective adaptation criteria that can be mainstreamed in key sectors such as urban planning and water resource management.

In conclusion, the 'Plan Local de Acción Contra el Cambio Climático de Bilbao' should be regarded as an 'inventory' of what the main climate change risks are for the city and relevant adaptation responses.

The signing of the Covenant of Mayors and the Sustainable Energy Action Plan

In May 2010, Bilbao's mayor signed the 'Covenant of Mayors' climate and energy declaration. With this signing, Bilbao committed to reduce its CO₂ emissions and monitor results. In the light of this commitment, Bilbao developed a 'Sustainable Energy Action Plan (SEAP)' in 2012 (Gogeaskoetxea et al. 2012). This action plan consists of actions, aimed to reduce GHG emissions in the municipality of Bilbao. SEAP can be regarded as the follow-up of the earlier developed 'Plan Local de Acción Contra el Cambio Climático de Bilbao' in 2010 (Olazabal, 2015).

An important result of SEAP has been the creation of an official Climate Change Office of Bilbao in 2009, named 'BIO'. The office was in first place set-up to raise public awareness on climate change issues in the city. Besides, the office functioned as a network for transmitting knowledge and ideas on reducing CO₂ emissions and changing unsustainable lifestyle habits. Unfortunately, the physical office of BIO closed in 2014 due to a lack of interest and budget deriving from the City Council. The responsibilities of the office were transferred (in theory) to the Area of Public Works and Services which now is also responsible for the completion of SEAP (Olazabal, 2015). It seems that the new Area of Environment is interested in starting a new climate change office (Gogeaskoetxea, 2017).



Figure 16: Official logo of the climate change office BIO. Source: climaticocambio.com, 2011

The signing of the Compact of Mayors

Bilbao became an official compliant of the Compact of Mayors in 2015⁴. As a full compliant, Bilbao commits to take serious climate change action, on mitigation as well as adaptation, in the coming years. The voluntary commitment entails for adaptation that Bilbao will report on a consistent basis on its adaptation planning progress and interim adaptation results. This reporting happens through public channels and adaptation recognized platforms. (Reil et al., 2016, p. 25).

5.4 The RESIN project; Bilbao's first steps within adaptation

Where the 'Plan Local de Acción Contra el Cambio Climático de Bilbao' of 2010 described the need of adapting to climate change impacts, the plan didn't deliver or initiated anything practical for starting an process of adaptation in Bilbao. Nevertheless, five years later, on the 6th of May 2015, Bilbao makes its first practical steps within adaptation as the city is selected as an official partner of the project of RESIN⁵. RESIN is a 3,5 year during interdisciplinary research project that investigates how cities can become more climate resilience and how they can increase their adaptive capacity. The ultimate aim of the project of RESIN is to conduct a standardized methodology for adaptation that helps cities with the process of conducting their own climate change adaptation strategy. Ideally, the developed adaptation instruments are not only used by RESIN city partners but available to use by all cities working on adaptation world-wide.

The partner cities selected for the RESIN project are: Bilbao, Bratislava, Paris and Greater Manchester. This choice is based on the cities' varied geography, climate statistics, characteristics of population and current phase of adaptation to climate change (RESIN 2015). Working with four different cities helps RESIN defining wat kind of adaptation measures and methodologies are most effective and efficient within different contexts of cities.

Being a partner of RESIN entails for Bilbao the commitment to work towards the development of an official adaptation strategy. This adaptation strategy must be submitted by the end of 2019. The development process of this strategy happens in four phases, described in the RESIN working framework (figure 19) (further elaboration, see Appendix B). These phases can be seen as building blocks for the city's final adaptation strategy. Besides, they function as the leading thread through the city's whole adaptation process. According to RESIN, adaptation should be treated like a flexible

⁴ The Compact of Mayors is the world's largest cooperative effort, among mayors and city officials, to reduce greenhouse gas emissions and climate risks in cities (C40, 2018).

⁵ The project is funded and raised by the European Union Horizon 2020 research and innovation program (RESIN, 2015).

process, meaning that there might be shifted between the different phases during the adaptation process (RESIN, 2015). RESIN states that cities might not complete all the phases of the working framework and are even able to stop with RESIN after finishing one of the phases. Although this would be a great loss for a city's developed adaptive competences, there are no regulated commitments or penalties attached to the partnership of RESIN.



Figure 17: The four phases of the Resin Working Framework. Source: Adjusted from; (J. Carter and A. Connelly 2016).

5.4.1 Bilbao's work within RESIN- up to now

Bilbao is currently in the first phase of the RESIN working framework, meaning that the city is busy developing the city's vulnerability assessment. The vulnerability assessment consists of an analysis of the most severe climate change risks predicted for Bilbao. Besides, it identifies the areas of Bilbao that are most in need of implementing adaptation measures. In collaboration with the EU-funded project of RAMSES, Bilbao identifies its climate change risks and its vulnerable groups and areas (further elaboration, see Appendix B). The newest and most accurate analysis of climate change risks will be used as the basis of the adaptation strategy in Bilbao.

Hitherto, Bilbao has published a 'City Assessment Report' (February 2016), functioning as a preliminary inventory for the conduction of the city's vulnerability assessment. The city assessment report of Bilbao is created by guidelines of RESIN and established in collaboration with ICLEI (Local Governments for Sustainability), The City of Bilbao, The Basque Centre of Climate Change (BC3) and the technical business institute Tecnalia.

The City Assessment Report discusses the most climate vulnerable groups of the city. The growing group of elderly people in Bilbao can be typed as the most climate vulnerable group within the city (Reil et al., 2016). Other vulnerable groups identified are children, people with disabilities and the most low-income households of Bilbao. The report emphasizes that a deeper analysis and elaboration on these vulnerable groups in Bilbao should form an important part of the future adaptation plan.

The report further identifies the housing sector and the public transport network of Bilbao as climate critical aspects. As there is a high demand for housing space in Bilbao, climate-related risks should be incorporated when deciding about the location of these new housing projects. This also holds for the public transport network since its infrastructure is mainly built around the flood prone riverbanks of the Nervión, increasing its climate vulnerability rate. In the prospect of an aging population in Bilbao, it is expected that public transport will become the most important transport sector in the future (Departamento de Circulación y Transportes. Ayuntamiento de Bilbao (2011). For these reasons, conducting adaptation measures applied to the city's critical infrastructure is an important task in the process of adaptation for Bilbao (Reil et al., 2016).

5.4.2 Stakeholder engagement within RESIN

The City Council departments of Bilbao that are directly involved with adaptation in Bilbao and with the work of RESIN are; the Area of Environment, - Citizen Security, - Urban Planning, - Public Works and Services and - Mobility (Reil et al. 2016, p. 24). Apart from the Mayor's office, these Areas are the main governmental drivers of the adaptation process within Bilbao. The Mayor's office is the highest institute of the City Council. As the mayor is the head figure of this institute, he/she is final responsible

for delegating policy-making tasks to the different Areas, also in the case of adaptation (Gogeaskoetxea, 2017).

Bilbao's City Assessment Report states that one should consider the involvement of other governmental Areas and non-governmental bodies (public-private and full private) within adaptation planning, as climate change impacts the quality of these sectors as well. An example of an Area that one should consider to involve is the Area of Health. The expectation of more frequent and intense heatwaves in Bilbao, and its impact on the sector of healthcare, stresses the fact that the Health Area needs to be engaged in the adaptation process when Bilbao wants to develop effective heat-stress measures (Ramses, 2017; Gogeaskoetxea, 2017). Nevertheless, engaging different stakeholders for adaptation topics like air pollution and sea level rise is a bit more complex. For example, adaptation measures for air pollution issues (initiated by climate change) need to be developed at regional level as air quality is the Basque Government's responsibility (Ihobe et al., 2017). The same applies for sea-level rise since the responsibility of water management is shared by local, regional and national level powers (See section 5.2). This means that adaptive measures need to be developed in collaboration with stakeholders of different governmental levels.

Stakeholders fully involved in adaptation in Bilbao and in the project of RESIN	Public-private parties indirectly involved in adaptation in Bilbao	Private parties indirectly involved in adaptation in Bilbao
- The Mayor's Office	- The Basque Government	- Euskatel, the biggest Basque telecommunication company
- the Area of Environment	- The Provincial council of Bizkaia	- Iberdrola, the biggest Energy Company Bilbao
- the Area of Citizen Security	- The Area of Health	- Gas Natural, biggest Energy Company Bilbao
- the Area of Urban Planning	- The Bilbao Bizkaia Water Consortium	
- the Area of Public Works and Services	- URA, the Basque Water Agency	
- the Area of Mobility	- Euskalmet, the Basque Meteorology Agency	
- The Basque Centre for Climate Change, BC3	- Foru Aldundia Diputación Foral, the Basque municipality for roads and transport	
- Tecnalia, The technical business institute	- IHOBE, the Basque Environmental Agency	

Table 3: Stakeholders directly and indirectly with the adaptation process of Bilbao. Source: The City's Assessment Report of Bilbao (Reil et al., 2016), adjusted by the researcher.

Private-public actors in Bilbao can, and should play an important role in the city's adaptation process. For some private-public stakeholders applies that, as they are already indirectly involved in the adaptation process of Bilbao, they should consider a more direct involvement in the process. Examples of such stakeholders are URA (the Basque Water Agency), Euskalmet, (the Basque Meteorology Agency), Foru Aldundia Diputación Foral, (the Basque municipality for roads and transport), IHOBE

(the Basque Environmental Agency) and the Bizkaia Water Consortium (the provincial water consortium).

Full private companies are at this moment minimally involved with the adaptation process of Bilbao. Companies that are slightly being involved are Euskatel (Basque telecommunication company), Iberdrola (Energy Company Bilbao) and Gas Natural (Basque gas company). These companies are involved as they deliver the information necessary for the conduction of the vulnerability assessment. It is strongly recommend that these companies consider from now on a more active involvement. For example, it would be very helpful if these companies participate in the process of developing and implementing adaptation measures related to energy and (telecommunication) infrastructure.

5.4.3 The Adaptation Committee

A part of the RESIN working team has organized itself in an Adaptation Committee (2017). This committee can be best described as a fundamental attempt to establish an institute, working on adaptation planning for the long term, and safeguarding the topic to be addressed in the coming years within the City Council. The main idea behind the creation of this committee is, when the funding of RESIN stops in 2019, there should be something established that can function as a body to promote adaptation for the long term (Gogeaskoetxea, 2017).

'The idea is to make adaptation a stable and practical subject for the city to work on. The main challenge is to mainstream adaptation in other plans and have the committee coordinating the processes.' (Gogeaskoetxea, 2017).

Except for the workers of the RESIN Bilbao project, four areas of the City Council are involved with the Adaptation Committee. These are representatives of the Area of Environment, - Mobility, - Health and the sub-area of Civil Protection and Emergencies. The leadership of the Adaptation Committee is with the Area of Environment.

The main goal of the Committee is ultimately to have the representatives of every Area of the City Council involved as a partner of the Adaptation Committee (González, 2017). When this will be the case, climate change sector-specific information like risks and opportunities can be identified in every involved policy-making area. Of course, this identification of risks and opportunities will be executed by the help of RESIN expertise (Gogeaskoetxea, 2017). The ideal situation is that the information that is gained from the different areas is used to feed the future adaptation strategy of Bilbao.

5.5 Mainstreaming of adaptation in Bilbao

5.5.1 Mainstreaming of adaptation described

Described in the City Assessment Report of Bilbao, the most structural challenge for Bilbao is to integrate the development of adaptation measures in other urban planning strategies across the different City Council departments and thus, various policy-making areas. This challenge of integration of adaptation in other policy domains is called *'mainstreaming'*.

For mainstreaming it is known that it can stimulate the effectiveness of policy making through combining objectives, increase efficient use of human and financial resources and ensure long-term sustainable investments (Uittenbroek et al., 2013, p.27). It is noticed that a high level of mainstreaming enhances the speed and scope in which adaptation measures are designed and implemented in a city (Hoppe, 2013). Besides, mainstreaming can help stabilizing the working status

of adaptation within a City Council (Gogeaskoetxea, 2017). As the positions within a City Council change with every election period, a topic like adaptation can easily lose its attention and budget (Van der Burgt, 2017). When adaptation is mainstreamed throughout different City Council Areas, adaptation benefits from undiminished attention as is captured within different City Council Areas (Gogeaskoetxea, 2017).

5.5.2 Mainstreaming of adaptation in Bilbao

Successful mainstreaming however cannot be reached without any organizational and leadership role. In order to mainstream adaptation practices in Bilbao effectively, policy-makers state that the Mayor's Office should take a strong leadership position and should demand that adaptation will be incorporated in different policy-making fields so it receives attention from all governmental Areas (Gogeaskoetxea, 2017; Olazabal, 2017). Luckily, Bilbao institutional structure features several advantages, making the process of mainstreaming adaptation feasible and accomplishable. For example, Bilbao is a medium-size city with a relatively small-scale City Council structure where adaptation results and impacts show relatively quickly in the city's landscape (Reil et al., 2016, p.30). It is assumed that notable adaptation results foster the interest and enthusiasm of policy-makers to work increasingly on the topic of adaptation (Van der Burgt, 2017). Ideally, this increased policy-making interest in adaptation will enhance adaptation to be further mainstreamed within the City's Council work.

At this moment, the Area of Environment is most active in mainstreaming adaptation in Bilbao. They work on mainstreaming as they are developing the first Sustainable Strategy of Bilbao, including a sustainable mobility plan and emergency plan featured by adaptation aspects (González, 2017). For different urban sectors, the plan analyses how to make these more climate adaptive and resilient to climate risks. For this analysis, the Area of Environment is using the first results and reports of RESIN (González, 2017).

Another mainstreaming practice can be found in the development of the new Urban Master Plan of Bilbao. The last Urban Master Plan of Bilbao originates from 1995 but has not been revised during time. Back in time, this Urban Master Plan was very ambitious as it contained the famous urban generation projects that transformed Bilbao from a former polluted industrial city to a modern attractive city (Section 5.1). The new Urban Master Plan that is currently being developed considers adaptation to climate change as a priority topic in urban development. For this reason, the plan integrates adaptation through all proposed urban planning plans. In addition, the material produced by RESIN is used for the description of the adaptation aspects.

These examples of mainstreaming practices within Bilbao indicate that the topic of adaptation is regarded as indivertible when establishing the future vision of urban planning in Bilbao (Gogeaskoetxea, 2017).

6 Developing a MER framework for Bilbao

Up to now the Bilbao case has been concerned with the description and analysis of the governmental and environmental policy-making context of Bilbao. This analysis has not only been informative, it also forms the basis of the research results described in this chapter. Thus here a MER framework for Bilbao is proposed, able to measure the successfulness of the city's adaptation practices and process. It is recommended that Bilbao treats this MER framework as a source of inspiration when developing their own MER-like approach, ideally included in the adaptation strategy that Bilbao wants to deliver in 2019.

The MER framework proposed is based on three important sources of information. First, knowledge is derived from the review of the two early adapter cities, Copenhagen and Rotterdam. Second, the framework is based on Bilbao's previous experiences in the field of monitoring, evaluating and reporting environmental strategies and/or policies. These experiences can be seen as the 'routines' and 'habits' Bilbao has developed through time for executing monitoring, evaluating and reporting tasks. Lastly, and certainly the most important source of information on which the framework is based are the interviews conducted with climate change and RESIN experts (see Chapter 3 on methodology).

6.1 Previous experience of Bilbao with monitoring, evaluation and reporting tasks

The substantial experience of Bilbao with (ex-post) monitoring, (ex-post) evaluating and reporting tasks indicates that the city is not starting from zero when developing a MER framework for adaptation. To illustrate better Bilbao's experiences with MER tasks, figure 20 gives four examples of important cases/projects executed in the city that undergo MER tasks. Especially the Area of Environment is familiar with monitoring tasks. Nowadays, ex-post monitoring is a routine practice for them as it is executed on a regular basis for a variety of environmental policies and aspects (González, 2017). For example, noise levels and waste generation are continuously monitored by the Area of Environment. Factors as temperature and the water level of the Nervión river are monitored by the Sub-area of Civil Protection and Emergencies. It is customary that the City Council Areas themselves create the monitoring indicators they need, whether or not with the help of relevant experts and stakeholders. Thereafter, evaluations are carried out and are reported to the Mayor's office (González, 2017).

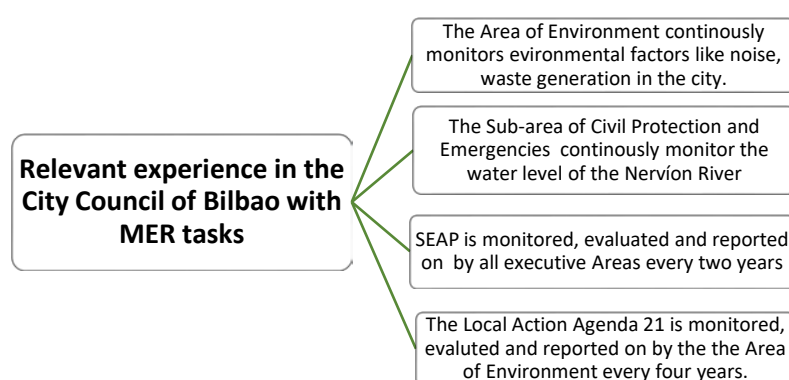


Figure 18: Relevant experience in the City Council of Bilbao with MER tasks.
Source: author, derived from own interview results

In general for environmental projects in Bilbao one has that monitoring, evaluation and reporting is more of a normality than an exception (González, 2017). For example, the Local Action Agenda is every four years monitored by the Area of Environment. In particular, it is monitored how implemented agenda measures are performing and where and what results are still missing.

The Sustainable Energy Action Plan (SEAP) is also monitored and evaluated every two years. As SEAP's projects are carried out by different City Council Areas, the Areas monitor the projects they have

executed themselves. Thereafter, the Area of Environment collects and evaluates the monitoring data, and writes the final report to the SEAP commission (Gogeaskoetxea, 2017).

6.2 Proposing the MER framework for Bilbao

6.2.1 The MER framework

Figure 21 visualizes the MER framework and process proposed for Bilbao to measure the successfulness of its adaptation practices. The framework shows the interactions patterns that need to be set up in order to conduct all MER tasks effectively and efficient. The framework also shows the hierarchical setting and division of responsibilities that is recommended for the organization of the MER process in Bilbao.

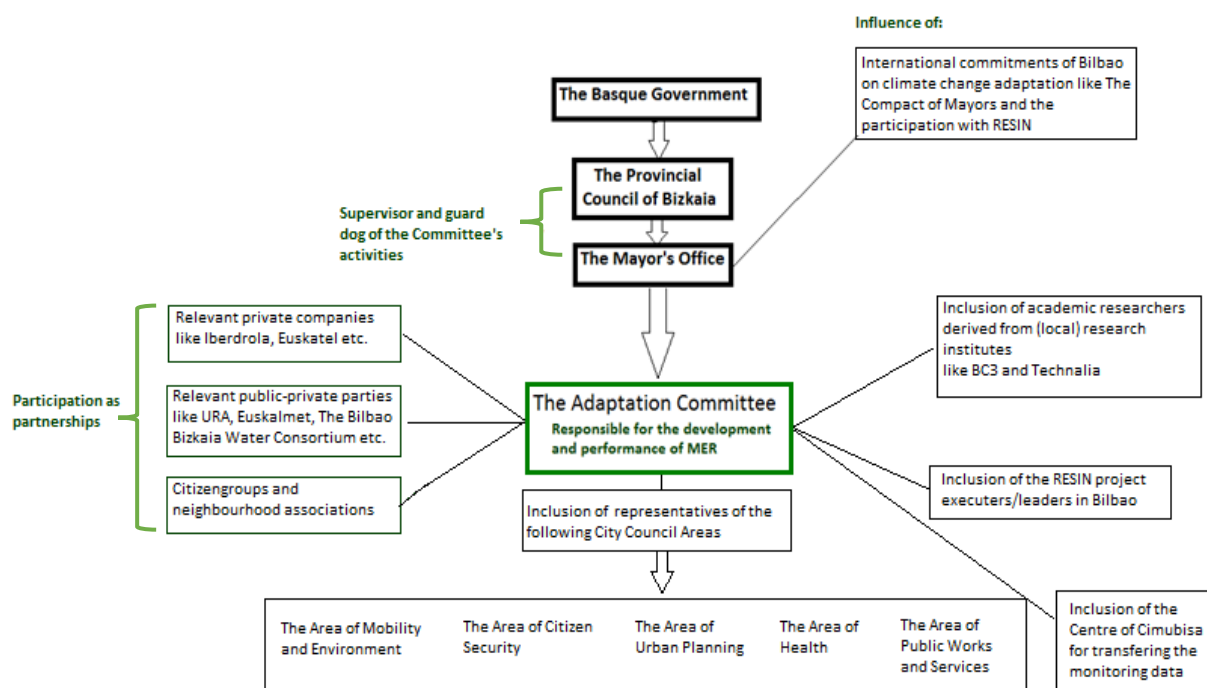


Figure 19: The proposed MER framework for adaptation functioning Bilbao. Source: Author, established by own research material.

As one can see, the Adaptation Committee is proposed as the main coordinative body in the MER process for adaptation in Bilbao. This committee can be thought of as a place where representatives of politics, science, industry and society meet for the joint production of shaping the MER practices (Muers, 2004). Functioning as a site of co-production, the committee connects the fields of science, society and policy. The creation of these type of multi-level committees is appreciated by many scholars as they increase the level of transparency of decision-making processes within societies (Boezeman et al., 2013).

The Adaptation Committee is already existent in Bilbao and functions as the leading party for the Bilbao RESIN project. At this moment participants in this committee are; (1) the RESIN project leaders in Bilbao and (2) the representatives of the Department of Mobility, Environment, Housing and Health. Seen its small scale, the committee receives little to no attention from the Mayor's Office and other City Council Areas at this moment (Gogeaskoetxea, 2017). For this reason, the committee conducts its own RESIN work but is not able to make progress in mainstreaming adaptation practices, nor making progress in conducting a MER framework and process.

In the proposed framework the Adaptation Committee is extended in its scope. As visualized in the framework, also representatives of various academic institutes are incorporated as a fundamental part of the committee. For example, we have representatives of the local research and innovation centres the Basque Centre for Climate Change (BC3) and Technalia. The inclusion of scientific institutions in the committee is seen as essential as scientists are regarded as the most capable stakeholders to safeguard *unbiased* ecological, social and economic aspects in the MER process. Another advantage of having climate change experts involved, is that they certainly will stimulate that most recent climate vulnerability maps and scenarios are developed and applied for measuring adaptation measures (Galaragga, 2017). As a last advantage of the involvement of scientists, it is more likely that a *double-loop learning process* will be established. In such a process, monitoring and evaluation data will be feed-back in the adaptation process in order to upgrade its process in effectiveness and efficiency (Klostermann et al., 2013).

Other groups of stakeholders that will be permanent part of the Adaptation Committee are: the (current) executers/leaders of the RESIN project in Bilbao, the representatives of five City Council Areas and the Centre of Cimubisa (part of the City Council of Bilbao), specialized in transferring technical monitoring data to practical information. There is deliberately chosen not to include all City Council Areas in the Adaptation Committee but solely the Areas that are already directly and indirectly involved in climate change adaptation practices in Bilbao and the project of RESIN. This is the best choice for Bilbao as in this way adaptation and MER of adaptation will be mainstreamed and generally promoted through the City Council but will not be forced upon Areas that have nothing to do with the topic.

The framework also visualizes the partnerships recommended for the Adaptation Committee. For example recommended as partnerships are: public-private parties, private companies, active citizen-groups and neighbourhood associations. The status of partnership entails that, these groups are not a formal part of the Committee but are asked to give recommendations for the development of the MER process. This partnership differs from other participation forms, like participation as consultation (stakeholders develop actively policies together) and participation as control groups (stakeholders control the final policy decisions) (Dryzek, 2009). The partnership of the Adaptation Committee with the named stakeholder groups is regarded as valuable as they create the potential for the Committee to gain new and different MER recommendations (Galaragga, 2017). Overall, it is a wise tactic for avoiding the occurrence of *environmental injustice* within a MER process. In an environmental injustice situation, stakeholder groups are left out of policy's advantages and thus are environmentally disadvantaged on purpose (Shi et al., 2016).

The Adaptation Committee has the authority and leadership over the process of MER for adaptation in Bilbao in the proposed framework. This power and authority is assigned by the Mayor's office as it positions the highest position in the City Council of Bilbao. Due to this authority, the Adaptation Committee features the power to demand all relevant data and information from involved stakeholders in order to fulfil as effective and efficient as possible the MER for adaptation tasks (Gogeaskoetxea, 2017). Nevertheless, although the committee has the full leadership and power over the MER adaptation process, it is recommended that the Mayor's Office regulates and supervises the Adaptation Committee continuously. In this way, the Mayor's Office acts as a 'guard dog' of the activities the Adaptation Committee is executing. This regulating role is respected and supported in the proposed MER framework by the higher governmental levels of the Province of Bizkaia and the Basque Government. Seen the international commitments that Bilbao made regarding adaptation, it is assumed that all governmental levels will respect and appreciate the authority that is assigned in the MER process to the Adaptation Committee and the Mayor's Office.

The foreseen advantages of appointing a supervisor for the process of MER is partly derived from the results of the early-adaptor reviews (Chapter 5). Both Rotterdam and Copenhagen emphasized the importance of setting up a regulatory institute when starting and executing the MER process. Both cities stated that, when a city lacks in supervision during its MER process for adaptation, there is a high change that MER tasks will lose their attention and resources, and in the end even might be dropped.

6.2.2. The Adaptation Committee as a deliberative system. The pro's and con's.

The Adaptation Committee, as it is proposed in the framework, features aspects of a *deliberative* decision-making system. A deliberative system is a form of poly-centric governance, which is the opposite of mono-centric governance in which the authority is with one political organ (Ostrom et al., 1961). A deliberative system can be defined as: an inclusive and open decision-making forum, typed by an extensive communication process between different stakeholders, speaking from their own interests and beliefs (Schouten et al., 2012). The only power allowed in a deliberative process is that of reasoned argumentation. Any type of hierarchical steering is banned in deliberative processes (Meadowcraft, 2004). One assumes that, through open and reasoned argumentation, free from manipulation and the exercise of power, better and more legitimate decisions arise (Backstrand et al., 2010). Deliberative systems are embraced by many scholars and green people as an effective method to tackle climate change (Machin, 2015). This method suggests namely that, through debate and dialog, persons with divergent ideas get united to share their insights reciprocally, allowing them to work towards a societal effective approach for climate change. In this way, deliberative systems can attribute to more climate-friendly decision-making processes (Dryzek, 2002).

Deliberative decision-making processes functions best at solving ambiguous, unstructured problems within society. This quality is derived from deliberative processes' character of finding solutions by allowing learning, promoting dialog and the development of a learning curve between the involved participants (Hoppe, 2011). In addition, a deliberative system pursues to find public justified decisions, widely supported by the public and not covering only opinions by individuals (Muers, 2004); (Meadowcraft, 2004).

Nevertheless, deliberative systems are pre-eminently good with solving short-term societal issues instead of long-term issues. As a deliberative system involves a great amount of stakeholders, it also incurs high transaction costs, overlapping authorities, divergent responsibilities, slackness and resistance from participants (Termeer, 2018). From these aspects is known that they might increase the chance of policy failure (Ostrom, 2009). Within short-term decision-making, the occurrence of such aspects will in general not stop the process of finding the best solution. Instead, in short-term context, a deliberative system gives the opportunity to flexibly cope with resistance and occurring risks in the decision-making process (Termeer, 2018). In contrast, within long-term decision-making, it can considerably reduce the chance of problem-solving as participants get fed up with the treacly, complex and slow process⁶.

For example, in The Netherlands there was a lot of criticism on the so called 'Energiedialoog'. This dialogue is organized by the Ministry of Economic Affairs as an instrument to accomplish the CO₂ emissions reduction goals established in the Energy Agreement, signed in 2013 (Ministerie van

⁶ It is difficult to define MER for adaptation surely as a short-term or long-term issue. Although adaptation to climate change is eminently a long-term issue that needs to come up with solutions that cover the consequences of climate change over the long-term. The development of a MER structure for measuring adaptation outcomes is a short-term issue as it must be a.s.a.p. developed to be included in the adaptation strategy of Bilbao. Besides, the framework is subject to governmental re-elections every four years, thus making it a short-term issue.

Economische Zaken, 2016). The main idea behind the dialogue is to enhance societal debate and dialogue on the energy future of the Netherlands. (EDN, 2014). Nevertheless, various groups think that this instrument is the wrong instrument for accomplishing a radical transition for a long-term issue like energy consumption. According to some, it is not only a bad instrument, they also claim that it is designed as a delay technique by the Ministry of Economic Affairs (Energie overhead, 2016; Milieudefensie, 2016). For this reason, every city governance/city council must be aware of the potential criticism and their response when installing a deliberative system for a long-term decision-making issue. Especially when it is a loaded topic like mitigation and energy consumption.

The choice for a deliberative system is mostly made by the idealistic view that it 'bridges the gap between society and politics' (Irvin and Stansbury, 2004). Nevertheless, one must not forget that in real life, a deliberative system as method of governance stands orthogonal on the responsibility of the government to solve the issue at stake themselves. Leaving the responsibility to a deliberative system is nevertheless a bad thing to do. Especially if the topic has never been a specialization of the city council, like climate change adaptation and MER for adaptation is, but always has been mainstreamed. Defining a deliberative system for the topic of MER for adaptation brings anyhow more focus and effort by the participants.

Considerations for Bilbao

Beforehand, when installing a deliberative system, every city council must ask itself the important question: Is participation through a deliberative system of decision-making worth the effort? (Irvin and Stansbury, 2004). To be very short on this question, as Bilbao lacks in knowledge on how to implement MER for adaptation and what to include in its process, it is by sure worth the effort and wise to start with a deliberative system to create a learning curve on adaptation and MER. Nevertheless, knowing the connotations, Bilbao should be aware of several bottlenecks when installing a deliberative system for the MER process for adaptation.

First, Bilbao needs to watch out for not only involving the 'usual suspects' as partnerships in its Adaptation Committee (Hoppe, 2011). Since adaptation is everyone's interest, as many people as possible must be addressed. Also, the maybe passive majority of the population. In the proposed framework, there is worked on this connotation by involving citizen groups and neighbourhood associations. On the other hand, one must be careful giving participants too much the feeling everything from them is heard and used. For example, if citizen participants are misled by the expectation that their decisions will be implemented, then when decisions are ignored or merely taken under advisement, resentment could develop over time (Irvin and Stansbury, 2004, pg.59).

Another aspect Bilbao has to be aware of is the potential asymmetry in scientific knowledge and deliberative skills among participating stakeholders. Despite deliberation systems' strong egalitarian stance, deliberative capacities, skills and interests are unevenly distributed among the population (Caluwaerts, 2011). The 'ideal conversation situation' of a deliberative system in most cases is nothing more than an utopian and unrealistic standard. Although one aims to have discussions that are free from hierarchical steering, in real life, deliberation on political themes will never be free from coercion and power. The strength of argumentation is always competing with vested interests from the most powerful groups (Caluwaerts, 2011). In order to make deliberative systems workable, one needs to discuss and establish the 'rules of the game' on forehand (Lieberink, 2006). These rules consist of (1) formal rules concerning the procedures of decision-making and implementation and (2) informal rules concerning the discussion's routines and interaction. Seen formal rules, one must think of defining responsibilities, accountability and rules of sharing (new) scientific information. In the case of informal rules, there can be assumed that these rules 'are always there' but never discussed within committees. With informal rules, one must think of the language (highly scientific or colloquial) that

is spoken and the principles and manures propagated by the participating stakeholders. For example, as scientific researchers are forming an important part of the Adaptation Committee, they have to make sure that they speak the same 'language' as policy-makers to be able to discuss and stimulate the defined adaptation and general learning objectives (Galarrraga, 2017).

The last aspect Bilbao should think of is the shape of the deliberative system. Common options are, for example, roundtables, dialogs, expert panels, focus groups, deliberative polling and surveys (de Cock Buning and Honigh, 2006). When choosing one of these options, Bilbao should have clear what the Adaptation Committee wants to extract from its participants. Do they like to have a discussion and give space for questioning? Or do they want to have the participants voting for a policy decision? Seen the context of the topic, it is recommended to install a roundtable form that allows open communication, information sharing and discussion (Schouten et al., 2012).

6.2.2 The proposed MER process for Bilbao

After the framework of MER for adaptation is presented and analysed, the three different tasks of MER will be discussed one by one. Before there can be start with the execution of these MER tasks, it is recommended for Bilbao to work through a preparatory phase, established on the basis of the theoretical framework of this research. This preparatory phase consists of tasks and questions that needs to be answered and fulfilled by the Adaptation Committee. The preparatory phase looks as follow:

1. What is/are the main reason(s) for Bilbao to perform MER for adaptation?
2. Where does MER take place in the adaptation policy-making cycle of Bilbao? Is there chosen to intertwine the tasks throughout the whole adaptation process, establishing a double-loop learning process. Or is there chosen to perform MER at one defined moment, establishing a single-loop learning process?
3. What does the system of interest look like? What is exactly monitored and evaluated and what is the adaptation context? (see section 2.3.2).
4. Describe the adaptation objectives and make them as specific as possible.
5. Identify the challenges/conflicts that could be occurring during the MER process. Is there a lack of money, information, stakeholder engagement, source of data etc. and how could be dealt with them?

After these essential questions/tasks are answered and executed, the Adaptation Committee can start filling in the MER tasks. These sequential tasks are described below:

1. Monitoring

As the Adaptation Committee will develop its own monitoring indicators, it is recommended that one person within the committee is appointed head-responsible for the development of the indicators. It is advisory to appoint someone that is already experienced with monitoring procedures. This person coordinates the development of indicators and brings together the necessary experts for the development process. For every adaptation theme/measure, the experts identified could be different.

The adaptation objectives defined in the preparatory phase should form the basis for the development of the monitoring indicators. In order to gain a best overall picture of the successfulness of the adaptation measures, it is recommended to develop process, output and outcome-indicators. There should be strived to make the indicators as specific but understandable for all users within the Committee. As visualized in the framework, the Centre of Cimubisa is the recommended stakeholder for processing the monitoring data into vulnerability maps and other visuals.

2. Evaluation

There needs to be an evaluation approach chosen by the Adaptation Committee itself. Just like for the development of indicators, it is recommended to appoint one person responsible for the coordination of the evaluation within the committee. This person collects all the evaluation reports derived from the Area's/Departments that have executed (parts of) adaptation measures and brings the information together. Besides, it is recommended to execute a process evaluation with all partnerships of the Adaptation Committee to evaluate how the MER process is going and its organization is perceived.

3. Reporting

Seen the guard's dog role of the Mayor's Office, reports are sent to the Mayor's Office with a predefined frequency. The Adaptation Committee needs to decide in collaboration with the Mayor's Office what the report must look like and what the targeted audience is. It is recommended to develop a report for the international adaptation platform separately. By sharing Bilbao's good and bad adaptation practices, this report will hopefully enhance an international learning process on adaptation from which other countries and cities working on adaptation can profit from.

6.3 Opportunities and challenges of Bilbao for the proposed MER framework and process

After proposing a MER framework for measuring adaptation practices in Bilbao, the opportunities and challenges for the functioning of this instrument in practice will be analysed. This analysis can be regarded as a preliminary conclusion, taking all the knowledge generated within the past research chapters into account.

Opportunities for the functioning of the proposed MER framework and process

1. Monitoring and evaluation is a routine task for the City Council in Bilbao. Throughout the years a lot of environmental policies and factors have been and still are being monitored and evaluated on their effects by selected City Council Areas. Although the City Council only executes ex-post monitoring tasks and develops solely output- and outcome indicators, the generated experience with monitoring and evaluation tasks increases the likelihood that Bilbao will develop and executes a MER framework for adaptation.
2. The high level of mainstreaming of adaptation practices within the City Council of Bilbao also increases the chance that Bilbao will develop and use a MER framework (see section 5.5). This mainstreaming entails, that adaptation practices and principles are increasingly being incorporated in the policies and plans developed by the City Council. As Bilbao is slowly initiating a sustainable transformation in its urban landscape, adaptation forms an important part of this vision. A high level of adaptation mainstreaming increases the urgency of the City Council to use a MER framework. This assumption is based on the fact that every Area is obliged to account the money and resources they have used for the implementation of the mainstreamed adaptation practices plus the results that it has delivered (Galarraga, 2017). Besides, all City Council Areas are as well obliged to report on all executed work to the mayor's office. For this reason, the MER framework will be an important but even more, an essential tool to do the reporting on adaptation practices.

3. Bilbao's adaptation practices are strongly under influence of the city's internationally signed environmental agreements and commitments. For example, the Compact of Mayors made Bilbao commit to create a climate change mitigation and adaptation strategy (section 6.5.1). The same applies for EU funding projects like RESIN at this moment. These kind of projects place increasingly pressure on Bilbao to develop and use an instrument like MER, able to measure adaptation practices' results. Besides, as the city council applies for EU H2020 funded projects like RESIN, Bilbao is formally obliged to be accountable for the invested resources and to report on the accomplished project's objectives (Galarraga, 2017). Also, when Bilbao applies for any project with the label of creating climate resilience and/or adaptive capacity in the future, the accomplishment of the projects' objectives have to be proven by the use of a MER framework. It is plausible that Bilbao will therefore use the proposed MER framework and process.
4. Another reason why it is plausible that Bilbao will develop a MER for adaptation is that it helps raising climate change awareness among citizens. Also, a MER framework helps the city respond to climate action demands from citizens that are already aware of the risks that climate change poses on their lives (StopClimateChange, 2017). For this reason, it is recommended and likely that Bilbao will develop and use an instrument like MER to show what it is doing in the field of adaptation and protecting its citizens from climate change risks.
5. Seen the history of urban degradation and transformation in Bilbao (section 5.1), it is likely that the city aims to preserve its image of being a city that can adapt successfully to the occurring risks while protecting its inhabitants and existent capital (Galarraga, 2017). By developing MER reports for different audiences, Bilbao is able to present its adaptation accomplishments while keep high the image of a city that keeps transforming to better living conditions.
6. It is expected that Bilbao will be increasingly exposed to climate change risks this century (Ramses, 2016). This prospect emphasizes how important it is to have a well-developed MER framework that will avoid unnecessary adaptation costs to be made. Not taking the right adaptation measures that sufficiently protect the city's inhabitants and capital will only raise the costs of adaptation in the future (De Murieta, 2017). Especially seen Bilbao's history with flooding and the prospect for this risk, conducting a MER framework in the earliest stage and using it from the beginning is of great importance to avoid life-risking situations in the city (Ihobe, 2017).

Challenges for the functioning of the proposed MER framework and process

1. Bilbao has not made any legislative commitment in the case of adaptation, only solely voluntary agreements like the Compact of Mayors and the partnership with RESIN have been established (RESIN 2015). This might induce that adaptation will lose its priority within the City Council when the partnership with RESIN finishes. The only way to overcome this challenging risk is to safeguard the Mayor's Office role of regulator and adaptation guard dog. When this role is well filled in, the Mayor's office can prosecute the adaptation tasks even after RESIN has finished. Besides, the Adaptation Committee can carry on functioning as the main coordinator of the MER process.

2. The occurrence of MER challenges during the process could pose a serious threat on the functioning of the proposed MER framework (section 2.3.3). For example, a shortage in resources or the missing of important data sets will hinder the Adaptation Committee in executing the MER process properly. For this reason, it is important that potential MER challenges are discussed in the preparatory phase by the Adaptation Committee in order to solve them before they become a serious threat within the MER process.
3. As the Adaptation Committee consists of a diversity of stakeholders with different interests, formal and informal rules need to be discussed. One important informal rule is about the language that is spoken. For example academic researchers are collaborating with policy-makers in the Adaptation Committee. In order to work effectively and on the same level, with the same ideas and principles, it is required that these party's both speak each other's language. They also should respect each other's (different) working interests and priorities. When one of the participating parties decides to be stubborn, the well-functioning of the MER framework is seriously threatened.
4. Although there is a lot of experience with monitoring and evaluating within the City Council, there is no experience yet with finding the right monitoring indicators for adaptation, developing process indicators, feeding back monitoring information and working with so many different stakeholders in one Adaptation Committee. Especially when Bilbao pursues to establish a double-loop learning process in adaptation, it requires that there is a well-thought process about how to feed the generated knowledge back into the adaptation process and to adjust earlier made decisions. Plus, writing separate adaptation reports for different audiences, like inhabitants and academic adaptation platforms, is a new practice for Bilbao. It should not be underestimated how much energy and determination it costs to start and proceed so many new tasks within a 'new' deliberative system and for a complex issue like adaptation.

6.4 Discussion

Based on the theoretical framework, the early-adaptor reviews and Bilbao's environmental policy-making experience, an ideal MER framework and process is proposed in this chapter. This framework consists of different partnerships, the main coordinative body 'the Adaptation Committee and the essential regulating stakeholder 'The Mayor's Office'. The Adaptation Committee is described extensively and an analysis is made of the pros and cons of its deliberative character. Although there are connotations to be placed with a deliberative system, the installing of a deliberative system is expected to be worth the effort in the case of MER for adaptation. Moreover, it is concluded that the here proposed MER framework for Bilbao has a high chance of succeeding. This is based on the six arguments named for the succeeding of the framework versus four arguments describing potential challenges and threats for the functioning of the framework.

One big opportunity for the well-functioning of the MER framework is both the City Council's experience with ex-post monitoring and the fact that every Area is obliged to share evaluation results and reports of implemented policies and strategies with the Mayor's office. Furthermore, a big opportunity occurs by the fact that Bilbao will be increasingly threatened by climate change induced flooding risks in the near future. Not finding out what the best adaptation practices are by using a type of MER framework will cost Bilbao a lot of money, capital and in the worst scenario, human lives in the coming years. The biggest challenge ahead for Bilbao when developing a MER for adaptation is

the lack of experience with the development of adaptation indicators, making adaptation evaluations and writing reports for a mixed public. The investigation of these new tasks takes a lot of dedication and effort of the Adaptation Committee participants, potentially leading to slackness and delays within the process.

In general it must be noticed that there are a lot of pitfalls on the road towards a smooth MER process, as already experienced by, for example, the two early-adapter cities Rotterdam and Copenhagen. Bilbao can avoid these by preparing themselves well. The first recommendation for Bilbao for avoiding stepping into these pitfalls is that the preparatory MER process has to be taken very seriously in its execution. The second recommendation is that the Adaptation Committee and the Mayor's Office should be continuously safeguarding the MER process and the stakeholders their participation within this process. Only in this way, disappointments about the process of MER can be avoided.

7 Testing the MER framework on Bilbao's first adaptation measure

In this chapter the MER framework proposed for adaptation in Bilbao in chapter 6 will be tested by applying it to the first adaptation measure implemented in the city, the opening of the Deusto Canal (Canal de Deusto). Regarding the measure's urgency of implementation and its leading position, this measure is foremost the best case to test the proposed framework on.

First, the motive and objectives of the adaptation measure will be illustrated. Second, the interesting society-policy interface of this measure is defined and analysed. Third and last, the proposed MER framework of chapter 6 is applied to this specific measure by describing the process of assessing the measure's results by executing MER tasks.

7.1 The adaptation measure of the opening of the Deusto Canal

In the 1950's, under the dictatorship of Franco, the peninsula of Zorrotzaurre -located in the north of Bilbao- was declared an enterprise zone for massive and heavy industries (Alcock, 2015). Situated on the outskirts of the city, Zorrotzaurre functioned for many years as an economic prosperous place for the Basque Country's iron and shipping industry. Nevertheless, with the economic collapse of the early eighties in Spain, industries and small businesses on Zorrotzaurre started to disappear. The peninsula became a degraded and abandoned place better typed as a 'no-man's land'. Slowly Bilbao's citizens started to forget about Zorrotzaurre, including its four hundred residents that were still living on the peninsula (Alcock, 2015, pg. 23). Unfortunately, this was not the only result of the economic crisis that hit Bilbao. The Deusto Canal that Franco had commanded to start digging with the purpose to link Zorrotzaurre's shipyard with the sea and to turn the peninsula into an island, was left unfinished.

By the year 2000, the peninsula got back into attention as Bilbao was increasingly urbanizing and looking for new expansion possibilities. Zorrotzaurre it's on the 'door-step' location made the peninsula an attractive and prime location for new urban development (Alcock, 2015). During time, more and more City Council members and private project developers became interested in investing on the 57 hectare big peninsula. Also brainstorm activities evolved in plan making, leading to the establishment of a Management Commission for Urban Development on Zorrotzaurre in 2002. This commission was led by the world-famous Iraqi-British architect Zaha Hadid, also the main designer of the 'new' Zorrotzaurre (figure 23) (European Climate Adaptation Platform, 2016). From this moment, a very long and complex decision-making process started, receiving many critics of participating stakeholders on what the peninsula ideally must look like according to them. The Zorrotzaurre Master Plan went through a long period of adjustments and discussions (Alcock, 2015, pg. 39). Finally, the ultimate Master Plan for Zorrotzaurre is delivered in November 2011 and states that Zorrotzaurre will be turned into an island by completely opening the Deusto Canal (Zorrotzaurre Management Commission, 2012). Furthermore, the new island of Zorrotzaurre will provide living, working and pleasure facilities. Hereby, the architectural plan aims to make Zorrotzaurre as 'low-carbon' as possible by developing car-free zones, good public transport connections with the rest of the city, green river-banks and other green zones on the island. Likewise, the plan works on social sustainability by building 5,473 social housing dwellings on the island. As a final aspect, it complies with the old residents' demand to have the old residential quarter preserved and renovated (Gil, n.d). Seen as a whole, the Zorrotzaurre project converts the degraded peninsula as it is today into a new attractive quarter of Bilbao that is also well-connected to the rest of the city. Expectations are high that Zorrotzaurre will become a vital and integral part of Bilbao's daily life again due to this transformation plan (Zorrotzaurre Management Commission, 2012).

7.1.1 The adaptation objective

Originally, the opening of the Deusto Canal that converts Zorrotzaurre into an island is decided as a flood preventive measure. Nonetheless, this measure is now framed as Bilbao's first climate change adaptation measure (Murieta, 2017). It must be noted that this adaptation measure is not part of the RESIN project since RESIN was set up after this measure was designed and approved. Although the opening of the canal was set to be completed in spring 2017, due to some delays the project is now set to be finished at the end of 2018 (RESIN, 2015). Currently, the biggest part of Zorrotzaurre is affected by a 100-year return period of flooding and some parts are affected by a 10- year flooding return period (figure 24). Seen this high risk, the Basque Water Agency (URA) demanded the Management Commission to come up with a solution to reduce the flood risks before Zorrotzaurre could be turned into a new residential area (De Murieta, 2017). By opening the Deusto Canal with 75 meter, the water and drainage capacity of the Nevión River and its estuary is increased. Due to this increase, flooding risks on Zorrotzaurre and of Bilbao's surrounding areas' is expected to decrease (Scussolini et al., n.d.) (European Climate Adaptation Platform 2016). Also the implemented green river banks and areas will minimise the flooding risks on the future island significantly (Reil et al., 2016).



Figure 20.: The peninsula of Zorrotzaurre nowadays. The Deusto Canal can be recognized as the upper canal in the photograph. Source: <http://www.bilbaopedia.info/zorrotzaurre>



Figure 21: The 'new' Zorrotzaurre as an island. The Deusto Canal is opened, visible in the picture marked in red. Source: <http://www.zorrotzaurre.com/en/images/>

The costs of opening the Deusto Canal are estimated at 15 M Euro and will be completely financed by the City Council of Bilbao. The Basque Centre of Climate Change (BC3) has carried out a study on request of the City Council on the costs and benefits of the opening of the Deusto Canal (Eraso et al., 2012). The research has estimated that there are significant economic benefits due to avoided flooding damages when the canal is opened (Abadie, de Murieta, and Galarraga, 2017).

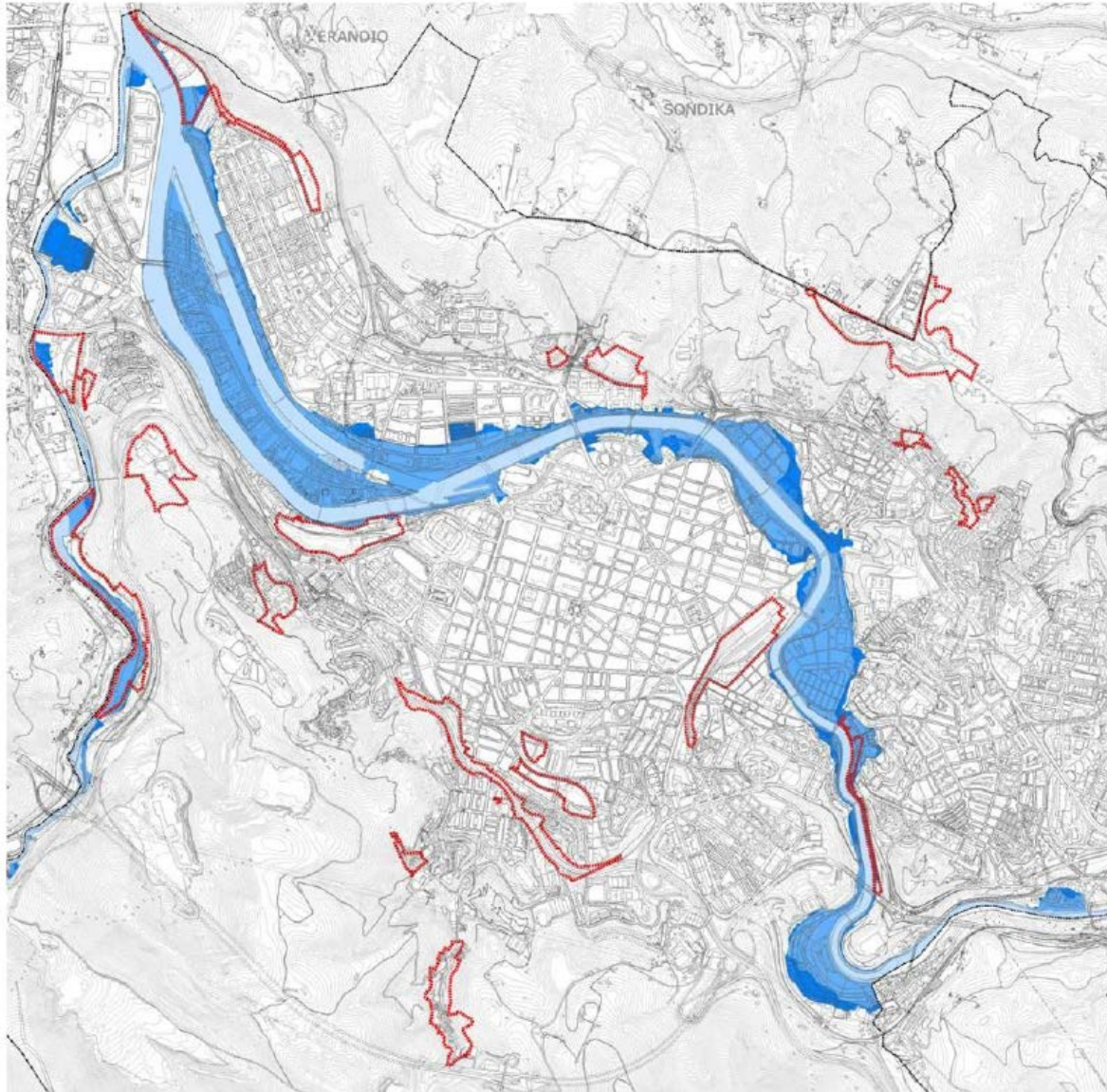


Figure 22. Areas prone to flooding in Bilbao. Light blue= 10-years return period. Middle blue= 100-years return period. Dark blue= 500- years return period. Source: The Territorial Plan for Rivers and Streams, Basque Government, 2000.

7.1.2 Two concerns regarding the reliability of the adaptation measure

There are two fundamental concerns considering the effectiveness of the adaptation measure of the opening of the Deusto Canal. The first concern is related to the framing of the measure of being a 'climate adaptation measure'. To be clear, the opening of the canal will certainly function as an adaptive measure since it creates 'room for the river'. The water level of the Nervión River will be significantly decreased and thus the occurrence of the river's (climate induced) flooding events. Nevertheless, there are no climate change scenarios produced and used for the design of this adaptation measure (de Murieta 2017). It is a common fact that climate change scenarios are not very much liked by policy-makers seen their high level of uncertainty. The integration of scenarios can limit

decisions and plans even though it is not clear if the scenarios will be right in the end. For this reason, the Management Commission did not see the extra value of producing and integrating these scenarios (De Murieta, 2017).

Regrettably, climate change scenarios have not been incorporated in the design of adaptation measures, like here with the opening of the Deusto Canal. This affects the measure's reliability of being climate adaptive for two reasons. First, the integration of climate change models in the design of adaptation measures should be a priority in the perspective of working on adaptation (RESIN, 2015). Secondly, climate scenarios are essential when one starts monitoring. These scenarios form the baseline for measuring the measure's effects (Turner et al., 2014). After the whole Zorrotzaurre master plan was decided (2011), producing climate change scenarios are becoming increasingly popular in Bilbao (see textbox 2).

The second concern is related to the fact that the opening of the Deusto Canal is a *grey adaptation measure* (González, 2017). Besides grey adaptation measures, green- and soft-adaptation measures can be distinguished (EEA, 2013). A grey adaptation measure can be described as a non-dynamic measure, consisting of a civil engineering project developed to increase the level of climate resilience and adaptive capacity in the implementation area (European Environmental Agency, 2013). Grey adaptation measures have the

Textbox 2. The production of Climate Change scenarios in Bilbao

The URA integrates the climate change scenarios of RCP4.5 and RCP8.5 in their hydrological models and flooding risk estimations for the Bilbao city district (Fifth Assessment Report IPCC AR5, 2014). For example, the URA produces flood probability maps covering the area in between the ocean's mouth, where the Nervión river starts, till the neighbourhood of La Peña, located at the edge of Bilbao (De Murieta, 2017). In total URA has developed five different flood probability maps in collaboration with the private company Sener, linked to the two IPCC scenarios. These maps are furthermore split in, (1) the situation when the Deusto Canal is opened and (2) when it is not opened. Since these maps are still in process and include confidential information, they cannot be shared yet within this master thesis.

characteristic of locking-in (financial) resources for the long-term. The occurrence of such a locked-in situation constraints an adaptation strategy in having a flexible adaptation process in which adjustments can be made during time. This means for Bilbao -when climate change induced events turn out to be more intense and frequent- that the locked-in situation of grey adaptation measures can endanger the accomplishment of the city's established adaptation objectives (Scussolini et al., n.d., pg. 35). Nevertheless, there are also arguments why the Management Commission prefers to implement grey measures on Zorrotzaurre: (1) The effects, risks and other implications of grey measures are, compared to green and soft measures, best measurable and therefore less risky; (2) Since their effects are most certain they are also least costly as grey measures don't include flexibility or adjustments over time; (3) Grey measures are less space consuming. As Bilbao has not much flat/non-mountainous land that is free of occupation, this is an important argument for the city to implement grey measures. Green measures require a lot more land for experimentation and their final implementation (De Murieta, 2017).

It also seems to be a conscious decision of the Management Commission not to invest in a flexible adaptation approach. According to Bilbao's policymakers, flexible adaptation is something that is very much liked in academic literature but really costly and complex to implement in practice. It looks really nice on paper but in reality it is a non-popular approach in policy-making since one needs to put more

money aside for it then when one does not choose the flexible option (De Murieta, 2017). Non-regret measures, like grey adaptation measures, are good in between options since they have benefits nonetheless what happens.

One response to the above described concerns by the Master Plan of Zorrotzaurre, is the proposal of other grey adaptation measures to be implemented on the future island. These measures are not directly implemented but will be when the opening of the Deusto Canal is not sufficiently enough protecting Zorrotzaurre and the rest of Bilbao from (climate change induced) flooding events. One complementary adaptation measure is the construction of three storm water tanks that are able to store excessive rain and river water in times of emergency (Reil et al., 2016). Another additional flood preventive measure is the construction of an one meter wall on the riverbanks of Zorrotzaurre. This last measure receives a lot of criticism as it pollutes the horizon of the people living on the island. It is important to note that both measures do not have an implementation instrument yet (Gogeaskoetxea, 2017).

7.2 The society-policy interface of the adaptation measure

The results of the interviews held with the inhabitants of Zorrotzaurre are used to sketch a society-policy interface of the adaptation measure of the opening of the Deusto Canal. A description of this interface is perceived as necessary since it is noticed, while doing fieldwork in the area, that there is a lot of commotion and mixed-feelings on the Zorrotzaurre Master Plan. It has been analysed that the inhabitants of Zorrotzaurre characterize the design and implementation process of the Master Plan of Zorrotzaurre by the words of *stagnation, disappointment and frustration*. These words are mainly caused by non-fulfilled agreements of the Management Commission towards the inhabitants of Zorrotzaurre. Many construction data continue to be postponed, often without informing the inhabitants about the reasons and the consequences. Nevertheless, most inhabitants know by hearsay the reasons behind the procrastination, namely a lack of investors, discovery of polluted soil, disagreement among executers etc. As a result of the chaotic process, inhabitants are getting more fed up with the Management Commission of Zorrotzaurre. Some inhabitants indicated that they do not believe anymore in the realization of all the projects stated within the Master Plan. Others believe that it will take at least fifty years until everything is realized.

Given the subject of flooding, the inhabitants of Zorrotzaurre feel that they are not considered as the main priority in the adaptation measure's objectives. Some of them feel that the economic value of Zorrotzaurre becoming an island receives more interest of policy-makers than the objective of protecting Zorrotzaurre's inhabitants and Bilbao's citizens from climate change increased flooding events. This feeling is enhanced by the fact that neighbourhood association of Zorrotzaurre is decreasingly involved in project's meetings organized by the Management Commission of Zorrotzaurre. Regarding the subject of flooding in general, most inhabitants tell that they experience small flooding events on a daily basis but are not bothered or harmed by these events. Regardless, they would appreciate to have other adaptation measures implemented on Zorrotzaurre when this is regarded as necessary to protect themselves sufficiently against future (climate change induced) flooding events.

Based on the analysed society-policy interface, it is recommended for MER to place emphasis on the establishment of a participatory evaluation process. In such a process, the neighbourhood association can speak out and give input for the adaptation process on Zorrotzaurre. In addition, reporting to the current and future inhabitants must be treated as a very important MER task. This reporting task should be carefully managed and executed frequently in order to maintain a good relation with the

inhabitants of Zorrotzaurre. By reporting, the Management Commission gives itself also the chance to respond to societal questions and doubts concerning the adaptation measure. In this way, societal unrest and dissatisfaction can be avoided as well.

7.3 Applying the MER framework

In this section the MER framework presented in chapter 6 is applied to the adaptation measure of the opening of the Deusto Canal. The context of performing MER for this case is explained, followed by more in-detail descriptions of how to execute the individual MER tasks for this measure.

7.2.1 Context for the application of the framework

This year, the Area of Environment carries out a monitoring pilot project for sustainable initiatives of Bilbao's Local Action Agenda 21 implemented on Zorrotzaurre (González, 2017). With this pilot project, the Area of Environment aims to develop an automatizing system for Local Action Agenda 21 monitoring indicators. Automatized indicators are in favour of policy-makers as they are assessed 'automatically' and can be easily transferred to instruments like GIS which can process them further in maps (González, 2017). During the pilot project, the Area of Environment is responsible for reaching out to, and coordinating the stakeholders (public as well as private) that are necessary for measuring the monitoring indicators. In the end, the Area of Environment collects all desired monitoring information in order to make an evaluation and report out of for the Local Action Agenda 21 (González, 2017).

The monitoring pilot project performed on Zorrotzaurre provides a good basis for the testing of the proposed MER framework on the adaptation measure of the opening of the Deusto Canal. Although the monitoring indicators developed for the Local Action Agenda 21 do not correspond with the indicators that need to be developed for the opening of the Deusto Canal. It gives a good idea of the efforts and resources necessary to perform MER for the adaptation measure of the opening of the canal. In this way, the wheel for 'how to practice monitoring' does not need not be invented again. As the Area of Environment also plays an important part of the Adaptation Committee, any extra gained experience of this Area with MER tasks is of great value for the committee.

7.3.2 Description of the MER tasks

Chapter 6 has presented a MER framework set-up to assess adaptation measures results in Bilbao. This framework contained characteristics of a deliberative system in which different stakeholders parties work together in the form of an Adaptation Committee. This subsection will describe in more detail what the tasks of the Adaptation Committee are when performing MER for the case of the opening of the Deusto Canal.

Monitoring

First of all, it is recommended that the Mayor's Office appoints as soon as possible a 'starters' budget to the Adaptation Committee to begin the MER thinking process. As soon as the committee has made an inventory of the money and resources necessary for the actual executing of MER tasks, the Mayor's Office can decide again over the appointment of more budget.

Although all stakeholder groups prescribed in the proposed MER framework should be involved in the MER process on Zorrotzaurre, some of these groups deserve more attention seen their expertise or status. One of these stakeholder groups is the Area of Environment, the Area that is currently working on the monitoring pilot project for the Local Action Agenda 21 measures. Seen this task, it is regarded

as the most experienced stakeholder for developing the monitoring indicators for the opening of the Deusto Canal on Zorrotzaurre as well. Therefore, it is recommended that the Area of Environment gets a special role assigned by the Adaptation Committee in developing the monitoring indicators.

Furthermore, as the adaptation measure's main objective is to prevent (climate change induced) flooding events, the Basque Water Agency 'URA' should be assigned as well and important role in developing monitoring indicators and generating monitoring data. Institutions that should also consider a more active role in developing monitoring indicators are: (1) Euskalmet, the Basque meteorology centre; (2) Eustat, Bilbao's statistic centre and (3) Sener, Basque engineering agency and co-producer of climate change scenarios. One of these institutions may already monitor particular aspects of the Nervión River including its flooding events, maybe even with climate change as a causative factor. Receiving this monitoring data will be incredibly helpful for the Adaptation Committee and its MER process (Jacob and Blake, 2010).

Other stakeholders that are recommended to contribute extra in this test case of Zorrotzaurre are the Area of Citizen Security and the Area of Urban Planning. These Areas already play an important role on Zorrotzaurre as they construct the housing and working facilities on the future island of Zorrotzaurre. Their involvement can be seen as a win-win situation as these Areas also need the monitoring data on flood risks for decision-making regarding the construction and maintenance of the housing facilities. The last but probably most important stakeholder to be involved when it comes to including social aspects in the development of monitoring indicators are the old and new residents of Zorrotzaurre. One way of establishing their active participation is by involving the neighbourhood association of Zorrotzaurre, named 'Asociación de vecinos de Zorrozaurre' in the practices of the Adaptation Committee.

Table 4 provides a summary of monitoring indicators developed for the opening of the Deusto Canal, recommended to use as an inspiration for the Adaptation Committee. These indicators are developed on the basis of local monitoring documents and interview results.

TYPE OF INDICATOR	DESCRIPTION OF THE INDICATOR
1. PROCESS INDICATORS	<ul style="list-style-type: none"> - All relevant stakeholders are identified and involved in the process of developing monitoring indicators and assessing monitoring data - The necessary data bases are up-to-date and available for all relevant stakeholders - The adaptation objectives of the opening of the Deusto Canal are clearly defined and agreed on by all stakeholders - Monitoring results are being evaluated by the Adaptation Committee, feed back into the adaptation process and communicated to the public by reports
2. OUTPUT INDICATORS	<ul style="list-style-type: none"> - The adaptation measure is finished in its implementation - The water level of the Nervión has decreased due to the opening of the

	Deusto Canal as described in the adaptation objective
3. OUTCOME INDICATORS	<ul style="list-style-type: none"> - The flood vulnerability of the future island of Zorrotzaurre is decreased - The flood vulnerability of other flood prone areas in Bilbao is decreased - The adaptive capacity of the inhabitants, existent capital and ecosystems on Zorrotzaurre is increased

Table 4: Proposed process, output and outcome indicators for the adaptation measure of the opening of the Deusto Canal. Source: Researcher's own work, made on the basis of document analysis and interview results.

Evaluating

In general, it is essential that the Adaptation Committee makes clear decisions about the frequency of evaluation and defines the moments of evaluation together with its participating stakeholders. Seen the type of evaluation, both effectiveness and efficiency evaluations are necessary to perform for this adaptation measure. Notwithstanding, the performance of an effectiveness evaluation of the increased adaptive capacity and climate resilience of Zorrotzaurre due to the opening of the Deusto Canal should be the Adaptation Committee's first priority. Likewise, an efficiency evaluation should be performed in the form of a cost- and benefit analysis of the adaptation measure. In this analysis benefits should be measured in terms of avoided flooding damage due to the opening of the canal. This evaluation is necessary to perform as the City Council of Bilbao paid the measure and they demand accountability of the costs and benefits made. Besides, when the measure's benefits outweigh its costs, such an evaluation can function as an example for the City Council to invest and stimulate the implementation of adaptation measures more often.

Further on, it is recommended that the Adaptation Committee enhances a double-loop learning process with the information extracted from the performed evaluations. Besides, the Adaptation Committee should be aware for indications of maladaptation within the evaluations. When they detect any maladaptive effects due to the measure its implementation in the evaluations, the committee should act as soon as possible in order to counter this.

As a final recommendation, the neighbourhood association of Zorrotzaurre should be actively involved in the process of evaluation, even more than for the process of monitoring. Since the old and new inhabitants of Zorrotzaurre are directly influenced by the measure its implementation process and effects, and their perception on these aspects are currently far from positive, it is highly recommended to invite the inhabitants for evaluation sessions. In this way, trust can be built up again and support can be increased for the implementation of future adaptation measures on the island.

Reporting

It is recommended that two institutes report on a regularly basis on the monitoring results and evaluation outcomes of the adaptation measure. First, off course, the Adaptation Committee should report frequently on the measure's results in all honesty to its interest groups. What the exact audience and tone of the reports is should decide the Committee internally in good consultation. Reporting by the committee must serve the main purpose of showing accountability of the used tax money to citizens plus sharing Bilbao's adaptation experience on the national and international adaptation platform.

Besides, the Management Commission of Zorrotzaurre has a task to report on all aspects regarding the opening of the Deusto Canal. This in order to inform all interest groups on the implementation process, status and results of the adaptation measure. Within these reports there should be focussed on the provision of information of prevented and still existing flooding risks on Zorrotzaurre and how one can respond to these and protect themselves and its capital. Likewise, the Commission can use these reports to inform about new adaptation measures when the opening of the canal turns out not to be sufficient enough.

8 Conclusion

8.1 Answering the main research question

In the last ten years an increasing number of countries show interest in developing and applying a MER framework for measuring their adaptation practices implemented on city level. Using this framework, a city government enables itself to assess adaptation measures' input, output and outcome results using the tasks of monitoring, evaluating and reporting. This master thesis research has been set out to analyse how the development of a MER framework for adaptation, as described in literature, can be translated and applied in practice within a city working on adaptation planning. For this research there has been chosen to apply the MER framework for adaptation to the city of Bilbao, Spain, for practical as well as climatic reasons described in the methodology.

The research has shown that MER literature narrates many idealistic reasons to develop and perform MER for adaptation. Emphasized reasons are for example: assessing effectiveness and efficiency of the adaptation measure, providing accountability of used resources, enhancing communication on climate adaptation, ensuring climate justice and establishing a double-loop learning process. The research also showed that there is, unfortunately, a clear lack of description on what is feasible and realistic for cities and their adaptation policy-makers to achieve from these purposes. In particular, some of them can be contradictory in the indicators, evaluation or reporting methods they demand. Additionally, an analysis of MER literature has shown that there are multiple financial, scientific and social challenges that could disturb or weaken the efficiency and effectiveness of the MER process implemented in cities. The occurrence of these challenges, like a scarcity of financial resources, lacking climate change knowledge, missing stakeholder expertise and absent climate change awareness makes the accomplishment of the earlier mentioned purposes of MER even harder. For this reason it is important that adaptation policy-makers are aware and prepare themselves for the most common MER challenges stated by literature when initiating a MER process. Likewise, it is very important and therefore recommended that cities share their good and bad MER practices with other cities on international and national platforms. Increasing the transparency on MER experiences is one of the best ways to successfully complement the current (scarce) amount of knowledge on developing and implementing MER for adaptation in cities.

An important part of this research has been the early-adapter reviews of Copenhagen and Rotterdam's MER process and identified MER challenges. These reviews have shown that, although the process of MER is often drawn as a straightforward and stepwise process in theory, in practice the phases and the execution of the different MER tasks are intertwined and happen most of the time at the same time in the adaptation process. The review results have also made clear that, defining the adaptation objectives and developing the right-set of indicators and evaluation methods to measure them is an often under-estimated challenge by policy-makers. Besides, both cities have emphasized the urgency of anchoring MER budgets, resources and responsibilities on the long-term in order to safeguard the successful execution of a city's MER process.

Based on the recommendations derived from the reviews and an analysis of Bilbao's documents regarding its work in the field of climate change, the structure of the City Council and its experience with the tasks of monitoring, evaluating and reporting has led to the proposal of a MER framework for Bilbao, ideally to be included in the city's future adaptation strategy. The proposed framework features characteristics of a deliberative system and assigns special responsibilities to the Adaptation

Committee and the Mayor's Office. As the proposed MER framework is the main focus of this research, an answer will be given to the main research question:

'What are Bilbao's main opportunities, pitfalls and recommendations when developing a MER framework for measuring adaptation practices, ideally used in the city's future adaptation strategy?'

Foremost, there can be concluded that Bilbao has a sound basis for conducting and starting a MER process for adaptation regarding its own institutional, climatic and historical context. Giving answer to the first research's question component, one important opportunity for the successful working of the proposed MER framework for Bilbao is the City Council's amount of experience with monitoring, evaluation and reporting tasks. The established MER routines will function as a great basis for the execution of MER tasks by the Adaptation Committee and its partners. Another opportunity is formed by the current high level of mainstreaming of adaptation planning principles within City Council policies and strategies. The fact that adaptation is commonly being mainstreamed in Bilbao shows that the city features already foundational awareness and willingness to incorporate adaptation' principles in different policy action areas. Assumingly, this settled awareness will help the Adaptation Committee execute their MER and general adaptation tasks. Supplementary to this mainstreaming advantage are Bilbao's signed environmental agreements and commitments like the 'Compact of Mayors' and the RESIN project. It is expected that these will strongly enhance Bilbao's dedication to work hard on its adaptation strategy and adaptation assessment tool, the MER framework. The last main opportunity is derived from Bilbao's climate change scenarios. As climate change hazards are expected to progressively affect the city's capital and its inhabitants in the coming years, Bilbao needs to know how to adapt effectively and efficiently these risks using the proposed MER framework.

First, an important limitation for the successful functioning of the proposed MER framework is the fact that Bilbao has not signed any binding 'contract' or commitment for working on adaptation and developing a MER framework in Bilbao. The lack of such a binding commitment forms a big concern as MER literature, review's results and Bilbao policy-makers have stated that, as long as there is no regulation that requires MER to happen, or as long there is no budget or commitment which requires a MER process, there is the chance that the City Government will not pay much attention to it. Furthermore, although the City Council has experience with MER tasks, there is no experience with measuring adaptation measures' results and developing the right indicators and selecting the best evaluation method for the complex and still unknown subject of adaptation. Moreover, Bilbao's City Council has only routine with ex-post monitoring and not with monitoring starting from the beginning of a policy-making cycle. Besides, Bilbao must learn right from the beginning how to enhance a double-loop learning process and how to feedback generated monitoring knowledge into the adaptation planning process in order to upgrade the effectiveness and efficiency of the developed adaptation measures. Lastly, a severe limitation for a successful working of the MER framework concerns the quality of the Adaptation Committee. The Committee will be in the first place challenged to establish informal and formal decision-making rules which will underlie the further success of the committee. Especially informal rules regarding 'the language that is spoken' are important as the committee deals with varying participants like scientists, policy-makers, business people and citizens. As most of the responsibilities and tasks of the Adaptation Committee are new and are not based on City Council experiences, they require exclusive attention and focus of the Committee in order to not let them fail.

As a response to the list of opportunities and limitations for the functioning of the proposed framework, recommendations for Bilbao are established. Following these recommendations will help Bilbao successfully to incorporate the proposed MER framework and to embed the topic of MER and

adaptation for the long-term. First of all and very obvious, it is recommended for Bilbao to use the MER framework and process, proposed within this research. As the main regulative power within the MER process, the Mayor's Office should appoint MER budget as soon as possible so the Committee can immediately start working. The second recommendation is that the Committee's participants must educate themselves in monitoring according to the principles of MER, including process-, input-, output and outcome-indicators. Besides, the Committee should continuously aim for a double-loop learning process within adaptation and should promote that Bilbao's adaptation reports are shared on the international platform in order to let other cities learn from their generated knowledge. A last issue that might really challenge Bilbao in the advancement of the MER process is the fact that the partnership with RESIN stops in 2019. For this reason it is recommended that the Adaptation Committee discusses with the Mayor's Office the continuation of the Committee tasks when City Council members and Mayor's Office positions change and thus the participants of the Adaptation Committee.

Lastly, it is strongly recommended that Bilbao applies the proposed MER framework to its first adaptation measure, the opening of the Deusto Canal in real-life. This to initiate as soon as possible a learning process of how to manage MER tasks, involve and coordinate necessary stakeholders, divide responsibilities and most of all, respond to any occurring MER challenge within a real adaptation project.

8.2 Recommendations for further research

Bilbao is still in an early stage of its adaptation process as the city has just finished its first RESIN assessment on the city's climate vulnerable aspects. For this reason, it is very much recommended that Bilbao will continue all the research regarding adaptation in the coming years while proceeding the construction of its adaptation strategy. As this master thesis research emphasizes, the development of a MER framework is an important, almost essential task for a city working on adaptation. Unfortunately, at the moment there are only a few cities worldwide that have developed a MER framework for adaptation and may enable other cities to learn from their experiences and good and bad adaptation practices. Hence, it is highly recommended to increase the research regarding MER, especially applied to one city, like here has been done for Bilbao. Both theoretical research studies on MER for adaptation and practical research studies within selected cities, are ideally to be enhanced in the coming years.

Additionally, I would like to give some further research recommendations especially to be performed in Bilbao. Regarding the research method that will be chosen when performing additional research on MER for Bilbao, I recommend to speak with policy-makers in other fields besides environmental policy-making. Especially for the reason that I think it is very interesting to analyse how other policy-makers in Bilbao perceive deliberative decision-making processes in general, and in particular, initiating one for the topic of adaptation. Additionally, it would be interesting to include other respondents, besides policy-makers and climate scientists, for capturing their ideas on adaptation and its measurement using a MER framework. Nonetheless, not every citizen chosen randomly would be capable to answer questions on this topic but for example, one could think of including technical monitoring experts and companies working on sustainability as interesting respondents.

Further on, according to me interesting topics for further research in Bilbao are for example to make an inventory of the MER challenges that could occur during the city's adaptation process and investigates how to respond to these. As a starting point for this research, Bilbao can use the list of known MER challenges as well as its own list of MER pitfalls described in this research. Moreover, Bilbao should conduct more research on how to develop monitoring indicators measuring at best the

adaptation objectives established. Herewith, it is very important that these monitoring indicators are developed at the same moment as Bilbao's adaptation objectives. Plus, Bilbao should investigate its options for differentiating input, output, outcome- and process indicators and the potential of developing standardized monitoring indicators. When Bilbao is capable of developing some standardized indicators for its adaptation strategy, the efficiency of the related MER process will greatly increase and simultaneously, the costs of performing a MER will decrease.

As a last note, it is very much recommended that Bilbao explores its options of testing adaptation monitoring indicators in any kind of environmental policy-making pilot project. In this way, Bilbao could start its adaptation's 'double-loop' learning process as early as possible, thus enabling adaptation policy-makers to upgrade the adaptation strategy that is in construction by the pilot projects' results.

8.3 Critical reflection on the research process

Besides aiming to find an answer for the main research question, this research has also been a learning process in how to improve as a scientist and researcher myself. This paragraph provides a critical reflection on the research that has been conducted, the methods that have been used for analysing the research results and my role as a researcher during the whole process.

During the performance of the research, Bilbao was still in an early stage of its adaption process, meaning that the city was still finishing its vulnerability assessment. Unfortunately, this early stage of adaptation has resulted in the fact that only a few stakeholders were capable to answer the research questionnaires made for the conduction of the MER framework. This led to the situation that only a select group of policy-makers and scientist were able to contribute profoundly to my MER framework development process. The scarce amount of expertized respondents, able to give input for the development of the MER framework, has significantly made the research process more difficult. For example, this small sample of expertized respondents has weakened the potential to regard the proposed MER framework as the 'perfect' framework for measuring adaptation in Bilbao. Nevertheless, this limitation also challenged me to look further and be creative in finding other sources of information and input for the development of the MER framework. For example, it has led to the establishment of the idea of me and my supervisor to do a review of two early adapter cities their MER experiences; that of Copenhagen and Rotterdam. This additional analysis of 'foreign' MER practices had led to the avoidance of an one-sided image on how to develop MER for a city working on adaptation.

Regarding the research methods chosen, there can be concluded that the selected triangulation of the qualitative research methods of (1) documentation analysis, (2) interviewing and (3) observation has served the research purpose very well. Besides, the set-up of the exploratory and elaborative research phase worked out really well. For example, throughout the research process it became apparent that, the interviews I was busy conducting in the elaborative phase with Rotterdam, Copenhagen and Bilbao, were perfectly complementary to the desk research that I had performed in the exploratory phase of my research. Additionally, the observations I've conducted for the test-case of Zorrotzaurre helped me getting a better understanding of how climate change physically affects the city, how Bilbao's citizens perceive the issue of climate change and what they demand from the adaptation measures that are being developed. In particular, these observations have been an important source for the development of the MER framework, proposed in chapter 6 of the research.

When discussing the research method selected for this research, one could say that a quantitative research method could have provided other advantages over the qualitative method now chosen. For

example, the development of a survey including questions on how a MER framework for adaptation would ideally look like according to different stakeholders, could have made the research process for instance more efficient. With such a survey, spread among City Council policy-makers, scientific experts and other adaptation related stakeholders, a significant greater amount of information could have been generated useful for the proposal of the MER framework. Furthermore, these survey results would have been statistical representative and would have increased the generalizability of the research's results in Bilbao. Nevertheless, the conduction of a survey would have excluded the option of going in-depth on the subject, something which appeared to be really valuable within this research. For this reason, when opting again for a research method for the same subject, a mixture of quantitative and qualitative methods will be a sound choice.

Undoubtedly, there are also a few things that could have been done better looking back on the research's process. For example, regarding the method I have used for analysing my research's results, developing and using a coding system could have made the data analysis process more structured and efficient. Now I have chosen to profoundly analyse the interview transcripts, summarize them and subsequently extract the fragments that were useful for the development of my MER framework. The data analysis probably would have been more structured if I had chosen to label the transcript fragments in a program like Atlas.ti. by the method of 'open coding' (Creswell, 2013). Although thoroughly developing codes would definitely have cost more time, it would have allowed me to use the research data in a more effective and efficient way in the next stages of the research.

Lastly, there needs to be reflected on my role as a researcher. One important aspect of this researcher's role has been my status of a foreign student researcher in a city that I did not knew before, Bilbao. Not being familiar with Bilbao's institutional and political context in which climate change adaptation is moving, has had significant influence on a research that had to be executed in a relatively short period of time. Moreover, the difference in language spoken and ways of communication of me and my selected respondents has significantly increased the amount of time and effort that was necessary to arrange and conduct interviews with my selected stakeholders.

References

- Abadie, L.M., De Murieta, E.S. and Galarraaga, I. (2017). *Investing in Adaptation: Flood Risk and Real Option Application to Bilbao*. Basque Centre for Climate Change, Bilbao.
- Alcock, R. (2015). *The Island That Never Was*. Bilbao: ZAWP.
- Araos, M., Austin, S.E., Berrang-Ford, L. and Ford, J.D. (2016). Public Health Adaptation to Climate Change in Large Cities: A Global Baseline. *International Journal of Health Services*. 46 (1): 53–78.
- Araos, M., Berrang-Ford, L., Ford, J.D., Austin, S.E., Biesbroek, R. and Lesnikowski, A. (2016). Climate Change Adaptation Planning in Large Cities: A Systematic Global Assessment. *Environmental Science & Policy*. 66 (June). Derived from: <http://www.sciencedirect.com/science/article/pii/S1462901116303148>.
- Areso, I. (2017). *Mas Context*. Bilbao. Website: <http://www.mascontext.com/events/bilbao-issue-launch-in-bilbao/>
- Arts, S.M.G. (2014). *Monitoren van Klimaat Adaptatie Op Lokale En Regionale Schaal: Casus Stadsregio Rotterdam, Nederland*. Wageningen: Wageningen University.
- Ayuntamiento de Bilbao (2017). *Titulares de Órganos Municipales*.
- Barnett, J. and O'Neill, S. (2010). *Maladaptation*. Melbourne: Department of Resource Management and Geography. Derived from: <https://www.udg.edu/LinkClick.aspx?fileticket=NiQcjVPeTCo%3D&portalid=152&language=c-a-ES>.
- Biesbroek, G.R., Termeer, C.J.A.M., Klostermann, J. E. M. and Kabat, P. (2013) On the nature of barriers to climate change adaptation, *Regional Environmental Change*, 13 (5), 1119-1129
- Boezeman, D., Vink, M., & Leroy, P. (2013). The Dutch Delta Committee as a boundary organisation. *Environmental science & policy*, 27, 162-171.
- Bours, D., McGinn, C., Pringle, P. (2014) *Guidance Note 2: Selecting Indicators for Climate Change Adaptation Programming*. Derived from: <http://www.ukcip.org.uk/wp-content/PDFs/MandE-Guidance-Note2.pdf>.
- Bryman, A. (2012). *Social Research Methods*. OUP Oxford.
- Caluwaerts, D. (2011) Deliberatieve democratie in verdeelde samenlevingen. *Politiek*, Jaargang 18, nr. 9 (november).
- Carter, J. and Connelly, A. (2016). *RESIN Conceptual Framework*.
- CDP (2014). *Global Cities Report*. How climate adaptation in cities creates a resilient place for business Based on the CDP responses from 207 global cities.
- Christiansen, L., Schaer, C., Larsen, C. and Naswa, P. (2016). *Monitoring & Evaluation for Climate Change Adaptation. A Summary of Key Challenges and Emerging Practice*. UNEP.
- City of Copenhagen (2011). *Copenhagen Climate Adaptation Plan*. Derived from: www.kk.dk/klima.
- Copenhagen CO2 Neutral 2025 (2016) *Evaluering Og Projektkatalog*. Derived from: KLIMAKVARTER.DK.
- Creswell, J.W. (2013). *Qualitative Inquiry & Research Design. Choosing among Five Approaches*. Sage Publications, Inc.
- De Cock Buning, J. T., & Honingh, N. G. (2006). Review van interactieve en participatieve methoden voor het achterhalen van stakeholdervisies omtrent genetische modificatie.
- De Murieta, E.S. (2017). Interview transcript.
- Denzin, N.K., and Lincoln, Y.S. (2000). *Handbook of Qualitative Research*. 2nd edition. Thousand Oaks, CA: Sage.
- De Pryck, K., Forino, G., Cunha, C.D., Remvikos, Y. and Gemenne, F. (2014). *Analytical Framework of the Decision-Making Process on Adaptation*. Ramses. Derived from: http://www.ramses-cities.eu/fileadmin/uploads/Deliverables_Uploaded/RAMSES_D7.1.pdf.
- Dinshaw, A., Fisher, S., McGray, H., Rai, N., Schaar, J. (2014). Monitoring and Evaluation of Climate Change Adaptation. *OECD Environment Working Papers*. Paris: Organisation for Economic

- Co-operation and Development. Derived from: <http://www.oecd-ilibrary.org/content/workingpaper/5jxrclr0ntjd-en>.
- Edwards, R. and Holland, J. (2013). *What Is Qualitative Interviewing?* Bloomsbury Publishing.
- EEA (2015). *National Monitoring, Reporting and Evaluation of Climate Change Adaptation in Europe*. Environmental European Agency. Derived from: <http://www.eea.europa.eu/publications/national-monitoring-reporting-and-evaluation>.
- Eisenack, K., Stecker, R. (2012). *A Framework for Analyzing Climate Change Adaptations as Actions*. Department of Economics, University Oldenburg.
- Energie Dialoog Nederland (2014). *Wat we willen*. Ministerie van Economische zaken.
- Energieoverheid (2016). *Energiedialoog is vertragingstactiek van EZ*.
- Eraso, O.N., Foudi, S., Galarraga, I. (2012) *Análisis del impacto socio económico del daño por inundación en la Ría de Nervión: un cambio de escenario ante la apertura del Canal de Deusto*, BC3 Basque Centre for Climate Change, Bilbao
- European Climate Adaptation Platform (2016). *Public-Private Partnership for a New Flood Proof District in Bilbao*. Climate-ADAPT-Sharing Adaptation Information across Europe.
- European Environmental Agency (2013). *Addressing Risks and Opportunities from Climate Change in the Context of Socio-Economic Developments*. Copenhagen, Denmark.
- Farthing, S. (2016). *Research Design in Urban Planning. A Student's Guide*. Sage Publications, Inc.
- Fenech, A., MacIver, D., Auld, H., Rong, R.B. and Yin, Y. (2005). *Climate change: building the adaptive capacity*. Occasional Paper.
- Foucault, M., (2008). *The birth of bio-politics: lectures at the Collège de France 1978–1979*. Basingstoke: Palgrave Macmillan.
- French Environment & Energy Management Agency (2011). *Monitoring & Evaluating Climate Change Adaptation at Local and Regional Levels*. Local authorities of France. Derived from: <http://www.ademe.fr/sites/default/files/assets/documents/monitoring-and-evaluating-climate-change-adaptation-7412.pdf>.
- Galarraga, I. (2017). Interview transcript.
- Gil, I. (n.d.). *Mas Context*. A place in transition.
- Global Reporting Initiative. (2015). *G4 Sustainability Reporting Guidelines. Reporting Principles and Standard Disclosures*. Derived from: <https://www.globalreporting.org/resourcelibrary/GRIG4-Part1-Reporting-Principles-and-Standard-Disclosures.pdf>.
- Gogeaskoetxea, E.S. (2017). Interview transcript.
- Gogeaskoetxea, E.S., Rincón, E., García, F.J., and Asua, A. (2012). *Plan de Acción Para La Energía Sostenible de Bilbao, 2020*. Ayuntamiento de Bilbao.
- Golafshani, N. (2003). *Understanding Reliability and Validity in Qualitative Research*. The Qualitative Report. Derived from: <http://nsuworks.nova.edu/tqr/vol8/iss4/6>.
- González, M. (2017). Interview transcript.
- González, S. (2006). *Scalar Narratives in Bilbao: A Cultural Politics of Scales Approach to the Study of Urban Policy*.
- Hallegatte, S. (2008). *Strategies to Adapt to an Uncertain Climate Change*. Derived from: https://www.researchgate.net/profile/Stephane_Hallegatte/publication/222549799_Strategies_to_Adapt_to_an_Uncertain_Climate_Change/links/0deec530cdbe7691ae000000/Strategies-to-Adapt-to-an-Uncertain-Climate-Change.pdf.
- Harley, M., Horrocks, L., Hodgson N. and Van Minnen, J. (2008). *Climate Change Vulnerability and Adaptation Indicators*. ETC/ACC. Derived from: http://acm.eionet.europa.eu/docs/ETCACC_TP_2008_9_CCvuln_adapt_indicators.pdf.
- Hedger, M.M., Mitchell, T., Leavy, J., Greeley, M. and Downie, A. (2008). *Evaluation of Adaptation to Climate Change from a Development Perspective*. Derived from: http://www.preventionweb.net/files/7845_GEF20final20report20Oct20081.pdf.

- Heimann, T. and Mahlkow, N. (2012). *The social construction of climate adaptation governance: cultural differences in European coastal areas*. Leibniz Institute for Regional Development and Structural Planning, Erkner.
- Hulme, M. (2009). *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity*. Published by Cambridge University Press.
- Hoppe, M. (2013). *A Closer Look at Mainstreaming Adaptation*. Adaptation Community. Derived from: http://www.adaptationcommunity.net/?wpfb_dl=39.
- Horsten, L. & Douven, I. & Weber, E. (2007), *Wetenschapsfilosofie*, Assen, Van Gorcum, p. 150.
- Houwen, M. (2017). Interview transcript.
- Hoppe, R. (2011). Institutional constraints and practical problems in deliberative and participatory policy making. *Policy & Politics*, 39(2), 163-186.
- Ibáñez et al. (2000). Las Inundaciones En La Vertiente Cantábrica Del País Vasco En Los Últimos Veinte Años: Principales Eventos, Consecuencias Territoriales Y Sistemas de Prevención. *Serie Geográfica*. Número 9. Universidad del País Vasco.
- Ihobe (2017). *Evaluación Del Impacto de Las Temperaturas Extremas Sobre La Salud En El País Vasco Bajo Condiciones de Cambio Climático*. Sociedad Pública de Gestión Ambiental, and Departamento de Medio Ambiente, Planificación Territorial y Vivienda Gobierno Vasco.
- Inhabitants of Zorrotzaurre (2017). Interview transcript.
- IPCC (2014). *Adaptation Needs and Options*. Derived from: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/drafts/fd/WGIIAR5-Chap14_FGDall.pdf.
- IPCC (2014). *Climate Change 2014: Synthesis Report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, 151 pp.
- IPCC (2014) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
- Irvin, R. A., & Stansbury, J. (2004). Citizen participation in decision making: is it worth the effort?. *Public administration review*, 64(1), 55-65.
- Jacob, K. and Blake, R. (2010). *Indicators and Monitoring*. New York City Panel on Climate Change 2010 Report. Annals of the New York Academy of Sciences. New York City.
- Juhola, S., Glaas, E., Linnér, B. and Neset, T. (2015). *Redefining Maladaptation*. Environmental Science & Policy 55 (October): 5.
- KLIMA 2050 Basque Country. (2015). *Climate Change Strategy of the Basque Country to 2050*. Administration of the Basque Country Autonomous Community Department of Environment and Territorial Policy. Derived from: http://www.ingurumena.ejgv.euskadi.eus/contenidos/informacion/klima_2050/en_def/adjuntos/KLIMA2050_en.pdf.
- Klostermann, J.E.M., Van de Sandt, K., Harley, M., Hildén, M., Leiter, T., Van Minnen, J., Pieterse, N., and Van Bree, L. (2015). *Towards a Framework to Assess, Compare and Develop Monitoring and Evaluation of Climate Change Adaptation in Europe*. Derived from: <http://edepot.wur.nl/363239>.
- Klostermann, J.E.M., Arts, S.M.G., Van de Sandt, K., Van Minnen, J. and Betgen, C.D. (2013). *Monitoring En Evaluatie van Adaptatie Op Regionaal En Lokaal Niveau*. Wageningen: Alterra Wageningen UR. <http://edepot.wur.nl/342516>.
- Kristensen, P. (2004). *The DPSIR Framework*. Denmark: National Environmental Research Institute, Denmark. Derived from: http://www.ifremer.fr/dce_eng/content/download/69291/913220/file/DPSIR.pdf.
- Kuzemko, C. (2015). Climate change benchmarking: Constructing a sustainable future? *Review of International Studies*, 41(5)
- Laclau, E. (1996). *Why do empty signifiers matter to politics*. Emancipation, 36, 46.

- Lamari, M., Poulin-Larivière, L. and Jacob, J.L. (2018). *Climate Change Adaptation in Coastal East Arctic Ecosystems: Complexity and Challenges of Monitoring and Evaluation*. In *Limits to Climate Change Adaptation* (pp. 227-244). Springer, Cham.
- Lauesen, T. (2017). Interview transcript.
- Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2007). *Playing it forward: Path dependency, progressive incrementalism, and the 'Super Wicked' problem of global climate change*. International Studies Association 48th Annual Convention. Chicago, February.
- Liefferink, D. (2006). The dynamics of policy arrangements: turning round the tetrahedron. *Institutional dynamics in environmental governance* (pp. 45-68). Springer, Dordrecht.
- Machin, A. (2015). Een andere kijk op politieke tegenstellingen over klimaatverandering. Wetenschappelijke Raad voor het Regeringsbeleid.
- Magnan, A. (2014). Avoiding maladaptation to climate change: towards guiding principles. *S.A.P.I.E.N.S. Surveys and Perspectives Integrating Environment and Society*, no. 7.1 March. Derived from: <https://sapiens.revues.org/1680>.
- Mendez, N.L. (2014). *Adaptation to Urban Floods by Planning and Design*. Stockholm, Sweden.-
- Moses, J., & Knutsen, T. (2012). *Ways of knowing: competing methodologies in social and political research*. Palgrave Macmillan.
- Mickwitz (2003). *A Framework for Evaluating Environmental Policy Instruments Context and Key Concepts*. Finnish Environment Institute, Finland. SAGE Publications.
- Milieudefensie (2016). *Bla-Bla Bingo wijst op doodlopende wegen tijdens Energiedialoog*.
- Muers, S. (2004). Deliberative democracy and urban regeneration: justification and evaluation. *Public Policy and Administration*, 19(4), 34-56.
- Naswa, P., Trærup, S.L.M., Bouroncle, C., Medellín, C., Imbach, P., Louman, B. and Spensley, J. (2015). *Good Practice in Designing and Implementing National Monitoring Systems for Adaptation to Climate Change*. Report 978-87-93130-48-7. Climate Technology Centre & Network.
- Olazabal, M. (2015). *Sustainable Urban Development under Climate Change and Resource Scarcity*. University of Cambridge.
- Olazabal, M., Galarraaga, I., Ford, J., Lesnikowski, A. and De Murieta, E.S. (2017) Towards successful adaptation: a checklist for the development of climate change adaptation plans. *BC3 Working Paper Series 2017-01*. Basque Centre for Climate Change (BC3). Leioa, Spain
- Pringle, P. (2011). *AdaptME Toolkit. Adaptation Monitoring & Evaluation*. UKCIP. Derived from: <http://www.ukcip.org.uk/wp-content/PDFs/UKCIP-AdaptME.pdf>.
- Ramses (2017). *Reconciling Adaptation, Mitigation and Sustainable Development for Cities*. Bilbao.
- Ramses (2015). WP 4: Climate change scenarios for urban agglomerations. D.4.2: Agglomeration-scale urban climate and air quality projections. RAMSES – D4.1.
- Ramses (2014). WP 4: Climate change scenarios for urban agglomerations. D4.1: Validation of agglomeration-scale climate projections. RAMSES – D4.1.
- Reil, A., Gogeaskoetxea, E. S., Ruiz, S., Tirado, N., Olazabal, M., Mendizabal, M., Garcia, G. (2016). *RESIN, City Assessment Report Bilbao*. City of Bilbao, BC3, Tecnalia.
- RESIN (n.d.). *Bilbao to Reduce Flood Risk by Opening the Deusto Canal*. The Basque Centre for Climate Change. Derived from: <http://www.resin-cities.eu/newsroom/deusto-canal/>.
- RESIN (2015). *Cities and Resilience*. Derived from: <http://www.resin-cities.eu/cities/>
- Robinson, M. (2011). Climate justice: challenge and opportunity. *Irish Studies in International Affairs*, 22, 67-74.
- Rotterdam Buurt Monitor (2017) Derived from: <https://rotterdam.buurtmonitor.nl/jive/report/?id=bevolking&openinputs=true>
- Rotterdam Climate initiative (2013). *Rotterdam Climate Change Adaptation Strategy*. Derived from: http://www.rotterdamclimateinitiative.nl/documents/2015-en-ouder/Documenten/20121210_RAS_EN_lr_versie_4.pdf.

- SAITEC (2007). *Estudio Hidraulico de la Apertura del Canal de Deusto*.
- Sanderson, H. (2017). Interview transcript.
- Saunders, M. L., Lewis, P. and Thornhill, A. (2009). *Research methods for business students*.
- Scheraga, J. D. and Grambsch, A. E. (1998). *Risks, Opportunities and Adaptation to Climate Change*. Climate Research. U.S. Environmental Protection Agency.
http://www.ccap.org/docs/resources/412/Risks_opportunities_and_adaptation_to_climate_change-_Nine_Fundamental_Principles_of_Adaptation.pdf.
- Schouten, G., Leroy, P., & Glasbergen, P. (2012). On the deliberative capacity of private multi-stakeholder governance: the roundtables on responsible soy and sustainable palm oil. *Ecological Economics*, 83, 42-50.
- Scussolini, P., Kaprová, K., Melichar, J. and De Murieta, E.S. (n.d.). *Description of Adaptation Options and Their Costs and Benefits*. ECONADAPT. The Basque Country: VUA, CUNI, BC3.
- Scussolini, P., Kaprová, K., Melichar, J., De Murieta, E.S. and Galarraga, I. (2013). *Policy and Decision Context of Case Studies*. ECONADAPT. VUA, CUNI, BC3. Derived from:
<http://econadapt.eu/sites/default/files/docs/Deliverable%206.1%20approved%20for%20publishing.pdf>.
- Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K. and Schenk, T. (2016). *Roadmap towards Justice in Urban Climate Adaptation Research*. *Nature Climate Change* 6 (2): 131–37. doi:10.1038/nclimate2841.
- Solecki, W., Leichenko R. and O'Brien, K. (2011). Climate change adaptation strategies and disaster risk reduction in cities: connections, contentions, and synergies. *Current Opinion in Environmental Sustainability*, 3(3), 135-141.
- Stadelmann, M., Michaelowa, A., Butzengeiger-Geyer, S. and Köhler, M. (2011). *Universal Metrics to Compare the Effectiveness of Climate Change Adaptation Projects*. Hamburg, Germany.
- Statbank (2017), *Statistics of Copenhagen*. Derived from:
<http://www.statbank.dk/statbank5a/selectvarval/saveelections.asp>
- Termeer, K. (2018). Powerpoint used in the course 'Perspectives and Themes in International Development Studies'. Wageningen University.
- Theobald, D. and Hobbs, N.H. (2002). A Framework for Evaluating Land Use Planning Alternatives: Protecting Biodiversity on Private Land. *Conservation Ecology* 6 (1). doi:10.5751/ES-00379-060105.
- Turner, S., Moloney, S., Glover, A. and Fünfgeld, H. (2014). *A Review of the Monitoring and Evaluation Literature for Climate Change Adaptation*. Technical report. Derived from:
https://www.researchgate.net/publication/281264794_A_review_of_the_monitoring_and_evaluation_literature_for_climate_change_adaptation.
- United Nations Development Programme (2009). *Handbook on Planning Monitoring and Evaluating for Development Results*. United Nations Development Programme. Derived from:
<http://web.undp.org/evaluation/evaluations/handbook/english/documents/pme-handbook.pdf>.
- UNFCCC (2015). *The Paris Agreement*'. Found on:
http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf
- UNFCCC (2017). Paris Agreement - Status of Ratification. Accessed March 9.
http://unfccc.int/paris_agreement/items/9444.php.
- Valadez, J. and Bamberger, M. (1994). *Monitoring and Evaluating Social Programs in Developing Countries*. Worldbank. Derived from:
<http://documents.worldbank.org/curated/en/793181468739768264/pdf/multi-page.pdf>.
- Van der Burgt, L. (2017). Interview transcript.
- Van den Berg, R., Feinstein, O.N. (2009). *Evaluating Climate Change and Development*. Chapter 15; *Monitoring and Evaluation of Adaptation to Climate Change Interventions*. Indiana University. Transaction Publishers.

- Van der Heijden, J. (2014). *Governance for Sustainability and Resilience: Responding to Climate Change and the Relevance of the Built Environment*. Cheltenham: Edward Elgar.
- Van de Sandt, K., Klostermann, J. Van Minnen, J., Pieterse, N and Van Bree, L. (2013). *Framework for Guiding Monitoring and Evaluation Of climate Adaptation Policies and Projects*. Netherlands: WUR-Alterra & PBL. Derived from: <http://edepot.wur.nl/328808>.
- Van Twist, M., Schulz, M., Van der Steen, M., Ferket, J. (2013) *De Deltacommissaris: Een kroniek van de instelling van een regeringscommissaris voor de Nederlandse delta*. NSOB.
- Vennix, J.A.M. (2006). *Theorie En Praktijk van Empirisch Onderzoek*. Pearson/Custom Publishing.
- Verschuren, P. and Doorewaard, H. (2007). *Het Ontwerpen van Een Onderzoek*. Boom Lemma Uitgevers.
- Villanueva, P.S. (2010). *Learning to ADAPT: Monitoring and Evaluation Approaches in Climate Change Adaptation and Disaster Risk Reduction – Challenges, Gaps and Ways Forward*. Derived from: http://www.ids.ac.uk/files/dmfile/SilvaVillanueva_2012_Learning-to-ADAPTD92.pdf.
- Webler, T., & Tuler, S. (2000). Fairness and competence in citizen participation: Theoretical reflections from a case study. *Administration & Society*, 32(5), 566-595.
- Wittrock, B., & Leon, P. (1986). Policy as a moving target: A call for conceptual realism. *Review of Policy Research*, 6(1), 44-60.
- WRR. (2006). *Klimaatstrategie-tussen ambitie en realisme*. Amsterdam: Amsterdam University Press.
- Zorrotzaurre Management Commission (2012). *Urban Master Plan Zorrotzaurre*. Bilbao. <http://www.zorrotzaurre.com/en/planning/special-urban-plan-for-zorrotzaurre/>.

Appendix A: Overview of the interview respondents

Position	Expertise	Date
1. Coordinator of the RAS strategy implementation and evaluation (L. vanderBurgt)	Coordination and evaluation process of RAS	06-04-2017
2. Coordinator and developer of the MER adaptation process of Rotterdam (M. Houwen)	Coordination and development process of monitoring indicators for the MER of RAS	18-04-2017
3. Coordinator of the Copenhagen adaptation strategy (T. Lauesen)	Coordination of the CCAP	11-05-2017
4. Worker on the adaptation strategy of Copenhagen (T. Bovbjerg)	Implementation process of the CCAP	(email conversation) 18-04-2017
5. Policymaker (E. S. Gogeaskoetxea)	Former head of the Climate Change Office BIO. Co-writer of the first Climate Change plan Bilbao. Works within RESIN, contributed to the City Assessment Report of Bilbao	03-05-2017
6. Policymaker (M. González)	Working in the Area of Environment. Working on the development of the Vulnerability Assessment of Bilbao	18-05-2017
7. Ex-policymaker (I. Galarraga)	Expertise on the tasks of the City Council of Bilbao and The Basque Government	15-06-2017
8. Scientific researcher (I. Galarraga)	Scientific knowledge on adaptation strategies and policy-making processes	15-06-2017
9. Scientific researcher (E. S. de Murieta)	Scientific knowledge on adaptation strategies and the adaptation measure of the opening of the Deusto canal	13-06-2017
10. Inhabitant of Zorrotzaurre	Participant in the communication and implementation process of the Urban Master Plan Zorrotzaurre	08-06-2017
11. Inhabitant of Zorrotzaurre	^	09-06-2017
12. Inhabitant of Zorrotzaurre	^	09-06-2017
13. Inhabitant of Zorrotzaurre	^	09-06-2017
14. Inhabitant of Zorrotzaurre	^	09-06-2017

Appendix B: Interview guides

Interview guide

Early-adapter reviews Rotterdam & Copenhagen

(Rotterdam: Luuk van der Burgt, Marja Houwen, Torkil Lauesen)

- Introducing myself
- Introducing the main objective of my research
- Explaining how long the interview lasts and the main conditions

Questions adaptation strategy

1. What is the main objective of Rotterdam/Copenhagen working on climate change adaptation planning?
2. In which phase of the adaptation strategy RAS is Rotterdam/ Copenhagen at this moment?

Questions monitoring

1. What are the reasons for Rotterdam/Copenhagen to monitor adaptation measures?
2. What is the place of monitoring in the policy-making process of adaptation?
Welke plek neemt monitoring in in het beleids proces van adaptatie?
3. What is to be monitored in the adaptation strategy? (system of interest)
Wat wordt er gemonitord? (belangenstelsel)
4. Which stakeholders are involved/will be involved with this monitoring?
Welke actoren zijn betrokken en verantwoordelijk voor de monitoring?
5. How are monitoring indicators being developed?
Hoe worden indicatoren voor monitoring ontwikkeld?
6. Is there enough information and proficient data bases to measure what you want to measure with monitoring?
Is er genoeg informatie en data beschikbaar om te meten wat gemeten moet worden met monitoring?
7. What is the frequency of monitoring?
Hoe vaak wordt er gemonitord?

Questions evaluating

1. What is the place of evaluation in the policy-making process of adaptation? (Pre, mid, post)
Welke plaats ken het uitvoeren van een evaluatie in het beleids process van adaptatie?
2. What kind of evaluation is being done? Process-based, outcome-based, or economic evaluation?
Wat voor evaluatie wordt gedaan? Proces gebaseerd, resultaat gebaseerd of een economische evaluatie?

Questions reporting

1. What are the main reasons for Rotterdam/Copenhagen to report on their adaptation strategy, progress and results?
Wat is de belangrijkste reden voor Rotterdam om the rapporten over de adaptatie strategie, progressie en resultaten?
2. When and how many times will there be reported on the adaptation strategy?
Wanneer en hoe vaak zal er worden gerapporteerd over de adaptatie strategie?

General questions:

1. What are the main **barriers and challenges** within monitoring, evaluating and reporting on the adaptation strategy?
Wat zijn de belangrijkste obstakels and uitdagingen tijden het monitoren, evalueren en rapporteren van de adaptatie strategie?
2. Is there monitoring of **maladaptation** or the occurrence of any negative side-effects of the adaptation actions being implemented?
Vindt er monitoring plaats van 'maladaptatie' of het voorkomen van enige negatieve bij-effecten van de adaptatie maatregelen die bewerkstelligd zijn?

Interview guide 'Bilbao Case'

Policy-makers Bilbao (Mikel RESIN, Esti City Council)

- Asking for approval of recording method
- Personal introduction
- Explanation of the research objective and the main goal of the interviews

Although Bilbao is now with RESIN still in the process of finishing the vulnerability assessment, it is important to start drafting a monitoring, evaluating and reporting framework for Bilbao. This framework should be included in the adaptation plan that is being developed in order to start monitoring already within the earliest phase of implementation of adaptive measures. MER is not only used in here to assess the 'successfulness' of the implemented adaptation measures but also to stimulate a 'learning and flexible' adaptation process and to avoid maladaptive practices to be implemented.

<Asking for an introduction of the respondents>

1. Were you familiar with monitoring before this presentation? And were you familiar with monitoring of adaptation measures?
2. Are you familiar with monitoring in other (environmental) fields in Bilbao?
3. As the Local Agenda 21 and the Sustainable Energy Action Plan are being monitored and evaluated, adaptation should also be monitored and evaluated on their progress and results. Do you think this is seen as **an essential and necessary step** by the stakeholders involved within RESIN?
4. Do you think that monitoring, evaluating and reporting can become and should be a **required/obligatory task** within adaptation?
(seen the shifting responsibilities with every election)
5. Thinking about how a certain monitoring and evaluation system can be set up in Bilbao, how could this be organized and realized?
Is it a possibility that there will be a special **monitoring, evaluating and reporting committee** created in which all departments are involved and the mayor's office has the main leadership function?
6. How do you see the evaluation of the adaptation process and progress? Is there a chance that there could be **multiple evaluation moments** during the implementation phase or is it more usual to have one evaluation moment at the end?
7. Who do you think can be **the responsible person for reporting** on the evaluation and monitoring of the adaptation measures? To say it in other words, who should publish on the adaptation progress and results? Should this be the responsibility of the mayor's office or the departments together?

8. What kind of **frequency of reporting** do you think is ideal? Is it better to publish when the first monitoring results are obtained or is it preferable to wait with a certain report till more adaptation measures are implemented and monitored?

----- Taking the opening of the Deusto canal and Zorrotzaurre Island as a case study -----

9. What is the current state of the opening of the Deusto canal within the Zorrotzaurre case?
10. What would be the good moment to start the monitoring and evaluation of the adaptation objectives?
11. **How flexible** is the adaptation process of Zorrotzaurre? Does it allow any adjustments during the implementation process found by monitoring results?
12. Which stakeholders will be necessary for **the development of the monitoring indicators** within this adaptation project? To say it in other words, which stakeholder will determine how to measure the successfulness and results of the project?
(for example, the urban development department, the public work and service department)
13. The stakeholder that develops the monitoring indicators, do you think that these stakeholders will also be responsible for **the collection of the monitoring data**?
For example, sometimes another stakeholder like a water agency actually collects the actual monitoring data.
14. What would be the **greatest challenges** in monitoring the Zorrotzaurre project?
For example, are these financial, institutional or research challenges?
15. What do you think about the following challenges:
How could there be dealt with the problem of **different timescales** for this adaptation measure when monitoring? This will be a problem since the benefits are probably for the long-term and the costs are of the short-term.
16. How could there be dealt with potential negative effects of the adaptation measure? This phenomena is called **maladaptation** and is seen as something that should be monitored.
What do you think about monitoring maladaptive practices within this project?
17. To continue on this subject, it would be very helpful if also **social factors** could be monitored. For example, if the adaptation measure has targeted the right people that are extra vulnerable like low-income households and elderly people in the area. Do you think there could be measured if the opening of the Deusto canal initiates an equal distribution of positive effects of the adaptation measure?

Would you recommend us interviewing someone else in the city council or external that can help us with any of the questions above (general adaptation/general monitoring/specific Deusto Canal)

Appreciations for the interview

Interview guide 'Bilbao Case'

Scientific Experts (Ibon Galaragga, Elisa Sainz de Murieta)

- Asking for approval of recording method
- Personal introduction
- Explanation of the research objective and the main goal of the interviews

Although Bilbao is now with the project of RESIN still in the process of finishing their vulnerability assessment (end of 2017) and is working towards an adaptation strategy (+/- 2019), it is important to start drafting a monitoring, evaluating and reporting framework which can be used for the adaptation measures that will be potentially implemented in Bilbao. This so called MER framework should ideally be included in the adaptation strategy that is going to be developed in order to start monitoring already in the earliest phase of the process developing the adaptation measures. The MER framework is not only used in here to assess the results and successfulness of the adaptation measures but also to stimulate a 'learning and flexible' adaptation process by learning from the monitoring results and evaluations that are conducted. In this way, the risk of implementing 'maladaptive practices' is also decreased.

1. Do you think that monitoring, evaluating and reporting can become and *should be* a required and obligatory task within the process of implementing adaptation measures? In general and especially in Bilbao?
2. Do you think that the tasks of monitoring, evaluation and reporting on adaptation measures can find common ground in the work of the city council/departments of Bilbao?
(Is there awareness of the importance and budget appointed?)
3. Since it seems from interviews that the Environmental Department has its experience with developing monitoring indicators and pointing out the necessary stakeholders to collect the monitoring data, the problem within a good functioning system seems to be within the purpose of evaluation and reporting on the monitored results. How can be made sure that the monitoring and evaluation of adaptation measures will enhance a learning process and will use the generated knowledge/experiences for the design of future measures?

→ How can 'monitoring just for the purpose of monitoring' be avoided within the city council of Bilbao?
4. Speaking about the task of evaluating the monitoring results of the adaptation measures. Is there a possibility that there is a collaboration between scientists, policy-makers, technicians and citizens in the evaluation of the adaptation measure? For example, to assess the increase of the adaptive capacity of the area and the new risk perception with the adaptation measure implemented. Is such a 'participative' evaluation moment common or too complex and problematic for policy-makers?
5. How should there be reported on the monitoring/evaluation results? Should there be a special report towards the citizens of Bilbao and one established for the international adaptation platform (platforms like RESIN, Climate-adapt, compact of mayors etc).
6. What should be a good frequency of this reporting? Could the mayor's office be the main responsible for this reporting, demanding the necessary information from the related

departments?

7. What would be the greatest challenge in establishing a well-functioning framework for MER in Bilbao? Will there be financial, institutional, political, social and perception barriers?
8. How great is the chance that the adaptation measures implemented in Bilbao will have a flexible implementation process in which any adjustments can be made during time?

Appreciations for the interview

Interview guide 'Test-case of Zorrotzaurre'

Inhabitants of Zorrotzaurre

- Asking for approval of recording method
- Personal introduction
- Explanation of the research objective and the main goal of the interviews

1. How do you experience the flooding risk on the peninsula nowadays?

¿Cómo experimenta el riesgo de inundación en la península hoy en día?

2. Do you know/notice that there is currently a probability of an intense flooding event every ten years? And an extreme flooding event every 100 years in this area?

¿Sabes que actualmente en esta península hay una probabilidad de un intenso evento de inundación cada diez años? ¿Y un evento de inundación extrema cada 100 años en esta área?

3. Is there a current warning system in the case of the threat of a flooding event?

¿Actualmente, Sabes que existe un sistema de alerta en el caso de la amenaza de una inundación?

With the current climate change predictions, flooding will be an increasing risk in this area due to sea level rise and more frequent storms and extreme rainfall. As an adaptation measure, Zorrotzaurre will turn into an island by opening the Deusto canal. This will decrease the flooding risks on the island. Since there will be many new constructions on the island build, like new offices, apartments and other public facilities, it is important that the 'new' flood risk will be monitored and kept tracked.

Con las predicciones actuales de cambio climático, las inundaciones serán un riesgo aumentando en esta área a causa de al aumento del nivel del mar, tormentas más frecuentes y lluvias extremas. Zorrotzaurre se convertirá en una isla para abriendo el canal de Deusto Como medida de adaptación. Se supone que esto reducirá los riesgos de inundación en la isla por disminuyendo el nivel de agua en 1 metro. Porque van a construir muchas construcciones nuevas en la isla, como nuevas oficinas, apartamentos y otros edificios públicos, es importante que el "nuevo" riesgo de inundación sea monitoreado y recibirán atención

4. Are you aware of the increased vulnerability and flooding risks because of climate change on Zorrotzaurre?

¿Estás consciente de aumento del tus vulnerabilidad y riesgos de inundación a cause del cambio climático en Zorrotzaurre?

5. How are the inhabitants and companies informed about the measure of opening the deusto canal?

¿Cómo se informa a los habitantes y empresas de la medida de apertura del canal de deusto?

6. Do you have any inconvenience from the opening of the Deusto canal? Any problems?

¿Tiene algún inconveniente debido a la apertura del canal de Deusto? ¿Algún problema?

7. Would you like to be informed about the decrease of the flooding risk and therefore your vulnerability of living/working here due to the opening of the canal?

¿Le gustaría estar informado sobre la disminución del riesgo de inundación y por lo tanto su vulnerabilidad de vivir / trabajar aquí debido a la apertura del canal?

8. Would you accept other flood preventive measures to be taken when there is still a huge risk of flooding on the island and the canal is not functioning sufficient enough?

¿Aceptaría que se tomaran otras medidas preventivas contra inundaciones cuando aún exista un gran riesgo de inundación en la isla y el canal no esté funcionando lo suficiente?

9. When the Deusto canal is not preventing flooding risks enough, there are multiple measures to be taken. For example, they could build a big concrete flood preventive wall to protect the island against floods and storms or they can manage the flood risks with 'green measures' like creating green riverbanks which can soak up the extensive water. Do you have a preference for one of these measures?

Cuando el canal de Deusto no previene los riesgos de inundación lo suficiente, hay múltiples medidas que deben tomarse. Por ejemplo, podrían construir un gran muro de hormigón preventivo contra inundaciones para proteger la isla contra las inundaciones y las tormentas o pueden manejar los riesgos de inundación con "medidas verdes" como la creación de riberas verdes que pueden absorber el extenso agua. ¿Tiene alguna preferencia por una de estas medidas?

10. The opening of the Deusto canal will be evaluated in its results and effectiveness on decreasing the flood risks on Zorrotzaurre and in other parts of Bilbao. Do you think these evaluations should be technical based or including the perceptions of inhabitants?

La apertura del canal de Deusto se evaluará en sus resultados y eficacia en la disminución de los riesgos de inundación en Zorrotzaurre y en otras partes de Bilbao. ¿Cree usted que estas evaluaciones deben ser de base técnica o incluir las percepciones de los habitantes?

11. Seen the fact that the new apartments will be elevated to prevent damage in the case of a flooding event, are the old houses also being elevated in the process of the renovation?

Visto el hecho de que los nuevos apartamentos serán elevados para evitar daños en el caso

de un evento de inundación, son las casas antiguas también se eleva en el proceso de la renovación?

12. Do you think that the inhabitants of Zorrotzaurre were able to participate enough in the designing of the projects of the Zorrotzaurre Master Plan?

¿Qué pensó sobre el proceso de participación de los habitantes en el diseño del plan maestro?

13. Do you know about the inclusion of the goal of making Zorrotzaurre a sustainable and carbon-neutral island?

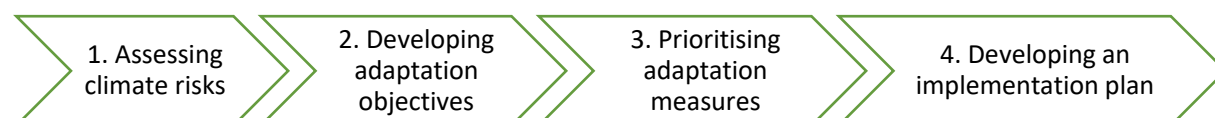
¿Conoces la inclusión del objetivo de hacer de Zorrotzaurre una isla sostenible y libre de emisiones de carbono?

Appreciations for the interview

Appendix B: Other material

-----Resin's Working Framework. Elaboration of page 48 & 49-----

The four phases of Resin's Working Framework for cities working on adaptation:



1. *Assessing climate risks:*

In this phase, there is a detailed understanding developed of the city's climate risks and vulnerable areas. There will be a vulnerability assessment developed which consists of the description of what is the city's critical infrastructure, the contextual adaptation situation and the main climate change effects and impacts. Besides, in this assessment it is important that the role of the stakeholders in the adaptation process is identified and their engagement in the process is committed.

2. *Developing adaptation objectives:*

Following on the vulnerability assessment, the purpose of this phase is to develop adaptation targets, priorities and guidance of the subsequent steps of the adaptation process. In here it is necessary to define and reach agreement on the adaptation goals and approach that is established. Barriers and challenges as well as local opportunities should be taken into account when deciding on the adaptation objectives.

3. *Prioritising adaptation options:*

The main purpose of this phase is to identify the adaptation measures that can be linked to the achievement of the adaptation objectives developed in the second phase. Within these identified adaptation measures it is necessary to make a prioritization considering which measures are most effective and efficient in their costs/benefits and should be implemented as first.

4. *Developing an implementation plan:*

This fourth and last phase of the RESIN process includes the development of a framework for the implementation of the prioritized adaptation measures. Aspects entailed in this framework are the allocation of resources, a reliable timeline, the division of responsibilities and the monitoring, evaluation and reporting requirements. These MER requirements are important in order to track the progress and results of the implemented adaptation measures.



Four kind of climate change hazards are identified by RAMSES for Bilbao. These are: (1) River and pluvial flooding, (2) air pollution, (3) sea-level rise and (4) heat waves (Ramses 2017).

RAMSES identification of Bilbao's sea-level rise and flooding hazards is substantiated by developed regional climatic models, suggesting that there will be a rise in extreme precipitations in the Basque Country following the IPCC climate change scenarios (Ihobe, 2017). The expected increase of rainfall will lead to an increased probability of flooding events in the Nervión River basin in which the metropolitan area of Bilbao is situated. There is the expectation that, due to global sea level rise, the Nervión River increases potentially with +22% in its peak flow and de water level in its related flood-prone areas with +3 %, all by the year 2050. This will cause an extreme increase of Bilbao's exposure level to future flood events that will also result in an increase of economic damages and losses found all around in the Nervión river basin area.

For the risks of heat waves, the climatic models suggest that Bilbao will be threatened by an increase of the average temperature in summer of +0.7 °C between 2020-2050 and +1.6 °C in between 2070-2100. In winter, the increase will be even greater and consists of an increase of +1.1 °C in between 2020-2050 and +2.5 °C in between 2070-2100. These predictions are all in comparison to the baseline of the present temperature (2017). One of the most recent reports produced on the occurrence of heat waves in the Basque Country includes also the linkage between heat wave events and the increase of the mortality rate in Bilbao. The changes in the mortality rate are predicted for the different heatwave scenarios that could become reality for Bilbao. The report that was published by the Basque Government in collaboration with the Basque Centre for Climate Change shows that the population of Bilbao will be scarcely affected by heat waves since the increase of the amount of heat stress days are not of at an alarming level (yet) (Ihobe, Sociedad Pública de Gestión Ambiental and Departamento de Medio Ambiente, Planificación Territorial y Vivienda Gobierno Vasco 2017). Nevertheless, the increase of the number of heatwaves and heat stress days will be a topic where Bilbao needs to start thinking about in terms of adaptation seen their growing group of climate vulnerable elderly people. Also the 'new' topic of cities becoming urban heat islands during summer and especially during heatwave events, is also a growing concern for Bilbao. In the context of this topic, Ramses has produced recently three different reports on the urban heat island effect of Bilbao. One report is modelling the urban heat island effect with different tools and scenarios⁸, the second one is investigating what the impact of the heatwaves is on atmospheric pollution in Bilbao⁹ and the third and last report shows an overview of the potential solutions within Bilbao to reduce the risks and impact of occurring heat waves¹⁰.

⁸ Ramses report called 'Climate change scenarios for urban agglomerations (2014). Found on: http://www.ramses-cities.eu/fileadmin/uploads/Deliverables_Uploaded/ramses_deliverable4.1_final.pdf

⁹ Ramses report called 'Agglomeration-scale urban climate and air quality projections (2015). Found on: http://climate-adapt.eea.europa.eu/metadata/publications/agglomeration-scale-urban-climate-and-air-quality-projections/ramses_2015_agglomeration-scale_urban_climate_and_air_quality_projections.pdf

¹⁰ Ramses report called: Green actions and design solutions to mitigate heat wave risk in the city of Bilbao. (2015)

-----Ten important criteria for the development of a good adaptation monitoring indicator -----
(Naswa et al. 2015, 18,19). Elaboration of page 20

Criterion	Description
1. Relevance	Include how well the adaptation initiative suits its overall objectives
2. Efficiency	Measure the efficiency of the adaptation initiative by how much output is received per unit of input
3. Effectiveness	Measure how well the initiative is achieving its adaptation objectives
4. Feasibility	Measure how practical and feasible an adaptation initiative is
5. Equity	Measure the extent to which an adaptation initiative is benefiting the most vulnerable population group
6. Beneficiaries	Measure the number of beneficiaries of the implemented adaptation action
7. Flexibility	Measure the flexibility of the adaptation action by its possibilities to change the path of implementation during time
8. Sustainability	Measure the self-sustaining level of the adaptation initiative and make sure that it is non-maladaptive
9. Acceptability	Measure the acceptability of the adaptation initiative to its relevant stakeholders and if there are any other issues with acceptance
10. Implementation compliance	Measure the compliance of the adaptation initiative with standard operating practices