Climate Services: Mapping of Providers and Purveyors in the Netherlands and Sweden

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KLIMATKOMPENSERAT
PAPPER

Preface

Climate Services is a relatively recently introduced concept. It refers to provision of actionable information and other means for societal actors' work on climate change adaptation. Such collection, provision and use of climate-related information is, of course, not altogether a new endeavour. However, Climate Services goes beyond such provision so far in the sense that it specifically responds to users' articulated needs to deal with climate change through the preparation of strategies, policy, measures and other action. Climate services are now being developed and worked on internationally and nationally, which engages service providers and users.

The aim of the present study is a mapping of climate services providers and purveyors in the Netherlands and Sweden, undertaken in order to better understand the availability of existing climate services and to identify possible gaps in the provision. A further aim is to compare the results from Sweden and the Netherlands with an eye to identifying what kind of similarities and differences there may be in terms of context and availability of services. The aspiration is that the study will provide actors within the field of climate services with information regarding how to increase effectiveness, promote cooperation and avoid duplication in the provision of climate services.

This report is a result of a cooperation project between Lund University in Sweden and the Koninklijk Nederlands Meteorologisch Instituut, KNMI, in the Netherlands. The study was carried out at Lund University under Work package 4 "Climate Services", project 4.2 "Climate information services in neighbouring countries", which is part of Theme 6 Climate Projections, in the Dutch Knowledge for Climate programme (KfC). The study also benefits the ongoing European mapping of climate services providers under the Joint Programming Initiative (JPI) Climate's Fast Track Activity 2.2.

Summary

The present study was a cooperation project between the Centre for Environmental and Climate research at Lund University in Sweden and the Koninklijk Nederlands Meteorologisch Instituut, KNMI, in the Netherlands. The overall aim was to provide an initial mapping of providers and purveyors of climate services in the Netherlands and Sweden, to compare the different landscapes of the climate services provision, and to identify possible gaps in this provision.

There are several varying definitions of the concept of "climate services" currently in use. An elaboration of various definitions nevertheless shows that the term climate services generally refers to climate data/information/knowledge which is disseminated in a user-friendly manner, and with the purpose of supporting decision-making. For this study, the following definition of climate services providers and purveyors was used: Actors who either produce their own climate data or other climate information, or mediate available climate data or other climate information, and add value for users.

The study was carried out during the second half of 2013. A questionnaire in the Netherlands and Sweden was employed for data collection. It was sent out to 101 organisations preliminarily identified as providers and/or purveyors of climate services using stakeholder analysis. The number of responses was 62, which were complemented with 39 face-to-face or telephone interviews. In total, 64 organisations participated in the study. The data were analysed using either statistical analysis or qualitative text analysis through categorisation of interview notes.

The current study does not attempt to present a full mapping of climate services providers and/or purveyors. The study has a limited extent and there are probably additional relevant organisations. The conclusions drawn from the findings should be viewed as indications and possible general tendencies.

The main results of the study are that:

- The most commonly indicated key competence among participating providers/purveyors of climate services in Sweden was *investigations or other specific analyses*. In the Netherlands, the most commonly indicated key competences were *applied technology* and *applied research*.
- While participating organisations in the Netherlands seemed to focus more on *impacts of climate change*, the thematic focus among participating organisations in Sweden was less clear.
- The most commonly provided and/or purveyed types of services in Sweden were *guidance, workshops or similar activities* and *synthesis reports or other knowledge reviews*. In the Netherlands, the most commonly provided and/or purveyed types of services were *graphics and maps, adaptation strategy* and *processed data*.
- For the least dominating type of services, *analytical method* and *financial tool or socio-economic indicator* stood out for both countries. For the Netherlands *metadata* can be added to the list, and for Sweden, *analytical tool* and *early warning system*. The results of this study would seem to suggest that these types of services could be examples of gaps in the provision of climate services. However, this would need to be compared to a mapping of users' needs to see if there is also a demand for these types of climate services. It should also be kept in mind that these results could be an effect of the selection of providers and purveyors included in the study.
- 80-90 percent of the participating organisations in both countries indicated that their means of communication involve direct contact with users. Most commonly used means of communication in Sweden were workshops or similar. In the Netherlands, presentation of results directly to users was the most commonly used means. Furthermore, a strong majori-

ty of participating organisations in both countries indicated that they promote their climate services, in general through webpages and/or workshops. Interaction with users in general was indicated to be high. In addition, most of the interviewees who elaborated on possible uncertainties related to climate services said that they inform their users about potential uncertainties in the provided climate services.

- Almost all of the Swedish organisations indicated that practitioners are using their climate services, followed by decision makers and/or politicians. In the Netherlands, decision makers and/or politicians top the list, followed by NGOs or other stakeholder groups. The results do not suggest that provision of sector specific services would be common, perhaps with the exception of the Water sector in the Netherlands.
- All participating organisations indicated that they are collaborating with other actors regarding climate services.
- Public funding was the most commonly indicated financing for the development of climate services for both countries. Payment for climate services is more commonly used in the Netherlands, compared to Swedish organisations. This is in line with the fact that the most common type of provider/purveyor among the surveyed organisations in the Netherlands was a private enterprise company, and a public authority in Sweden.
- Obstacles to the production of climate services were elaborated on during the interviews. Most commonly mentioned obstacle was lack of resources, followed by lack of data and information, the unavailability and unclear organisational structure and/or coordination issues.

The findings of this study indicate that the use and understanding of the term climate services differs to a quite large extent among organisations. This is in line with the more general state of affairs within the field of climate services. A majority of the participating organisations in this study did not use the term at the workplace. Most providers and/or purveyors can also be seen as users of climate services, which make the picture even more complex.

Contents

1. Introduction

This chapter provides a background to the report by investigating the concept of climate services at large, and sets this specific study in a broader context with examples of other ongoing projects related to climate services. The remaining chapters will present and explain the methods and material used in this study (Chapter 2), the results (Chapter 3), which is followed by a discussion (Chapter 4), ideas for further work (Chapter 5) and a summary of the key findings (Chapter 6).

1.1. What are climate services?

The origin of the term climate services is somewhat elusive. There are a number of definitions, which to some extent differ from each other. For example, the World Meteorological Organization (WMO) explains that "a climate service is a process of developing and delivering climate information in such a way as to meet a user's need."[1] The Joint Programming Initiative (JPI) Climate defines climate services as "user driven development and provision of knowledge for understanding climate, climate change and its impact, as well as guidance in its use to researchers and decision makers in policy and business."[2] These two definitions differ as one emphasises a service meeting the user's need and one about being user driven right from the start. The National Research Council of the USA describes climate services as "mission-oriented and driven by societal needs to enhance economic vitality, maintain and improve environmental quality, limit and decrease threats to life and property, and strengthen fundamental understanding of the earth."[3] The matter of the definition of climate services is discussed in some additional detail in Section 3.7. However, one may note that focus is on the use, the user, and the delivery.

Climate-related information and products are not new as such, but the concept of climate services is. The latter is directly motivated and associated to dealing with climate change, in addition to climate variability on different time scales. This is emphasised in statements such as "global decision makers are increasingly concerned by the adverse impacts of climate variability and change, and there is a growing demand for better climate services."[4], "the present and future climate is affected by human activities. This influence has to be detected, measured, and monitored over time to understand how it influences and is influenced by the natural climate variability."[5], and "climate services will help with adaptation to climate change and its mitigation. The past political focus on mitigation has suggested that curbing emissions is the only way to avoid disastrous climate change. But the interest in a full evaluation of both adaptation and mitigation measures is growing, partly owing to the realization that, no matter which mitigation strategies we introduce, the climate will be changing over the next few decades – because of the greenhouse gases that are already out there, but also because of natural climate variability."[6]

Descriptions of climate services in general employ a broad view of the groups who are using these services and the ones providing them. Overall, the literature suggests everyone, the whole global community, as the recipients of climate services. For example, the WMO explains, that "to make better decisions that involve climate, households, communities, businesses and governments need to have access to climate information that is suited to their particular needs as well as practical guidance on how they can use it"[4], and that "the principal categories of users are policymakers, managers, engineers, researchers, students and the public at large"[7]. Also researchers can be recipients of climate services, be their interest in understanding the functioning of natural systems, the climate itself or for the functioning of the human society or its sectors. The latter can mean groups of farmers, engineers or investors who need to make decisions about what and where to plant, where and how to build, how to invest, etc.: "Climate services will have even greater potential for benefiting a

wide range of economic sectors and human well-being at the global, regional and national level, and beyond weeks to months, seasons and decades."[8]

The users of climate services are thus hard to narrow down as in principle everyone is affected by climate and can profit from better climate services. This, together with the novelty and difficulty defining climate services, also implies that it is not clear who the providers and purveyors of climate services are. The WMO mentions that "in most countries the networks established for weather forecasting purposes do double-service by contributing weather data to the national climate archive, particularly on temperature, rainfall, humidity, wind speed and pressure. Data collected for weather forecasting thus provides the major source of climate data, although the priorities for climate stations and weather stations sometimes differ. Climate information depends on long-term, stable records of data, but such criteria are not as critical to inform weather forecasting needs."[9] That the traditional weather and climatological services do not imply climate services is exemplified by the fact that to be able to work on weather information as well as climate information, some countries are "reorganizing their institutions to provide climate services that bridge the gap between local weather and global climate change information."[6]

Like user groups, the number of potential providers and purveyors is large. According to one definition of climate services providers and purveyors, a provider is an actor who "produces its own climate data and adds value for users", and a climate services purveyor an actor who "uses climate data available from other providers and adds value for users".[10] Of course, a user of climate services can also be a purveyor, for example scientists getting climate or weather information and presenting their results in studies or reports to a wider audience, or a national weather service that on one hand collects climate-related data and on the other refines and distributes derived products based on it.

The WMO writes about how the provision of climate services can meet the user's need: "The climate services sought by users include the provision of data, data summaries and statistical analyses and predictions as well as tailored information products, scientific studies and expert advice delivered with ongoing support and user engagement. A requirement may be as simple as providing the temperature for a particular place and date or as complicated as an assessment of environmental factors in constructing a billion-dollar infrastructure project. A service package may encompass past historical data, recent and current conditions and future predictions and projections. Services may be provided directly in response to specific requests or in anticipation of the needs of particular groups. Services may be supplied free or at a price."[9]

Globally, there is a high demand for climate services. For example based on conclusions from the High-Level Taskforce for the Global Framework of Climate Services, Asrar and colleagues state that "[…] already existing climate services generate great value for the society. However, the demand for such services greatly exceeds the supply, especially in the developing regions of the world."[11]

Regional climate services are discussed, for example by Krauss and von Storch, as a means to help people understand the huge topic of climate change through a few local examples. They see climate services as a post-normal practice and promote communication between science and public "as a multi-level and open process, which permanently has to adapt to both the meteorological and societal changes in process."[12] The authors argue that "the communication about climate change between science and the public is severely disturbed."[12] Krauss and von Storch's findings show that there has been a decline in public interest for the issue of anthropogenic climate change and suggest that "[…] the present decline in public interest is to some extent a result of the drifting apart of scientific discourse and the everyday experience and perception of climate and weather."[13] In order to bridge this gap, regional climate services have to provide scientific knowledge and to initiate communication, particularly bearing the users in mind: "One is to explore the range of perceptions, views, questions, needs, concerns and knowledge in the public and among stakeholders about climate, climate change and climate risks. The other task is to convey the content of scientific knowledge into the public, to media and to stakeholders."[14] The last point also has to include the limitations of such knowledge and to explain that there are known uncertainties. The idea behind this is obvious. In order to make the public aware of climate change, social and cultural aspects need

to be included into climate research and communication. Here, weather forecasting can perhaps serve as an example of what can be achieved: "One successful example of application of science and technology in serving the global community is the short-range and mid-range weather forecast and advisories."[5]

1.2. About the study

This study contributes to the Dutch Knowledge for Climate programme (KfC), co-financed by the Ministry of Infrastructure and the Environment in the Netherlands[15], and it was carried out under KfC's Theme 6 Climate Projections, Work package 4 "Climate Services", project 4.2 "Climate information services in neighbouring countries". The overall aim of the KfC is to find a strategy to climate-proof the Netherlands, through the development of knowledge and services.

The specific aim of the present study was to produce an overview of approaches in climate services focusing on climate change in two European countries, Sweden and the Netherlands. In particular, this meant a mapping of providers and purveyors of climate services, as well as to obtain a better understanding of available services and possible provision gaps.

Furthermore, the study also aims to contribute to the Joint Programming Initiative (JPI) Climate Theme/Module 2 "Researching Climate Service Development and Deployment". Two of JPI Climate's Fast Track Activities (FTA) relate to climate services. FTA 2.1 focusses on a mapping of users' requirements, while FTA 2.2 focusses on a "mapping of Climate Services Providers in Europe".[16] As part of the working group 2, a website with the aim of building a network of climate services providers in Europe, the Climate Knowledge Hub, has been established.[17]

1.3. The project in a wider context

An exhaustive list of projects and initiatives that seek to improve or contribute to the interaction between providers/purveyors and users of climate services is beyond the scope of this study. Nevertheless, a few prominent examples help set the stage for the specific national developments in the studied two countries:

- **Global Framework on Climate Services (GFCS)** is a global partnership, under the WMO, of governments and organisations involving both users and providers of climate services. Its aim is to coordinate researchers, producers and users of climate services to ameliorate and increase the provision of climate services worldwide, in particular in developing countries.[18]
- **Regional Climate Centres (RCC)** brings together WMO member countries in different regions to strengthen the capacity to meet national climate information needs and to ameliorate the provision of climate services and products including regional long-range forecasts. The concept of the centres also aims at facilitating networking among different actors. The main users of the RCCs are the National Meteorological and Hydrological Services.[19]
- **Climate Services Partnership (CSP)** is a global platform for knowledge sharing and collaboration with the aim of increasing resilience and advancing climate service capabilities. It connects users, providers, donors and researchers in the field of climate services, and strives towards increased communication and engagement among climate services actors, with the aim of increasing climate-smart decision-making. The CSP was formed at the First International Conference on Climate Services (ICCS), held in New York in 2011.[20]
- **JPI Climate: Theme/Module 2 Researching Climate Service Development and Deployment.** The Joint Programming Initiatives connect European countries in order to jointly address research challenges. One of the JPIs so far is on climate. Its Theme/Module 2 focusses on the one hand on the development and deployment of climate services, and on the other on

avoiding duplication by the establishment of a network of climate services providers, with the aim of developing a "European Network of Climate Service (ENCS)."[21]

- **Climate Knowledge Hub** is an initiative to support JPI Climate, with the aim of getting an overview of and connecting different climate services actors in Europe. Climate services providers can connect themselves to the network by providing the initiative with relevant information.[17]

- **Climate-ADAPT: The European Climate Adaptation Platform** was initiated by the European Commission together with the European Environment Agency and is a platform where users get assistance in sharing and accessing information to support climate change adaptation.[22]

- **CIRCLE-2: Climate Impact Research & Response Coordination for a Larger Europe** is a European network of research funders and managing organisations with 34 institutions from 23 countries. It shares knowledge on climate adaptation, and promotes and facilitates long-term cooperation among national and regional climate change programmes.[23]

- **European Climate Assessment and Database (ECA&D)** provides information on changes in weather and climate extremes, as well as a daily dataset to monitor and analyse these extremes. It was initiated in 1998 and today (2014) receives data for 62 countries.[24]

From the Sweden and the Netherlands, two examples of prominent national networks are:

- **The Climate Adaptation Portal,** which is a cooperation of 14 Swedish public authorities with the aim of supporting climate change adaptation work and to provide information about the topic.[25]

- **Netherlands cooperation on Water and Climate Services,** which is a cooperation of 45 organisations based in the Netherlands offering water and climate services.[26]

In addition, there are quite a few research programmes and projects, which either directly or indirectly relates to the development of climate services through provision of basal information, analyses and scenarios and development of methodologies. There are also many specific actors and networks which, within their overall operations either nationally or in an international setting, consider matters related to climate services.

1.4. Definition of climate services used for the project

There is no single and established definition of climate services. Some of the internationally commonly used definitions are quoted below (see Section 3.7 for an elaboration of these definitions compared to the results from this study). Within the study, we investigated how the term is being used among the providers and purveyors.

World Meteorological Organization (WMO)

> Climate services encompass a range of activities that deal with generating and providing information based on past, present and future climate and on its impacts on natural and human systems. Climate services include the use of simple information like historical climate data sets as well as more complex products such as predictions of weather elements on monthly, seasonal or decadal timescales, also making use of climate projections according to different greenhouse gas emission scenarios and time frames. Included as well are information and support that help the user choose the right product for the decision they need to make and that explain the uncertainty associated with the information offered while advising on how to best use it in the decision-making process.[4]

> Climate services are the dissemination of climate information to the public or a specific user. They involve strong partnerships among providers, such as NMHSs, and stakeholders, including government agencies, private interests, and academia, for the purpose of interpreting and

applying climate information for decision making, sustainable development, and improving climate information products, predictions, and outlooks.[27]

Joint Programming Initiative (JPI) Climate

User driven development and provision of knowledge for understanding climate, climate change and its impacts, as well as guidance in its use to researchers and decision makers in policy and business.[2]

Climate services produce science-based client-oriented information about projected regional climatic changes and regional and sectorial impacts. They should be based on a good understanding of the stakeholder needs, and provide easy access to up-to-date information and expertise regarding specific policy or research questions. Strengths, limitations and uncertainties about current knowledge should be adequately communicated, in support of robust decision-making.[28]

Climate Service Partnership (CSP)

Climate services involve the production, translation, transfer, and use of climate knowledge and information in climate-informed decision making and climate-smart policy and planning. Climate services ensure that the best available climate science is effectively communicated with agriculture, water, health, and other sectors, to develop and evaluate mitigation and adaptation strategies. Easily accessible, timely, and decision-relevant scientific information can help society to cope with current climate variability and limit the economic and social damage caused by climate-related disaster. Climate services also allow society to build resilience to future change and take advantage of opportunities provided by favorable conditions. Effective climate services require established technical capacities and active communication and exchange between information producers, translators, and user communities.[29]

Definition of climate services providers and purveyors in this study

In order to be able to pre-identify organisations and actors to contact as providers and/or purveyors of climate services, and for use in the contacts, the definition of climate services used in the study came to be:

Actors who either produce own climate data or other climate information, or mediate available climate data or other climate information, and add value for users.

This definition was modified from Bessembiner and Zölch's definitions of a climate service provider as one who "produces its own climate data and adds value for users"[10], and of a climate service purveyor as an actor who "uses climate data available from other providers and adds value for users".[10]

2. Methodology

In this chapter, the study approach is presented and discussed, followed by an explanation of how providers and purveyors of climate services contacted for this study were selected. This chapter also presents the material used and how this material was analysed. As a final note, this chapter briefly discusses delimitations of the study.

2.1. The approach

The project was carried out during the second half of 2013 and it considered two countries, the Netherlands and Sweden. The approach was built on experiences from the JPI Climate mapping of Climate Services providers, which facilitates further use of the results within the JPI Climate efforts. A number of tasks were conducted:

- Identification of different types of climate services providers and purveyors;
- A stakeholder analysis of the identified types of climate services providers and purveyors to select the types of organisations to contact;
- Database searches, as well as inspection of lists of participants in climate change related events to complement the identification of climate services providers and purveyors;
- Contact with climate services providers and purveyors to request contact information to relevant individuals to contact for the mapping;
- The questionnaire activity;
- Follow-up interviews;
- Analysis and reporting.

The two main methods used to collect material needed were: a questionnaire and interviews.

The questionnaire used for the mapping under the JPI Climate[a] was used as a base, but further modified. As many questions as possible were maintained in order to facilitate possible comparison of the results with those under the Climate Knowledge Hub[17]. These questions were complemented with questions directly relating to the aim of the current study (see Section 1.2. above), i.e. to map providers and purveyors, but with additional focus on aspects such as how climate services are defined, availability of funding for climate services, communication and interaction with users of climate services, and obstacles to providing climate services. As far as feasible, the questions (see Annex 4 for the questionnaire) were designed as multiple response questions, rather than open ones, to facilitate statistical data analysis. Questions deemed better to be posed as open questions and/or sensible or possibly confusing and, as such, in need of further explanations, were included in the interview template.

To construct the questionnaire, the following recommendations based on Esaiasson et al.[30] were applied:

- Avoid complicated and complex issues;
- Avoid using difficult words;

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[a] For the progress in the mapping and the questionnaire, see the Climate Knowledge Hub at http://www.climate-knowledge-hub.org/index-en.html

- Be precise and avoid vague phrasings such as "How often...?" and ask instead e.g. "how many times per week...?";
- Construct as short questions as possible, without making questions unclear;
- Ask one thing at the time;
- Avoid negations.

As "climate services" is a relatively new term and without an agreed definition, the use of a questionnaire could be inappropriate in light of the first recommendation. However, the respondents to the survey were selected based on their occupation; they were all working with questions related to climate and the organisations contacted were all preliminarily identified as either providers or purveyors of climate services. Therefore, the nature of this survey can be described as an "elite-survey". This type of survey is, according to Esaiasson et al.[30], excluded from the first recommendation. Furthermore, with just a few exceptions, all contact persons were contacted directly by phone or email (those contacted by email who did not reply were at a later stage contacted by phone) and given the opportunity to pose questions regarding the topic of the survey. Based on this, a combination of questionnaires and interviews was deemed suitable for this study.

The questionnaire was constructed with the aim of designing it to be as user-friendly as possible, without becoming too superficial. The JPI Climate questionnaire was used as a basis, but modified in order to minimize the time needed for filling it out. The interviews were set up to complement the questionnaires to get a better and deeper understanding of the field of climate services.

Open questions can be advantageous when trying to understand a phenomenon, rather than to provide the respondent with a number of answers to choose from. Open questions can provide a lot of interesting information as they allow for more elaboration by the respondents and, therefore, some open questions were also included, such as: "Has your organisation, to your knowledge, encountered any obstacles in producing climate services? Is there anything that you see would need to be ameliorated?"

Open questions posed in this study were analysed using a qualitative approach, while the closed questions, mainly multiple-choice, were analysed with a statistical tool. For the latter, an excel sheet was used to collate data. The sheet was filled out promptly as questionnaires were returned. The data were then analysed using the statistical software SPSS®.

The questionnaire was sent out to collect some of the most basic information needed for the mapping. When considering questions to include, those that were considered as potentially confusing, in need of follow-up questions and/or too sensitive to pose in a questionnaire, were included in the interview template instead.

The aim of the questionnaire was twofold. The first aim was to collect information about the organisations, such as the number of employees and contact information, as well as how the actors produce their services. Second, the questionnaire functioned as a part of the mapping of climate services providers and purveyors. Questions related to networks, collaboration and awareness of other actors providing similar services served to identify additional providers not identified in the initial mapping. The returned questionnaires were also used as a basis for the follow-up interviews.

The aim of a relatively short questionnaire was to increase the number of replies. A long questionnaire might not have received a significant number of replies. The inclusion of interviews was to create a forum for a more in-depth understanding of the providers/purveyors.

The interview questions were of two types. The first type involved generic questions (see Annex 5 for the interview guide). However, in some cases it was not possible to pose all the generic questions, due to the interviewee's time constraints. Furthermore, some of the generic questions were not relevant for particular organisations and thereby not posed during some of the interviews. For every interview question referred to below, the number of elaborations is shown.

The second type of questions consisted of tailored questions adapted to the type of organisation and/or based on the responses of the questionnaire. Background information about the interviewed

organisations was collected and, if relevant, interview questions were constructed to build on this. These tailored questions were sometimes posed merely to ascertain that the organisations could be considered climate services providers/purveyors, but more often simply to get a better understanding of the organisations and their work.

Along with the questionnaire, an introduction to the research was sent out (see Annex 3), informing the recipients that participating organisations would be listed in a report. The interviewees were informed that their replies would be kept anonymous.

The analytical approach to the qualitative data in this study can be described in terms of Naturalistic-Positivism, according to Folkestad.[31] Central to this approach is that also qualitative data are seen as giving answers to certain questions; providing "facts" possible to analyse. The possibility of analysing the collected data is achieved by applying standardised procedures for the analysis and by using an interview template consisting of either structured or semi-structured questions. The latter is true for the current survey. The approach taken for this study is that there is a reality that is possible to observe and the interviewer is seen as an objective collector of information.

Common criticism to the positivist approach to interview analysis is connected to the role of the interviewer and the influence he or she has on the interview situation, as well as the influence of other external factors.[31] The situation changes from interview to interview; every interview is unique. During a study such as the current one, the interviewer gets a better understanding of the issue in every interview and can possibly ask more and more relevant questions in the next interviews. The interviewer also gets familiarised to the interview situation and more comfortable in the role as interviewer. The emotions reflected by the interviewer can also affect the informant and in turn make him or her more or less comfortable with the situation. Another external factor that can have an impact on the quality of data and be reflected in the data collected is the venue for the interview. It can, for example, not be overlooked that an informant will respond differently depending on whether the interview is held in an office, or in a more informal venue such as a café.[31]

Two common biases connected to surveys are according to Esaiasson et al.[32] These are that respondents have a tendency to 1) try to "please" the interviewer and to give a "correct" answer, rather than to answer what they really think and 2) answer questions they have not really reflected upon and/or cannot answer.

For practical reasons, the interviews conducted in this study were held both over the phone as well as face-to-face. The face-to-face interviews were held at the respondents' work place, with a few exceptions. That external factors, such as the ones presented above, could have had an impact on the data collected cannot be excluded. However, the theme of the interviews "climate services" is not one of the more sensitive topics such as for example personal relationships, religion, political opinions etc., and the bias should therefore be smaller than in the case of more sensitive topics. Furthermore, all respondents were informed beforehand of their rights, how data would be processed and that the name of the organisation would be listed. The interviewees were informed that the interviews would not be recorded but that notes would be taken. Furthermore, they were informed that citations would be kept anonymous, unless otherwise specifically agreed. These arrangements aimed at decreasing biases as much as possible.

The analysis of the material collected in the interviews took the following steps, following Folkestad's description of the naturalistic approach.[31]

1. Read the first unit of data;
2. Read the second unit ;
3. Proceed in this fashion until all units have been assigned to categories;
4. Develop category titles or descriptive sentences or both that distinguish each category from the others;
5. Start over and read the units of data again.

First, the interview notes were separated under different labels, such as "the user", "the services", and so on. Second, the notes were read through and information belonging to other labels was transferred as appropriate. Third, the notes were cut down to categories of information and included under different sub-labels. This led to a general description of the information provided by the interviews. Figure 1 displays, in a simplistic way, how the analysis was undertaken.
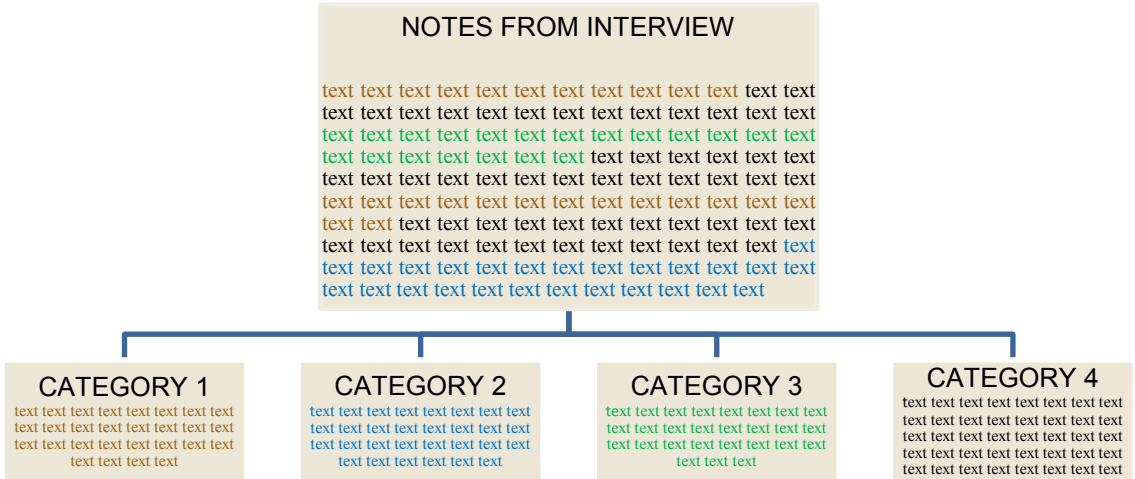
Figure 1. Procedure of qualitative interview analysis. The answers to the questions were analysed one at a time and separated into different, overarching categories. After a preliminary categorisation, the procedure was repeated as appropriate.

2.2. Selecting climate services providers and purveyors to contact

When it comes to climate services, there are many potential providers. In this study, a stakeholder analysis was used to preliminarily identify relevant actors. This was also the approach taken by JPI Climate.[33] The actors were included into a power-interest matrix, as described by for example Bryson[34], defining each stakeholder to potentially be included in the study as having either high or low power and either high or low interest. The actors that were defined as both having high power as well as high interest were selected as key actors to contact first. Actors classified as having high power but low interest or high interest but low power were to be contacted if the time allowed for it. The lowest priority was assigned to actors classified as having low power and low interest (see Annex 2 for the matrix).

Stakeholder analysis is a way to make sure that the actors contacted have been strategically chosen. However, actors' degree of interest and power is constantly fluctuating. Therefore, a new analysis has to be made and the list of actors to contact revised every time that a certain, or a similar, study is carried out.

2.3. Material

The following types of material were used to provide background and context to the study, to support the stakeholder analysis and/or in the subsequent analysis of the responses:

- Reports, websites and scientific articles regarding climate services. This gave a better understanding of the state of research today, what kinds of definitions of climate services there are and which other studies regarding climate services have been carried out or are underway;
- Lists of participants in various climate change related events. This supported the identification of relevant actors;
- Responses to the questionnaire;
- Notes from the interviews;
- Information acquired directly from the respondents, such as links to particular websites, reports or other material containing information about for example specific studies;
- Information regarding the organisations contacted, obtained from the respective webpages. This information was used mainly as a way to construct more tailored questions to the actors participating in interviews.

2.4. Additional remarks

The current research project does not aim at a full mapping of climate services providers/purveyors in Sweden and the Netherlands. The following delimitations were made in order to fit the timeframes:

Selection of study area

The study focused on the Netherlands and Sweden. The questionnaire that was sent out and the interview questions were designed to be in line with the mapping of climate services providers under the JPI Climate Fast Track Activity 2.2 "Mapping Climate Services Providers in Europe".

Selection of stakeholders to contact

Delineation of providers/purveyors depends to some degree on the definition of climate services. The study focussed on the stakeholders identified as having high interest and large resources, based on the stakeholder analysis. Nevertheless, yet additional actors could have been contacted, such as more local actors, insurance companies and the media. In a possible extension of this survey, it could be interesting to include such additional groups to see if the results still stand. Furthermore, a simple search on the internet to find possible providers/purveyors of climate services to contact hardly suffices. We also employed alternative approaches, such as looking through participation lists of climate conferences as well as information from organisations already contacted, to identify actors. The identification of actors could nevertheless be further refined.

Language used

The interviews with the Swedish providers/purveyors were held in Swedish and also the questionnaire directed to them was translated into Swedish. Nuances and differences between different languages are unavoidable and, hence, some questions might have been interpreted differently between the Swedish and the Dutch respondents. Whenever such a potential bias has been noted, it has been highlighted in the presentation of the results in Chapter 3.

The results of the study are presented in the following chapter.

3. Results

The questions from the questionnaire are presented along with an analysis of the information collected through interviews in this Chapter. The English version of the questionnaire can be found in Annex 4 and the generic interview questions in Annex 5.

A total of 62 replies to the questionnaires and 39 interviews have been analysed. Tables 1 and 2 summarises this material. Some organisations returned more than one questionnaire and in this case the questionnaires have been merged as the questionnaire was directed to the organisation and not a specific department or individual. The only exceptions were organisations having sub-organisations with different employees and different tasks, as these could be seen as separate actors. As an example, the Swedish County Administrative Boards in general have one person in charge of climate change adaptation and one in charge of climate change mitigation. If these two individuals would fill out a questionnaire each, these would be merged and counted as one reply from the regional board.

Table 1. Number of organisations participating in the study and response rate.

Total		
	Count	*Percent*
Number of questionnaires sent	101	100
Number of organisations replying to the questionnaire	62	61
Number of declines (after receiving the questionnaire)	4	4
Number of interviews held	39*	39
Number of organisations participating in the survey	64**	63 (66 if the organisations declining to participate are excluded)
Comments:		
*For practical reasons, two of the respondents to the questionnaire participated in the same interview.		
**One organisation in Sweden and one in the Netherlands did not respond to the questionnaire, but participated in the interview.		

Table 2. Number of organisations participating in the study and response rate: Country specific information.

	Sweden		The Netherlands	
	Count	*Percent*	*Count*	*Percent*
Number of questionnaires sent	54	100	47	100
Number of organisations replying to the questionnaire	34	63	28	60
Number of declines (after receiving the questionnaire)	3	6	1	2
Number of interviews held	19*	35	20	43
Number of organisations participating in the survey	35**	65	29**	62
Comments:				
*For practical reasons, two of the respondents to the questionnaire participated in the same interview.				
**One organisation in Sweden and one in the Netherlands did not respond to the questionnaire, but participated in the interview.				

The questionnaire and interview topics are displayed and explained below, together with an analysis. A reference to the number and section of the question in the questionnaire/interview guide is provided in brackets after the questions. More information about the graphs and the statistics behind them are included in Annex 6.

3.1. Who is the provider/purveyor?

The first question in the questionnaire and the first related to the provider/purveyor was on contact details.

> Your organisation: Contact details. (A 1)

The respondents were told that this information will only be used to know who to contact again if needed. The questionnaire was however only exceptionally sent to a generic email-address; in most cases a contact person was identified either through direct contact with the organisation or via the webpage in question. Hence, a contact person was already established and only in a few cases did the contacted person redirect the questionnaire to a colleague.

Organisational structure

> What organisational structure does your organisation have? (Check all that apply and/or specify in the box marked "other"). (A 2)

The question was constructed with the mapping of providers and purveyors in mind. Before the questionnaire was sent out, a stakeholder analysis was undertaken (see Section 2.2) and potential providers/purveyors preliminarily assigned to a specific organisational structure. In many cases the organisational structure was not clear from the organisations webpage and it was decided to pose the question to the organisations directly. Therefore, more potential alternatives were given than we thought would be needed. It was also decided to already from the start give more alternatives of different types of organisations than the questionnaire was meant for as it would facilitate a possible extension or follow-up to the questionnaire. As an example, municipalities were through the stakeholder analysis excluded from the first round of organisations to contact. At a later stage a few municipalities were, however, contacted to get a better understanding of their role regarding climate services.

The organisation of climate services can vary from country to country. This is an important aspect to elucidate as it will help to see if there are gaps in the provided services and how to proceed to improve the provision of climate services in a certain country, as well as to provide a basis for further research and/or inventory. Furthermore, the existing organisational structure can be reflected in the operation of different providers in terms of background of the providers (are they usually from the private sector, from a research institute and so on?) as well as the availability or absence of funding for climate services. Getting an overview of the organisational structure in a specific country can demonstrate links and relationships between providers. In some countries, there is an official national provider assigned, while some other countries have a multitude of different providers and no clear scheme of providers. Understanding the organisational structure can also help to understand how the provision of climate services can be made more efficient, if needed.
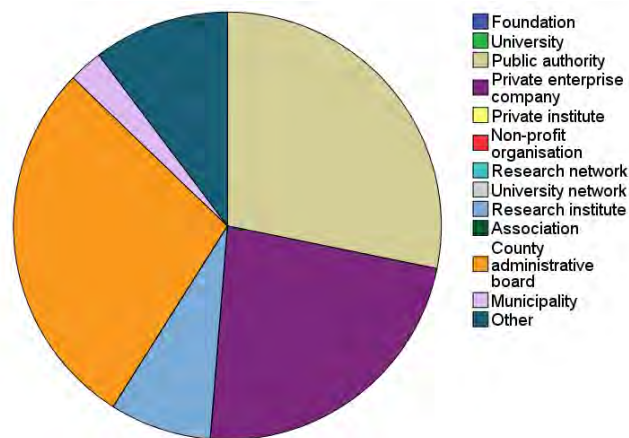
18

Figure 2. Organisational structure: Sweden.
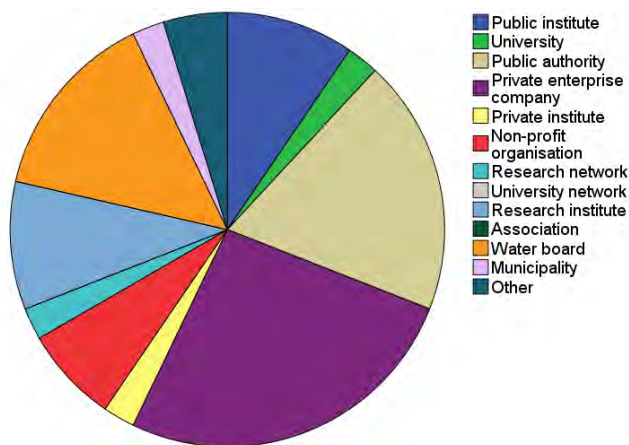
Figure 3. Organisational structure: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. "Public institute" is not commonly used in Sweden and thus was not included; instead, "foundation" ("stiftelse" in Swedish) was used. For Sweden, County Administrative Board was included. For the Netherlands, Water Board was used instead.

Figure 2: N = 34, missing = 0, percent of cases[b]: 115.

Figure 3: N = 28; missing = 0, percent of cases: 150.

Figure 3 displays the organisational structure in the Netherlands. The figure shows a scattered organisational structure. The organisational structure of Sweden in Figure 2 gives a more homogenous impression. Among the participating organisations in this study, the most common organisational type was in the Netherlands a private enterprise company, followed by public authority, and in Sweden a County Administrative Board or other public authority. It cannot be excluded that the difference between the countries can be explained by a biased choice of organisations to contact. For the Netherlands, many organisations were found via the platform *Netherlands Cooperation on Water and Climate Services*[26], which comprises of many private actors. As no specific climate services platform was found for Sweden, most organisations included in the Swedish mapping were identified from various sources such as participant lists of climate related seminars. However, as explained

[b] The term "percent of cases" indicates that the question is a multiple-choice question and hence may result into more than 100 percent replies. If, for example, the percent of cases is 200, this means that in average each organisation provided two replies. Would the question have been a single choice question, the percent of replies could not have exceeded 100 percent. For multiple-choice questions, the percentage displayed for each available option indicates the percentage of respondents giving a positive response to each respective option. If one response option has, for example 80 percent, this means that 80 percent of all respondents indicated this specific response option.

above, the same stakeholder analysis was made on both countries, which meant that some types of organisations (those that did not match the "high interest and large resources" box) were intentionally left out. For a potential follow-up to this study it could be interesting to include additional types of providers and purveyors, such as the media, and investigate whether there are differences between the Netherlands and Sweden.

The alternatives given in the questionnaire had to be adapted to the national context. For the regional level for example, County Administrative Boards were contacted in Sweden while Water Boards were appropriate for the Netherlands. In Sweden, the alternative "public authority" was labelled "other public authority", as County Administrative Boards and universities also count as public authorities.

The question allowed for multiple answers, so one organisation could fit under several types of organisation, allowing for a response rate higher than one hundred percent, which is indicated by the term "percent of cases". The percentage of the total number of replies for this question was for the Netherlands 150 percent and for Sweden 115 percent. This indicates that most respondents to the Swedish questionnaire identified themselves with only one type of organisational structure, while every other respondent in the Netherlands in general identified themselves with two categories.

Number of employees

How many employees does your organisation have? (A 3)

The question was included with the aim to get a better understanding of the national organisational structure; to distinguish if the players on the climate services scene are mainly small or large actors. It was also included as a possible explanatory variable to the availability of climate services, as bigger organisations could be expected to have a different climate services portfolio compared to smaller actors.
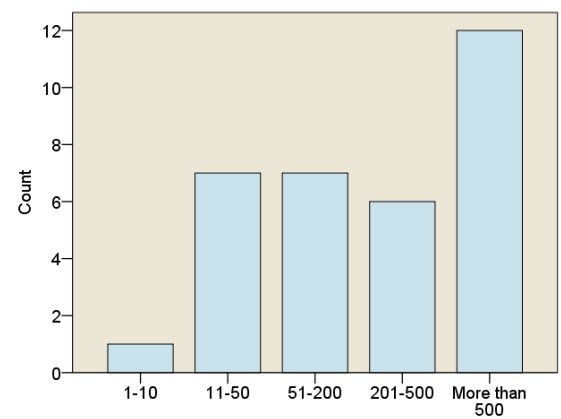
Figure 4. Number of employees at the participating organisations in Sweden.

Figure 5. Number of employees at the participating organisations in the Netherlands.

Comments: Single choice question. Total number of replies. Number of employees in intervals.
Figure 4: N = 33, missing = 1.
Figure 5: N = 28, missing = 0.

Most organisations contacted are larger rather than smaller organisations (they have 200 employees or more). As the survey focussed on the key players, it cannot be excluded that many more small organisations exist within the countries. The result from Sweden shows that there is a tendency towards larger organisations than in the Netherlands. However, these results do not provide infor-

mation regarding whether or not only a part of the organisation is assigned to work with climate services. In a possible follow-up to this study, this information could be relevant to collect in order to get a more detailed picture of the nature of the climate services providers/purveyors.

Starting point

Since when does your organisation offer climate services? (B 2)

The question was included to give an indication of how well established the provision as well as the concept of climate services are. By asking how long the specific organisation has been offering climate services it is possible to look into if the field is new or more established.
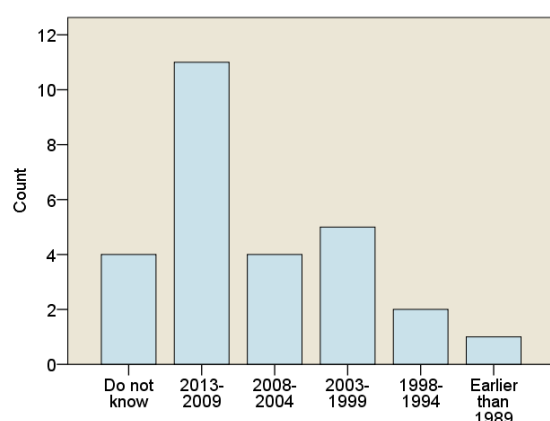
Figure 6. Starting year of the provision of climate services in Sweden.
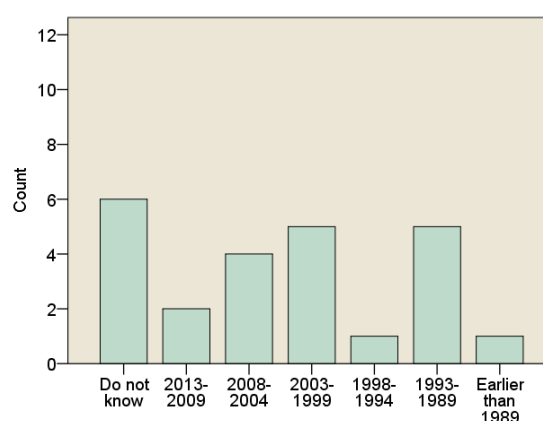
Figure 7. Starting year of the provision of climate services in the Netherlands.

Comments: Single choice question. Total number of replies. Years in intervals. No Swedish respondent replied 1993-1989. The category "do not know" includes two options, "do not know" and "prefer not to disclose.
Figure 6: N = 27, missing = 7.
Figure 7: N = 24, missing = 4.

The question was an open question and the replies were sorted into intervals of five years for the analysis. Answers of the type "for a very long time" were excluded from the analysis (three Swedish organisations and one Dutch. They are included in the account of missing answers above). For Sweden (Figure 6) the most common starting point was the past five years, while the most common reply for the Netherlands (Figure 7) was "do not know/prefer not to disclose".

Development of services

How did the development of your organisation's climate service/services start? (Check all that apply and/or specify in the box marked "other"). (B 9)

The answers to the question were expected to reflect the nature of the different types of organisations. As an example, a public authority has a mission to answer to requests from the government. The question was also posed to get an insight in whether the provision of services is supply or demand-driven. A possible bias might be that respondents could be tempted to, perhaps even not intentionally, slightly glorify the reality. For example, it would be possible that, due to the for the respondents known scope of the questionnaire, they would rather answer that the underlying reason would be own initiative to respond to a societal need due to the portrayed urgency of the climate

change issue, rather than to answer that the reason is an existing demand and therefore a market to sell these types of services at.
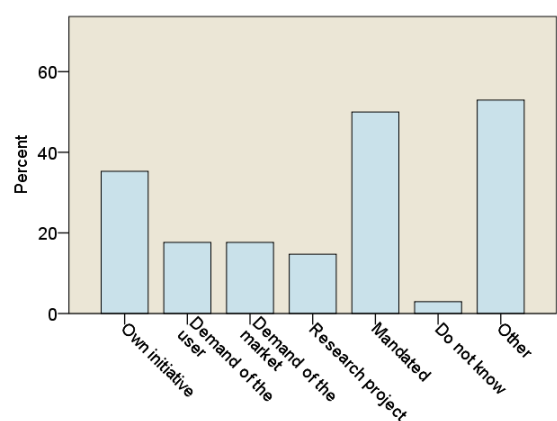
Figure 8. Development of services: Sweden.
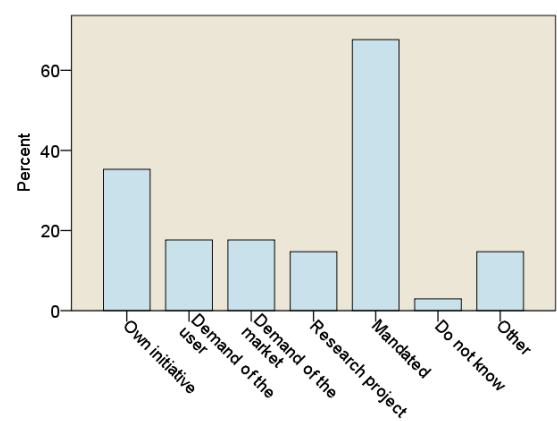
Figure 9. Development of services: Sweden (alternative).

Figure 10. Development of services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. "Demand of the market" refers to the questionnaire option "To meet the demand of the market". "Research project" refers to the questionnaire option "As an externally financed research project". "Mandated" refers to the questionnaire option "Mandated from another actor". The category "do not know" includes two options, "do not know" and "prefer not to disclose.
Figure 8: N = 28, missing = 0. Percent of cases: 189.
Figure 9: N = 34, missing = 0. Percent of cases: 191.
Figure 10: N = 34, missing = 0. Percent of cases: 171.

Figures 8 and 9 would seem to show, for Sweden, two different answers to the question why the organisation started with the development of climate services. Many actors ticked the box "other" and then specified with "upon request by the state/the government/within our mandate". When constructing the questionnaire, this was thought to fit under the alternative "mandated from another actor". From the specifications provided to "other", it was not clear if this clarification was meant as a new option (Figure 8) or as a specification of "mandated by another actor" (Figure 9). Thus, two different results are displayed above to show that due to a bias, for example lack of alternatives/misleading explanation, the result could look different than from a first analysis of the replies given.

The most common reply differs between the countries. The most common for the Netherlands (Figure 10 above) is "own initiative", while, as already mentioned, "other actor"/"upon request from another actor" for Sweden. This goes hand in hand with the organisational structure of the countries – the most common type of organisation in the Netherlands is private enterprise company and thus the answer to the question why the development started could be assumed to be something else than upon request by another actor. The more public organisational structure in Sweden would assumingly give more answers indicating that the development has been made upon request by another actor.

Key competences

> What is your organisation's key competence? (Check all that apply and/or specify in the box marked "other"). (B 4)

This question was used to get an overall understanding of the types of climate services providers and purveyors. Although some services could probably be linked to certain types of providers, knowledge about the key competences provides an overview of the direction of the provided services, as well as the possibilities for new developments of services. The scope of the services could be assumed to depend on the targeted group and the demand, but it also depends on the providers' capacities. The information given from this section of the survey can also give an idea of where capacity needs to be increased. Is there funding missing, is the demand too low and why, or is the competence missing and more capacity building of the providers themselves needed?

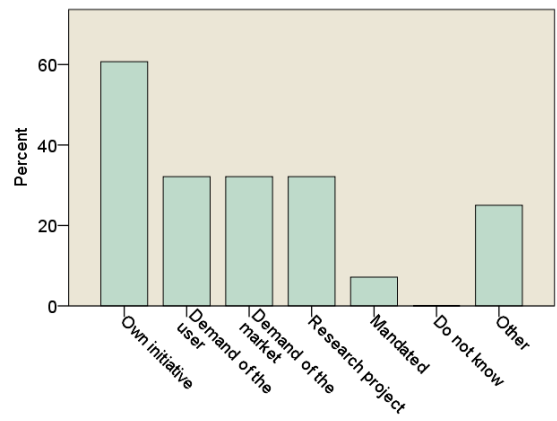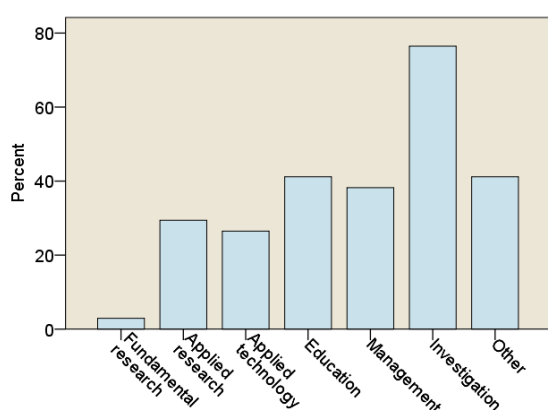**Figure 11.** Key competences: Sweden. **Figure 12.** Key competences: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. "Investigations" refers to the questionnaire option "investigations or other specific analyses".
Figure 11: N = 34, missing = 0. Percent of cases: 256.
Figure 12: N = 28, missing = 0. Percent of cases: 211.

The question was a multiple response question. On average, every participating organisation in Sweden ticked more than 2.5 boxes each, while the number for the Netherlands is more than 2 answers per organisation.

Figure 11 shows the key competences of the Swedish providers. The by far most common was "investigations or other specific analyses", such as assessments, commissions and inquires. One explanation could arguably be linked to the most common type of providers, namely public authorities that often are requested to undertake investigations on behalf of the government or other actors.

Figure 12 displays the key competences of the Dutch providers. The most common answer for the participating organisations was here "applied technology", followed by "applied research".

There is sometimes a fine line between the categories, as for example in the case of this question between "applied research" and "investigations". Sometimes the meanings of these terms overlap. Furthermore, as discussed in Section 2.4 above, the possibility of differences in nuances between the Swedish and the English versions of the questionnaire further implies that different interpretations of the categories cannot be excluded. For example, while "investigation" in English is a rather broad term, the word "utredningar" in Swedish is often associated with the work of public authorities.

Worth noting is also that the replies from the Dutch providers/purveyors were more diverse. A similarity between the both countries is that "fundamental research" is not a common key competence (only two participating organisations indicated this answer, one in Sweden and one in the

Netherlands). This could be an indication that many of the contacted organisations, when it comes to climate services, can be categorised better as purveyors, rather than providers. Generally it seems that the organisations are taking climate information and/or data from other actors and add value to this in forms of for example applied research/technology and investigations. It should however be noted that it is difficult to separate between purveyors, providers and users – many actors have all of these roles. Also, even if climate service purveyors are mainly using material from other actors, it does not mean that they would not occasionally carry out fundamental research as well. This is for example often the case of climate impact researchers.

3.2. What climate services are the providers and purveyors offering?

The aim of investigating the providers' and purveyors' services was foremost to get an overview of what services that are available in a specific country or region and what is missing, to inform providers where there is still a gap to fill; to provide information on how to improve the climate services provided in a certain area. Furthermore, this information was requested to get an idea of the demands of climate services – are some services more demanded than others? In this regard it also tells us something about the organisational structure. If, for example, funding is given to a certain area more than to others, this could influence the content of the existing climate services portfolios. Similarly, if there is a national organisation undertaking the provision of climate services in a certain domain but not others, this could also be reflected in the providers' service portfolios.

Thematic focus

> What is the thematic focus of your organisation's climate services? (Check all that apply and/or specify in the box marked "other"). (B 3)

This question was posed to get an overall idea of existing climate services, for example if there is a particular focus on adaptation to climate change or mitigation of climate change.

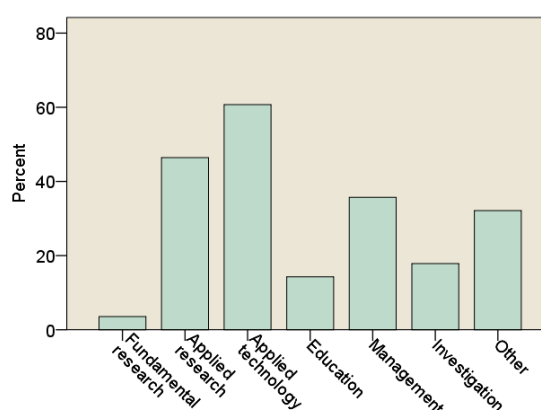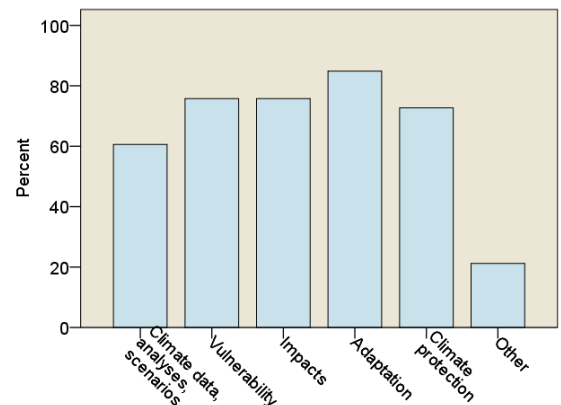**Figure 13.** Thematic focus: Sweden.　　**Figure 14.** Thematic focus: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. "Vulnerability" refers to the questionnaire alternative "Vulnerability to climate change". "Impacts" refers to the questionnaire alternative "Impacts of climate change". "Adaptation" refers to the questionnaire alternative "Adaptation to climate change".
Figure 13: N= 34, missing = 0. Percent of cases: 385.
Figure 14: N= 28, missing = 0. Percent of cases: 307.

Figure 13 displays the thematic focus of climate services in Sweden. The result from the questionnaire displays a fairly even distribution between the different themes. Figure 14 shows that "impacts of climate change" is the most common thematic focus among the participating organisations in the Netherlands. Worth noting is that the focus on "climate protection" (mitigation of climate change), was indicated to be much more common among the Swedish actors compared to the Dutch. Hence, while the climate services portfolios in Sweden seem quite evenly distributed between the different thematic themes, the results from the Netherlands give an indication of a focus on the impacts of climate change, rather than climate change mitigation.

Again, as the study is not an exclusive mapping of climate services providers and purveyors, these results should only be read as indications. It cannot be excluded that the tendency shown by the results of this study to focus on the effects of climate change rather than climate change mitigation in the Netherlands is due to a bias in the selection. It could also be a reflection of the long historical focus on water management in the Netherlands. Organised water management has been ongoing at least since the Middle Ages and has developed over time.[35] Although climate change came into the picture much later, the capacity to work with water management including for example sea level rise and other anticipated impacts of climate change could be assumed to be well established. In its 2007 Water Vision, the Dutch government included resilience to climate change as one of five special focuses.[35]

Types of services

> What types of climate services does your organisation offer? (Check all that apply and/or specify in the box marked "other"). (B 5)

The question was posed in order to get a more detailed understanding of the provision of climate services. We wanted to see if some types of services were more dominant than others and if there were gaps in the provision of climate services. It should be noted that the alternatives in the questionnaire do not make up a complete list of possible types of climate services, as well as that a specific climate services can have either a narrow or broad targeted user-group.

Figure 15. Types of provided climate services: Sweden.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "Synthesis report" refers to the questionnaire alternative "Synthesis report or other knowledge reviews". "Financial tool" refers to the questionnaire alternative "Financial tool, socio-economic indicators". "Decision support tool" refers to the questionnaire alternative "Other decision support tool". "EWS" stands for "Early warning system".

Figure 15: N = 34, missing = 0. Percent of cases: 827.

Figure 16. Types of provided climate services: The Netherlands.
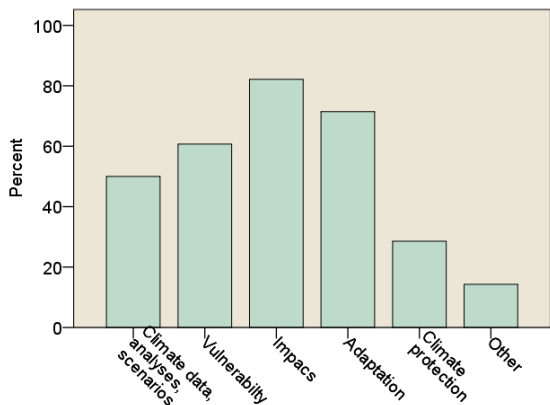
Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "Synthesis report" refers to the questionnaire alternative "Synthesis report or other knowledge reviews". "Financial tool" refers to the questionnaire alternative "Financial tool, socio-economic indicators". "Decision support tool" refers to the questionnaire alternative "Other decision support tool". "EWS" stands for "Early warning system".
Figure 16 (the Netherlands): N = 38, missing = 0. Percent of cases: 671.

The results of the questionnaires show that the top three types of climate services provided by the participating organisations in Sweden are guidance, workshops or similar activities and synthesis reports or similar (Figure 15). In the Netherlands the result is a bit more fragmented, but the most common answers given to the questionnaires were graphics and maps, adaptation strategy and processed data (Figure 16).

The results also show that the organisations in general indicate that they provide several services; in average almost seven for the Dutch organisations and more than eight for the Swedish organisations. As, however, some of the categories such as "guideline/manual" and "guidelines" could be seen as overlapping, this result does not necessarily mean that the organisations are providing as many specific services as they have indicated.

Perhaps the most outstanding difference between the available portfolios of types of climate services is that several of the types of climate services offered in Sweden were offered by a majority of the participating organisations. In Sweden, eight of the 19 different types of climate services were offered by more than 60 percent of the participating organisation, while this only barely holds for two of the types of climate services in the Netherlands. This could indicate that climate services providers and/or purveyors in the Netherlands are more specialised than the Swedish providers and/or purveyors. The types of climate services with a lower frequency than 20 percent (the alternative "other" excluded) are for the Swedish organisations: "analytical tool", "analytical method", "finan-

cial tool or socio-economic indicator" and "early warning system". For the Netherlands, these are: "metadata", "analytical method" and "financial tool or socio-economic indicator". Based on this study only, these types of climate services could be seen as gaps in the provision. This result, however, would need to be compared with a mapping of the users' need to conclude if there is a real gap in the provision of climate services, or if these simply are not requested by the users and thus not provided

Time horizon

> Which time horizon is relevant for your service? (Check all that apply). (B 6)

The question was included to provide another dimension of available climate services, namely what time horizon they cover. This is another piece of information to take into consideration when looking at how the provision of climate services can be improved.

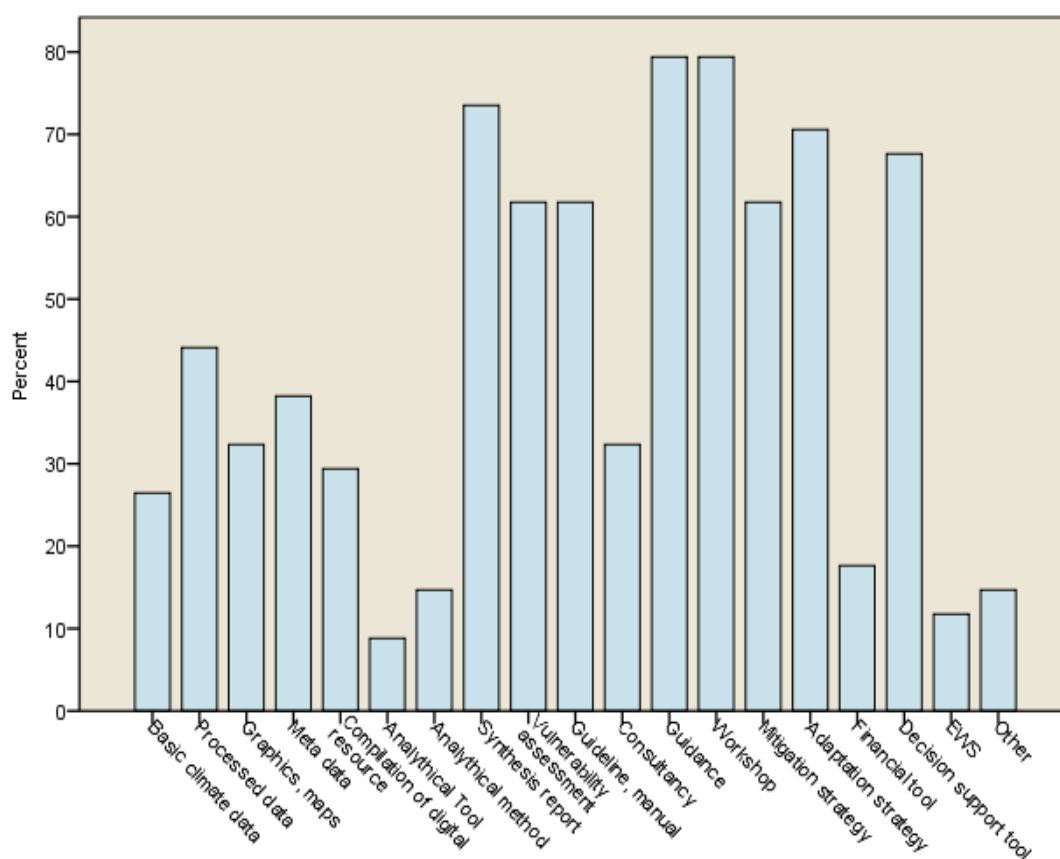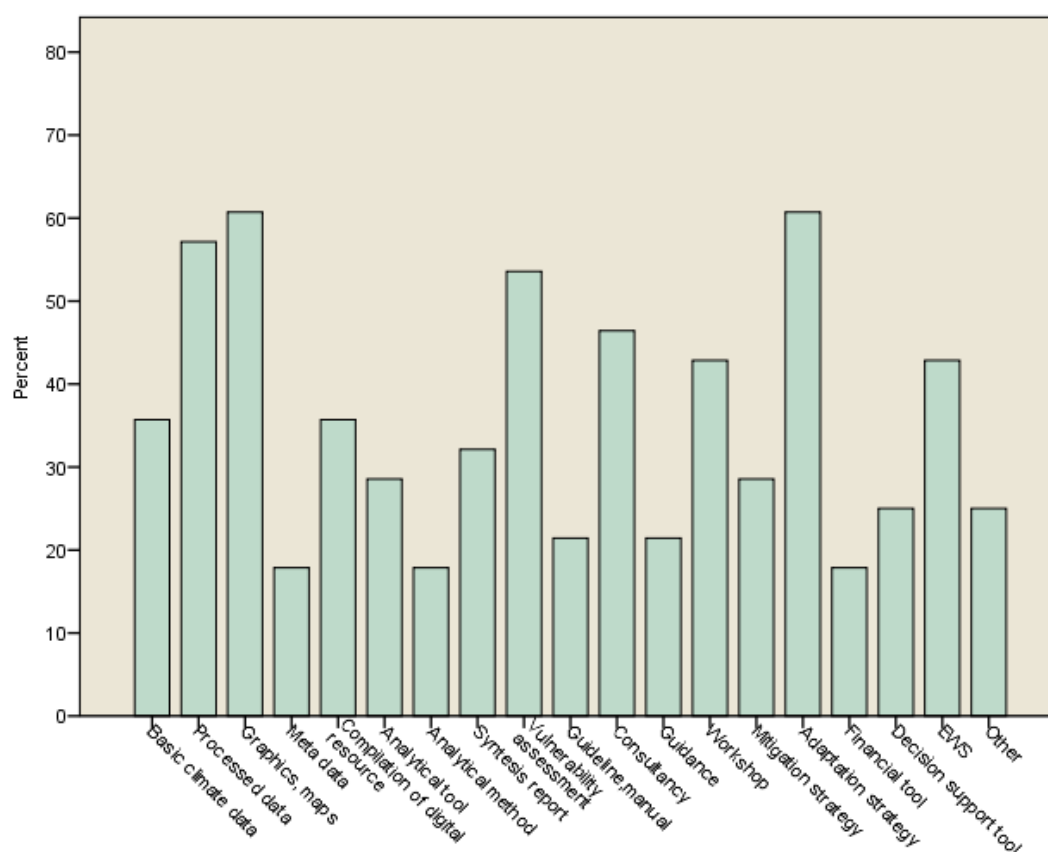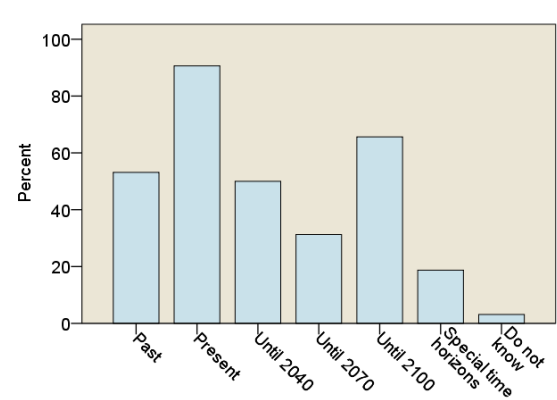**Figure 17.** Time horizon relevant for climate services: Sweden.

Figure 18. Time horizon relevant for climate services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "do not know" includes two options, "do not know" and "prefer not to disclose. The categories with the intervals such as "Until 2040" refer to the questionnaire alternatives such as "Future until approx. 2040" and so on. The category "Special time horizons" in the questionnaire was presented with an example "e.g. seasonal projections".
Figure 17: N = 33, missing = 1. Percent of cases: 321.
Figure 18: N = 28, missing = 0. Percent of cases: 264.

For both countries the time-frame "present" is the most relevant one. The time-frame "past" is seen as almost equally relevant with approximately half of the participating organisations in both countries indicating this time-frame as relevant. The participating organisations in Sweden have indicated more options than those in the Netherlands, with an average of approximately 3.2 and 2.6 options per organisation, respectively.

In the questionnaire we asked what time-frames were relevant for the provided/purveyed services. As a possible follow-up it could be interesting to see what motivates the choices, if they for example respond to users' needs, are based on available data or are requested by another actor. For further research efforts, it could be interesting to investigate if the time-frames provided correspond to the users' needs.

Spatial scale

> What is the spatial scale of your service? (Check all that apply). (B 7)

As the question regarding time-frames, the question regarding spatial scale was included to get more information regarding the existing climate service portfolios, beyond the types of services. This information is important for the actual mapping; to see at what spatial scale the providers/purveyors are foremost operating and if some scales are not covered by the existing climate services portfolios.
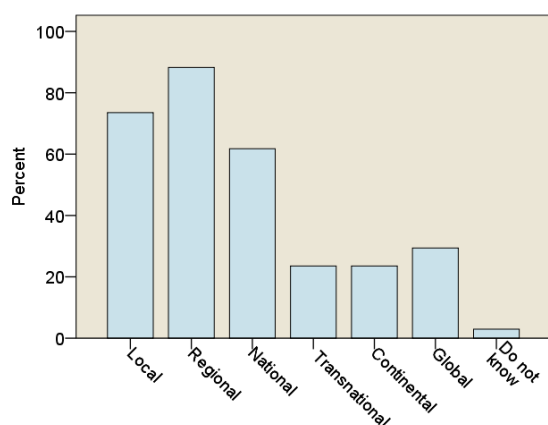
Figure 19. Spatial scale relevant for climate services: Sweden.
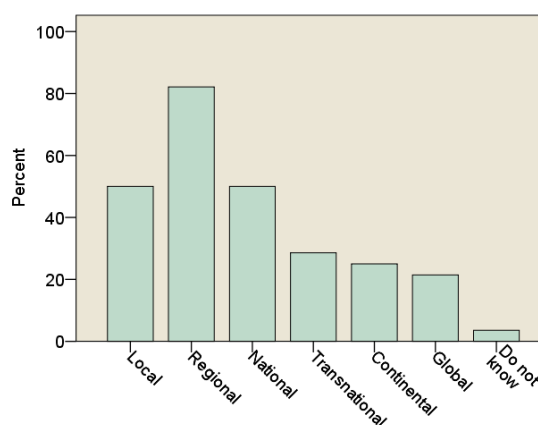
Figure 20. Spatial scale relevant for climate services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "do not know" includes two options, "do not know" and "prefer not to disclose.
Figure 19: N = 34, missing = 0. Percent of cases: 303.
Figure 20: N = 28, missing = 0. Percent of cases: 261.

The distribution of spatial scale for provided/purveyed climate services is quite similar between the two countries. Still, the scale "local" and also "national" is more common among the participating organisations in Sweden, while "transnational" and "continental" are slightly more common in the case of the Netherlands.

Methods used to produce climate services

> What method is your organisation using to produce your climate services? (Check all that apply and/or specify in the box marked "other"). (B 8)

The question gives an understanding on how the services are produced, and an idea of whether the nature of the participating organisations has a tendency towards providing rather than purveying climate services, or vice versa. One of the generic interview questions was about the sources used to produce climate services, the analysis is summarised in the section below.

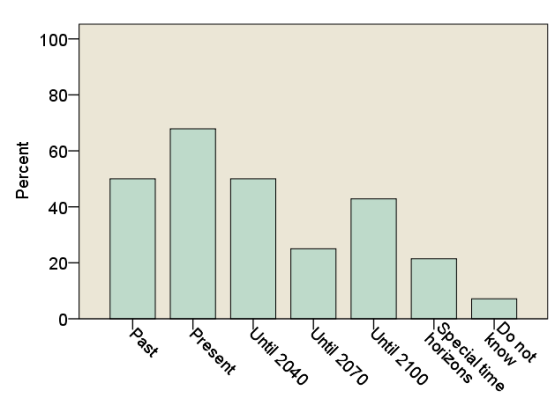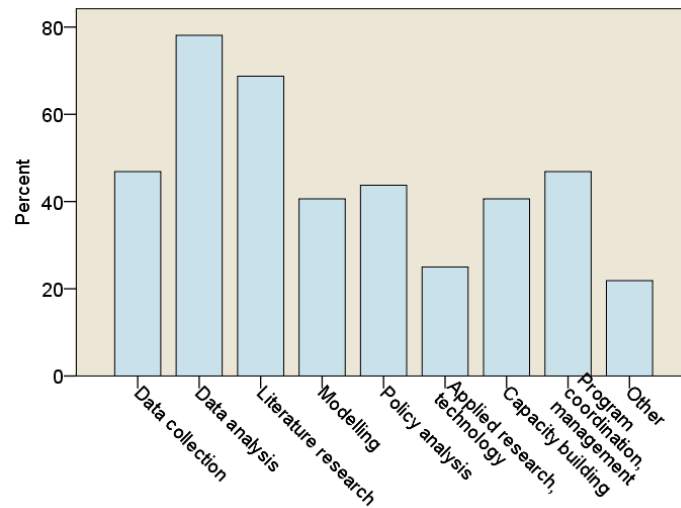**Figure 21.** Methods used to produce climate services: Sweden.
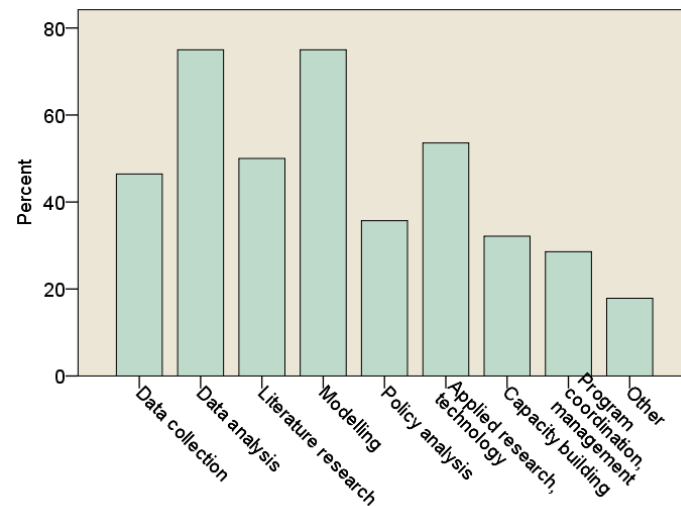
Figure 22. Methods used to produce climate services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option.

Figure 21: N = 32, missing = 2. Percent of cases: 413.

Figure 22: N = 28, missing = 0. Percent of cases: 414.

Figure 21 displays the distribution of methods used to produce climate services in Sweden. The result of this study indicates that the most commonly used methods are "data analysis", followed by "literature research". In the Netherlands (Figure 22), the most commonly used methods are "data analysis" and "modelling". Compared to the results regarding key competences, this could perhaps be anticipated; the most common key competences of the Swedish providers turned out to be "investigations or other specific analyses", while the most common key competences from the Dutch result were "applied technology", followed by "applied research". Within these results, the most common type of Swedish climate services actor has more likeness with "purveyor" - mediator of climate data/information, than what the Dutch organisations do.

However, one general aspect to have in mind when considering these results is that all the participating organisations indicated that they are cooperating with other organisations regarding the development of climate services (see Section 3.5 below). This could mean several things. For example, it could mean that most contacted organisations are not only providers/purveyors but also users,

that they all receive information from other actors of that the contacted organisations to a greater extent are purveyors rather than providers.

Material and sources used to produce climate services

> What sources does your organisation use to collect material used to produce your climate services? (Interview question 3)

This question was posed during the interviews when time allowed for it, either directly or indirectly when discussing the development of climate services. This question was included to see if there are some types of climate services providers and purveyors who are frequently consulted by other providers and/or purveyors. This question was also included to see if providers and purveyors of climate services in general are also users of climate services.
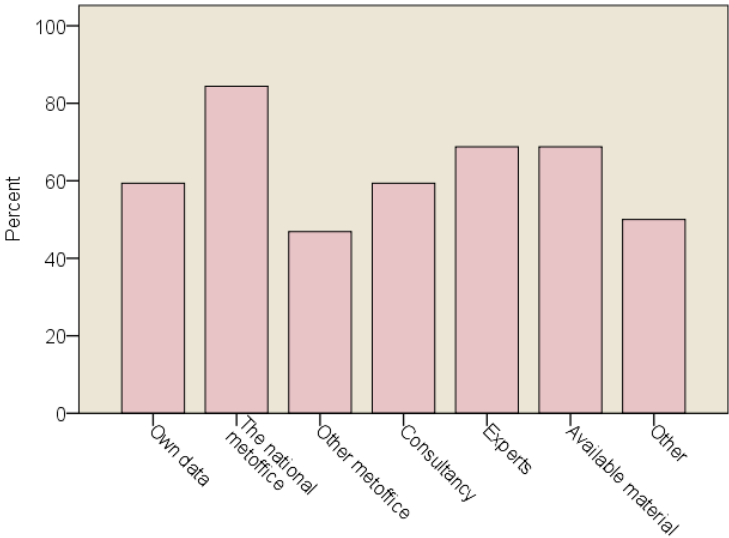
Figure 23. Material and sources used to produce climate services.

Comments: Interview question. Multiple-choice question. Categorisation of responses. The category "Own data" refers to the response option "We produce own data". "The national metoffice" stands for "The national meteorological office. "Other metoffice" stands for "Other meteorological offices". "Consultancy" refers to the response option "We collaborate with consultancies". "Experts" refers to the response option "We consult experts in climate information". "Available material" refers to the response option "We use specific available material (e.g. from the Internet)". "Other" refers to the response option "We consult actors/use sources other than the above mentioned".
Figure 23: N = 31, missing = 7. Percent of cases: 452.

The most common source used for the production of climate services is data and information from the national meteorological offices (here: KNMI and SMHI, as appropriate). Under the category "consultancy", consultancies were hired both to collect certain information, as well as to assist in the development of climate services. Regarding "available material", interviewees were asked if they use some specific sources of available material, such as databases they regularly turn to, for the development of climate services. The nature of the available materials was in general internet-based, such as IPCC reports and other reports.

Worth noting is that among the 16 organisations indicating that they "consult actors/use sources other than the above mentioned" (category "other" in Figure 23), 14 indicated that this material comes from actors at the local and regional level, including the users of the products such as municipalities, regional authorities and companies (interviews 1; 2; 9; 10; 14; 17; 24; 25; 26; 28; 29; 30; 35 & 38). This could be an indication that in these cases the development of climate services is a two-way communication. These cases are also examples of when the provider/purveyor is to some

extent also user and the user also a provider/purveyor, which highlights that the development of climate services may involve complex interactions and that a line between providers/purveyors and users is not always easy to draw.

Uncertainties

During the interviews we asked how the organisations are dealing with uncertainties related to their services, as well as if and how they communicate uncertainties to the users. Figure 24 provides a summary of the replies to both questions.
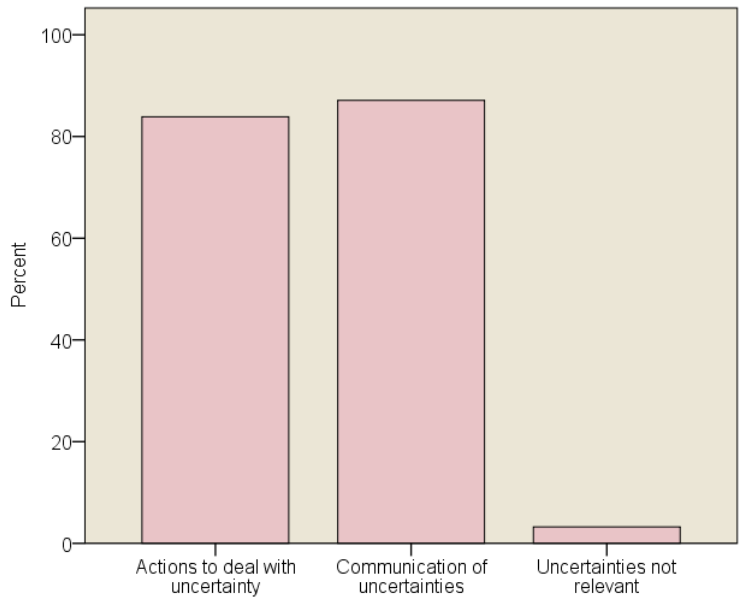
Figure 24. How uncertainties are dealt with; are uncertainties related to the climate services communicated to the users.

Comments: Interview question. Open question. Categorisation of responses to the questions: "How are uncertainties related to the climate services dealt with?" and "Do you communicate uncertainties in the climate services to the users?". One organisation answered that uncertainties in the climate services are not relevant for the work of the organisation.
Figure 24: N = 31, missing = 8 Percent of cases: 174.

Figure 24 above demonstrates that out of the 31 organisations polled about uncertainties related to their climate services, 26 described actions undertaken to deal with the uncertainties and 27 that they communicate uncertainties in the climate services they provide to the users of their services. One organisation answered that they do not find uncertainties relevant for their work regarding climate services.

> If applicable: How does your organisation handle possible uncertainties related to your service/to the data and/or the indicators you are using? (Interview question 6)

Out of the 31 organisations that discussed uncertainties during the interviews, 26 elaborated on actions undertaken to deal with uncertainties related to their climate services. These include actions to decrease uncertainties as well as approaches on how to relate to uncertainties and how to decrease their importance. Figure 25 displays the categorisation of these interview replies.
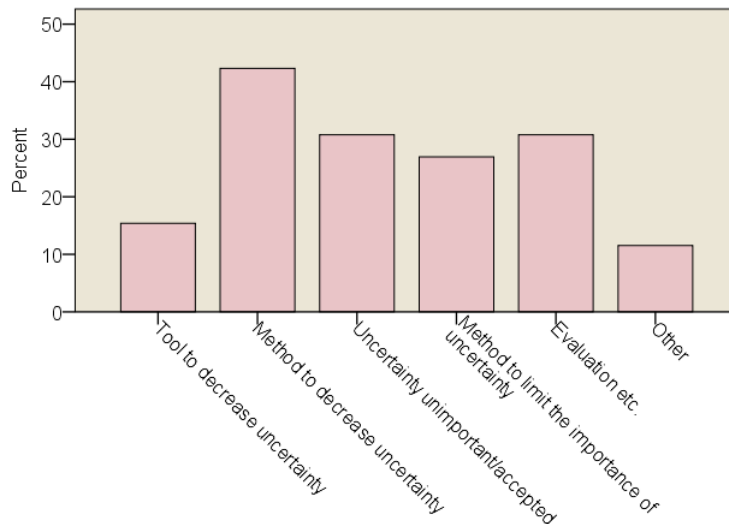
Figure 25. Actions to deal with uncertainties.

Comments: Interview question. Open question. Categorisation of responses. Tools and methods used to decrease uncertainty also include actions to increase the understanding about the scope of the uncertainties related to the provided climate services. The category "Evaluation etc" includes all sorts of evaluation, including internal evaluation and evaluation from users as well as cooperation with other actors to decrease uncertainty.

Figure 25: N =26, missing = 13 (of total number of interviews). Percent of cases: 158.

Out of the 31 organisations that discussed uncertainties during the interviews, four mentioned specific tools used to decrease uncertainty and/or to increase knowledge about uncertainty in the climate services. These include: sensitivity alternatives/analysis (interview 7), ensemble runs of climate models (interviews 8 & 32) and likelihood/uncertainty-intervals (interviews 18 & 32).

Eleven of the organisations (interviews 2; 4; 7; 9; 24; 25; 27; 34; 36; 38 & 39) highlighted different methods/approaches that the organisations have established in order to decrease uncertainty/increase knowledge about uncertainty in the climate services. One of the most common approaches mentioned during the interviews was to use and compare different sources, models, data and/or scenarios (interviews 7; 9; 25; 34; 36 & 39). A specific example was to run analyses with past climate data. If one factor is uncertain in the past data, the present data are suspected to be even more uncertain (interview 7). Other examples include to provide the user with all data used to produce the service and to be transparent about assumptions made so that more data easily can be included, by the organisation or another actor, when available (interview 2). One interviewee said that the organisation actively tries to collect more data from other sources in order to fill gaps in the datasets used, but also that data from different sources cannot always be calibrated and that the process is time-consuming (interview 38). Eight organisations (interviews 4; 8; 9; 10; 14; 16; 24 & 34), explicitly mentioned different types of evaluations of their services, such as peer-reviews, feedback from users and/or different kinds of quality assessments.

Eight of the organisations (interviews 8; 9; 19; 25; 30; 31; 34 & 35) formulated some form of acceptance of uncertainties and/or argued that uncertainties are not so important for their climate services. The arguments were that the future is uncertain and uncertainty is therefore a normal feature (8; 9; 25; 30 & 31), and that exact numbers/estimates of uncertainties are not so important; it is more important to take action (interviews 31; 34 & 35). As a specific example, one organisation explained that uncertainty is important to researchers, but that they only need to know an approximate direction to take (interview 19). Related to this, two organisations discussed that they can present different scenarios and highlight uncertainties, but in the end the users have to decide how to relate to uncertainties (interviews 10 & 34).

Seven of the organisations (interviews 5; 10; 11; 12; 17; 19 & 24) described methods/approaches used in order to limit the importance of uncertainties/incorporate uncertainties without decreasing the uncertainty. Two of the organisations mentioned the use of robustness tests, i.e. to look for actions/choices that will be beneficial independent of the choice of climate scenario (interviews 5 & 10). Other examples include to use a common set of recommendations for implementation, independent of the climate scenario used (interview 19), or to use a value-oriented approach rather than a problem-oriented, i.e. to ask what kind of society we want to have, instead of asking how to solve a certain climate related issue. This way, according to the interviewee, exact numbers are not so important (interview 17). Yet another example mentioned during one interview was to look at effects of policies, i.e. what will happen if we implement a certain policy, instead of trying to figure out what will happen in the future. According to the interviewee, uncertainties in future scenarios then become less important (interview 11).

How does your organisation communicate uncertainties to your users? (Interview question 7)

Out of the 31 organisations that discussed uncertainties during the interviews, 27 answered that uncertainties in the climate services are communicated to the users. Figure 26 displays the categorisation of these replies.
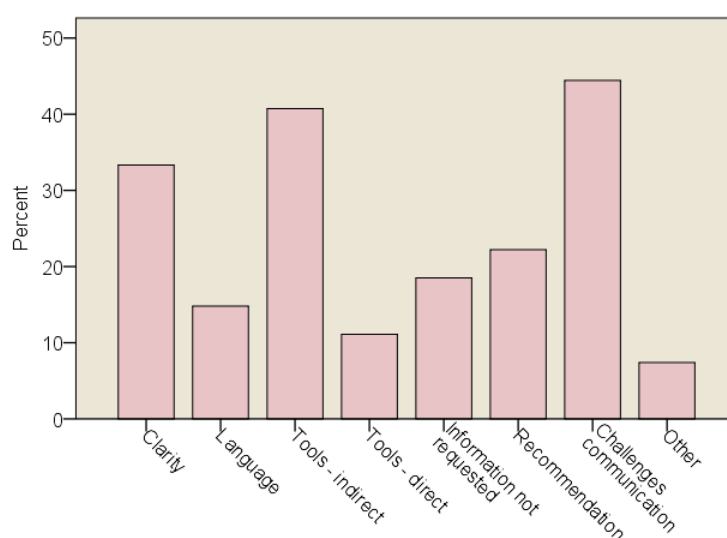
Figure 26. Communication of uncertainties to users.

Comments: Interview question. Open question. Categorisation of responses. The category "Tools - indirect" also includes unspecified means of communication. "Information not requested" also includes replies stating that information about uncertainties related to climate services is not seen as important by the users.
Figure 26: N = 27, missing = 12 (of total number of interviews) Percent of cases: 193.

Among the interviewees who discussed communication of uncertainties, nine stressed that it is important to be clear, open and/or explicit about uncertainties to users (interviews 5; 7; 8; 14; 18; 20; 24; 28 & 37). Two specifically said that it is important to not give the user the impression that they are more certain than they are (interviews 5 & 20).

During eleven of the interviews (interviews 4; 8; 9; 14; 15; 16; 17; 18; 20; 32 & 37), different tools for indirect communication of/provision of generic information about uncertainties were described. Six organisations mentioned unspecified means of communication, such as that they "inform about", "display", "show", etc. uncertainties in the services (interviews 8; 16; 17; 18; 32 & 37). Four organisations specified that they provide written information about uncertainties on the webpage (interviews 4; 9; 16 & 20). Other tools include different means of visualization of uncertainties, for example use of different colours for different levels of uncertainties and/or by displaying the result of several models/scenarios together (interviews 14; 15 & 20). One specific example was to keep grids on the maps, to use the rough, original graphs instead of smoothing them out, and to

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use large grid sizes in order to visualize that scenarios cannot be downscaled to specific places without constraints (interview 20). Two organisations said that they do not use the words forecast and prediction but rather scenario or 'studies of the future' in order to highlight that their conclusions have uncertainty (interviews 5 & 7). One organisation mentioned that they get assistance from another actor on how to communicate uncertainties to users (interview 36), and another one that they adapt the level of detail of the information regarding uncertainties according to the targeted recipients (interview 12). Three organisations highlighted tools/approaches used foremost for direct communication with users (interviews 2; 26 & 34). Direct communication with users includes workshops, dialogues, presentations, demonstrations and similar, as well as direct information provided to a specific user instead of generic information.

Six organisations indicated that they, on top of informing users about uncertainties, also give recommendations on how to handle uncertainties/what actions to undertake after taking uncertainties into consideration (interviews 9; 10; 19; 31; 32 & 37). Five organisations described that information about uncertainties, especially more specific information, is not particularly requested by the users (interviews 2; 17; 19; 27 & 31). Related to this, twelve organisations expressed that they experience the communication of uncertainties to users as challenging (interviews 8; 9; 10; 14; 15; 16; 20; 26; 36; 37; 38 & 39). Three organisations mentioned that stakeholders in general want definite answers, not different options due to uncertainty in the estimations (interviews 9; 16 & 20). As an example, one organisation described that it is challenging to keep a good balance between keeping the interest of policy-makers by not adding too much information and not losing scientific soundness (interview 15).

3.3. Nature of the services

This section sums up the material collected on why the provision of climate services looks as it does – why, for example, some types of climate services are more common than others. There are many possible factors that could affect the provision of climate services. One could be how climate services are financed. If public funding is available, the services could be expected to be, to a greater extent, publicly available and target a broader user group, compared to services financed in other ways. Another example could be whether or not there are public authorities or other major actors responsible for the provision of certain types of services or if the provision is more regulated by the market and the responsibility of other actors. This section also gives some insight on whether information about existing services is being spread, and whether they are promoted and how.

Dissemination of climate services to users

> How does your organisation disseminate the service to the user? (Check all that apply and/or specify in the box marked "other"). (C 3)

This question was included in the questionnaire in order to gain an understanding about the dissemination of climate services to the users. One of the keystones in the different definitions of the term climate services is that the services should, in one way or another, be communicated to the user. Some definitions also include user-friendliness as a feature.
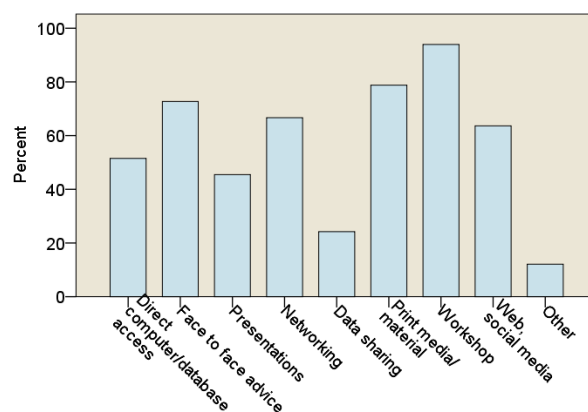
Figure 27. Means of dissemination of climate services to users: Sweden.
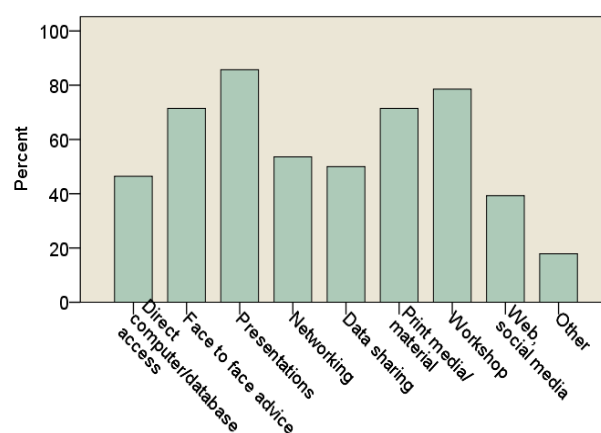
Figure 28. Means of dissemination of climate services to users: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "Presentations" refers to the questionnaire alternative "presentations of results directly to user". "Workshop" refers to the questionnaire alternative "workshop, symposium, course".
Figure 27: N = 34, missing = 0. Percent of cases: 518.
Figure 28: N = 28, missing = 0. Percent of cases: 514.

The most commonly used means of dissemination of climate services in Sweden are "workshop, symposium or course", followed by "print media/material" (Figure 27). Most of the given alternatives of means of communication of climate services were used by half or almost half of the participating organisations, with the exception of "data sharing" and "other means".

Similarly, in the Netherlands (Figure 28), most of the alternatives of means of dissemination of climate services were used to a large extent, with "presentations of results directly to the user" as the most commonly used, followed by "workshop, symposium or course".

Some differences between the countries when it comes to specific means of dissemination are that "data sharing" is used among twice as many organisations in the Netherlands compared to Sweden, while "web and social media" is used more frequently in Sweden.

One general tendency according to these results is that direct interaction with users seems to be quite high as more than ninety percent of the participating organisations in Sweden use "workshop, symposium or course" and more than eighty percent of the participating organisations in the Netherlands use "presentations of results directly to the user" as a means of communicating climate services. The topic interaction with users was further elaborated on during the interviews, and the results presented below (see Figure 33).

Promotion of climate services

Does your organisation promote your organisation's climate services? (B 11)

The question was included to see if the contacted organisations actively spread information about their climate services. For the organisations that answered that they do promote their services we asked what means of communication they use to reach out. The figures below display how common it is to promote services, followed by what means of communications are used for the promotion of services.
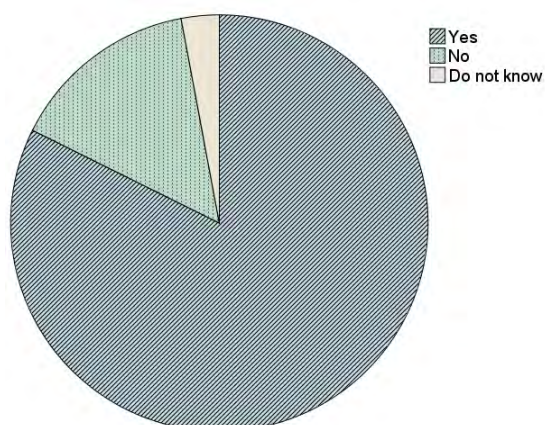
Figure 29. Promotion of climate services: Sweden.
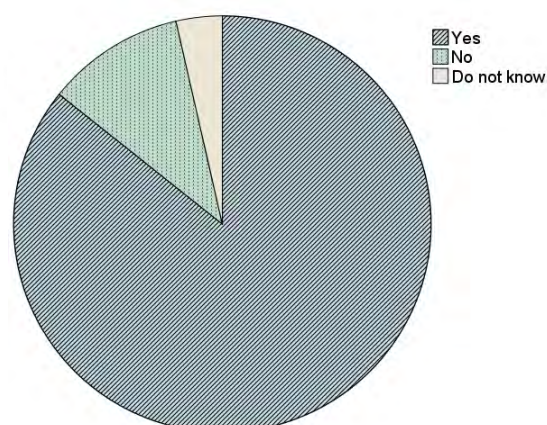
Figure 30. Promotion of climate services: The Netherlands.

Comments: Single choice question. The category "do not know" includes two options, "do not know" and "prefer not to disclose. One respondent in each country respectively answered "do not know/prefer not to disclose". 5 out of 34 respondents in Sweden and 3 out of 28 respondents in the Netherlands answered that they do not promote their climate services.
Figure 29: N = 34, missing = 0.
Figure 30: N = 28, missing = 0.
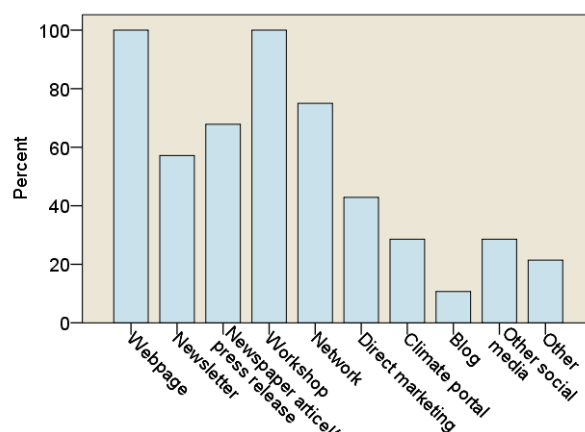
Figure 31. Means of communication to promote climate services: Sweden.
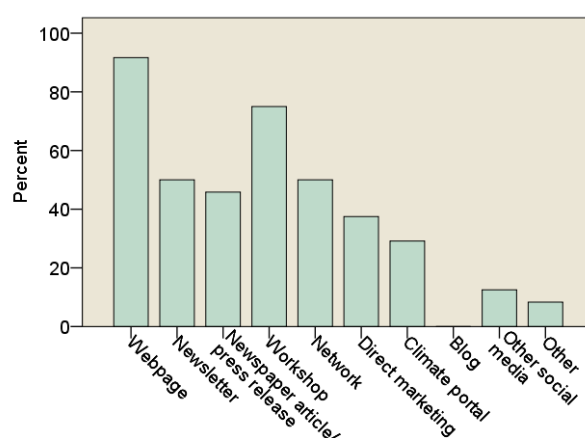
Figure 32. Means of communication to promote climate services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "Webpage" refers to the questionnaire alternative "The organisation's webpage or other webpage". "Workshop" refers to the questionnaire alternative "workshop, symposia, course or similar". "Direct marketing" refers to the questionnaire alternative "direct marketing to users (existing users and/or potential users)"
Figure 31: N = 28, missing = 0. Percent of cases: 532.
Figure 32: N = 24, missing = 0. Percent of cases: 401.

Most of the participating organisations in both countries do promote their services. 28 out of 34 organisations in Sweden indicated that they promote services, compared to 24 out of 28 organisations in the Netherlands.

All means of communication for promotion of services are used to a higher extent among the participating organisations in Sweden (Figure 31) compared to the participating organisations in the Netherlands (Figure 32), with the only exception being "climate portals" which is used to an equally large extent in both countries. All of the participating organisations in Sweden that indicated that they promote their services indicated that they use webpages, as well as workshop, symposia, course or similar. These were also the most common means of communication for the promotion of services in the Netherlands.

Interaction with users

> In general, how would you rate the extent of interaction with the users of your services? (Interview question 9)

In order to further understand the communication with users, a question regarding interaction was posed during the interviews (unless the matter had already been elaborated on during the course of the interview). This question was included to get a better understanding of the level of users-friendliness, as this was assumed to be increased with the level of interaction; if services are tailored to the users' need and/or if providers/purveyors have regular contact with users during the process of production and/or dissemination of the service. On the other hand, frequent contact could also reflect that the user needs guidance in the use of the service, which in turn could imply that the original service was not tailored to the user's need, or that the user needs more training in using the service in question. In such a case, the communication could however allow for an improvement in the long run of the user-friendliness of the service.
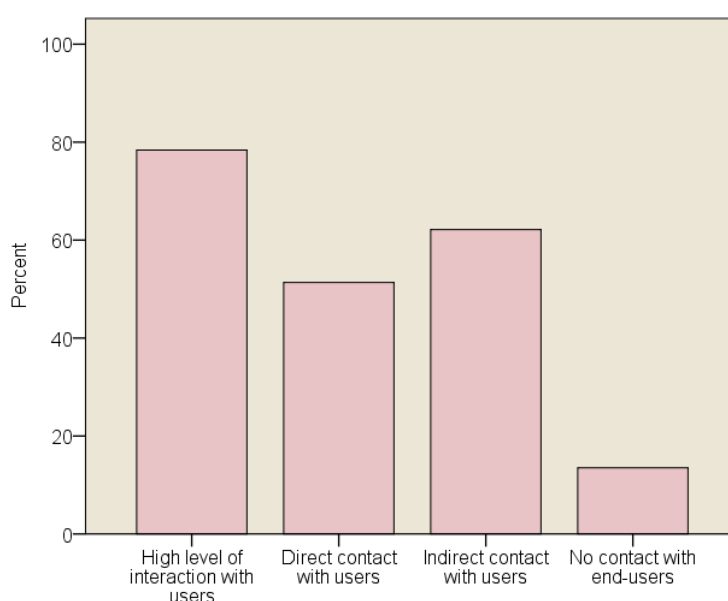
Figure 33. Interaction with users.

Comments: Interview question. Open question. Categorisation of responses.
Figure 33: N = 37, missing = 2. Percent of cases: 205.

Answers were categorised according to the level of interaction using the following categories:

- High level of interaction with users: This category includes such two-way communication with users as face-to-face meetings and tailoring of products to their needs.
- Direct contact with users: This category includes all kind of one-way communication with users, such as presentations or meetings with a larger audience.
- Indirect contact with users: This category includes indirect contact with users, such as through webpages without interaction with the users.
- No direct contact with end-users: This category includes actors who provide data/information to another actor – a purveyor, who in turn provides it to end-users.

The most commonly indicated level of interaction was "high-level of interaction". On average, the answers were found to match two different categories each. This gives an indication that participating organisations in general offer different services with a different level of interaction. An example of this could be an organisation that works with pilot-studies with high level of interaction with users and turns the lessons learned and experiences gained into generic information and advices.

One factor regarding climate services that makes it hard to draw general conclusions regarding the level of interaction is that climate services can be produced in project-forms and the level of interaction varies between projects. Furthermore, in the case of consultancies and private enterprise companies in general, services are often provided in such a way the users request it. Thus, in these cases the level of interaction can also vary from user to user.

Establishment of contact with users

> In general, how is the contact between your organisation as a provider of climate services and your users established? (Interview question 8)

This question was discussed during 34 of the 39 interviews. It was posed in order to get a better understanding of the contact with the users, to see if organisations are actively contacting potential users or if users in general are requesting certain services.
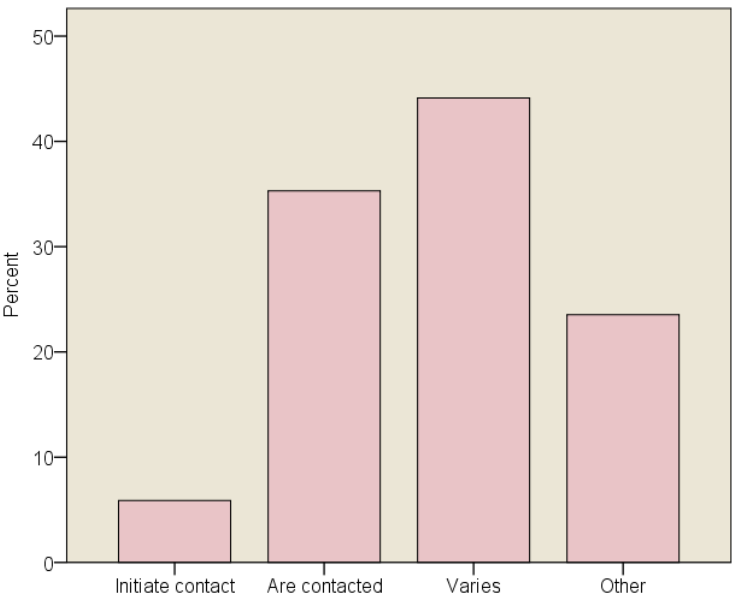
Figure 34. Establishment of contact with users.

Comments: Interview question. Multiple-choice question. Categorisation of responses. The category "Initiate contact" refers to the response option "We contact potential users of our services". "Are contact" refers to the response option "We are contacted by potential users of our services". Potential users include new as well as already established users. The category "Other" in the interview template was divided into "Other" and "Varies" for the analysis, because so many interviewees responded that establishment of contact with the users varies.
Figure 34: N = 34, missing = 5. Percent of cases: 109.

The most common answer was that it varies. This category was not initially included in the template, but as it was the most frequent answer under the more unspecific category "other", it is displayed as an own category in Figure 34.

It should be noted that the responses were difficult to analyse. For example, many public authorities do not have a clear user of the services. Services are often requested by the government or some other actor, or are part of a specific task. During the interviews it was also indicated that sometimes another actor, for example the EU, requests a particular product and provides funding for this. Climate services actors then compete to get the project (interviews 3; 14; 25 & 33). While the actor requesting the product is clear, the "establishment of contact" is not, and thus the question is difficult to answer. Other situations where the establishment is unclear are when a new climate services

project is initiated through an already existing cooperation and/or project (interviews 1; 15; 19; 21; 22 & 36).

Financing of services

> How does your organisation finance the development and the provision of your climate service? (Check all that apply and/or specify in the box marked "other"). (B 10)

This question was included both for acquiring information about providers' available funding and to get a better understanding of the organisational structure. A country with more public funding directed to research and development relevant for climate services could be assumed more likely to have more providers from the research community while a higher demand for market-based service providers might apply in a country in which such support to R&D is less.
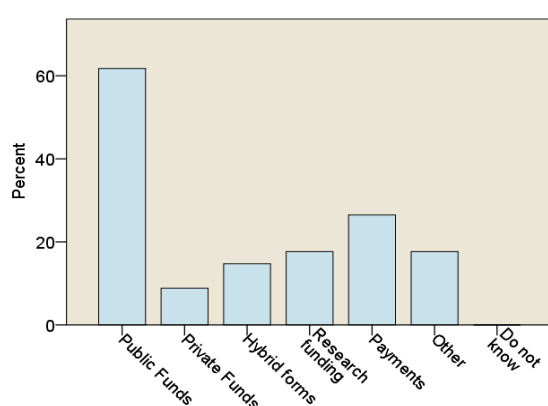
Figure 35. Financing of the development of climate services: Sweden.
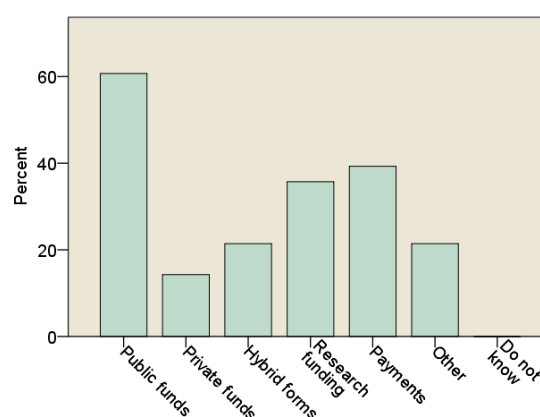
Figure 36. Financing of the development of climate services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "Hybrid forms" refers to the questionnaire alternative "Hybrid forms of public and private funding". "Payments" refers to the questionnaire alternative "Payments for the services". The category "do not know" includes two options, "do not know" and "prefer not to disclose. No respondent ticked this category.
Figure 35: N = 34, missing = 0. Percent of cases: 147.
Figure 36: N = 28, missing = 0. Percent of cases: 193.

The result indicates that public funding is used as financing for the provision of climate services among approximately sixty percent of the participating organisations in both Sweden and the Netherlands.

This result perhaps provides an indication, but cannot be confirmed, that there are many (research) projects related to climate services. Research funding is often provided on project basis, and it could be assumed that the same holds for research projects relating to climate services. In line with this, one aspect that could be further investigated in a future study concerns the time frames of climate services projects; are they long and include capacity building in order to turn the project into regular services, or do the services cease once the project is finished? If the latter is the case, the quality and efficiency of the provision of climate services could be improved by introducing means of making the results operational.

The result also shows that payments for climate services are more common among the participating organisations in the Netherlands compared to Sweden. A better understanding of payments for climate services could perhaps lead to more insight to the availability of the services. If the services are free of charge, it could be assumed that they are available for more users compared to if there is a

cost. On the other side, adding a fee to the service might facilitate developing services. It would be interesting to investigate whether more services are provided in an area where services are to some extent not free of charge compared to areas where most services are free of charge. In this line it could be interesting for future climate services related research to look at whether services that are not free of charge are more tailored to the users than services that are free of charge, and if it is common that providers provide both types of services. Other questions to pose could include investigating the role of the financer and whether, for example, the source of funding has an impact on the length of the projects carried out, as well as if there is a difference between services focussing on the current climate compared to those focussing on climate change. For both Sweden and the Netherlands there is a clear division of responsibility for services dealing with the current climate. In Sweden, private actors broadcast most of the weather forecasts, with the exception of the public radio Sveriges Radio (SR), to which the weather news is provided by the SMHI. In the Netherlands, weather news is exclusively provided by commercial actors.

The result from this study, regarding financing of the climate services, could be an indication that the demand from the market is not so high, as most services are financed publicly. On the other hand, if climate services are anyway provided by public authorities, perhaps there is less room for commercial actors to enter the market. Market-demand of climate services is touched upon in Section 3.6 below.

3.4. Users of the services

In this section we present results related to information about the users of the provided climate services; which user groups and sectors are relevant for the services provided/purveyed? As many providers also are users of climate services and *vice versa,* it is important to get information about who the users are, to provide a more extensive mapping. Related to this, we also look at cooperation with other actors. Furthermore, an aspect of the inventory is to see whether providers are focussing on specific groups of users and/or sectors and how such focus has developed. Moreover, asking the providers/purveyors of climate services about their users also aims at trying to see if the providers know who their users are, which may provide information on to what extent the products can be tailored to the users or not. One of the key aspects for climate services is that the products should be user-friendly, and related to this also tailored to the users. However, one may also need to reach out to many users, which could result in a goal conflict. Pertinent issues herein are as follows. How can services be provided to a large public but still be user-friendly and of value for specific users? Are there generic guidelines available on how to use the products? Is there a variety of products so that the users who have specific needs also can get the services adapted to their needs? Information on these kinds of issues was also sought in the interviews.

Users

> Who are the users of your service? (Check all that apply and/or specify in the box market "other"). (C 1)

This question was included to get an overall idea of who the users of the offered climate services are – and whether or not the participating organisations know who the users are. The questionnaire provided the respondents with seven common user-groups to choose from, as well as the open-answer option "other" and "do not know/prefer not to disclose".
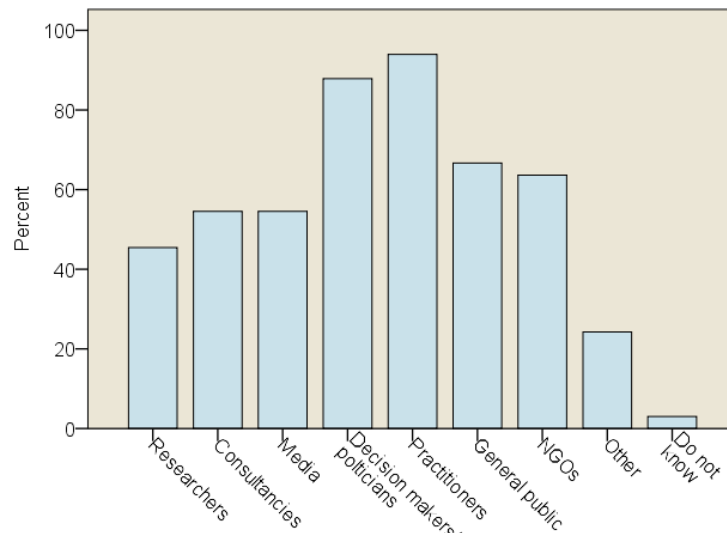
Figure 37. Users of the provided services: Sweden.
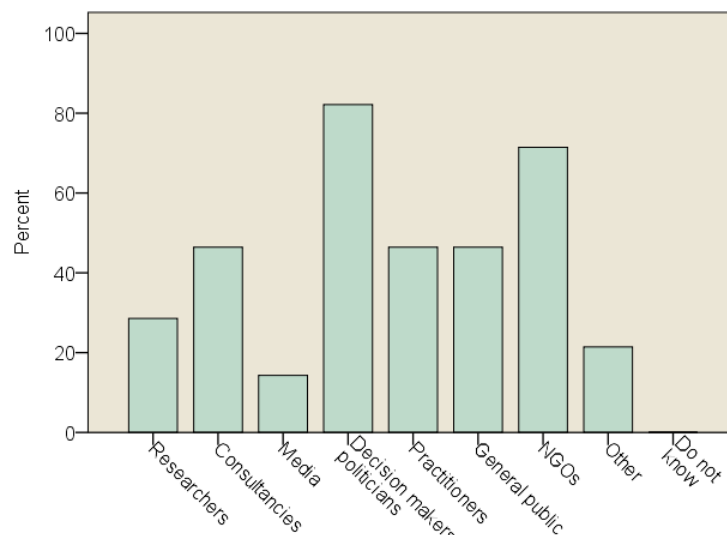
Figure 38. Users of the provided services: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "NGOs" refers to the questionnaire alternative "NGOs and other stakeholder groups". The category "do not know" includes two options, "do not know" and "prefer not to disclose.
Figure 37: N = 33, missing = 1. Percent of cases: 494.
Figure 38: N = 28, missing = 0. Percent of cases: 357.

The result for the Swedish providers/purveyors shows that almost all participating organisations have practitioners as one user group, followed closely by decision-makers/politicians. Almost none answered that they do not know who the user is. In fact, all user-groups except of researchers and "other" are served by half or more than half of the participating organisations.

The result for the Dutch providers/purveyors indicates decision-makers/politicians as the most common user-group, followed by NGOs and other stakeholder groups. When constructing the questionnaire "other stakeholder groups" was envisioned as other stakeholder groups similar to NGOs. However, "other stakeholder groups" could also be interpreted as all users in general; a possible bias in the survey for this question. Also worth noting is that around twenty percent of the organisations in both countries answered "other", which could be an indication that the survey omitted certain user groups. Out of the six organisations in the Netherlands and the eight organisations in Sweden answering "other" most referred to legal entities in contrast to the questionnaire's

general focus on groups of natural persons. Of these 14 organisations, nine answered bodies such as "public authorities", "cities", "county administrative boards", "the regional and local levels" "nations" and "companies". Four organisations mentioned different types of civil servants. These answers represent groups which are often seen as providers/purveyors of climate services. Hence, these answers could be an indication that many providers and purveyors of climate services are also users of the services.

In line with the results regarding types of climate services provided (see Section 3.2 above), the Dutch results taken together (Figure 38) indicate a more specific provision of climate services. Some user-groups are quite common while others are fairly uncommon, compared to a more even distribution of user-groups in Sweden. Another indication of this is that the participating organisations in Sweden on average indicated almost five user-groups each, while the participating organisations in the Netherlands indicated around 3.5 user-groups each. This could perhaps be linked to the respondents being more dominated by commercial companies in the Netherlands and more public actors in Sweden.

Sectors

> In which sector/sectors do the users operate? (Check all that apply and/or specify in the box marked "other"). (C 2)

This question was included to get more detailed information about the users, but also to get an indication if the provided services are tailored to specific sectors and, if so, if some sectors are not targeted. Furthermore, an indication of whether services are sector-specific was also possible to interpret from the results from the questionnaire. If services are sector-specific, providers/purveyors would arguably be more likely to indicate only a few sectors, rather than check every box, or the "do not know/prefer not to disclose" box.
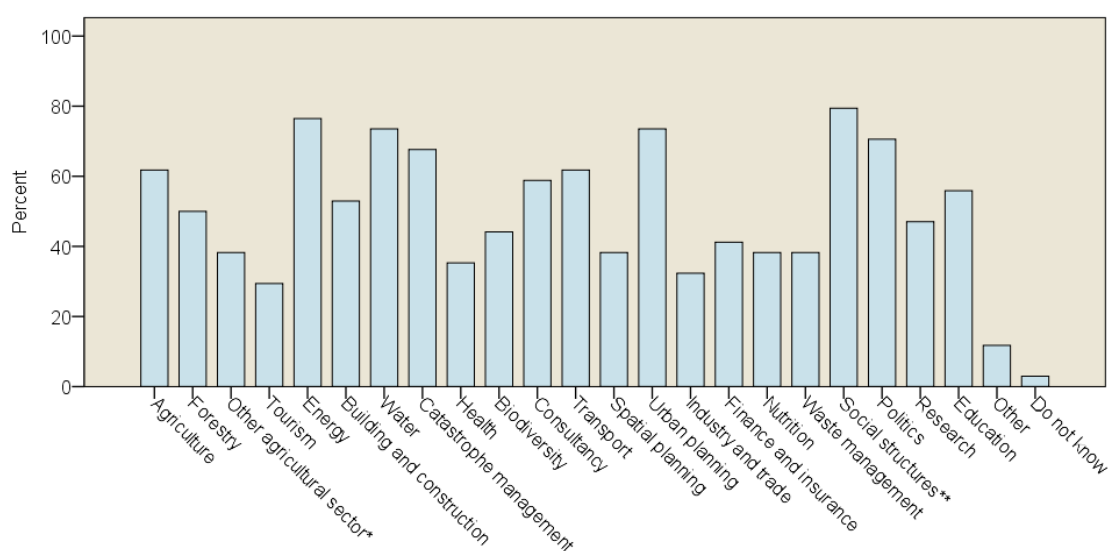
Figure 39. Sectors to which the users of the services can be allocated: Sweden.
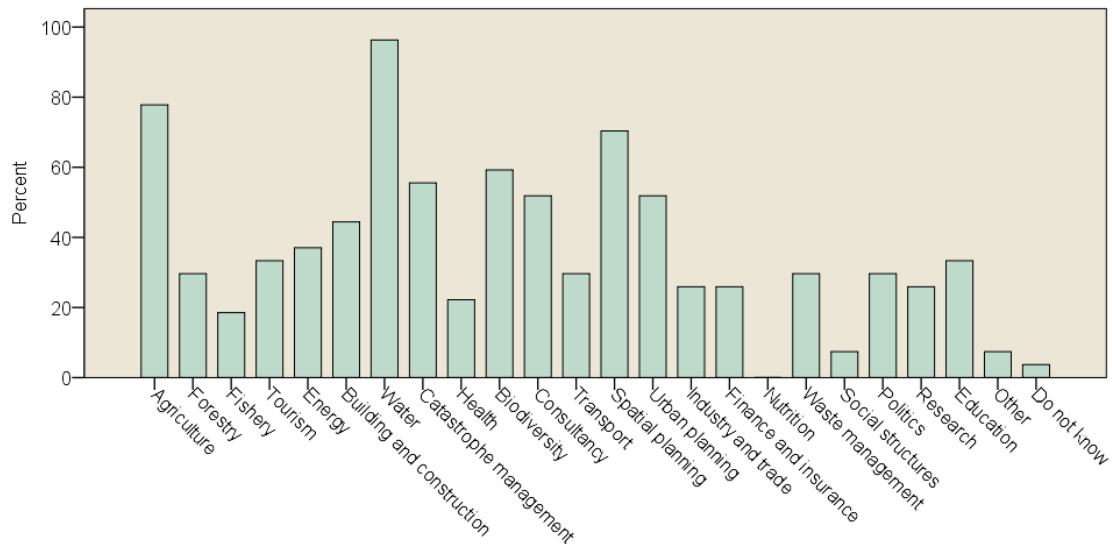
Figure 40. Sectors to which the users of the services can be allocated: The Netherlands.

Comments: Multiple-choice question. Percentage of respondents giving a positive response to each available option. The category "Catastrophe management" refers to the questionnaire alternative "Catastrophe/Natural hazards management and/or civil contingencies". "Biodiversity refers to the questionnaire alternative "Biodiversity, nature conservation". The category "do not know" includes two options, "do not know" and "prefer not to disclose.

From the Swedish questionnaire: *Other agricultural sector, which in the Swedish version of the questionnaire was termed "annan areell näring", is a term that refers to other types of production than forestry and agriculture, based on the capacity of land or water, in this case this could include e.g. fishery and reindeer-management. **The category "Social structures" was in the Swedish version of the questionnaire translated to "samhällsbyggnad", which can be interpreted in various ways. See the text below regarding biases for a further elaboration.

Figure 39: N = 34, missing = 0. Percent of cases: 1179.

Figure 40: N = 28, missing = 0. Percent of cases: 846.

In general, the spread between sectors is fairly even for the Swedish case (Figure 39). On average, the organisations indicated around almost twelve sectors each, which could be an indication that the provided services are often not sector-specific. The most common sectors are "energy" and "social structures", followed by "urban planning" and "water". Caution should however be given to the sector "social structures" as the translation into Swedish could perhaps be interpreted also in terms of urban planning.

In the Netherlands (Figure 40), the most common sectors relevant for the provision of climate services were more obvious, with "Water" on the top of the list, followed by "agriculture" and "spatial planning". This could perhaps be explained by the historical focus in the Netherlands on water management[35], but could also result from the selection of participating organisations as many of them were found through the portal "Netherlands Cooperation on Water and Climate services".[26] As in Sweden, the participating organisations in the Netherlands tended to indicate a rather high number of sectors in which their users operate; more than eight (almost twelve in Sweden).

3.5. Cooperation

Cooperation for the development of services

> Does your organisation collaborate with others regarding climate services? (D 1)

This question was used both as a way to understand the relationship between providers and to see how common it is to cooperate in the production of climate services; are private actors less prone to cooperate than state-bound? It was also used as a way to inform us about providers that we had not already taken into consideration. This was a method also within the JPI Climate mapping and recommended as climate services providers are not always easy to identify. This could arguably be explained with the lack of a common definition of climate services (providers might not call their services "climate services". Providers might not even be aware of the fact that they are indeed providers of climate services, and are therefore not advertising themselves using the term "Climate service provider"). All participating organisations (34 in Sweden, 28 in the Netherlands) answered this question and without exception indicated that they are cooperating with other actors regarding climate services.

Knowledge of other actors providing similar product

> Are there any other organisations you are aware of engaging in similar activities? (D 2)

This question complemented the search for additional providers of climate services, as well as to see if the key actors have been included in the survey.
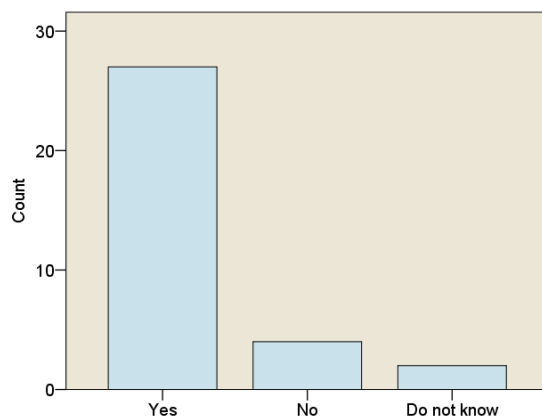
Figure 41. Knowledge of other actors providing similar services in the own country: Sweden.
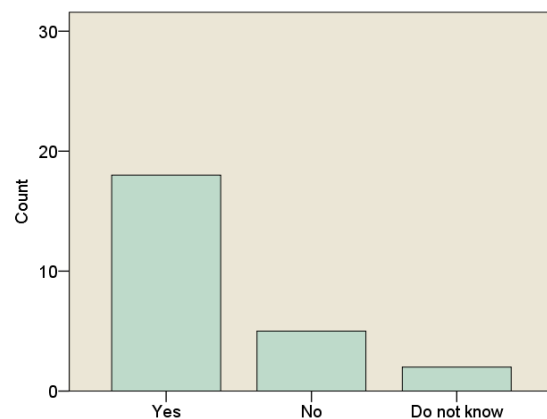
Figure 42. Knowledge of other actors providing similar services in the own country: The Netherlands.

Comments: Single choice question. Total number of replies. The category "do not know" includes two options, "do not know" and "prefer not to disclose.
Figure 41: N = 33, missing = 1.
Figure 42: N = 25, missing = 3.

Out of the 34 participating organisations in Sweden, one did not answer the question, two answered "Do not know/prefer not to disclose", four that they do not know of other actors offering similar services, and 27 that they do know of other actors offering similar services (Figure 41).

Similarly, out of the 28 Dutch organisations, two answered "Do not know/prefer not to disclose", five that they do not know of other actors offering similar services, and 18 that they do know of other actors offering similar services (Figure 42).

3.6. Obstacles/problems

> Has your organisation, to your knowledge, encountered any obstacles in producing climate services? Is there anything that you see would need to be ameliorated? (Interview question 12)

This question was included to inform the process of improving the provision of climate services. The responses may also give a hint on how differences in the operational structures or other differences can be explained and why the product portfolios look as they do.

Out of the 39 interviewed organisations, 36 elaborated on the question. It was constructed as an open question and the answers were sorted into different categories. Some answers fit under several categories. A summary of the categories and number of answers which fit under them is displayed in Figure 43 below.
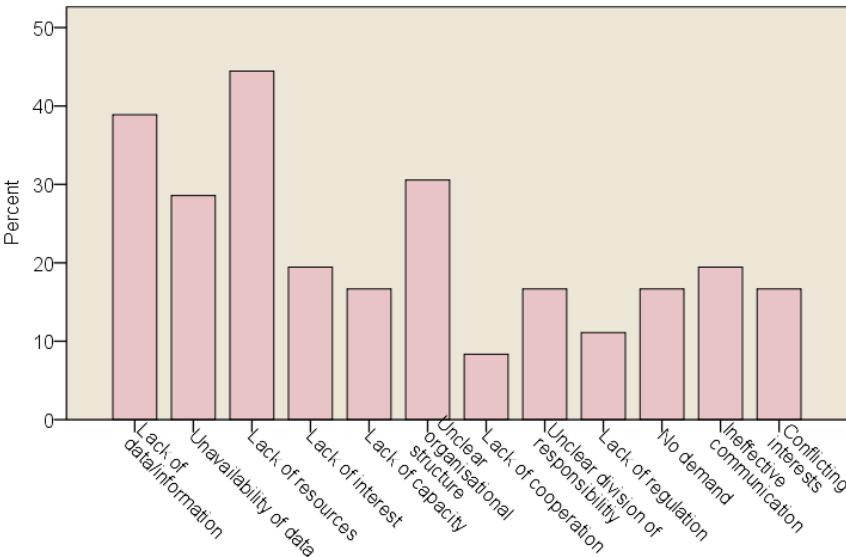
Figure 43. Obstacles for providing climate services.

Comments: Interview question. Open question. Categorisation of responses. Categorisation of responses. The category "Lack of interest" also includes "lack of awareness raising". "Unclear organisational structure" also includes "coordination issues". "No demand" refers to "no demand from the market".
Figure 43: N = 36, missing = 3. Percent of cases: 267.

Lack of data/information

14 of the interviewed organisations, ten in the Netherlands (interviews 11; 16; 17; 25; 26; 31; 35; 36; 37 & 39) and four in Sweden (8; 19; 20 & 28), said that lack of data and/or information is an obstacle for the production of climate services. Out of these, two referred to the density of observation stations is too low (interviews 8 & 16), one of the interviewees said that it is a general problem in Europe (interview 16) and the other that the density of observation stations has decreased the past fifty years (interview 8). Another two referred to data availability in particular in developing countries (interviews 25 & 39).

Unavailability of data

Ten of the interviewed organisations, eight in the Netherlands (interviews 9; 11; 14; 15; 16; 24; 25 & 27) and two in Sweden (interviews 32 & 38) said that the accessibility of data is an obstacle; data exist, but they are confidential or not available, unless one pays for them and/or has good contacts. This was however not a particular problem in the Netherlands; several of the interviewed organisations said that datasets for the Netherlands are easily accessible; the problem comes up when datasets are needed from other countries.

The KNMI provides all data as an open-access resource. Sweden is pursuing the same and more and more data from the SMHI are now publicly available. However, when data are needed from other countries in Europe and/or other countries, access becomes an issue. For example, one of the interviewed private enterprise companies in the Netherlands explained that due to the cost of purchasing data, it is sometimes too expensive for them to establish climate services in foreign countries (interview 27). The fact that some information is confidential, and thus could only be used for certain projects and not turned into a generic service, was also indicated to be a particular problem (interview 9).

During three of the interviews, references were made to the EU INSPIRE directive[c], with anticipation of more data to soon become publically available (interviews 11; 16 & 21).

Lack of resources

One issue related to the inaccessibility of data is lack of resources. We refer to "resources" in a wider sense than pure financing, including availability of time (which indirectly could imply lack of financing, as more staff otherwise could be employed). As mentioned above, implied inaccessibility of data does not need to mean that there are no data, but may also be about the datasets not being open-source resources, and therefore costly and inaccessible if resources are constrained. Lack of resources was mentioned as an obstacle for producing climate services by 16 actors (ten in the Netherlands [interviews 9; 10; 11; 13; 15; 18; 24; 31; 33 & 36], five in Sweden [interviews 8; 21; 22; 28; 30 & 38]). Of these, five mentioned lack of available funding as the obstacle (interviews 10; 11; 21; 22 & 33). Four referred to lacking resources at the local level, which in this study in general refers to one of the user-groups (interviews 18; 22; 28 & 30). This could mean a lack of demand from the users; if they cannot afford to undertake measures, it could assumedly lower the demand for climate services.

Lack of interest/awareness raising

Seven of the interviewed organisations expressed that other actors' lack of interest for the issue of climate change is an obstacle (four in the Netherlands, interviews 11; 18; 31 & 36, and three in Sweden, interviews 20; 29 & 34) for producing climate services specifically related to climate change. They expressed the need for more awareness-raising among decision-makers or within their own organisations. Although this obstacle can perhaps not be seen as a direct obstacle for producing climate services, it could be indirectly linked to a low demand from the users/the market. If policy-makers are uninterested in climate change related issues, public funding for climate services related to climate change would reasonably be lower than otherwise. The same relationship but more direct

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[c] The European Commission INSPIRE directive entered into force on 15 May 2007. It aims at developing an infrastructure for spatial data for the European Union and to increase sharing of data and the availability of data among member states. See:
http://inspire.ec.europa.eu/index.cfm/pageid/48

could be assumed to be true for private actors – if there are no buyers of climate services then there are also no resources available for the development of climate services.

Unclear organisational structure/coordination issues

Out of the answers given to the question presented above, eleven referred to issues related to the organisational structure and/or coordination. Four of these are from the Netherlands (interviews 11; 36; 37 & 39) and seven from Sweden (interviews 5; 8; 19; 20; 21; 30 & 32).

Although the answers can be interpreted as dealing with the same kind of basic problem, they differ in nature. Some actors referred to coordination issues or unclear structure within their own organisation, while others referred to obstacles related to the work of external actors or the national organisational structure. One reoccurring topic in the Swedish context is that actors find it hard to separate the role of certain authorities from the same authority's role as a consultancy. In these cases it could be difficult for other actors to know what they have the "right" to receive from an authority and what they have to pay for. Also in the Swedish context, and in the context of adaptation in particular, it was mentioned that there is no clear guidance on the national level and therefore it is hard as a climate services provider/purveyor to know what services they should provide and what services are the responsibility of other actors. It can also, for the same reason, be difficult to foresee what services will be requested in the future.

Other obstacles

Every answer to the question was assigned at least on one category. The categories were constructed based on the answers, collating similarities in the answers. As a result, some categories came to have only few answers. These are presented below in brief. In some other context or if more providers/purveyors were included, it could be so that the categories presented below also are important obstacles for the development of climate services.

Lack of cooperation

Three organisations, two in the Netherlands (interviews 17& 36) and one in Sweden (interview 4) referred to lack of cooperation. As an example, one organisation said that there is a need for increased cooperation within the private sector, but that many companies are against cooperation as they do not want to risk revealing company strategies (interview 4).

Lack of capacity among users

Three organisations in the Netherlands (interviews 11; 18 & 31) and three in Sweden (interviews 20; 32 & 34) cited this reason. The answers elaborated on the difficulty to communicate effectively to users on how to use the products, and that users would need capacity-building to be able to use the provided services in an accurate way. It was also mentioned that the organisations would like to make more data/information available, but are afraid that it would be misinterpreted.

Lack of regulation

One organisation in the Netherlands (interview 17) and three in Sweden (interviews 19; 21 & 29) indicated that there is a lack of regulation regarding climate change in general. As an example, one of the regional authorities in Sweden expressed that the relevant legislation within the area of climate change adaptation is conflicting and it is therefore difficult to give advice and make recommendations to users (interview 19).

Ineffective communication, including difficulties to communicate uncertainties

Seven organisations, three in the Netherlands (interviews 9; 18 & 37) and four in Sweden (interviews 6; 8; 20 & 34) mentioned that effective communication can be difficult to achieve, for several reasons. For example, two organisations mentioned that the challenge of providing climate services is not lack of data or information. Rather, it is to reach out to the stakeholders (interviews 20 & 34). Under this category, also statements referring to the difficulty of communicating uncertainties in the data/information were included.

Effective communication could be described as one of the corner-stones in climate services. Actions undertaken to improve the communication between providers/purveyors and users of climate services could reasonably have a positive effect on managing also other identified obstacles, such as the lack of capacity among users.

Unclear division of responsibility

Six organisations mentioned unclear division of responsibility between actors as an obstacle. Of these one was from the Netherlands (interview 17) and five from Sweden (interviews 8; 19; 21; 30 & 32). Three of these particularly referred to the area of climate change adaptation (interviews 21; 30 & 32). For example, one interviewee argued that when climate change adaptation is everyone's responsibility, it easily falls between the cracks, and that someone therefore needs to be in charge of organising the work (interview 30). This category could perhaps have been included under the category organisational structure/coordination issues, but as the word "responsibility" came up in these cases it was assigned an own category.

Conflicting interests

Conflicting interests were pointed out by six organisations as an obstacle. Of these, five were from the Netherlands (interviews 12; 15; 16; 35 & 36) and one from Sweden (interview 19). Three answers referred to the fact that sometimes the regional interest is not in line with the local interest (interviews 19; 35 & 36). As implementation of climate change mitigation and adaptation actions usually occur at the local level, this could be a significant issue if it is widespread. It could, arguably, be interesting to further investigate if this is a common issue.

One organisation said that it is a challenge to provide straight-forward advice and recommendations to users as requested by them, and at the same time respond to the requirements of sound scientific work, such as highlighting uncertainties (interview 15).

3.7. The term climate services

One of the aims of this study was to see how the term "climate services" is being used and how it is interpreted. As the term is relatively new and has no commonly agreed definition, we wanted to see if its usage is in line with some of the most common definitions of the term.

In the questionnaire, providers and purveyors were asked to give their own definition or elaboration of climate services. In order to avoid leading the respondent in some specific direction, no definition was presented in the questionnaire. In the introductory letter sent out together with the questionnaire, a definition (slightly modified from Ref. 10) was, however, provided. This was to make sure that the respondents could assess that the questionnaire was relevant for them and that they could associate themselves with the role of a provider and/or purveyor of climate services. Even though this may have nudged the respondents towards a set definition, the advantages were seen as overweighing the disadvantages.

In Section 1.4 of this report, a few commonly used definitions were presented. These are elaborated on below, in order to explore their synergies and differences.

Elaboration on some of the commonly used definitions of climate services

JPI Climate defines climate services as:

> User driven development and provision of knowledge for understanding climate, climate change and its impacts, as well as guidance in its use to researchers and decision makers in policy and business.[2]

The World Meteorological Organization (WMO), in the report "Climate Knowledge for Action: A global framework for climate services – empowering the most vulnerable" defines climate services as:

> Climate services encompass a range of activities that deal with generating and providing information based on past, present and future climate and on its impacts on natural and human systems. Climate services include the use of simple information like historical climate data sets as well as more complex products such as predictions of weather elements on monthly, seasonal or decadal timescales, also making use of climate projections according to different greenhouse gas emission scenarios and time frames. Included as well are information and support that help the user choose the right product for the decision they need to make and that explain the uncertainty associated with the information offered while advising on how to best use it in the decision-making process.[4]

The WMO describes climate services also with:

> Climate services are the dissemination of climate information to the public or a specific user. They involve strong partnerships among providers, such as NMHSs, and stakeholders, including government agencies, private interests, and academia, for the purpose of interpreting and applying climate information for decision making, sustainable development, and improving climate information products, predictions, and outlooks.[27]

The Climate Services Partnership (CSP), which is a global platform of climate information users, providers, researchers and donors in the field of climate services (see Section 1.3 for more information), describes climate services with:

> Climate services involve the production, translation, transfer, and use of climate knowledge and information in climate-informed decision making and climate-smart policy and planning. Climate services ensure that the best available climate science is effectively communicated with agriculture, water, health, and other sectors, to develop and evaluate mitigation and adaptation strategies.

> Easily accessible, timely, and decision-relevant scientific information can help society to cope with current climate variability and limit the economic and social damage caused by climate-related disaster. Climate services also allow society to build resilience to future change and take advantage of opportunities provided by favorable conditions.

> Effective climate services require established technical capacities and active communication and exchange between information producers, translators, and user communities.[29]

Although the definitions/descriptions of climate services above differ in for example the level of detail, some general elements can be noted. These are elaborated on below.

The what; what information/data/knowledge the services are built upon

While the CSP and the WMO on their respective webpages only mention "climate information" or similar, the JPI Climate specifies this further by adding "[…] knowledge for understanding climate, climate change and its impacts […]. In the 2011 report the WMO goes further into including time

frames and examples: "[…] based on past, present and future climate and on its impacts on natural and human systems. Climate services include the use of simple information like historical climate data sets as well as more complex products such as predictions of weather elements on monthly, seasonal or decadal timescales, also making use of climate projections according to different greenhouse gas emission scenarios and time frames".

The who; the user of climate services

Regarding the user of climate services, the WMO in its 2011 report does not specify this and also on the webpage there is only a rather generic mention of "[…] the public or a specific user […]". The CSP is more detailed by specifying the agriculture, water and health sectors, but still also refers to "other sectors" as well as to the society at large. JPI Climate has another kind of generic specification and states that climate services are to be used by "[…] researchers and decision makers in policy and business".

The how; how climate data/information becomes climate services

Although the description of which climate information/data/knowledge can be used as a basis for climate services is very inclusive in these four definitions/descriptions, it is complemented by how this information should be provided. The JPI Climate specifies that the development and provision should be user-driven and include "guidance in its use". Along the same lines, WMO in its 2011 report specifies that: "Included as well are information and support that help the user choose the right product for the decision they need to make and that explain the uncertainty associated with the information offered while advising on how to best use it in the decision-making process." On its webpage WMO further writes that climate services involve "strong partnerships" among providers and stakeholders. The CSP writes that climate services involves not only the production but also the "[…]translation, transfer, and use of climate knowledge and information […] and adds that "*effective* climate services require established technical capacities and active communication and exchange between information producers, translators, and user communities" (authors' emphasis).

The why; for what purpose do we need climate services

Regarding for what use or purpose we need climate services the WMO in its 2011 report specifies that climate services incorporate information on how to choose the best product for decisions and how this product should best be used in the decision-making process. This purpose is broadened on the webpage by stating that climate services are "[…] for the purpose of interpreting and applying climate information for decision making, sustainable development, and improving climate information products, predictions, and outlooks." The CSP describes that climate services are used for "[…] climate-informed decision making and climate-smart policy and planning.", as well as "[…] to develop and evaluate mitigation and adaptation strategies." The CSP further elaborates on the societal value by saying that climate services can limit adverse effects of climate change and to increase society's resilience.

The definitions above have an inclusive view of what kind of information can be seen as climate services; the time-frames are not limited and there is no limitation to exclude for example climate change mitigation and to rather focus on adaptation. The view on the user is in general also inclusive; it can be anyone who uses climate information/knowledge/data. These definitions also seem to agree that climate services go beyond climate data. It is information about the climate, based on science that is made, in one way or another, user-friendly. Furthermore, even though they have a broad view on user-groups, they all mention that climate services are used for decision-making, or by decision-makers.

In the next section, the descriptions and definitions of climate services provided by the participants in this study are discussed.

Inputs from the questionnaires – definitions and views on the term "climate services"

> What does your organisation understand to be the definition of climate services? (E.g. what types of services, processes and/or products does your organisation usually see as "climate services"?) (B1)

For the purpose of scrutinising the understanding of the term "climate services" we kept this question as an open one. The participating organisations were asked to provide their definition/understanding. The aim was to see if the term is established and if so, if there are similarities or differences in its use and understanding.
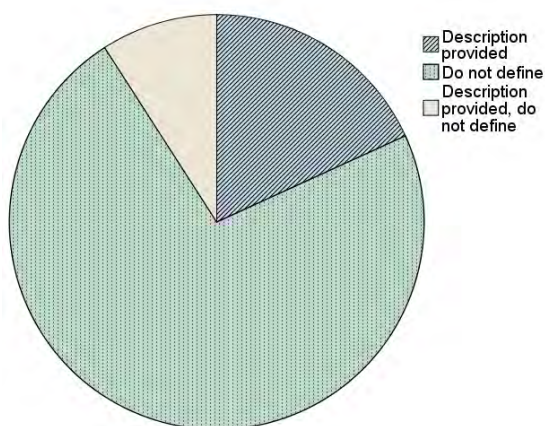
Figure 44. Defining and describing the term *Climate Services*: Sweden.
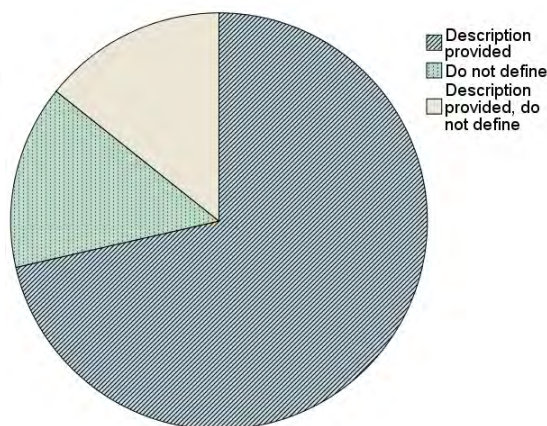
Figure 45. Defining and describing the term *Climate Services*: The Netherlands.

Comments: Partly open question. The understanding of the definition was left open, while the respondents could also choose from "we do not define climate services" and "do not know/prefer not to disclose". None of the respondents answered "do not know/prefer not to disclose". Respondents who ticked the box "we do not define climate services", but still provided a description of the term have been included under the category "Description provided, do not define".
Figure 44: N = 33, missing = 1.
Figure 45: N = 28, missing = 0.

The results show a different picture for Sweden compared to the Netherlands (Figures 44 and 45). While most participating organisations in Sweden answered that they do not define climate services (slightly over 70 percent of the respondents), most of the participating organisations in the Netherlands did provide a definition/description of climate services (slightly over 70 percent of the respondents). Around 9 (14) percent of the Swedish (Dutch) organisations answered that they do not define climate services, but still provided a description of the term.

This difference could hypothetically be an indication that the term climate services is more commonly used in the Netherlands, but also a bias to the choice of organisations (as many of the participating organisations in the Netherlands were identified through the web portal "Netherlands Co-operation on Water and Climate Services"[26]; these particular organisations could be assumed to have a definition of the term). Hence, caution should be taken when drawing conclusions from this result.

To get better insight in the use and understanding of the term climate services, we included a follow-up question among the generic interview questions:

Is the term climate services a term that you use at your workplace? (Interview question 1)
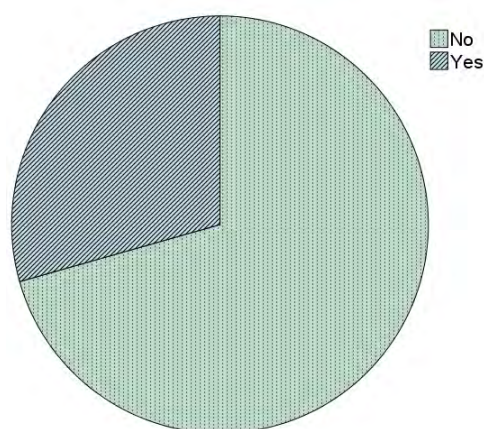
Figure 46. Use of the term *Climate Services* at workplace: Total.
Comments: Interview question. Single choice question. Percentage of total replies. 71 % answered that they do not use the term climate services at the workplace, 29 % that they do.
Figure 46: N = 34, missing = 5
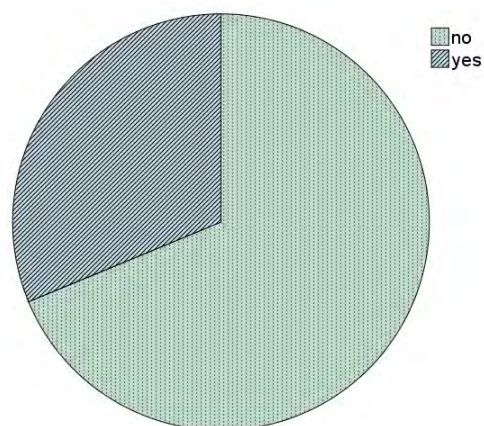
Figure 47. Use of the term *Climate Services* at workplace: Sweden
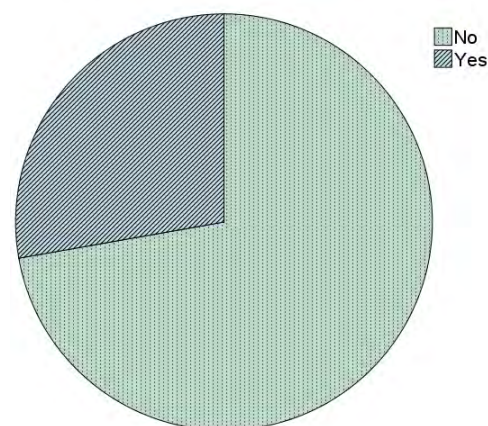
Figure 48. Use of the term *Climate Services* at workplace: The Netherlands.

Comments: Interview question. Single choice question. Percentage of total replies
Figure 47: N = 16, missing = 3. 69 % of the Swedish organisations answered that they do not use the term climate services at the workplace, 31 % that they do.
Figure 48. N = 18, missing = 2. 72 % of the Dutch organisations answered that they do not use the term climate services at the workplace, 28 % that they do.

The question regarding the use of the term climate services at the workplace was elaborated on during 34 of the 39 interviews. The figures above display that in contrast to the question regarding the understanding of the definition, the results from the participating organisations in Sweden and the Netherlands are almost the same; around seventy percent of the respondents answered that they do *not* use the term at the workplace.

To further characterise the understanding of the term climate services among participating organisations in this study, their definitions/description are given below, followed by an elaboration of these definitions/descriptions compared to some of the commonly used definitions already presented in this report (see Sections 1.4 and 3.7).

"Climate services are the dissemination of climate information to the public or a specific actor (WMO)".

"The WMO's definition, dissemination of climate information to the public or a specific actor."

"Climate services are not defined in any law."

"We have not defined climate services but for this survey we have included [examples of products/publications], research related to climate change, literature reviews, studies, different analyses related to climate change etc."

[…] we develop and deliver climate data and information on the past, current and future climate to (mainly) professional users of climate data. This means for example that we develop climate normals/climate atlas, statistics on e.g. extreme precipitation, climate scenarios, and we are/were involved in many tailoring projects in which we tailor data for specific users [example of projects]. Tailoring also includes finding out what users really need, developing the data/information, advise on how to use the data/information, how to deal with uncertainties (interaction with the users is very important). We do not have one definition at [xxx] of Climate Services. Internationally there are many different and very broad definitions. At [xxx] it is limited to climatological services, although we work together with many others to make them able to produce also data and information on impacts and adaptation option (we realise that for many end users information on impacts and adaptation is most interesting) […]."

"Presentations of information on changes in weather and climate extremes, as well as the daily dataset needed to monitor and analyse these extremes."

"Information that can be used in Environmental assessments we do for the [xxx] government. In addition, climate services also include information secondary related to climate, like climate vulnerabilities and impacts."

Regional/local level

"Disaster risk analyses based on future climate, climate data, emission data, as well as energy data."

"Climate data from the [National Meteorological Organisation], universities or research institutes. Planning basis for climate adaptation and climate protection."

"We are the regionally coordinating organisation, which mediates knowledge regarding regional climate changes and how the society can adapt to these changes. We are the link between municipalities and the national authorities and the regional mediator of climate change related issues."

"Technical advice related to climate change and the spatial planning and infrastructure in cities and flood protection."

"We use climate data from the [National Meteorological Organisation] and use this to calculate the impact on the water system […]."

"Acceptance of climate change and adaptation/mitigation of this given in the work and our responsibilities."

"Operational use and proliferation of weather data in water management context; climate scenarios in strategic water management and allocation plans; coincidence of sea level surge & precipitation."

"First of all, we don't use the term 'climate services' in our organisation, but we do discuss about climate change, the effects of climate change (on water system, land use) and ways to deal with those effects. It's common to distinguish measures ('or services') in adaptation and mitigation, both could be seen as climate service. In our point of view 'climate services' might be covered by this description: - Measures which decline the amount of climate change (global warming, greenhouse gasses) or decline the negative effects on the water system and land use.[…]."

"Developing and implementation of mitigation- and adaptation strategy, including carry through adequate measures."

"Contributions to prevention of climate change and actions to mitigate consequences of and adaption to climate change. Although in general we do not use the terminology of 'climate service'."

Private sector and academia

"Since this affiliate was founded, which only deals with climate change, we do not need to use the term 'climate services' as frequently as before. Traditionally it has referred to consulting services related to climate change."

"Calculating climate impact, developing climate strategies, climate off-setting."

"Climate strategies, calculating climate impacts, climate actions program, climate off-setting and communication of climate information."

"Missions with the aim to mitigate climate change effects or to adapt the society to a changing climate."

"Making climate information available to change agents (governments, companies, NGOs)."

"Soil water and meteo[rological] sensor data acquisition, telemetry, visualisation and interpretation."

"Climate data of the past."

"[we offer] access to tools and information on satellite data as well as to satellite date itself. However, we do not focus on a particular use or user community and therefore we do not consider our services as climate services. The Environmental group offers models and tools on a project basis to produce [xxx] scenarios with and without policies for global and detailed [xxx] emissions inventories. These [xxx] may be used for climate calculations. As such, the environmental group could be considered as delivering [xxx] data for climate services."

"Applying available climate information in our consultancy and advising."

"We frame climate services from a GIS perspective: climate maps in relation to spacial planning."

"We prefer adaptation services which we see as an extension of climate services, which generally means rainfall, temperature and sea level data and impact indicators."

"Providing services to end-users (in our case water authorities) to support them in making climate adaptive decisions on operational (daily) and strategic (long-term) basis."

"The interpretation of climate data and development of advisory services based on climate information for our clients."

"Our services in the energy and climate fields focus on the one hand on limiting CO2 emissions (by such means as low-energy designs, energy reduction and renewable energy supplies) and on the other on measures to adapt to climate scenarios (such as climate-proof designs, adapted urban water management and high-water protection)."

"Services based on ground measured or satellite derived, climate related data."

"Providing detailed and usable information on the weather, such as radar or satellite images/data, but also to present information on the impact of possible climate change on the water system and its surroundings."

The commonly used definitions of climate services, which were elaborated on previously in this section, emphasise three fundamental aspects, i.e.:

- The user of climate services can be anyone from climate experts to the general public, but there is a user;
- The information should be disseminated to the user and in such a way that it can be useful to the user;
- The use of climate services should involve some kind of decision-making.

The descriptions/definitions provided by the participating organisations map to the aspects listed above as follows:

- At the national level:
  - 4 out of 7 organisations mentioned a user;
  - 5 out of 7 organisations mentioned dissemination of information.
- At the local/regional level:
  - 1 out of 10 organisations mentioned a user;
  - 3 out of 10 organisations mentioned dissemination of information.
- Within the private sector:
  - 3 out of 16 organisations mentioned a user;
  - 8 out of 16 organisations mentioned dissemination of information;
  - 1 out of 16 organisations explicitly mentioned decision-making.

These findings would seem to suggest that the organisations did not focus on users, as only around one out of four organisations mentioned a user, and around half of them mentioned dissemination of information/data. Neither did the participating organisations in general mention much about user-friendliness. It should, however, be noted that the questionnaire did not specifically ask for information about the user, but rather opened up for the possibility to give examples of services that the organisations in general see as climate services. Also, the results from the questionnaire presented in Section 3.4 regarding users show that almost all organisations did specify their user-groups (almost no organisation indicated that they "do not know/prefer not to disclose"), and among these, decision-makers in particular.

Many of the quotes mention activities that could assumingly be related to decision-making such as "strategic water management and allocation plans" and "impacts and adaptation options". They also indirectly speak about decision-making by specifying users such as the government, public authorities and other actors who are decision-makers (political decision-making or decision-making in general either in a broad or a narrow sense).

Particularly at the regional and local level, many respondents referred to climate change related measures undertaken by their organisations. These measures could be climate services, if the measures are, for example, summarised as lessons learned and distributed to other actors who could benefit from this information, especially if this information is provided to decision-makers/to be used in decision-making. If, however, the measures are undertaken as part of the organisations ordinary tasks, without providing any information to other actors, these measures are not climate services according to the commonly used definitions, as there are no users. A concrete example would be an organisation assigned to adapt society to impacts of climate change, which do so without providing information to other actors. From the definitions provided by the organisations it can nevertheless not be concluded that they are not climate services providers/purveyors. From the interviews it was clear that many organisations did not see themselves as climate services providers/purveyors, but when they explained what kind of work they do and how they communicate with stakeholders, their work did fall under the commonly used definitions of climate services.

One explanation for the discrepancy mentioned above is that the term "service" may be confusing. While measures undertaken to combat climate change and/or its impacts are indeed a service to the society at large, it is not a *climate service* if there is no user of the information acquired.

The following quote illustrates one of the complications when mapping climate service provider/purveyors:

> "[we offer] access to tools and information on satellite data as well as to satellite date itself. However, we do not focus on a particular use or user community and therefore we do not consider our services as climate services. The Environmental group offers models and tools on a project basis to produce [xxx] scenarios with and without policies for global and detailed [xxx] emissions inventories. These [xxx] may be used for climate calculations. As such, the environmental group could be considered as delivering [xxx] data for climate services."

Other definitions/descriptions showcased above speak about being the bridge between providers and users of climate services. When using the commonly used definitions of climate services to map providers and purveyors of climate services, it is clear that the definitions are broad and give little advice on delimitating the mapping. When reflecting about the production of climate services, it is also evident that in most cases providers/purveyors also have to be users of climate services; experts in a certain area need input from other actors. One indication from the questionnaire confirming this reflection is that all participating organisations are cooperating regarding climate services (see Section 3.5). The quote above tells us that this particular organisation provides access to climate relevant data, but is not focussing on specific user groups. As the user of climate services based on the commonly used definitions can be pretty much anyone interested, this organisation could be seen as a provider (or perhaps purveyor as it is not clear if the dataset is their own or not) to very specific users of this particular data. They are also providing data to purveyors of these data who in turn repack it and deliver it to the end-user. Hence, although many stakeholders could probably be separated into being mostly providers, purveyors or users, the results from this study indicate that they, in many cases, often belong to two or all of these three groups.

In sum, these findings give some indication of the understanding of the term climate services among participating organisations. Most organisations do not refer to any of the commonly used definitions, such as the WMO's, and the descriptions/definitions of the term climate services collected from the questionnaire replies focus more on the actual tasks carried out than the users or dissemination of climate services. Other results of this study do however signal that the providers/purveyors in general know who the users are and carry out work that could be described as climate services, even though some organisations do not associate themselves with the term climate services providers/purveyors.

3.8. Summary of the results

This section sums up the results of the study. The most common type of climate services provider in Sweden and the Netherlands covered by this study are presented, and a general summary of the results is provided, including a comparison between the Swedish and the Dutch cases.

The most common type of climate service provider/purveyor

The most common type of climate service provider in the Netherlands

- Is a private enterprise company, which has between 201 and 500 employees;
- It is unclear when the company started providing/purveying climate services, but it started as an initiative from the company;
- The company's key competence is applied technology;
- The thematic focus of the services is on impacts of climate change;
- The top three provided/purveyed climate services are graphics and maps, adaptation strategy and processed data;
- These services are typically developed through modelling or data analysis;
- The most relevant time horizon is the present;
- The most relevant spatial scale is the regional scale;
- The services are most often disseminated to users through presentations, with workshops, symposia or courses as runner up;
- The company promotes its services through workshops or such like, but more often through webpages;
- The services are financed through public funds;
- The typical users of the services are "decision-makers/politicians" and "NGOs or other stakeholder groups";
- The users are most often within the water sector, followed by agriculture and spatial planning;
- The company cooperates with other actors regarding climate services, and knows about other organisations with similar products;
- Has a definition of climate services.

The most common type of climate service provider in Sweden

- Is a County Administrative Board or other public authority, with more than 500 employees;
- Started fairly recently to provide/purvey climate services (between 2009-2013), upon request by another actor (typically the government);
- The authority's key competence is investigations or other specific analyses;
- The thematic focus of climate services provided varies without any clear single focus;
- The top three provided/purveyed climate services are guidance, workshop and synthesis reports or other knowledge reviews;
- These services are developed through data analysis or literature research;
- The most relevant time horizon is the present time;
- The most relevant spatial scale is the regional scale;
- The services are disseminated to users through workshops, symposia or courses, with printed media or material as runner-up;
- The authority is promoting their services through workshops or similar activities as well as through webpages:
- The services are financed through public funds
- The typical users of the services are "practitioners" and "decision-makers/politicians"
- Users do not typically belong to a specific sector, perhaps with an exception of the energy and the planning sectors;

- The authority is cooperating with other actors regarding climate services and knows about other organisation with similar products;
- Has not defined climate services.

Similarities and differences

Organisational type: The result of this study shows a more diverse picture in the Netherlands than in Sweden. This could be a bias due to the selection of participating organisations. A more extensive mapping would be needed for drawing broader conclusions. Most common organisation type in Sweden is a public authority (County Administrative Board or other public authority). In the Netherlands the most common organisation type is a private enterprise company, followed by public authority.

Number of employees: One of the delimitations to the current study was the focus on key stakeholders. Thus, it is not surprising that the participating organisations are larger rather than smaller in terms of number of employees. It cannot be concluded that many small providers/purveyors of climate services would not exist.

Starting point of the provision of climate services: while most organisations in Sweden answered that they started providing climate services during the past five years, the picture for the Netherlands is less clear. Most organisations answered "do not know/prefer not to disclose". It was also more common to indicate that the organisations have been providing climate services for a long time. It is evident that if it is unclear what types of tasks are covered by the term climate services (and as climate services do not have an agreed upon definition, it could be seen as unclear) it is also challenging to indicate a starting point for the provision of climate services. However, and perhaps surprisingly, most participating organisations in Sweden answered that they do not define climate services and neither did they provide a description of what is usually seen as climate services, despite that they usually indicated when they started to provide climate services, while the opposite relationship describes the scene in the Netherlands.

Regarding the *development of climate services,* the result differs between the countries. While own initiative is the most common reason behind the initiation of the development of climate services in the Netherlands, the picture is less clear for Sweden. Here, the most common reason behind the development of climate services is either the undefined "other" or "mandated by another actor". This is somewhat in line with the distribution of types of organisations in the respective countries, namely private enterprise companies in the Netherlands and public authorities in Sweden.

Another relationship that could also follow from the organisational structures regards the providers' and the purveyors' *key competences.* In particular among participating organisations in Sweden, the by far most commonly indicated key competence was "investigations or other specific analyses". For the Netherlands, the result showed a more diverse distribution of key competences, with "applied technology" being the most common key competence among participating organisations, followed by "applied research". Notably, the key competence "fundamental research" was not common. There are at least two possible explanations behind this result. It could be an indication that the participating organisations in this study would rather fit under the label "purveyors" of climate services, rather than "providers". It could also be an indication that there are dominant actors in both countries who deliver the data needed to other actors. Thereby there would be no demand for other actors to produce the same data.

Regarding *thematic focus,* the Swedish results show a quite even distribution between the themes. Again, the results from the Netherlands are more diverse and indicate that the most common focus is on impacts of climate change, and an overall focus on effects of climate change rather than climate change mitigation. As the mapping of climate services providers and purveyors in this study is not exclusive, this can only be an indication, not a conclusion. However, taking the long tradition of water management in the Netherlands into account, including how to deal with flooding and sea

level rise – anticipated impacts of climate change – a focus on the effects of climate change and, as will be described later, on the water sector, may perhaps be anticipated.

Going more into details and looking at the most commonly provided *types of climate services*, there is a clear difference between the two countries. The most commonly provided services in Sweden among the participating organisations are guidance, workshops or similar activities and synthesis reports or similar. This result can be seen as in line with the result of the organisational structure, with an emphasis on public authorities. Furthermore, the result also agrees with the most commonly indicated key competence, namely investigations or other specific analysis. Moreover, out of the 19 alternatives of types of climate services in the questionnaire, eight were provided among more than 60 percent of the participating organisations in Sweden, compared to two in the Netherlands. Among the participating organisations in Sweden, the average number of types of climate services offered per organisation was 8.3, compared to 6.7 in the Netherlands. This could perhaps suggest that the participating organisation in the Netherlands are slightly more specialised than those in Sweden. In the Netherlands, the most commonly offered types of climate services were graphics and maps, adaptation strategy and processed data.

When looking at the least commonly offered *types of climate services*, the result is quite similar between the two countries. For Sweden, analytical tools, analytical methods, financial tools or socio-economic indicators and early warning systems are offered by less than 20 percent of the participating organisation, compared to metadata, analytical methods and financial tools or socio-economic indicators in the Netherlands. Looking only at the result from this study, these types of services could be seen as possible gaps in the provision. However, this study was not an exclusive mapping of providers and purveyors of climate services and may only provide an indication. Moreover, to decide whether there is really a gap in the provision one would also need to speak to the users and see if they are missing these services, or if the reason why they are not commonly offered is simply that the demand from the users is low, or alternatively that the services are provided by one or just a few climate services providers in such a way that the users' needs are already met.

Regarding time horizons and spatial scales relevant for the provided or purveyed climate services, the result from both countries are quite similar. The present and the regional level are seen as the most relevant in both countries.

Regarding the distribution of *methods used to produce climate services* in Sweden, this study indicates that the most commonly used methods are data analysis, followed by literature studies. This is in line with the fact that the most indicated key competence for the Swedish providers/purveyors involves investigations or other specific analyses. Similarly, for the Dutch providers/purveyors, the most commonly used methods are data analysis and modelling, which relates well to the most common key competences being "applied technology", followed by "applied research".

In general terms, the tendency in the findings of this study is that *communication with users* seems to be quite recurrent. A majority of the different means of communication quoted in the questionnaire were indicated to be used by half or more of the participating organisations in both countries. Not least direct contact with users is highlighted, such as workshops or similar (most commonly used in Sweden) and presentations directly to the users (most commonly used in the Netherlands).

Furthermore, a large majority of participating organisations in both countries are also promoting their services to already established or potential users. The different means of promotion were used to a higher extent in Sweden than in the Netherlands, with the exception of climate portals. The participating organisations in Sweden that promote their services, all indicated that they use webpages as well as workshops or similar. These are also the most commonly used means of promoting services in the Netherlands.

Regarding *financing* of climate services, the most common answer was public funding, in both countries. Payments for climate services were more commonly used among participating organisations in the Netherlands, which is in line with the most common organisational type among the participating organisation in the Netherlands being a private enterprise company.

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When it comes to *user-groups* of the offered climate services, the landscapes look a bit more different in the two countries. All user-groups except researchers and "other" were indicated as users of the provided services by half or more of the participating organisations in both countries. Among the Swedish participants, almost all indicated that they have practitioners as one user group, followed closely by decision-makers/politicians. In the Netherlands, decision-makers/politicians[d] are at the top of the list, followed by NGOs or other stakeholder groups. One difference between the countries is that the participating organisations in Sweden indicated more user groups per organisations, in average around 5 compared to 3.5 in the Netherlands.

The overall tendency from the results of this study shows that most organisations are not explicitly sector-specific, based on the indicated number of sectors using the services per organisation. In average, the organisations in Sweden indicated almost twelve sectors to which the users belong, compared to around eight in the case of the Netherlands. However, for the Netherlands, the water sector stood out as most participating organisations indicated users from this sector. Hence, for the Netherlands, a tendency towards a focus on the water sector is indicated from the result of this study.

Cooperation regarding climate services is common. In fact all of the participating organisations indicated that they do cooperate with other actors regarding climate services. Furthermore, almost all participating organisations know of other actors offering similar products.

During the interviews, *obstacles* encountered were elaborated on. When categorising the answers, the most commonly mentioned obstacle was lack of resources (44 percent). This could perhaps be linked to another obstacle mentioned during the interviews, namely the unavailability of data (28%). It was indicated that data can be hard to access and/or expensive, especially from other countries. On this note, various kinds of lacks of data and information were mentioned. Another obstacle, most commonly mentioned among interviewees in Sweden, was unclear organisational structure and coordination issues.

Finally, regarding the use and understanding of the term climate services, the result from the questionnaire differs to a great extent between the countries. While most participating organisations in the Netherlands provided a description/definition of climate services, most participating organisations in Sweden indicated that they do not define climate services. When following up this question during interviews, the result was however almost identical between the countries: around 70 percent indicated that they do not use the term climate services at the workplace.

When comparing the provided description/definitions of the term climate services from the questionnaire to some internationally commonly used definitions, it is clear that most of the former are not in line with the latter. This could have many different explanations and one should not conclude that the general understanding of what climate services are would be very different. Rather, the variety of different views of the term is in line with the general state of affairs. There is simply so far no commonly agreed upon definition.

As such, the results of this study indicated that the overall provision of climate services is more specialised in the Netherlands and more generalised in Sweden. This is based on the results showing that the participating organisations in Sweden indicated more answers in average for most questions than the participating organisations in the Netherlands. The Swedish answers are also more evenly distributed between different alternatives, while the answers are more diverse for the Netherlands.

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[d] It should be noted that the questionnaire did not specify whether the user is the end-user or any user. For the category decision-maker/politicians it is likely that this user-group is intended as the end-user, but that it is delivered to intermediary persons such as policy-makers, practitioners or other relevant stakeholders.

4. Discussion

This section provides some further elaboration and discussion around some of the findings presented above. The indications seen are put into a wider context, looking at possible implications and lessons for further developments of mappings of climate services providers and purveyors. The focus is on four topics:

- *What are the implications of the definitions of Climate Services used in the countries for activities and products?*
- *Which products are provided by the various providers and why? What are the implications of the organisational structure on the provision of Climate Services?*
- *Which means of communication are used and what are the limitations and possibilities/advantages?*
- *How could knowledge on successful provision of Climate Services products and communication on Climate Services be transferred between countries?*

What are the implications of the definitions of Climate Services used in the countries for activities and products?

The results from the questionnaires show that the term "Climate services" is used in many different contexts. For the most part, the participating organisations do not refer to definitions provided by other actors, such as the WMO. From the result of this study it is hard to tell whether the term is used differently in Sweden compared to the Netherlands, as most organisations in Sweden did not specify how they use it. This could be due to a bias in the survey, for example due to the translation of the questionnaire into Swedish (see below. The questionnaire was distributed in English in the Netherlands), but also simply due to the term not widely being used. The latter was indeed indicated during the interviews.

"Climate services" translates into "klimaatdiensten" in Dutch and into "klimattjänster" in Swedish. A simple search on the internet for "klimattjänster" gives a broad spectrum of results. Some of the participating organisations in this study were indeed identified using this technique. However, the search also picks up many other kinds of actors, for example suppliers of indoor-climate regulators. Hence, the term climate services is not necessarily clear in the Swedish context. Furthermore, the word "tjänster" in Swedish is commonly interpreted as a service that comes with a fee. Hence, it is not given that for example non-profit organisations and public authorities without a consultancy-wing would associate themselves with providing a service.

From the descriptions/definitions from the questionnaire result, it is evident that especially at the regional/local level climate services are sometimes seen as *measures* to combat climate change or to adapt to climate change, which would seem to be well outside the scope of the commonly used definitions. Such measures would not, by definition, be viewed as stand-alone climate services.

What information and products can be seen as climate services is, in turn, not straightforward. From the results at hand it is clear that the term climate services is not commonly used in the workplaces among participating organisations. The result from the questionnaire does show that the time-frame most commonly seen as relevant for the offered climate services is the present. Often when speaking about climate change, longer time-frames are looked at. "Climate" is commonly defined as weather over longer time-frames; thirty years or longer. While information regarding shorter time-frames could be seen as weather services, it may also relate to climate as climate variability (variability is an inherent characteristic of the climate system and occurs on different time scales. In addition to, for example, thirty-year means, a determination of "climate" also encompasses amplitudes of, say, interannual variability, return periods and other measures of the likelihood of

extreme weather events), and thus also such information can provide for climate services. As a further example, early warning systems are used to give warnings about extreme *weather and water-related* events, such as flooding. However, inasmuch such events are expected to become more severe due to climate change, early warning systems could be seen as climate services.

The employed definitions are so broad in scope that basically everyone could be seen as a user (the general public is included!), almost any actor working with anything related to climate towards some specific user or the society at large could be seen as a provider or purveyor. For example, raw climate data would not be seen as a climate service by most users of climate services, unless it is explained how it can be used and delivered in a user-friendly way. Experts who have the capacity to make use of the raw data would regard it as a climate services. Very basic climate information would on the other hand not be seen as a climate service by most professionals and researchers within the field, but could very well be a climate service to the general public.

Hence, adherence to commonly used definitions of climate services does not provide a clear delimitation when mapping climate services actors. This has implications for the design of possible extensions of mapping of service providers and purveyors and suggests a rather open-ended identification of actors.

In general, and for any mapping of climate services actors, yet another factor to consider is that it is not always straightforward to label climate services actors as providers, purveyors or users. As was shown in Chapter 3, organisations approached in this study can be providers or purveyors and users of climate services at the same time.

As was elucidated in Section 3.7, common international definitions used as a basis for the analysis of the term climate services in this report refer to policy and decision-makers as a particularly timely user-group. If the aim of climate services is to provide ground for policy and decision-making, then a mapping could preferably also focus more specifically on this user group, their needs and what kinds of services are available. One would perhaps also need to consider more closely what kinds of decisions are being targeted. Is one interested in supporting *political* decision-making and if so, on what level, or decision-making in general, including for example farmers making decisions regarding the next season?

Another possible approach, as suggested by a few descriptions/definitions gathered from the questionnaire replies and presented in Section 3.7, would be to break down the term climate services into subdivisions of the term, such as climate adaptation services. This way it would arguably be easier for potential users to find relevant providers/purveyors to contact.

To derive data and information about the climate is not a new endeavour. Climate research has a long history and uses of research outcomes as well as observed climate data are well established, such as in water management, farming techniques and physical planning. The concept of climate services brings with it, however, a new dimension. It highlights the user and the users' needs. It goes beyond the customary publishing of scientific results in scientific journals. It highlights the need of making the information more available and actionable, and adds further value for the users.

In order to make the available information more actionable, it is crucial to reach out to potential users. Users need to know who they can contact for the services they need, and the providers/purveyors need to know what services their users need. A mapping of climate services providers and purveyors provides clarity to the availability of services and who are providing them. However, as the use of the term climate services is rather new and still emerging, one would also need continuity in a mapping. Also, issues surrounding the sufficiency and needs of climate services would need to be probed from the users' perspective. Then one could assess the already available services, the providers/purveyors of these services, and conclude if there are redundancies or unexploited opportunities in the provision of climate services.

In conclusion, the results show that while climate research and use of climate-related information in various ways are not new activities, the concept of climate services is. At the same time, the term is

not yet very well established. An implication is that to create a network of providers/purveyors to gather around the term climate services, the concept of climate services needs to be better defined, explained, established and made relevant for the participating organisations.

Which products are provided by the various providers and why? What are the implications of the organisational structure on the provision of climate service?

The present study has a limited extent and it does not attempt to provide a complete mapping of climate services providers/purveyors and their portfolios in the two countries. Therefore, the conclusions regarding existing climate services should be seen as tendencies or possible indications.

One overall tendency when comparing Sweden to the Netherlands is that the providers/purveyors in the latter country seem to be more specialised and those in Sweden seem more general in their approaches. An indication that the provision of climate services in the Netherlands is more specialised than in Sweden is suggested in several findings of this study. For example, organisations in Sweden indicated that they provided more types of climate services to more user groups within more sectors than the organisations in the Netherlands. Furthermore, no general thematic focus of the services was evident among organisations in Sweden; on average almost four thematic focuses out of six possible were indicated per organisation and the distribution between them is fairly even. This could, however, result from the choice of the organisations to include. For example, the Swedish organisations probed are in general larger in terms of employees than those considered from the Netherlands and could thus be assumed to have greater capacity to deliver different types of climate services.

While the result of this study by no means attempts a complete mapping, it may give some indication on implications to the availability of climate services of the organisational structure and the types of organisations delivering climate services. The most represented type of organisation in Sweden participating in this study was a public authority (it should be noted that County Administrative Boards and universities also fall under the label "public authority" in Sweden). The most common type of provider/purveyor in the Netherlands was a private enterprise company. The distribution of types of organisations represented in the study could arguably explain many of the results presented in this report. For example, the development of climate services in the Netherlands started as the provider's/purveyor's own initiative, whereas in Sweden the start was upon request by another actor or "other" reason (as discussed in Section 3.1 (Figures 8 and 9), the most indicated reply for Sweden was "other" followed by the specification "upon request by the government", or similar). These relationships could well be linked to the organisational structure; in a simplified way it could be said that a public authority is mandated to respond to missions given, although it could also show initiative and responses to demands from society, while a private enterprise company is more likely to respond to an evolving market, for example by starting up new business under its own initiative. Another reflection on the impact of who the provider/purveyor is regards the fact that payments for climate services are more common in the Netherlands than in Sweden. Furthermore, regarding the climate services portfolios, the most common types of climate services provided in Sweden were indicated to be *guidance, workshops or similar activities* and *synthesis reports or other knowledge reviews* and the most common key competence *investigations or other specific analyses.* This suggests a more generic climate services portfolio, perhaps anticipated from public actors, who in general carry out missions to respond to the society's needs. In the Netherlands the most common types of climate services are *graphics and maps, adaptation strategy* and *processed data* and key competences *applied technology* and *applied research.* This suggests more specialised climate services, for more specific user-groups.

In conclusion, the results indicate that the organisational structure and legislation have a signature in the landscape of climate services, which needs to be recognised when addressing the provision of climate services in a country or a larger region.

It would be interesting to continue looking at whether these indications are general or specific for the particular selection of actors. It would also be interesting to look deeper into the implications of

different organisational structures, regarding for example the financing of climate services, and how they are accessed by users. The result of this study shows that most actors operate on public funding. This could imply that users are not so dependent on own resources when it comes to accessing the services. On the other hand, public funding may not be available for more tailored products, for specific users.

Another possible implication related to how climate services are funded relates to project-bound climate services. While there could very well be a demand for such services, there is arguably also a need for services without a fixed end-date; a service that can be provided whenever needed, perhaps in particular for services related to our current climate. More research would be needed to establish whether or not project-bound climate services are common, and if so, their length and nature. Guidelines, good practice and lessons represent more generic flavours of climate services. In the end, given the many types of user-groups of climate services, a variety of providers and purveyors is likely needed. Climate management, whether related to the current climate or climate change, requires diversity of expertise. Different providers and purveyors have different roles as there are many user-groups, each with specific needs, capacities and resources. Further research can underline advice on what types of climate services are possibly missing and what could be done to meet this demand in terms of financing.

Regarding obstacles to the provision of climate services, problems related to the organisational structure and coordination issues were more commonly mentioned during the Swedish interviews than the Dutch. While the number of respondents is low and no general conclusions can be drawn based on the material collected for this study, it could be worth looking further into to see if it *de facto* limits the process of developing new services, and if so, what could be done to overcome this obstacle.

Which means of communication is used and what are the limitations and possibilities/advantages?

Even though the commonly used definitions of the term climate services are very broad when looking at who the users and providers are and what types of climate data/information/knowledge that can be regarded as climate services, the definitions are more specific when it comes to the dissemination of the climate services. The information should in general be science-based and client-oriented. It should be based on a good understanding of the users' need, include good communication and updated information. The question is if there are resources available for this and if the organisational structure allows it.

Looking at the results from this study, the means of communication of the climate services generally involve direct contact with the user. On the other hand, promoting services is most commonly done through webpages, which implies one-way communication. For the information to be working as a promotion or visualization of available services the potential user arguably needs to understand how the service is relevant for him or her.

Regarding communication of climate services, a conflict of goals can be seen. By definition the services should be provided in a user-friendly way and tailoring services to a user would certainly lead to a higher level of user-friendliness (although some climate services of course are much less in need of tailoring, such as more generic information). At the same time climate services are, as discussed in Section 1.1, requested by increasing numbers of actors. Addressing all the needs of all the users is a challenging task. However, as discussed above, different providers of climate services have different roles to play and there is a need both for tailored information and for delivering user-friendly information for larger audiences.

How could knowledge on successful provision of climate services products and communication on climate services be transferred between countries?

A mapping of climate services providers can provide information for locating gaps in the provision of climate services and identify opportunities. The result from the questionnaire shows that all of

the participating organisations cooperate regarding climate services. This indicates that climate services providers and purveyors are aware, at least to some extent, of who to contact in case they need to collaborate, although the scale of the collaborations would need to be further investigated. During two of the interviews it was mentioned that the organisations visit other countries to increase their capacity and to exchange ideas (interviews 19 & 21). During the interviews, this information was not something we specifically asked for and it can therefore not be analysed whether it is a "method" used frequently or not so often. Although some services are quite specific for a certain context, there are also services that could very well be exported or shared. Increased cooperation can of course also be problematic when actors are competing over the same user groups. As an example from the current study, it was indicated that inaccessibility of data/information due to restrictions and/or secrecy can be an obstacle for providing climate services.

There are, however, ways to collaborate without competing. Two examples from the interviews are:

- One of the Dutch organisations was at its inception thought of as a research institute. It was, however, uncovered early on that most of the users were also research institutes. Instead of competing with the other actors, the organisation was transformed into a hub and a platform for actors within the field. Through this, the organisation's new role also filled a previous gap at the scene of climate services (interview 33).
- One of the organisations in Sweden previously experienced unwillingness to cooperation among private sector actors within the fields of climate services and sustainable development. Although cooperation was generally seen as positive, the resistance was high as actors were afraid to reveal company secrets and to loose market shares. As a step towards increased cooperation the organisation initiated a platform with a structure for cooperation among private sector actors, including high confidentiality among participating organisation (interview 4).

Bearing in mind the broad use of the concept of climate services, it could perhaps be more meaningful for similar actors to be more specific regarding their areas of services, such as providers/purveyors of climate *adaptation* services or climate *mitigation* services. This could provide further clarity into networks and make contacts easier and ideas and knowledge relevant for the actors involved in the network could be exchanged. On the other hand, this approach could risk to not fully incorporating the fact that there are synergies between climate change mitigation and adaptation to climate change. One possible path forward indeed could be indeed use the broad term climate services for broad applications, but use more specific terms in other contexts, such as for establishing networks of certain types of climate services providers and/or purveyors.

5. Further research needs

The study presented in this report is not a comprehensive account of climate services in Sweden and the Netherlands. In addition to the outcome of the study as such (see Chapter 3), the results suggest some guidance for research needs:

- Categorisation of providers/purveyors could improve the understanding of the dynamics of climate services, how they are used and how their dissemination could be improved. It could also help to find out whether there are gaps in the provision of climate services. It could potentially also facilitate cooperation and exchange between climate services actors, as it would bring clarity to which climate services actors are involved in the development of some specific services and/or within a specific field. A structured categorisation could separate groups of providers/purveyors according to different types of climate services, for example specific services targeted to specific groups of stakeholders or sectors and more general services. A categorisation could also look into different types of providers/purveyors, such as private and public actors, and what kind of services they typically provide. Yet another perspective could be to consider the whole chain of climate services, be they services focused on climate data or services developed to inform decision-making, in order to investigate which actors are involved throughout the chain, how the services are disseminated and how information is used in decision-making. A categorisation would need to deal with the fact that climate services actors are not always easily separated. As our study highlights, some providers/purveyors are also users of climate services. In particular private actors as well as actors financed through projects of limited extension could be assumed to change their focus according to market demand and/or requests from the funding body.
- Expand the mapping to include yet additional types of climate services providers/purveyors, and investigate if the same similarities and differences between the countries as identified in this study still be noticed.
- Expand the mapping to other countries and investigate similarities and differences in the initiation, provision and use of climate services, such as the JPI Climate's ongoing mapping of climate services actors in different European countries. This could inform about how providers/purveyors from different countries could work together. An expanded mapping could also provide information on whether it would be possible, and if so useful, to further establish European or other transnational climate services.
- Look further into the existing collaboration of climate services actors. How large is the scale of collaboration, how and why has it emerged? This could inform about possible ways of enhancing collaboration and lead to the identification of best practices.
- Further investigate implications of different types of organisational structures on the provision of climate services, such as the kinds of products, successful communication of their availability and utility, value-for-money, etc.
- Further investigate possible obstacles to produce climate services and how these could be handled.
- Look into user-needs, from the users' point of view, and to see if the indicated gaps in the provision of climate services following the findings of this study are gaps also for the users and thus true gaps. A user-perspective could also better reveal what kind of opportunities for the development of climate services there are, as well as if there are climate services around which do not match users' needs.
- Look at the dichotomy between tailoring products and reaching out to as many users as possible. Does this require different providers/purveyors, and if so, for which parts of the chain of steps which connect relevant basic and applied climate research, development of services, their delivery and feedback from the users?

6. Conclusions

The present study is a pilot mapping of climate services providers/purveyors in Sweden and in the Netherlands. The key findings, in brief, are:

- Climate service portfolios:
  - Most common types of climate services in Sweden are: *guidance, workshops or similar activities* and *synthesis reports or other knowledge reviews*. In the Netherlands, the same are: *graphics and maps, adaptation strategy* and *processed data*.
  - Possible gaps in the provision are: *analytical method* and *financial tool or socio-economic indicator* (both countries), *metadata* (the Netherlands) and *analytical tool* and *early warning system* (Sweden).
  - The most common key competence in Sweden is *investigations or other specific analyses*, and in the Netherlands *applied technology* and *applied research*.
  - The most common thematic focus in the Netherlands is: *impacts of climate change*. The results from Sweden do not indicate a clear single focus as the distribution is quite even between different types of focus areas.
- Communication of climate services:
  - *Participative methods* are in general used to disseminate climate services to users.
  - *Indirect methods* are in general used to promote climate services.
  - The interaction with users is in general *high* during the development of climate services.
  - Most of the interviewed organisations do communicate *uncertainties* in the services to their users. Most of these organisations also undertake actions to deal with uncertainties in the material used to develop climate services.
- Users of climate services:
  - The most common user groups in Sweden are *practitioners* and *decision-makers/politicians*, and in the Netherlands *decision-makers/politicians* and *NGOs or other stakeholder groups*.
  - Most of the organisations indicated that they are serving users within many different sectors, which could be interpreted as a demonstration that there is no strong sector specific provision of climate services. However, for the Netherlands, the results from this study indicate that there is a strong focus on the water sector.
- Development of climate services:
  - All providers/purveyors are cooperating with other actors regarding climate services, although it should be noted that the nature of these collaborations were not investigated in this study and they could therefore vary from limited and irregular collaborations to established networks (see also Chapter 4 and Section 3.5 above).
  - *Public funding* is an important source of funding the development of climate services.
  - Most commonly mentioned obstacles to the development of climate services are *lack of resources, lack of data and information* and *unclear organisational structure and/or coordination issues*.

The findings from this study and the lessons learned indicate that in order to provide information on how to improve the provision of climate services, it could be effective to focus on specific user-groups and their needs, what available services there are and which actors are providing/purveying these. A mapping of the users and their needs to the provision of services could be a possible starting point. Thereafter it would be possible to look at gaps in the provision; are services missing and/or does the communication between users and providers need to be improved? Is the problem that the promotion of the services not sufficient – are there services available that users do not know

of? Are the services disseminated in such a way that they can be useful to the user? In order to make use of the full potential of climate services, whether as for example tailored products or as climate data/information made available and actionable to a larger audience, it also needs to be clear to the users who are providing which climate services.

With the aim of promoting climate services and enabling cooperation, especially transnationally, the findings from this study indicate that the fact that the concept of climate services is not well-established is unfortunate. If the users do not recognise the concept, it will be more difficult to attract their interest and market the climate services. If the providers/purveyors who have relevant data/information do not embrace the dialogue aspect inherent in the climate services, their full potential will be more difficult to realise. Also, without a clear and shared understanding of the concept, it will be more difficult for actors to find each other and establish collaborations.

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14. Private enterprise company, the Netherlands [interview] (2013-10-16)
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16. Public authority, the Netherlands [interview] (2013-10-17)
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21. Association, Sweden [telephonic interview] (2013-09-27)
22. Local level, Sweden [telephonic interview] (2013-10-04)
23. County Administrative Board, Sweden [telephonic interview] (2013-10-04)
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25. Private enterprise company, the Netherlands [telephonic interview] (2013-10-28)
26. Water board, the Netherlands [telephonic interview] (2013-10-29)
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30. County Administrative Board, Sweden [telephonic interview] (2013-11-04)
31. Water board, the Netherlands [telephonic interview] (2013-11-07)
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33. Association, the Netherlands [telephonic interview] (2013-11-21)
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35. Water board, the Netherlands [telephonic interview] (2013-11-27)
36. Water board, the Netherlands [telephonic interview] (2013-11-28)
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39. Private enterprise company, the Netherlands [telephonic interview] (2013-12-10)

9. Annexes

Annex 1. Participating organisations

Sweden

2050 AB

Arvika Teknik AB

DHI Sverige

Energimyndigheten (Swedish Energy Agency)

FOI, Totalförsvarets forskningsinstitut (Swedish Defence Research Agency)

Forskningsrådet Formas (Swedish Research Council Formas)

Jordbruksverket (Swedish Board of Agriculture)

Kunskapscentrum för Klimatanpassning (National Knowledge Centre for Climate Change Adaptation)

Länsstyrelsen i Blekinge län (County Administrative Board of Blekinge)

Länsstyrelsen i Halland (County Administrative Board of Halland)

Länsstyrelsen i Jönköping (County Administrative Board of Jönköping)

Länsstyrelsen i Kalmar (County Administrative Board of Kalmar)

Länsstyrelsen i Norrbotten (County Administrative Board of Norrbotten)

Länsstyrelsen i Skåne (County Administrative Board of Skåne)

Länsstyrelsen i Uppsala (County Administrative Board of Uppsala)

Länsstyrelsen i Västernorrland (County Administrative Board of Västernorrland)

Länsstyrelsen i Västmanlands län (County Administrative Board of Västmanland)

Länsstyrelsen i Västra Götaland (County Administrative Board of Västra Götaland)

Länsstyrelsen i Östergötland (County Administrative Board of Östergötland)

Livsmedelsverket (National Food Agency)

Myndigheten för samhällskydd och beredskap, MSB (Swedish Civil Contingencies Agency)

Naturvårdsverket (Swedish Environmental Protection Agency)

Peab AB

Projektengagemang Energi och Klimatanalys

Ramböll Sverige AB

Respect Climate RSCS AB

Rossby Centre (SMHI)

Stockholm Environment Institute, SEI

Swedish Geotechnical Institute, SGI

Skanska Sverige AB

Skogsstyrelsen (Swedish Forest Agency)

Sveriges meteorologiska och hydrologiska institut, SMHI (Swedish Meteorological and Hydrological Institute)

Svenskt Vatten (the Swedish Water and Wastewater Association, SWWA)

Tricorona Climate Partner AB

Tyréns

The Netherlands

Acacia Water

Climate Adaptation Services Foundation (CAS)

Delta Alliance

Deltares

EARS Earth Environment Monitoring B.V.

European Climate Assessment & Dataset, ECA&D (KNMI)

Eijkelkamp Agrisearch Equipment

eLEAF

Euroconsult Mott MacDonald

Geodan

Grontmij Nederland B.V.

HKV Lijn in Water (HKV Consultants)

Hoogheemraadschap van Delfland (Delfland Water Board)

HydroLogic B.V.

Ingenieursbureau Amsterdam

Institute for Environmental Studies, IVM (VU University Amsterdam)

KNMI Koninklijk Nederlands Meteorologisch Intituut (Royal Netherlands Meteorological Institute)

Meteo Consult

Nelen & Schuurmans

National Aerospace Laboratory, NLR

Planbureau voor de Leefomgeving, PBL (Netherlands Environmental Assessment Agency)

Waterschap Hunze en Aa's (Water Board Hunze en Aa's)

Waterschap Noorderzijlvest (Regional water authority Noorderzijlvest)

Waterschap Regge en Dinkel (Water Board Regge and Dinkel)

Waterschap Rijn en Ijssel (Water Board Rijn en Ijssel)

Waterschap Rivierenland (Water Board Rivierenland)

Waterschap Roer en Overmaas (Roer and Overmaas Regional Water Authority)

Waterschap Scheldestromen (Scheldestromen Water Board)

Witteveen+Bos

Annex 2. Stakeholder analysis

A stakeholder analysis was used to preliminarily identify relevant actors. As discussed in Section 2.2 of the report, undertaking a stakeholder analysis is a way to make sure that the actors contacted have been strategically chosen. It is a tool used for making a broad selection, in this case based on estimated levels of interest and power. "Interest" was here seen as the estimated importance of climate services for the organisation. "Power" was seen as the estimated size of the organisation, as well as availability of resources and influence in decision-making.

Stakeholders included in the analysis were different types of providers and purveyors of climate services, based on previous literature. This means that common *users* of climate services such as researchers, engineers, managers and decision-makers dealing with climate change and also stakeholders, were excluded. Following the same reasoning, e.g. "Private enterprise company" below only includes those that provide and/or purvey climate services – not private enterprise companies in general.
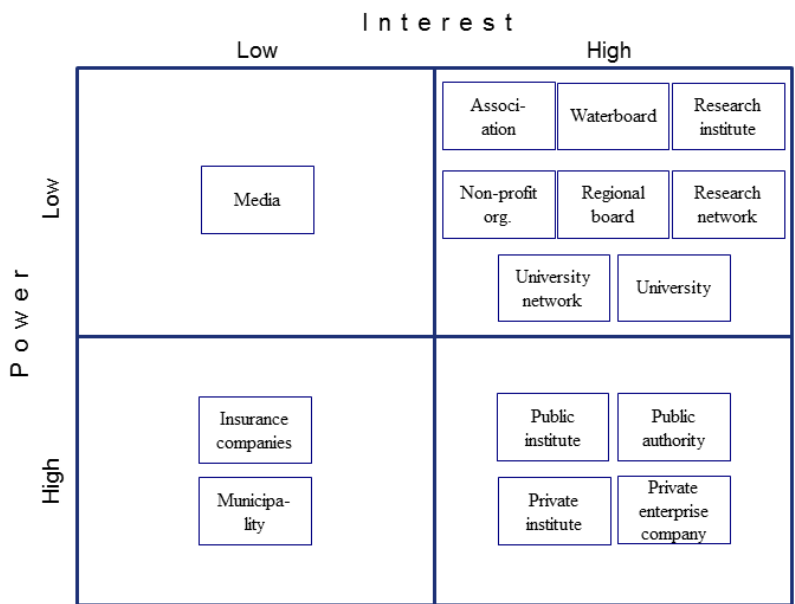
Figure A1. Result of the stakeholder analysis.

Annex 3. Introductory letter to the questionnaire

LUND
UNIVERSITY
Centre for Environmental
and Climate Research (CEC)

Introduction to the questionnaire "Providers and Purveyors of Climate Services"

Lund University in Sweden, in cooperation with *Koninklijk Nederlands Meteorologisch Instituut* (KNMI), is currently carrying out a research study regarding providers and purveyors of climate services.

The aim of the study is to conduct a mapping of providers and purveyors of climate services, as well as to get a better understanding of available services and possible provision gaps. Furthermore, the inventory will provide information to actors within the field of climate services on how to increase effectiveness, promote cooperation and avoid duplication. The findings of the study will be presented in a report, which will be made available to the public. Moreover, a mapping of climate services at a European level is presently also being carried out, which this research study aims to contribute to.

We have preliminarily identified you as a provider or purveyor of climate services[1] and would thereby like to invite you to participate in this research study by completing the attached questionnaire. The questionnaire comprises questions regarding e.g. what types of climate services your organisation is offering and your organisation's key competences. If your organisation is neither providing nor purveying any climate services, please inform us accordingly by replying to the email you have received.

The enclosed questionnaire takes ten to fifteen minutes to complete. Participation is of course voluntary. In the summary report of this survey, information gathered will be displayed at a group level. The report will also contain a list of participating organisations. The responses will be analysed at Lund University and KNMI.[2] If you prefer not to answer a particular question, just leave it blank.

If you have any questions regarding the questionnaire or this research study in general, please contact project assistant Terese Göransson at the Centre for Environmental and Climate Research at Lund University, Sweden.

Within the next two weeks we will follow-up the questionnaires. In connection to this we will ask for your permission to ask additional questions. If you do not wish to be contacted again, please indicate this in a reply to the email that you have received.

Thank you for taking the time to read through this introduction and for your consideration. We would like to thank you in advance for your participation; your assistance will make a valuable contribution to our research study.

Sincerely,

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Research
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[1] For this research study, providers and/or purveyors of climate services have been defined as actors who either produce own climate data or other climate information, or mediate available climate data or other climate information, and add value for users.

[2] As a public authority, Lund University is covered by the Swedish Principle of Public Access to Official Records. Thereby, documents received by, or established at the university, which regard the university's work, can in some cases be classified as official records, hence open to public access upon request. Information classified as confidential according to the Swedish Official Secrets Act is excluded from this principle.

Annex 4. Questionnaire

<div align="center">

Questionnaire: Providers and Purveyors of Climate Services

</div>

Please type in your answer in the corresponding box and/or indicate your answer with a cross. After completion of the questionnaire, please save it and attach it as a reply email to the one you have received. More information regarding the research study is provided in the document "Introduction questionnaire". Thank you for your assistance!

<div align="center">

LUND
UNIVERSITY

</div>

A.	**The following section deals with background information about your organisation**

1.	**Your organisation: Contact details**
Organisation	
City	
Contact person(s) (name)	
Department	
Position	
Telephone	
Email	

2.	**What organisational structure does your organisation have? (Check all that apply and/or specify in the box marked "other")**			
Public institute	☐	Research network	☐
University	☐	University network	☐
Public authority	☐	Research institute	☐
Private enterprise company	☐	Association	☐
Private institute	☐	Water board	☐
Non-profit organisation	☐	Municipality	☐
Other, please specify:			

3.	**How many employees does your organisation have?**			
1 to 10	☐	201 to 500	☐
11 to 50	☐	More than 500	☐
51 to 200	☐	Do not know/prefer not to disclose	☐

1.   What does your organisation understand to be the definition of climate services? (E.g. what types of services, processes and/or products does your organisation usually see as "climate services"?)

We see climate services as:

We do not define climate services	☐
Do not know/prefer not to disclose	☐

2.   Since when does your organisation offer climate services?

Since:

Do not know/prefer not to disclose	☐

3.   What is the thematic focus of your organisation's climate services?* (Check all that apply and/or specify in the box marked "other")

Climate data, analyses and/or scenarios	☐	Adaptation to climate change	☐
Vulnerability to climate change	☐	Climate protection	☐
Impacts of climate change	☐	Other, please specify:	

4.   What is your organisation's key competence? (Check all that apply and/or specify in the box marked "other")

Fundamental research	☐	Education	☐
Applied research	☐	Management	☐
Applied technology	☐	Investigations or other specific analyses	☐

Other, please specify:

5.   What types of climate services does your organisation offer? (Check all that apply and/or specify in the box marked "other")

Basic climate data	☐	Guideline, manual	☐
Processed data (e.g. indexes, scenarios and/or projections)	☐	Consultancy	☐
Graphics, maps	☐	Guidance	☐
Meta data (i.e. description or other docu-mentation of relevant data)	☐	Workshop	☐
Compilation of digital resource (e.g. web portal)	☐	Mitigation strategy	☐
Analytical tool (e.g. for trends)	☐	Adaptation strategy	☐
Analytical method (e.g. for trends)	☐	Financial tool, socio-economic indicators	☐
Synthesis report, or other knowledge reviews	☐	Other decision support tool	☐

Vulnerability assessment	☐	Early warning system	☐

Other, please specify:

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6. Which time horizon is relevant for your service? (Check all that apply)

Past	☐	Future until approx. 2070	☐
Present	☐	Future until approx. 2100	☐
Future until approx. 2040	☐	Special time horizons (e.g. seasonal projections)	☐
		Do not know/prefer not to disclose	☐

---

7. What is the spatial scale of your service? (Check all that apply. Please specify.)

Local	☐	Where:
Regional	☐	Where:
National	☐	Where:
Transnational	☐	Where:
Continental	☐	Where:
Global	☐	
Do not know/prefer not to disclose	☐	

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8. What method is your organisation using to produce your climate services? (Check all that apply and/or specify in the box marked "other")

Data collection	☐	Policy analysis	☐
Data analysis	☐	Applied research/ technology	☐
Literature research	☐	Capacity building	☐
Modelling	☐	Program coordination/ management	☐

Other, please specify:

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9. How did the development of your organisation's climate service/services start? (Check all that apply and/or specify in the box marked "other")

Own initiative	☐	As a an externally financed research project	☐
On demand of the user	☐	Mandated from another actor	☐
To meet the demand of the market	☐	Do not know/Prefer not to disclose	☐

Other, please specify:

10. How does your organisation finance the development and the provision of your climate service? (Check all that apply and/or specify in the box marked "other")				
With public funds	☐	Research funding	☐
With private funds	☐	Through payments for the services	☐
Hybrid forms of private and public	☐	Do not know/Prefer not to disclose	☐
Other resources or funds, namely:				

11. Does your organisation promote your organisation's climate services?		
Yes →	☐
No	☐
Do not know/Prefer not to disclose	☐

→ If you answered "yes" above, please specify what means of communication you use:
(Check all that apply and/or specify in the box marked "other")

The organisation's webpage or other webpage	☐	Direct marketing to users (existing users and/or potential users)	☐
Newsletter	☐	Climate portal	☐
Newspaper article/press release	☐	Blog	☐
Workshop, symposia, course or similar	☐	Other social media	☐
Network	☐	Other, please specify:	

C. The following section deals with users of your organisation's climate services

1. Who are the users of your service? (Check all that apply and/or specify in the box marked "other")				
Researchers	☐	Practitioners	☐
Consultancies	☐	General public	☐
Media	☐	NGOs and other stakeholder groups	☐
Decision makers/ politicians	☐	Do not know/prefer not to disclose	☐
Other, please specify:				

2. In which sector/sectors do the users operate? (Check all that apply and/or specify in the box marked "other")				
Agriculture	☐	Transport	☐
Forestry	☐	Spatial planning	☐
Fishery	☐	Urban planning	☐
Tourism	☐	Industry and trade	☐

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Energy	☐	Finance and insurance	☐
Building and construction	☐	Nutrition	☐
Water	☐	Waste management	☐
Catastrophe/Natural hazards management and/or civil contingencies	☐	Social structures	☐
Health	☐	Politics	☐
Biodiversity, nature conservation	☐	Research	☐
Consultancy	☐	Education	☐
Do not know/prefer not to disclose	☐	Other, please specify:	

3. How does your organisation disseminate the service to the user? (Check all that apply and/or specify in the box marked "other")			
Direct computer/database access	☐	Data sharing	☐
Face-to-face advice	☐	Print media/material	☐
Presentation of results directly to user	☐	Workshop, symposium, course	☐
Networking	☐	Web, social media	☐
Other, please specify:			

D. This final section deals with your organisation's networks

1. Does your organisation collaborate with others regarding climate services?	
Yes →	☐
No	☐
Do not know	☐
→ If you answered "yes" above, with whom do you collaborate? How?	

2. Are there any other organisations you are aware of engaging in similar activities?	
Yes →	☐
No	☐
Do not know	☐
→ If you answered "yes" above, please, provide examples:	

Thank you for supporting our survey!

Do you have any comments or something that you would like to add?

Annex 5. Interview questions

This annex display the interview guide used in this study. Interview questions in black were used to inform the study, the collected information was analysed and the results presented in the report. Interview questions marked in blue were posed and the information retrieved was used to inform the analysis, as background information and/or for the analysis of other interview questions, as some questions are interlinked. Interview questions marked in brown were intended to be analysed, but due to lack of data, due to lack of time, that the question was not relevant to the interviewees or that the question was difficult to answer and the replies thus difficult to analyse, have been excluded from the analysis.

Interview questions: Providers and Purveyors of Climate Services

1. Is the term climate services a term that you use at your workplace?				
Yes→	☐		No	☐

→ If yes: How do you usually use the term?

We:

Comment:

In the questionnaire you indicated what types of climate services your organisation is offering. We would now like to know a bit more about these types/focus areas, regarding e.g. how the services are being produced, what material is used as well as which other actors you collaborate with to produce these services (if relevant).

2. Which services would you describe as the most important for you organisation?

Please, describe the climate services:

- o What are the products?
- o Who are the users?
- o How are the services disseminated to the user?

---

3. What sources does your organisation use to collect material used to produce your climate services? (Check all that apply and/or specify in the box marked "other")		
We produce own data	☐	Please specify:
We consult experts in climate information	☐	Please specify:
We consult the national meteorological office	☐	Please specify:
We consult other meteorological offices	☐	Please specify:
We collaborate with consultancies	☐	Please specify:
We use specific available material (e.g. from the Internet)	☐	Please provide examples:
We consult actors/use sources other than the above mentioned	☐	Please specify:
Other	☐	Please specify:
Comment:		

4.	**Do you use climate data/climate indicators to produce your climate services?**

a.	**If relevant: What climate data/indicators do you use?**

5.	**Do you use climate scenarios?**

a.	**If relevant: What scenarios are used?**

b.	**If relevant: How are uncertainties dealt with?**

6.	**If applicable: How does your organisation handle possible uncertainties related to your service/to the data and/or the indicators you are using?**

We:

Not applicable →	☐	→ go to question 7 below

7.	**How does your organisation communicate uncertainties to your users?**

We:

Do not know/Prefer not to disclose	☐

8.	**In general, how is the contact between your organisation as a provider of climate services and your users established?**

We contact potential users of our services	☐
We are contacted by potential users of our services	☐
Other →	☐
Do not know	☐

→ If you answered "other" above, please specify:

Comments:

9.	**In general, how would you rate the extent of interaction with the users of your services?**

Do not know/Prefer not to disclose	☐

10.	**Are you offering services tailored to the users of your services?**

Yes	☐
No	☐
Do not know/prefer not to disclose	☐

Comment:

11. Is your organisation, to your knowledge, part of any network of climate services other?		
Yes →	( )	
No	( )	
Do not know	( )	
→ If you answered "yes" above, please, provide examples:		

12. Has your organisation, to your knowledge, encountered any obstacles in producing climate services? Is there anything that you see would need to be ameliorated?	
Yes →	☐
No	☐
Do not know/Prefer not to disclose	☐
→ If you answered "yes" above, please specify:	

13. Do you have any comments or something that you would like to add?

Thank you for supporting our survey!

Annex 6. The statistics in tables

In this annex, the statistical descriptions are presented. A reference to the corresponding subchapter is displayed within brackets. The corresponding figure in the report is displayed below the table. All values have been rounded off, which for the totals, in some cases, sums up to e.g. 99 or 101, instead of 100.

Who is the provider/purveyor? (3.1)

Table A 1. Organisational structure: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Public authority	11	28%	32%
Private enterprise company	9	23%	27%
Research institute	3	8%	9%
County administrative board	11	28%	32%
Municipality	1	3%	3%
Other	4	10%	12%
Total	**39**	**100%**	**115%**

Figure 2: N = 34, missing = 0, percent of cases: 115.

Table A 2. Organisational structure: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Public institute	4	10%	14%
University	1	2%	4%
Public authority	8	19%	29%
Private enterprise company	11	26%	39%
Private institute	1	2%	4%
Non-profit organisation	3	7%	11%
Research network	1	2%	4%
Research institute	4	10%	14%
Water board	6	14%	21%
Municipality	1	2%	4%
Other	2	5%	7%
Total	**42**	**100%**	**150%**

Figure 3: N = 28; missing = 0, percent of cases: 150.

Table A 3. Number of employees at the participating organisations: Sweden and the Netherlands.

Questionnaire alternative	Sweden		The Netherlands	
	Frequency	*Percent*	*Frequency*	*Percent*
1-10	1	3%	3	11%
11-50	7	21%	4	14%
51-200	7	21%	7	25%
201-500	6	18%	10	36%
More than 500	12	36%	4	14%
Total	**33**	**100%**	**28**	**100%**

Figure 4 (Sweden): N = 33, missing = 1. Figure 5 (the Netherlands): N = 28, missing = 0.

Table A 4. Starting year of the provision of climate services: Sweden and the Netherlands.

| | Sweden | | The Netherlands | |
Questionnaire alternative	Frequency	Percent	Frequency	Percent
Do not know/prefer not to disclose	4	14%	6	25%
2013-2009	11	41%	2	8%
2008-2004	4	15%	4	17%
2013-1999	5	19%	5	21%
1998-1994	2	7%	1	4%
1993-1989	0	0%	5	21%
Earlier than 1989	1	4%	1	4%
Total	**27**	**100%**	**24**	**100%**

Figure 6: N = 27, missing = 7. Figure 7: N = 24, missing = 4.

Table A 5. Development of services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Own Initiative	12	19%	35%
On demand of the user	6	9%	18%
To meet the demand of the market	6	9%	18%
As an externally financed research project	5	8%	15%
Mandated from another actor	17	26%	50%
Do not know/prefer not to disclose	1	2%	3%
Other	18	28%	53%
Total	**65**	**100%**	**191%**

Figure 8: N = 34, missing = 0. Percent of cases: 191.

Table A 6. Development of services: Sweden (alternative).

Questionnaire alternative	Frequency	Percent	Percent of cases
Own Initiative	12	21%	35%
On demand of the user	6	10%	18%
To meet the demand of the market	6	10%	18%
As an externally financed research project	5	9%	15%
Mandated from another actor	23	40%	68%
Do not know/prefer not to disclose	1	2%	3%
Other	5	9%	15%
Total	**58**	**100%**	**171%**

Figure 9: N = 34, missing = 0. Percent of cases: 171.

Table A 7. Development of services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Own initiative	17	32%	61%
On demand of the user	9	17%	32%
To meet the demand of the market	9	17%	32%
As an externally financed research project	9	17%	32%
Mandated from another actor	2	4%	7%

Other	7	13%	25%
Total	**53**	**100%**	**189%**

Figure 10: N = 28, missing = 0. Percent of cases: 189.

Table A 8. Key competences: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Fundamental research	1	1%	3%
Applied research	10	12%	29%
Applied technology	9	10%	27%
Education	14	16%	41%
Management	13	15%	38%
Investigations or other specific analyses	26	30%	77%
Other	14	16%	41%
Total	**87**	**100%**	**256%**

Figure 11: N = 34, missing = 0. Percent of cases: 256.

Table A 9. Key competences: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Fundamental research	1	2%	4%
Applied research	13	22%	46%
Applied technology	17	29%	61%
Education	4	7%	14%
Management	10	17%	36%
Investigations or other specific analyses	5	9%	18%
Other	9	15%	32%
Total	**59**	**100%**	**211%**

Figure 12: N = 28, missing = 0. Percent of cases: 211.

What climate services are the providers and purveyors offering? (3.2)

Table A 10. Thematic focus: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Climate data, analyses and/or scenarios	21	16%	62%
Vulnerability to climate change	25	19%	74%
Impacts of climate change	26	20%	77%
Adaptation to climate change	28	21%	82%
Climate protection	24	18%	71%
Other	7	5%	21%
Total	**131**	**100%**	**385%**

Figure 13: N= 34, missing = 0. Percent of cases: 385.

Table A 11. Thematic focus: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Climate data, analyses and/or scenarios	14	16%	50%
Vulnerability to climate change	17	20%	61%
Impacts of climate change	23	27%	82%

	Frequency	Percent	Percent of cases
Adaptation to climate change	20	23%	71%
Climate protection	8	9%	29%
Other	4	5%	14%
Total	**86**	**100%**	**307%**

Figure 14: N= 28, missing = 0. Percent of cases: 307.

Table A 12. Types of provided climate services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Basic climate data	9	3%	27%
Processed data	15	5%	44%
Graphics, maps	11	4%	32%
Meta data	13	5%	38%
Compilation of digital resource	10	4%	29%
Analytical tool	3	1%	9%
Analytical method	5	2%	15%
Synthesis report, or other knowledge reviews	25	9%	74%
Vulnerability assessment	21	8%	62%
Guideline, manual	21	8%	62%
Consultancy	11	4%	32%
Guidance	27	10%	79%
Workshop	27	10%	79%
Mitigation strategy	21	8%	62%
Adaptation strategy	24	9%	71%
Financial tool, socio-economic indicators	6	2%	18%
Other decision support tool	23	8%	68%
Early warning system	4	1%	12%
Other	5	2%	15%
Total	**280**	**100%**	**827%**

Figure 15: N = 34, missing = 0. Percent of cases: 827.

Table A 13. Types of provided climate services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Basic climate data	10	5%	36%
Processed data	16	9%	57%
Graphics, maps	17	9%	61%
Meta data	5	3%	18%
Compilation of digital resource	10	5%	36%
Analytical tool	8	4%	29%
Analytical method	5	3%	18%
Synthesis report, or other knowledge reviews	9	5%	32%
Vulnerability assessment	15	8%	54%
Guideline, manual	6	3%	21%
Consultancy	13	7%	46%
Guidance	6	3%	21%

Workshop	12	6%	43%
Mitigation strategy	8	4%	29%
Adaptation strategy	17	9%	61%
Financial tool, socio-economic indicators	5	3%	18%
Other decision support tool	7	4%	25%
Early warning system	12	6%	43%
Other	7	4%	25%
Total	**188**	**100%**	**671%**

Figure 16: N = 38, missing = 0. Percent of cases: 671.

Table A 14. Time horizon relevant for climate services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Past	18	17%	55%
Present	30	28%	91%
Future until 2040	17	16%	52%
Future until 2070	11	10%	33%
Future until 2100	22	21%	67%
Special time horizons	7	7%	21%
Do not know/Prefer not to disclose	1	1%	3%
Total	**106**	**100%**	**321%**

Figure 17: N = 33, missing = 1. Percent of cases: 321.

Table A 15. Time horizon relevant for climate services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Past	14	19%	50%
Present	19	26%	68%
Future until 2040	14	19%	50%
Future until 2070	7	10%	25%
Future until 2100	12	16%	43%
Special time horizons	6	8%	21%
Do not know/prefer not to disclose	2	3%	7%
Total	**74**	**100%**	**264%**

Figure 18: N = 28, missing = 0. Percent of cases: 264.

Table A 16. Spatial scale relevant for climate services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Local	25	24%	74%
Regional	30	29%	88%
National	21	20%	62%
Transnational	8	8%	24%
Continental	8	8%	24%
Global	10	10%	29%
Do not know/prefer not to disclose	1	1%	3%
Total	**103**	**100%**	**303%**

Figure 19: N = 34, missing = 0. Percent of cases: 303.

Table A 17. Spatial scale relevant for climate services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Local	14	19%	50%
Regional	23	32%	82%
National	14	19%	50%
Transnational	8	11%	29%
Continental	7	10%	25%
Global	6	8%	21%
Do not know/prefer not to disclose	1	1%	4%
Total	**73**	**100%**	**261%**

Figure 20: N = 28, missing = 0. Percent of cases: 261.

Table A 18. Methods used to produce climate services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Data collection	15	11%	47%
Data analysis	25	19%	78%
Literature research	22	17%	69%
Modelling	13	10%	41%
Policy analysis	14	11%	44%
Applied research/technology	8	6%	25%
Capacity building	13	10%	41%
Program coordination/management	15	11%	47%
Other	7	5%	22%
Total	**132**	**100%**	**413%**

Figure 21: N = 32, missing = 2. Percent of cases: 413.

Table A 19. Methods used to produce climate services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Data collection	13	11%	46%
Data analysis	21	18%	75%
Literature research	14	12%	50%
Modelling	21	18%	75%
Policy analysis	10	9%	36%
Applied research/technology	15	13%	54%
Capacity building	9	8%	32%
Program coordination/management	8	7%	29%
Other	5	4%	18%
Total	**116**	**100%**	**414%**

Figure 22: N = 28, missing = 0. Percent of cases: 414.

Table A 20. Material and sources used to produce climate services: Sweden and the Netherlands.

Category, analysis of interview material	Frequency	Percent	Percent of cases
We produce own data	19	14%	61%
We consult the national meteorological office	27	19%	87%

We consult other meteorological offices	15	11%	48%
We collaborate with consultancies	19	14%	61%
We consult experts in climate information	22	16%	71%
We use specific available material (e.g. from the Internet)	22	16%	71%
We consult other actors/use other sources than the above mentioned	16	11%	52%
Total	**140**	**100%**	**452%**

Figure 23: N = 31, missing = 7. Percent of cases: 452.

Table A 21. How uncertainties are dealt with; are uncertainties related to the climate services communicated to the users.

Category, analysis of interview material	Frequency	Percent	Percent of cases
Actions to deal with uncertainties related to climate services	26	48%	84%
Communication of uncertainties to users	27	50%	87%
Uncertainties are not relevant	1	2%	3%
Total	**54**	**100%**	**174%**

Figure 24: N = 31, missing = 8. Percent of cases: 174.

Table A 22. Actions to deal with uncertainties.

Category, analysis of interview material	Frequency	Percent	Percent of cases
Tools to decrease uncertainties/increase knowledge about uncertainties	4	10%	15%
Method/approach to decrease uncertainties/increase knowledge about uncertainty	11	27%	42%
Declaration of acceptance of uncertainties/uncertainties are not important	8	20%	31%
Method/approach to limit the importance of uncertainties	7	17%	27%
Evaluation of uncertainties/cooperation with other actors to deal with uncertainties	8	20%	31%
Other	3	7%	12%
Total	**41**	**100%**	**158%**

Figure 25: N =26, missing = 13 (of total number of interviews). Percent of cases: 158.

Table A 23. Communication of uncertainties to users.

Category, analysis of interview material	Frequency	Percent	Percent of cases
Clarity	9	17%	33%
Language	4	8%	15%
Tools – indirect, including unspecified means of communication of uncertainties to users	11	21%	41%
Tools - direct	3	6%	11%
Information about uncertainties is not requested by/not important to users	5	10%	19%
Recommendation	6	12%	22%
Challenges communication	12	23%	44%

Other	2	4%	7%
Total	**52**	**100%**	**193%**

Figure 26: N = 27, missing = 12 (of total number of interviews). Percent of cases: 193.

Nature of the services (3.3)

Table A 24. Means of dissemination of climate services to users: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Direct computer/database access	18	10%	53%
Face-to-face advice	25	14%	74%
Presentation of results directly to user	16	9%	47%
Networking	23	13%	68%
Data sharing	8	5%	24%
Print media/material	27	15%	79%
Workshop, symposium, course	32	18%	94%
Webb, social media	22	13%	65%
Other	5	3%	15%
Total	**176**	**100%**	**518%**

Figure 27: N = 34, missing = 0. Percent of cases: 518.

Table A 25. Means of dissemination of climate services to users: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Direct computer/database access	13	9%	46%
Face-to-face advice	20	14%	71%
Presentation of results directly to user	24	17%	86%
Networking	15	10%	54%
Data sharing	14	10%	50%
Print media/material	20	14%	71%
Workshop, symposium, course	22	15%	79%
Webb, social media	11	8%	39%
Other	5	4%	18%
Total	**144**	**100%**	**514%**

Figure 28: N = 28, missing = 0. Percent of cases: 514

Table A 26. Promotion of climate services: Sweden and the Netherlands.

	Sweden		The Netherlands	
Questionnaire alternative	Frequency	Percent	Frequency	Percent
No	5	15%	3	11%
Yes	28	82%	24	86%
Do not know/prefer not to disclose	1	3%	1	4%
Total	**34**	**100%**	**28**	**100%**

Figure 29 (Sweden): N = 34, missing = 0. Figure 30 (the Netherlands): N = 28, missing = 0.

Table A 27. Means of communication to promote climate services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
The organisation's webpage or other webpage	28	19%	100%
Newsletter	16	11%	57%
Newspaper article/press release	19	13%	68%
Workshop, symposia, course or similar	28	19%	100%
Network	21	14%	75%
Direct marketing to users	12	8%	43%
Climate portal	8	5%	29%
Blog	3	2%	11%
Other social media	8	5%	29%
Other	6	4%	21%
Total	**149**	**100%**	**532%**

Figure 31: N = 28, missing = 0. Percent of cases: 532.

Table A 28. Means of communication to promote climate services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
The organisation's webpage or other webpage	22	23%	92%
Newsletter	12	13%	50%
Newspaper article/press release	11	11%	46%
Workshop, symposia, course or similar	18	19%	75%
Network	12	13%	50%
Direct marketing to users	9	9%	38%
Climate portal	7	7%	29%
Blog	0	0%	0%
Other social media	3	3%	13%
Other	2	2%	8%
Total	**96**	**100%**	**401%**

Figure 32: N = 24, missing = 0. Percent of cases: 401.

Table A 29. Level of interaction with users.

Category, analysis of interview material	Frequency	Percent	Percent of cases
High level of interaction with users	29	38%	78%
Direct contact with users	19	25%	51%
Indirect contact with users	23	30%	62%
No contact with end-users	5	7%	14%
Total	**76**	**100%**	**205%**

Figure 33: N = 37, missing = 2. Percent of cases: 205.

Table A 30. Establishment of contact with users.

Category, analysis of interview material	Frequency	Percent	Percent of cases
We contact potential users of our services	2	5%	6%
We are contacted by potential users of or services	12	32%	35%
Varies	15	41%	44%
Other	8	22%	24%
Total	**37**	**100%**	**109%**

Figure 34: N = 34, missing = 5. Percent of cases: 109.

Table A 31. Financing of the development of climate services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
With public funds	21	42%	62%
With private funds	3	6%	9%
Hybrid forms of private and public	5	10%	15%
Research funding	6	12%	18%
Through payments for the services	9	18%	27%
Other	6	12%	18%
Total	**50**	**100%**	**147%**

Figure 35: N = 34, missing = 0. Percent of cases: 147.

Table A 32. Financing of the development of climate services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
With public funds	17	32%	61%
With private Funds	4	7%	14%
Hybrid forms of private and public	6	11%	21%
Research funding	10	19%	36%
Through payments for the services	11	20%	39%
Other	6	11%	21%
Total	**54**	**100%**	**193%**

Figure 36: N = 28, missing = 0. Percent of cases: 193.

Users of the services (3.4)

Table A 33. Users of the provided services: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Researchers	15	9%	46%
Consultancies	18	11%	55%
Media	18	11%	55%
Decision makers/politicians	29	18%	88%
Practitioners	31	19%	94%
General public	22	14%	67%
NGOs and other stakeholder groups	21	13%	64%
Do not know/prefer not to disclose	1	1%	3%
Other	8	5%	24%
Total	**163**	**100%**	**494%**

Figure 37: N = 33, missing = 1. Percent of cases: 494.

Table A 34. Users of the provided services: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Researchers	8	8%	29%
Consultancies	13	13%	46%
Media	4	4%	14%
Decision makers/politicians	23	23%	82%
Practitioners	13	13%	46%
General public	13	13%	46%
NGOs and other stakeholder groups	20	20%	71%
Other	6	6%	21%
Total	**100**	**100%**	**357%**

Figure 38: N = 28, missing = 0. Percent of cases: 357.

Table A 35. Sectors to which the users of the services can be allocated: Sweden.

Questionnaire alternative	Frequency	Percent	Percent of cases
Agriculture	21	5%	62%
Forestry	17	4%	50%
Other agricultural sector	13	3%	38%
Tourism	10	3%	29%
Energy	26	7%	77%
Building and construction	18	5%	53%
Water	25	6%	74%
Catastrophe/Natural hazards management and/or civil contingencies	23	6%	68%
Health	12	3%	35%
Biodiversity, nature conservation	15	4%	44%
Consultancy	20	5%	59%
Transport	21	5%	62%
Spatial planning	13	3%	38%
Urban planning	25	6%	74%
Industry and trade	11	3%	32%
Finance and insurance	14	4%	41%
Nutrition	13	3%	38%
Waste management	13	3%	38%
Social structures	27	7%	79%
Politics	24	6%	71%
Research	16	4%	47%
Education	19	5%	56%
Other	4	1%	12%
Do not know/prefer not to disclose	1	0,2%	3%
Total	**401**	**100%**	**1179%**

Figure 39: N = 34, missing = 0. Percent of cases: 1179.

Table A 36. Sectors to which the users of the services can be allocated: The Netherlands.

Questionnaire alternative	Frequency	Percent	Percent of cases
Agriculture	21	9%	75%
Forestry	8	3%	29%
Other agricultural sector	5	2%	18%
Tourism	9	4%	32%
Energy	10	4%	36%
Building and construction	12	5%	43%
Water	27	11%	96%
Catastrophe/Natural hazards management and/or civil contingencies	15	6%	54%
Health	6	3%	21%
Biodiversity, nature conservation	16	7%	57%
Consultancy	14	6%	50%
Transport	8	3%	29%
Spatial planning	19	8%	68%
Urban planning	14	6%	50%
Industry and trade	7	3%	25%
Finance and insurance	7	3%	25%
Nutrition	0	0%	0%
Waste management	9	4%	32%
Social structures	2	1%	7%
Politics	8	3%	29%
Research	7	3%	25%
Education	9	4%	32%
Other	2	1%	7%
Do not know/prefer not to disclose	1	0,4%	4%
Total	**236**	**100%**	**846%**

Figure 40: N = 28, missing = 0. Percent of cases: 846.

Table A 37. Cooperation with other actors regarding climate services: Sweden and the Netherlands.

	Sweden		The Netherlands	
Questionnaire alternative	*Frequency*	*Percent*	*Frequency*	*Percent*
Yes	34	100%	28	100%
No	0	0%	0	0%
Total	**34**	**100%**	**28**	**100%**

N (Sweden) = 34, missing = 0. N (the Netherlands)= 28, missing = 0.

Table A 38. Knowledge of other actors providing similar services in the own country: Sweden and the Netherlands.

Questionnaire alternative	Sweden		The Netherlands	
	Frequency	*Percent*	*Frequency*	*Percent*
No	4	12%	5	20%
Yes	27	82%	18	72%
Do not know/prefer not to disclose	2	6%	2	8%
Total	**33**	**100%**	**25**	**100%**

Figure 41 (Sweden): N = 33, missing = 1. Figure 42 (the Netherlands): N = 25, missing = 3

Obstacles/problems (3.6)

Table 39. Obstacles for producing climate services.

Category, analysis of interview material	Frequency	Percent	Percent of cases
Lack of data/information	14	15%	39%
Unavailability of data	10	10%	28%
Lack of resources	16	17%	44%
Lack of interest/awareness raising	7	7%	19%
Lack of capacity	6	6%	17%
Unclear organisational structure/coordination issues	11	12%	31%
Lack of cooperation	3	3%	8%
Unclear division of responsibility	6	6%	17%
Lack of legislation	4	4%	11%
No demand from the market	6	6%	17%
Ineffective communication	7	7%	19%
Conflicting interests	6	6%	17%
Total	**96**	**100%**	**267%**

Figure 43: N = 36, missing = 3. Percent of cases: 267

The term "Climate Services" (3.7)

Table A 40. Defining and describing the term *Climate Services*: Sweden and the Netherlands.

Category, analysis of questionnaire material	Sweden		The Netherlands	
	Frequency	*Percent*	*Frequency*	*Percent*
Do not define climate services	24	73	4	14%
Description provided	6	18	20	71%
Description provided, but do not define climate services	3	9	4	14%
Total	**33**	**100%**	**28**	**100%**

Figure 44 (Sweden): N = 33, missing = 1. Figure 45 (the Netherlands): N = 28, missing = 0

Table A 41. Use of the term climate services at workplace: Total.

Reply, interview	Frequency	Percent
No	24	71%
Yes	10	29%
Total	**34**	**100%**

Figure 46: N = 34, missing = 5.

Table A 42. Sweden: Use of the term climate services at workplace: Sweden and the Netherlands.

Reply, interview	Sweden		The Netherlands	
	Frequency	*Percent*	*Frequency*	*Percent*
No	11	69%	13	72%
Yes	5	31%	5	28%
Total	**16**	**100%**	**18**	**100%**

Figure 47 (Sweden): N = 16, missing = 3. Figure 48: N (the Netherlands) = 18, missing = 2.