KNOWLEDGE BROKERING AND RESEARCH UTILIZATION IN THE CONTEXT OF ENVIRONMENTAL POLICY IN FINLAND

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Tiivistelmä – Referat – Abstract

Kestävyysongelmat, kuten biodiversiteetin väheneminen ja ilmastonmuutos, koettelevat yhteiskuntia ympäri maailmaa (Rockström et al., 2009). Tieteellä ja politiikalla on muiden yhteiskunnallisten sektoreiden ohella merkittävä rooli näiden ongelmien ratkaisemisessa. Tämä, ja muut samanaikaiset vaikuttavat tekijät, ovat taustalla yleistyneessä keskustelussa tietoon perehtyvästä päätöksenteosta ympäristöpolitiikassa, sekä tiedon välittämistyöstä (eng. knowledge brokering) keinona edistää paremmin tietoon perehtyneitä päätöksiä. Tiedon välittämistyö koostuu tiedon tuottajien, välittäjien ja käyttäjien välisistä prosesseista, joissa tutkimustuloksia käännetään politiikkavaihtoehdoiksi, päätöksentekijöiden tarpeita tulkataan tutkimusongelmiksi ja -kysymyksiksi, ja luodaan yhteyksiä tutkijoiden ja muiden yhteiskunnan toimijoiden välille.

Tässä tutkimuksessa tutkin tutkimustiedon hyödyntämistä ja tiedon välittämistyötä suomalaisessa ympäristöpolitiikassa. Tutkimuksen tuloksia käytetään Ympäristötiedon Foorumin toiminnan vaikuttavuuden kehittämisessä. Tätä lähestytään kolmen tutkimuskysymyksen kautta. Miten päätöksentekijät mieltävät tehokkaan tiedonvälitystyön? Miten päätöksentekijät mieltävät tutkimustiedon hyödyntämisen politiikassa? Mitkä ovat päätöksentekijöiden mielestä merkittävimmät tiedon välittämistyötä edistävät tai jarruttavat tekijät?

Aineistona käytetään tammi-huhtikuussa kerättyä haastatteluaineistoa. Haastattelut toteutettiin semi-strukturoituina avainhenkilöhaastatteluina yhteistyössä Ympäristötiedon Foorumin koordinaattoreiden kanssa. Haastatteluja toteutettiin 18. Aineisto analysointiin käytettiin sisällönanalyysiä.

Analyysin mukaan päätöksentekijät pitkälti näkevät tiedonvälittämistyön Turnhoutin ym. (2013) sillanrakennus-kategorian mukaisesti. Tiedonvälitystyön onnistumista pidetään tieteen toimialan vastuuna, ja päätöksentekijät näkevät selkeän ja vahvan jaon tieteen ja politiikan toimialojen välillä. Tutkimustiedon hyödyntäminen nähdään pitkälti Weissin (1979) ongelmanratkaisu-mallin tai vuorovaikutteisen mallin mukaisena, eli tutkimustietoa hyödynnetään ratkaistaessa olemassaolevia ongelmia ja vuorovaikutuksessa muiden tiedonlähteiden kanssa.

Merkittävimmät edistävät tekijät tiedon välittämistyölle liittyvät tutkimuksen mukaan kommunikaatioon. Esimerkkejä näistä tekijöistä on muun muassa tietotuotteen muotoilu ja aito vuorovaikutus. Monet merkittävät jarruttavat tekijät liittyvät yksilöön, kuten osallistujien kyvyt ja asenteet. Yksittäisistä tekijöistä tieteenalojen, tiedon lajien ja asiantuntijoiden monipuolisuus, sekä viestin muotoilu, nähdään merkittävimpänä edistävänä tekijänä. Jarruttavista tekijöistä merkittäviä ovat asenteet ja luottamus, resurssit ja ajoitus.

Tämän tutkimuksen pohjalta syntyneet suositukset rajapinnan organisaatioille:

1. Ajoitukseen, viestin muotoiluun ja monipuolisuuteen tulee kiinnittää erityistä huomiota suunniteltaessa ympäristöpolitiikkaan liittyvää tiedon välitystyötä.
2. Uusia keinoja korostaa päätöksentekijöiden ja tutkijoiden jaettua vastuuta tehokkaasta ja tilanteeseen sopivasta tiedon välitystyöstä tulee kehittää ja testata.
3. Rajapinnan organisaatioiden tulee löytää keinoja luoda kyvykkyyksiä rakentavia tieto-politiikka yhdyspinnan ylittäviä verkostoja.

Avainsanat – Nyckelord – Keywords
Tiedon välittämistyö, ympäristöpolitiikka, tutkimustiedon hyödyntäminen, tietoon perehtyvä päätöksenteko

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Tiivistelmä – Referat – Abstract

All societies globally are faced with alarming sustainability issues, such as biodiversity loss and climate change (Rockström et al., 2009). Science and policy, along with other societal sectors, play crucial roles in trying to find answers to these problems. This, alongside other influencing factors, has resulted in a stronger emphasis on evidence-informed policy in the context of environmental policy, and on knowledge brokering as a tool to reach more evidence-informed decisions. Knowledge brokering is a process between the producers, brokers, and users of knowledge, in which research findings are translated to meaningful policy options, needs of decision-makers are interpreted to research problems and questions, and connections between researchers and other actors of the society are created.

In this study, I study research utilization and knowledge brokering in the context of environmental policy in Finland. The results are aimed to be utilized in improving the impact of the Forum for Environmental Information in Finland. The study has three research questions: What decision-makers perceive as efficient knowledge brokering? How decision-makers perceive research utilization in environmental policy? What are the most important promoting and hindering factors in decision-makers viewpoint to knowledge brokering process?

The data for this thesis was collected via 18 semi-structured key-informant interviews in January-April 2018. The data was analyzed using content analysis.

According to the analysis, the decision-makers mostly see knowledge brokering under the bridging category by Turnhout et al. (2013). Decision-makers mostly see knowledge brokering as a responsibility of the science domain and see a clear and strong division between science and policy. The interviewees mostly see research utilization in the problem-solving or interactive model by Weiss (1979), which means that research is utilized to solve an existing problem, and among other sources of knowledge.

Of the promoting factors, the most relevant factors were related to the communication, such as formulation of the knowledge-product and genuine interaction. Many relevant hindering factors were on the individual level, such as capacities and attitudes of the participants. For the single factors, diversity of branches of science, types of knowledge and of experts is seen as the most relevant promoting factor. Following is the formulation of the message. Of the hindering factors, most relevant according to the analysis are attitudes and trust, resources and timing.

Recommendations for boundary organizations on the basis of this research:

1. Special attention should be paid to timeliness, formulation, and diversity when planning knowledge brokering actions for environmental policy.
2. New ways to highlight the shared responsibility of both the decision-makers and the researchers in an efficient and adequate knowledge brokering process should be created and tested.
3. Boundary organizations should find ways to create long-lasting networks to the interface between science and policy to build capacities and alter attitudes on both sides of the interface.

Avainsanat – Nyckelord – Keywords
Knowledge brokering, environmental policy, research utilization, evidence-informed policy

TABLE OF CONTENT

Figures:

Tables:

1. Introduction

1.1 Sustainability crisis and the responses of the academia

All societies globally are faced with alarming sustainability issues, such as biodiversity loss, climate change and disturbance of chemical cycles of the planet (Rockström et al., 2009). We live in a time referred to as the Anthropocene (Crutzen, 2002) or capitalocene (Haraway, 2015), which highlights the overarching and adverse effect the human kind and our economic systems have on the rest of the planet and ourselves. This state is also referred to as a sustainability crisis (Trainer, 1997). In addition to political, economic and cultural spheres of the society, the scientific community also faces these same challenges and has the possibility to either mitigate or intensify this development.

Bielak et al. (2008) argue that the changing society has pushed science in society to at least two new trajectories. There have been changes within science to solve the so-called ‘wicked problems' (Rittel & Webber, 1973)., e.g. non-traditional forms of knowledge production, conceptualized as for example ‘Mode 2' science by Gibbons (1994). The Mode 2 science is ‘science in the context of its application', which also emphasizes the robustness and ‘usability' of science. In relation, traditional Mode 1 science, is linear, discipline-oriented and only accountable to the scientific community. Also, the emerging field of sustainability science, which is aimed at producing robust knowledge to help guide and bring about sustainability transition, has risen to the global discussion (Kates et al., 2009).

There have been changes in ways science interacts with the rest of the society as well. Intermediate organizations have risen to the knowledge systems globally, suggesting that not only the nature of the scientific knowledge has to change, but the whole knowledge system which supports the utilization of research in decision-making also has to do the same (Bielak et al., 2008). Further emphasis is put on evidence-based, or evidence-informed, policy (Bowen & Zwi, 2005). As a

tool to reach more evidence-informed policy options, discussion on knowledge brokering has emerged within both the academia and the society surrounding it.

Knowledge brokering is a process between the producers and users of knowledge, in which research findings are translated into meaningful policy options (Van Kammen, De Savigny, & Sewankambo, 2006), or more broadly speaking its function is to, ‘create connections between researchers and their various audiences' (Meyer, 2010). Both new forms of knowledge production, i.e. Mode 2 science, and the rise of intermediate organizations and knowledge brokering, can be seen as answers to the sustainability crisis facing the humankind.

This is highly necessary, since sustainability issues of the 21st century have an especially high degree of complexity, due to the diversity of spatial scales, temporal inertia, and urgency, and because functions of the systems are complex and the definition of ‘usable knowledge' is vaguer, as scientific research and application become entangled (Kates et al., 2001). In solving these ever more complex and multidimensional problems, enhanced use of evidence and knowledge via knowledge brokering in environmental policy is seen beneficial (Michaels, 2009).

With this on the background, I study the knowledge brokering actions undertaken by the intermediate organizations within environmental policy in Finland. Especially, the results of this study are aimed to be used in further improving the impact of Forum for Environmental Information (see chapter 3). For its close connection to a real-life problem that needs to be solved and a close link to the Forum, a non-academic actor, this thesis can be seen as transdisciplinary research (Kates et al., 2001). Pohl (2007) divides transdisciplinary research into three forms, each of which has their own role in knowledge creation: systems knowledge, target knowledge, and transformation knowledge. In this framework, this study is strongly related to Pohls' (ibid.) description of systems knowledge: this study describes ‘the genesis and possible development of a problem and the problem interpretations.'

The research problem this thesis tackles is the need for more efficient knowledge brokering within environmental policy-making. It is approached through three research questions. To improve the impact of boundary organizations such as the Forum, it is useful to look at the knowledge brokering process on three levels: which actions are undertaken, which factors other than the action itself should be considered and how the research will eventually be utilized, i.e. what kind of knowledge the decisionmakers need.

First, I analyze what decision-makers perceive as efficient knowledge brokering (RQ1). This is relevant, for it allows for reflection in the intermediate organizations, and helps to answer questions such as 'Which functions should be further developed?' ‘To which functions is it worthawhile to put effort to?'

Second, I analyze how decision-makers perceive research utilization in environmental policy (RQ2). This is analyzed via the models of research utilization by Weiss (1979). This sheds light to the kind of knowledge decision-makers need: different kinds of knowledge and forms of knowledge brokering are most useful in different types of research utilization. As the last research question, I look at the different factors which either hinder or promote the success of knowledge brokering. What are the most important promoting and hindering factors in decision-makers viewpoint to knowledge brokering process? (RQ3)

The research problem is approached through these three questions, for they are the most relevant factors in further improving the efficiency of knowledge brokering in boundary organizations in Finland. The results are to be used when the Forum considers knowledge brokering actions they undertake, the factors they consider when planning these actions and the knowledge needs of decision-makers.

The three questions give perspectives to three kinds of questions: What should the knowledge brokers in boundary organizations do, which actions should they undertake? To which factors should they pay special attention to? What kind of knowledge do decision-makers need? (see section 6.2. for action suggestions).

1.2 Evidence-informed policy

As the call for more evidence-informed policy has had a major impact on the rising interest for knowledge brokering and intermediate organizations, a brief introduction on the call for evidence-informed policies is needed. Even if knowledge brokering can have multiple goals (see section 2.2.1.), knowledge brokering is most often seen as a means to enhance evidence-informed policies (Michaels, 2009; Van Kammen et al., 2006). In the 21st century, policy often pursues to be evidence-informed, i.e. to ‘use different types of evidence and scientific information from different sources, while keeping in mind and being reflective to the policy context' (Bowen & Zwi, 2005).

However, politics is politics and should not aim to be free of values and power struggles, and the role of science in society is to ‘search for the truth' in society overall. What really drives the need for evidence-informed policy? First, the sustainability issues presented in the previous chapter pose a strong argument. All sectors of society should be included in solving these issues. Secondly, in Finland, the value of scientific knowledge in decision-making is recognized throughout society. In the Finnish Science Barometer polling laypeople (Tiedebarometri, 2016), 69% of respondents agreed strongly or somewhat strongly with the argument: "Political decision-making takes far too little advantage of information based on scientific research". Only 4% denied the claim. In a report tracking the perceptions of both knowledge producer and users, 57% saw that collection of multidimensional information, i.e. multidimensional impact assessments to decisions and collection of information from multiple sources, is the most important tool in looking for answers to complex societal challenges (Hellström & Ikäheimo, 2017). Also, more than 80% of representatives of research institutes, universities or institutions of higher education (n=190) saw that the use of research information in societal decision-making should be increased (ibid.)

Tuomisto et al. (2017) summarized that scientific information has a special and recognized significance in the decision-making process to both knowledge users and producers in Finland. The utilization of research often faces practical obstacles, and the decision-making system lacks systemic means to bring

scientific information to the decision-making (Tuomisto et al., 2017). In a report published in Finland in 2017, people from all sides of the science-policy interface saw that decision-makers do not have enough time to acquaint themselves with information needed for the decision-making (about 80%), the use of knowledge is tactical (80%) and saw that different sources of information are not compared systematically in the preparation of decision. (Hellström & Ikäheimo, 2017.)

These problems are also visible on a practical level. One of the most visible ways to bring scientific information to the political processes are the institutionalized scientific assessments during the legislation process. Yet, a study conducted by the Finnish National Research Institute of Legal Policy (Rantala, 2011) found the insufficient use of research-based knowledge to be one of the main reasons for poor quality of legislative drafting. The apparent lack of scientific evidence occurred especially in projects with strong political steering (Rantala, 2011) when occasionally unpleasant information was simply put aside (Slant, Rantala & Sipilä, 2014).

1.3 Research approach: Knowledge brokering and research utilization

In this research, I shed light on decision-makers understandings on the role of scientific knowledge in the environmental policymaking. Through the concept of knowledge brokering, the different actions, which lead to a more significant role for scientific knowledge in political decision-making are investigated. Knowledge brokering is analyzed via repertoires by Turnhout et al. (2013), which also shed light to decision-makers perceptions of the science-policy interface. The models of research utilization by Weiss (1979) add to the analytical framework of knowledge brokering by helping to analyze how decision-makers perceive themselves as knowledge users and how they understand research utilization in the decision-making. In addition, the different factors, which either hinder or promote the success of knowledge brokering, are investigated.

Rather than discussing the ‘efficiency' of knowledge brokering actions, the actions are approached by studying factors that either promote or hinder the success of any knowledge brokering process. The examination is moved from a single action

to different traits that should be taken into consideration in all knowledge brokering processes and to different context-related factors that affect the success. As, for example, Cairney (2016), I argue that knowledge brokering, and research utilization are too complex and context related issues to be studied by an instrumental ‘input-output' model, and no research can show which knowledge brokering actions would be ‘the best' to achieve increased impact for the Forum of Environmental Information. Yet, some factors promoting or hindering the process can be located, and this information can be utilized in developing Forums’ functions.

In the combination of these three, knowledge brokering actions, models of research utilization and promoting and hindering factors, I contribute to further developing knowledge brokering work in Finnish policy setting, which contributes to the higher goal of improving the evidence-base for environmental policies. This study is done in cooperation with Forum for Environmental Information (from this on the Forum, see more in chapter 3), which seeks to improve their knowledge brokering strategies in the coming years.

In this study, I use qualitative content analysis to analyze the perceptions of decision-makers in the Finnish environmental policy. I analyze their perceptions of knowledge brokering, the promoting and hindering factors in a knowledge brokering process, and their perceptions of research utilization in political decision-making.

2. Literature review and analytical framework

In this section, the three research questions are motivated and elaborated. First, the science-policy interface where knowledge brokering takes place is discussed. Then, the main concept of knowledge brokering and its different forms and aims are discussed in section 2.2. After this, models of research utilization by Weiss (1979) and different promoting and hindering factors are presented in 2.3. Finally, the analytical framework is summarized in section 2.4.

2.1. Science-policy interface

‘Science' as a concept and its relations to surrounding society have developed into its own research agenda, Science and Technology studies, with MA programs, journals, and traditions. To summarize, science and different domains in the society, i.e. policy, have different grading criteria and goals (e.g. peer review-protocol in the academia versus referendums in democratic societies, search of ‘truth' versus maintaining power) (Turnhout, Hisschemöller, & Eijsackers, 2007) and a constant boundary work creating the boundaries between science and non-science keeps these domains separate in the society (Gieryn, 1995).

Even if the domains are seemingly separate, researchers have found it useful to contextualize an interface, rather than a boundary, separating the two. Turnhout et al. (2007) have described the interface as a 'fuzzy boundary area where science and policy overlap'. Discussion on the interface rather than on boundary highlights the flexibility and the continuum characteristics of the area between these two seemingly separate domains. Rules and institutions deriving from the science domain have been located in policy-arenas and vice versa; these two domains are not divided by clear, insurmountable, borders (Rip, 1997; Guston, 2001). At the interface, scientific knowledge is translated to usable knowledge, and policy questions to research questions; i.e. knowledge is brokered (Turnhout et al., 2007).

2.2. Knowledge exchange, knowledge translation and knowledge brokering

The body of literature concerned with the impact of research is growing, but the lack of coherent terminology makes comparison and synthesis difficult. McKibbon et al. (2010) found a hundred terms used only in the healthcare literature describing implementing research findings into practice. In literature, the terms knowledge translation, KT (e.g. McKibbon et al., 2010) and knowledge exchange, KE (e.g. Cvitanovic, McDonald, & Hobday, 2016) are often used besides knowledge brokering. Different definitions highlight different dimensions of the same, complicated phenomena, and one, overarching definition or term could hardly be established (Fazey et al., 2013).

Fazey et al. (2013) have conducted a summary of the different terms and meanings, and they emphasize that the terms highlight specific attributes of one phenomenon. According to them, knowledge translation highlights the role of mediating language and the needs of the recipient, while knowledge exchange emphasizes the learning process and mutual benefits. Other terms discussed, which somehow refer to the same process of making research impactful, are for example knowledge generation, coproduction of knowledge, knowledge transfer, storage of knowledge, knowledge sharing, transformation of knowledge and knowledge mobilization (ibid.)

In this study, the focus is on the role of the intermediator at the interface between the two domains of science and society. Also, I wish to emphasize the multidimensionality and complexity of the process. For these reasons, the term knowledge brokering, or knowledge brokerage was chosen for this study. According to Fazey et al. (2013), the term highlights deliberation between different parties, and mediation by a third party to resolve difficulties in the communication between two cultures. The term will be further examined in the following section.

2.2.1. Knowledge brokering

In this section, knowledge brokering is first elaborated with a focus on the knowledge broker. The definition of knowledge brokering is approached via the functions within the knowledge brokering framework, following definitions based on the different goals and intentions of knowledge brokering. Finally, different frameworks for analyses of knowledge brokering are presented.

Knowledge brokering can be done by the knowledge producer, the knowledge user or a third outside party, a designated knowledge broker (Bielak et al., 2008; Meyer, 2010), who holds a responsibility to both the science community and the policy (Van Kammen et al., 2006). Yet, it is important to note that even if in the scope of this research knowledge brokering occurs between science and policy, also other societal actors can take part in knowledge brokering, as more widely discussed below.

The versatility of the term ‘knowledge brokering' is both a blessing and a curse. Knowledge brokering is hard, if not impossible, to define unambiguously (e.g. Fazey et al., 2013; Oldham & McLean, 1997), but for this thesis, the versatility allows for analysis and comparison of a large set of functions within the same framework. As Oldham and McLean suggest (1997), a good starting point in exploring the knowledge brokering concept is to look at the specific words. In the Oxford English Dictionary ‘brokerage' is defined: ‘One employed as a middleman to transact business or negotiate bargains --.' A knowledge broker is a middleman between the two domains of science and policy; operating somehow outside, yet taking part in both of these both domains (Turnhout et al., 2013).

To put simply, in knowledge brokering knowledge is moved, and connections are created between researches and their stakeholders (Meyer, 2010). Knowledge brokering can enhance and alter different dimensions of the knowledge-system: the creation of substantive knowledge, the creation of knowledge-based networks to ‘multiply, disseminate and expand knowledge' and also to enhance the abilities to adapt and build knowledge (Oldham & McLean, 1997). It can constitute of multiple actions: identification and localization of knowledge, redistribution,

dissemination, rescaling and also transformation of knowledge (Meyer, 2010). In addition to this, it can also include ‘involving relevant experts also from outside science', ‘integrating and transforming existing knowledge into usable knowledge', ‘management and facilitation of processes' and ‘articulation of knowledge demand of non-scientific actors and translation into scientific questions' (Meyer, 2010).

As the concrete work around and within knowledge brokering is both diverse and constantly changing and developing, defining the specific set of functions that ‘counts' as knowledge brokering is not relevant. I find it most useful to define knowledge brokering mostly in the light of its intention and aims rather than concrete forms of actions

As a rule of thumb, the characteristic that separates knowledge brokering from traditional science communication is its goal to promote a cultural shift (Bielak et al., 2008). Rather than simply ‘pushing science to undefined audiences', knowledge brokering also aims to enhance generation, dissemination and eventual use of knowledge (ibid.). Knowledge brokering enhances the production of information relevant to the decision-makers, the utilization of research by the policy domain (Van Kammen et al., 2006) and appreciation of new knowledge by the decision-makers (Michaels, 2009). Also, a knowledge broker enhances communication between these processes (Van Kammen et al., 2006). The cultural shift takes place in the science domain, science policy interface and policy domain, where traditional science communication mostly improves practices within the science-policy interface.

To clarify the field of knowledge brokering, Oldham and McLean (1997) have identified three different knowledge brokering frameworks which describe different dimensions of knowledge brokering. The knowledge system framework looks at the whole of knowledge system from creation to acquiring, assimilating, using and disseminating knowledge. As the writers note, the knowledge system framework is extremely generic and almost any sort of knowledge brokering actions can be analyzed through this framework. (Oldham & McLean 1997.) In

the scope of this thesis, the knowledge system framework mostly serves as a tool to emphasize how broad the field of knowledge brokering can be, and how diverse the actions undertaken in it are.

For the more specific investigation, Oldham & McLean (1997) suggest two frameworks highlighting two different dimensions of knowledge brokering: the transactional framework and the social change framework. In the social change framework, the ‘users' of the knowledge are generic population and the actions aim to enhance access to knowledge throughout the whole society. In the scope of this thesis, the transactional framework focusing on the interface between organizations that either create or use knowledge in decision-making is the most useful (ibid.).

2.3. Three perspectives on improving the impact of the Forum

In the following chapter, the three perspectives chosen to best improve the impact of the Forum (knowledge brokering actions, other factors than the action itself that should be considered in planning knowledge brokering, and how research will eventually be utilized in the policy) are further discussed and justified. In 2.3.1., the action repertoires of knowledge brokering are presented. The models of research utilization are discussed in 2.3.2. Different promoting and hindering factors and a framework for their elaboration are presented in 2.3.3. This is followed by a summary of the literature review in 2.4.

2.3.1. Action repertoires of knowledge brokering

To allow for further analyses of knowledge brokering, Turnhout et al. (2013) have divided the actions in knowledge brokering into three repertoires: supplying, bridging and facilitating (see Figure 1). The categorization is created based on interviews of researchers strongly motivated to enhance knowledge brokerage between the fields fo science and the policy. This way, the repertoires do not only serve as a valuable tool for analysis but also shed light to the state of knowledge brokering. How do knowledge brokers closer to the science domain perceive knowledge brokering? What can be studied through the framework? Since Turnhout et al. (2013) have selected their interviewees based on their specific

interest on knowledge brokering, it can be argued that their analysis portrays a sophisticated and versatile picture of possible actions within the knowledge brokering framework.

The division by Turnhout et al. (2013) is done based on the perspective of a relation between the science and policy domains. The sets of actions in different repertoires are based on empirical evidence of knowledge brokers highlighting a certain relationship between knowledge production and use. To summarize, knowledge brokers with a certain conception of the relationship between science and policy domains are most likely to engage in a certain set of activities. It is after all important to note that the framework is not a framework of knowledge brokers, rather a framework of different roles that knowledge brokers employ based on different structures in the process, such activities, and roles performed by other actors in the same process (Ward, House, & Hamer, 2009). A knowledge broker can employ one or more of these repertoires during the same process, switch between roles in different processes or strongly relate to only one repertoire.

In the supplying repertoire, the relationship between science and the rest of the society is seen mostly linear: knowledge production and utilization are considered as different domains and the actions undertaken in the repertoire do not aim to blur the borders separating the two domains, but pieces of information are moved from one domain to other. Actions are passive in nature; the knowledge broker can put the different actors together but does not aim to impact the process. (Turnhout et al., 2013). If combined with the definition and intentions of knowledge brokering overall, I should be noted that the actions in the supplying repertoire are quite close to the so-called traditional knowledge communication, for its impact on cultural change is questionable.

In the bridging repertoire, the broker has a more active role, and the interaction forming knowledge brokering is more intense. The border between science and policy is bridged by actions, but , the relationship is linear, and the science domain has a clear role of a knowledge producer, are policy domain clearly

provides questions, not answers. When compared to the supplying repertoire, there is a stronger emphasis put on the process in the bridging repertoire.

The most ‘intense' form of knowledge brokering takes place within the facilitating repertoire, where the knowledge production and utilization are integrated. Designing a good process of knowledge creation to find solutions for a problem is given a more substantial role in the facilitating repertoire than in the other two. Building an atmosphere of trust and building motivation is an essential part of knowledge brokering in the facilitating repertoire. The non-scientific partners are also seen as a source of knowledge, not merely as setting the problem. Borders between science and policy domains are not highlighted, as in the supplying repertoire, or bridged, as in the bridging repertoire, but blurred. (Turnhout et al., 2013.)

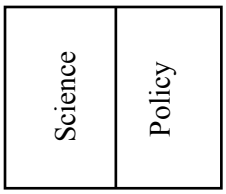
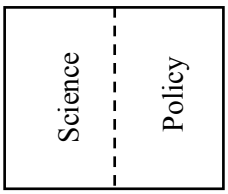
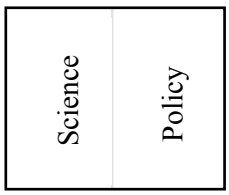
	Supplying	Bridging	Facilitating
Science-policy relation	*Clear border and a linear relationship*	*A border is bridged but visible, the relationship is linear*	*The border is blurred*
Visualization of the relation			
Actions	Providing knowledge users with appropriate experts Interacting with knowledge users to know what questions need to be answered Providing knowledge users with relevant knowledge in its original form.	Mediating and translating answers and solutions Broker persuades knowledge producers to interact with knowledge users Summarizing and synthesizing research and policy Persuading knowledge users to articulate their questions 'Stepping over' uncertainties involved in scientific knowledge	Designing a good process of interaction Including or accepting other forms of knowledge which are found to be important in order to find the solution. Integration of knowledge production and use in order to create solutions for the problem at hand Motivating participants

Figure 1: Knowledge brokering repertoires (Turnhout et al., 2013)

2.3.2. Research utilization

As discussed, knowledge brokering can have multiple goals. Among other things, it enhances the utilization of research in policymaking. Yet, the utilization of research is often more complex than suggested in the literature on knowledge brokering, evidence-based, and evidence-informed policy (Bowen & Zwi, 2005;

Elliott & Popay, 2014). As suggested by e.g. Bowen and Zwi and Cairney et al. (2005; 2016), the social and political context in which evidence is utilized and adapted is often neglected by researchers. In the context of this study, occasions that decision-makers see as potential or beneficial occasions for research utilization are assessed, to enhance the impact of knowledge brokering.

In this research, the utilization of research is analyzed through the framework of research utilization models by Weiss (1979). In her transformative research, Weiss (1979, 1980) has discussed how the term ‘research utilization' has more multifaceted meanings than first meets the eye. The old idea of a knowledge user adopting a piece of knowledge, e.g. a set of recommendations, as such, and implementing it to their decisions, has been set aside out of the way of a much more diverse set of functions that scientific knowledge has in decision-making. For example, a piece of evidence can spark an interest in a whole new policy topic, reframe a discussion or affect who is included in the discussion (Cairney et al., 2016). In her paper Weiss (1980) highlights how the most proper description often is ‘knowledge creep'; knowledge creeps into policy deliberations in more subtle ways than ‘utilization' refers. Weiss (1979) describes the ‘many meanings' of research utilization, referred to as ‘thought models' by Sunesson and Nilsson (1988). The models are the knowledge-driven model, problem-solving model, interactive model, political model, tactical model, the enlightenment model, and research as part of the intellectual enterprise of the society (Weiss, 1979).

By the knowledge-driven model, Weiss (1979) refers to a classic, linear ‘basic research -> applied research -> development -> application' model. Since it is already noted in the Weiss' (1979) original article that the model is best suited for physical sciences, the first model has often been left out from the future applications of Weiss' model (e.g. Heiskanen, Mont, & Power, 2014; Sunesson & Nilsson, 1988).

The problem-solving model is close to what e.g. Heiskanen et al. (2014) refer to as instrumental utilization. In the model, the politicians recognize the ‘knowledge gap', which research fulfills, which clarifies the situation and reduces uncertainty.

Again, as in the knowledge-driven model, the model is linear, but the initiative is on the side of knowledge users. (Weiss, 1979.)

In the interactive model, scientific knowledge is seen as a part of a nonlinear, interactive process, in which scientific knowledge is ‘one set of participants among many'. Science does not necessarily provide decision-makers with explicit conclusions, but takes part in a process where administrators, practitioners, politicians, interest groups etc. make sense of the problem and move ‘closer to the potential policy responses’. (Weiss, 1979.)

The political and the tactical model both represent models of research utilization, in which science is employed as a weapon or tool to support one's own agendas. In the current discussion on evidence-informed policy and research utilization, this is often classified as a problem rather than a model among others (Hellström & Ikäheimo, 2017; Kemiläinen & Keinänen, 2016). In what Weiss (1979) and Sunesson & Nilsson (1988) refer to as a ‘political model', research findings are utilized to advocate one's own, pre-set position. According to Weiss (1979), this model of research utilization is most employed in situations where the political debate has continued for a long time, and opinions are set. Utilizers look for conclusions which support their stands, built on ‘interest, ideology or intellect' (Weiss, 1979). In the tactical model, the research itself, not its results, are harnessed as tools to strengthen the utilizer’s own agenda. Weiss' (1979) examples cover situations where conducting research is utilized to highlight that the utilizer is doing something and has responded to the situation at hand, and situations where ‘research' as an abstract notion is used to avoid responsibility for unpopular decisions.

As Sunesson & Nilsson (1988) note, the distinction between the instrumental and enlightenment model of knowledge utilization is theoretically the most important one and empirically easiest to detect. In the enlightenment model, no significant findings or conclusions are necessarily utilized, rather the theoretical perspectives and concepts originally stemming from research shape the way decision-makers perceive a certain problem or policy question; science diffuses through different,

even surprising, channels and provides ‘ways of making sense out of a complex world' (Weiss, 1979), even over long periods of time or subconsciously. Weiss (1979) notes that even if this model of meaning can be quite comforting because it suggests that research may have an impact even if it not measurable or easily visible, it does hold some questionable aspects as well. Uncoordinated and indirect channels can create invalid generalizations, which can be ‘partial, oversimplified, inadequate, or wrong' (Weiss, 1979). Also, often happen that as the body of literature on a certain theme or problem expands, the picture of the phenomena grows to be ‘more complex, varied and even contradictory' (ibid.) rather than clearer. So, the ‘enlightenment' idea of science naturally flowing into decision-making to ‘make sense' of the world can be quite naïve. (Weiss, 1979.)

Weiss' (1979) last model of research utilization, research as part of the intellectual enterprise of the society, has not gained such remarkable attention, possibly for its vagueness and multidimensionality, and applications such as Sunesson and Nilsson, Bowen and Zwi and Nutbeam (2005; 2003; 1988), have not included the model. The main idea in this model is that research does not operate independently from the rest of the society, but themes that rise from the rest of the society to science domain affect scientific research as well. When a certain theme or problem arises to the common discussion in the society, it is quite likely that both policy and science somehow are affected by it. Sometimes, through instruments such as funding, this link can be quite straight-forward. (Weiss, 1979.)

Weiss' (1979, 1980) ideas have been largely accepted and adapted. Many meanings of research utilization have been summarized and adapted differently by different writers. Heiskanen et al. (2014) summarize Weiss' idea to three main categories: instrumental, tactical and enlightenment.

Yet it is important to note, that the models of research utilization do not exclude each other from one process, or even from one knowledge user. An interactive model-type of research utilization can be used to solve a pre-set problem (the

problem-solving model) and it is easy to imagine a situation where political and tactical model utilization follows each other in the same process.

In this thesis, the models of research utilization form one dimension of a knowledge brokering processes. Naturally, the process is more effective, if it fits the existing model of knowledge utilization and answers to the knowledge needs of the decision-makers. Next, I will move on to the other dimension of knowledge brokering: promoting and hindering factors to the process.

2.3.3. Promoting and hindering factors in a knowledge brokering process

As knowledge brokering is highly context related, no best-practice recommendations for e.g. a certain action can be given to enhancing the impact of knowledge brokering. Rather, different factors which decision-makers perceive to bring about efficiency, or simply a better process, are assessed in this study.

This thesis contributes to the academic discussion (e.g. Cairney et al., 2016; Hukkinen, 2016; Michaels, 2009) which aims to widen the scope of knowledge brokering discussion away from a linear input-output model. The discussion around the issue has risen globally after the ‘rise of evidence-informed policy' and continues. It is highlighted, that policy and political decision-making are complex, nonlinear and operates in networks rather than hierarchies (Cairney, 2016). In the following, I will argue against instrumental measurements of knowledge systems. Then, I will move over to introducing the promoting and hindering factors.

As said in the previous chapters, knowledge brokering is better understood through its aims and goals than concrete actions, and the actions leading to the goals are not always clear. This brings additional own challenges to measuring the efficiency of knowledge brokering. For example, actions such as trust-building in personal relationships and networking are seen to be highly relevant in knowledge brokering processes (Dobbins, Robeson, et al., 2009; Michaels, 2009, Cairney et al. 2016), yet hardly measurable. The impacts of knowledge brokering are hard to detect, and consequently, even harder to measure (e.g. Fazey et al., 2013).

Firstly, knowledge brokering has many aims and goals (see section 2.1.1), and a focus on only one aspect of it does not paint a full picture. How can, for example, the creation of robust research questions be measured? In addition, whether research results have been considered in the formulation of a certain policy program or decision is rarely visible in the end result. As concluded in the previous chapter, research can be utilized in highly subtle and inconspicuous ways. Also, the temporal and spatial limits to an efficiency assessment are hard to set. The impacts, such as the continued development of relationships, can take place long after knowledge brokering efforts have ended (Phillipson, Lowe, Proctor, & Ruto, 2012).

For these reasons, I find it more fruitful to look at different factors which either promote or hinder a knowledge brokering process altogether, rather than to look for a best set of actions or functions in knowledge brokering. Many things have been found to affect the impact of knowledge brokering efforts. At least timing in policy cycle (Hukkinen, 2016; Michaels, 2009; Mitton et al., 2007), the nature of the problem at hand (Michaels, 2009), the organizational culture in the receiving organization (Dobbins et al., 2009; Willison & MacLeod, 1999), and personal perceptions of the nature of knowledge (Fazey et al., 2013) have been found to be significant.

In this study, I lean to a framework of promoting and hindering factors created by Mitton et al. (2007) in their review-study of the main barriers and facilitators found in the literature on knowledge transfer and exchange (KTE). The terminology in this research is altered from the original study from barriers to hindering factors and from facilitators to promoting factors (borrowing the terminology from e.g. Cameron and Lart (2003) and Schildkamp et al. (2017) in a knowledge brokering process. Term ‘facilitator' has later been established to refer to a person facilitating e.g. a workshop or a process (e.g. Lang et al., 2012), and the change of terminology was done to avoid confusion.

Mitton et al. (2007) divide the promoting and hindering factors into four categories: individual level, organizational level, related to communication, and

related to time or timing. On the individual level, they find ongoing collaboration, respect for research, networks, the building of trust and clear roles and responsibilities being the most important facilitators. Most important barriers were found to be lack of experience and capacity for assessing evidence, mutual mistrust, and negative attitude toward change. On an organizational level, most important barriers were unsupportive culture, competing interests, researcher incentive system and frequent staff turnover. Significant facilitators were the provision of support and training (capacity building), sufficient resources, authority to implement changes, and collaborative research partnerships. (Mitton et al., 2007.)

Important communication-related facilitators were face-to-face exchanges (a view challenged by Dobbins, 2009), the involvement of decision-makers in research planning and design, clear summaries with policy recommendations tailored to a specific audience, the relevance of research, knowledge brokers and inclusion of ‘opinion leaders' or decision-makers in the research design. Barriers related to communication were poor choices of a messenger, information overload, traditional, academic language and no actionable messages in the research. On timing, differences in timeframes between the researcher and the decision-maker and limited time to make decisions were found to be important barriers. The inclusion of short-term objectives to satisfy decision-makers was found to be an important facilitator. (Mitton et al., 2007).

In this study, the promoting and hindering factors are assessed both in categories by Mitton et al. (2007) and as single impacting factors. This is to show first, which bigger themes, such as communication or organizational factors, have an important impact on success of a knowledge brokering, and then look more closely to more detailed factors.

2.4. Summary of the literature review

To analyze the complex phenomena of knowledge brokering, three concepts are applied: models of research utilization, promoting and hindering factors, and repertoires of knowledge brokering actions. Together these form an analytical

framework which forms a basis for the development work of knowledge brokering in the science-policy interface in Finnish policy in general, but more concretely in the Forum for Environmental Information.

The premise of the research is that knowledge brokering is most efficient when the knowledge brokering action matches the research utilization model of the knowledge user. Furthermore, the promoting or hindering factors help to ensure that the process is as useful as possible and considering different actions and action repertoires can help the knowledge broker to select the most suitable one for the context.

3. Research setting and methodology

In this study knowledge brokering, is defined as a complex social phenomenon, which is best described using qualitative methods (Eskola & Suoranta, 1998). In the following section, the data collection and the data are first introduced. Second, the choice of the analysis method is motivated and the selected method, qualitative content analysis, is described on a general level. Thrid, the analysis process and the coding scheme for this study are described. At the end of this chapter, the validity, reliability, and credibility are discussed.

This study is done in cooperation with the Forum for Environmental Information. The Forum has been established in 2010 to promote the utilization of environmental knowledge in decision-making, and to increase interaction between the knowledge producers and knowledge users. To reach this goal, the Forum organizes events where producers and users of knowledge meet, and the current environmental information is discussed. The events promote dialogue between these knowledge producers and users about current environmental questions. (Ympäristötiedon foorumi, 2017.) In 2018, the Forum aims to further increase their impact based on a wider impact assessment of their actions. Two Master's theses, this being one of them, are produced as a part of the impact assessment.

3.1. Data collection

The data for this thesis was collected via interviews on January-April 2018 by me and experts from the Forum. Altogether eighteen interviews were conducted, of which one was a group interview with three interviewees (see Appendix 1 for a list of interviewees). Interviews were conducted as semi-structured key-informant interviews (Alastalo, Åkerman, & Vaittinen, 2017), and the interviewees were identified as significant decision-makers in the field of environmental policy at the national level in Finland by science-policy experts in the steering committee of the Forum. The interviewees represent different sectors of environmental governance in Finland: members of the government, members of the parliament,

and government officials occupied with the preparation of policies and research. All interviewees were engaged with environmental affairs in their day to day work, but to get a comprehensive picture of the utilization of environmental scientific information, the interviewees did not represent merely the environmental governance but also different sectors, such as foreign policy and Ministry of Economic Affairs and Employment (for the list of interviewees, see Appendix 1).

In qualitative research, the number of interviewees is always a demanding part of the research design. No exact estimation of a sufficient number of interviews can be given because it is always related to the research question. When determining the sufficient size, Hirsjärvi and Hurme (2001) discuss the compromise between the depth of the analysis and the sheer number of interviewees: a sample small enough to allow in-depth analysis, yet representative. Karisto and Seppälä (2004) discuss saturation alongside with sample coverage. If the material is large enough it saturates, i.e. no new concepts or meanings rise from new interviewees. After a certain point is reached, increasing the number of interviewees ceases to create extra value. However, Hirsjärvi and Hurme (2001) criticize the notion of a saturation point and point out that the new information gained from interviews is also a matter of the skills of the researcher. Saturation was not applied in this research, and the list of interviewees was finalized before the interviews began. Yet, I did not recognize saturation in my sample. Even if some components were repeated in most of the interviews and certain themes saturated, new dimensions of the phenomena were revealed in all interviews.

3.1.1. Semi-structured key-informant interview

A key-informant interview can be executed using different interview strategies, but it is defined by the status of the interviewee as someone who has special knowledge on the topic of the study, that no other, or very few, interviewees could provide (Alastalo et al., 2017). Definition of a key-informant is always related to

the research question and design. In the terminology of Bogner and Merz (2005)[1] the interviews for this thesis were theory-generating, for they did not only explore the ‘objective' knowledge experts had, but also aimed to draw implicit information on the ways experts function and interpret phenomena related to them.

Key-informant interviews are not a specific type of an interview comparable to walking interviews or group interviews but hold some special traits. First, experts and key-informants are often harder to contact than lay people. Also, during the interview, it is important for the interviewer to present herself or himself as an expert, to gain the respect of the interviewee. (Alastalo, Åkerman, & Vaittinen, 2017.). As the practicalities of the interviews were conducted by the Forum, which is a recognized intermediate organization, this was not an issue in this research design. As suggested by Alastalo et al. (2017), additional focus was paid to the preparation of the interviews, to gain the trust and respect of the interviewee. For these reasons, the interaction in the interview was characterized by an ‘expert to expert' setting, portrayed e.g. by the comfortable use of abbreviations and terminology typical to the policy domain by the interviewees.

Key-informant interview was chosen as the method because the information sought for was only available from key informants. Key-informant interviews provide information on the state of the art societal developments and dynamics of complex interactions (Alastalo, Åkerman & Vaittinen, 2017). For my research questions related to the perceptions of decision-makers, other types of interviews could not have provided the same information. For the list of interview questions, see Appendix 2.

The key-informant interviews were conducted as semi-structured interviews. The term has multiple definitions and some definitions overlap, but the main characteristics remain. A semi-structured interview aims at a balance between

[1]The original terminology is in German, first published in English in Littig (2009)

structure and space for new meanings from the interview; structure guarantees that some specific dimensions are addressed, while enough space allows the interviewee to offer unexpected insights (Galletta, 2013). Three of the recognized experts were interviewed together for practical reasons, which might have affected their answers, as people portray different sides of themselves among other people than in a personal interview (Gillham, 2005).

A semi-structured interview is best suited for ‘understanding complicated phenomena often accepted as unproblematic' (Galletta, 2013), which describes well knowledge brokering and research utilization. My research problem is more concerned with structures and shared constructions than personal viewpoints, but as Galletta (2013) mentions, the questions covering individual agency also reveal something about the structures in which the individuals are situated.

3.2. Content analysis

Content analysis is mostly used to locate ‘humane meanings' from data in the written form (Tuomi & Sarajärvi, 2003). The meanings are located from the text by classifying large amounts of text into categories which each represent different meanings associated with the research topic (Weber, 1990). By the systematic treatment of data, content analysis allows the researcher to inference formerly unseen meanings, while assuring an objective analysis of all the analysis units. The possibility of inference allows the researcher to ask questions from the data that are not clearly visible; ‘texts may become meaningful in ways that a culture may not be aware of'. (Krippendorff, 1989.)

The content analysis is the most suited method of analysis because my research question focus on perceptions. Underlying attitudes and perceptions are hard to track by simple interview questions that the interviewees would be comfortable to answer. With the interference allowed by content analysis, more underlying assumptions and perceptions can be traced from the data.

Content analysis can be divided into three different approaches according to the relation between the data and theory: deductive, inductive and abductive (Graneheim, Lindgren, & Lundman, 2017; Tuomi & Sarajärvi, 2003). Different approaches are most useful in answering different research questions (Graneheim et al., 2017). In this thesis RQ1 and RQ2 (see section 1.1.) were analyzed deductively, and RQ3 was analyzed using an abductive approach. In the next section, I elaborate on the deductive approach and give reasons why I decided to use it. Following this, I look into the abductive approach and why it suits the research question 3.

3.2.1. Deductive approach

RQ 1 and RQ 2 were analyzed deductively. The deductive approach is theory led, i.e. the goal is to test existing theories or explanatory models in the collected data. Deductive analysis moves ‘from theory to data' or ‘from general to specific'. The categories are selected from pre-existing explanatory framework or theory, and the analysis units from the data are arranged accordingly. (Graneheim et al., 2017.). The deductive analysis was a natural choice for the analysis for RQ1 and RQ2, for a comprehensive framework which fit the needs of the research questions was available by Turnhout et al. (2013) for RQ1 and Weiss (1979) for RQ2. Inductive approach is best suited when the existing theory of research literature on a phenomenon is limited (Hsieh & Shannon, 2005), which was not the case in these analyses.

3.2.2. Abductive approach

Abductive approach, also referred to as ‘combined approach' (Elo & Kyngäs, 2008) was used in analyzing the answer to RQ3 (see section 1.1.). It can be seen as a combination of deductive and inductive approach: it is led neither by the theory nor the data. The existing theories are not avoided, as in the inductive approach, even though the categories would be formed based on the data, not on the theory (Tuomi & Sarajärvi, 2003). For example, the sub-categories can be

derived from the text, but main categories in which the sub-categories are organized in are based on a pre-existing theory or explanatory model (Tuomi & Sarajärvi, 2003). This was the method used in this thesis. In RQ3, the analyses combined both inductive and deductive elements (Tuomi & Sarajärvi, 2003) and ‘moved' between inductive and deductive approach (Graneheim et al., 2017).

For RQ3, abductive approach was chosen, for the existing framework for promoting and hindering factors by Mitton et al. (2007) was not seen comprehensive enough. When using the deductive approach, there often is the problem of what to do with data that does not fit the pre-existing explanatory model (Graneheim et al., 2017). To counter this obstacle, the analysis was altered to be abductive, and new sub-categories under the main categories, presented by Mitton et at. (2007), were derived from the text. This solution is suggested by e.g. Tuomi and Sarajärvi (2003).

3.2.3. The analysis process

The analyses process for this thesis began with the operationalization of the theory to a coding scheme, which is one of the most important phases in assuring reliability, validity, and credibility of a qualitative content analysis (Poole & Folger, 1981). The operationalization of the theory was done on the basis of the literature review and different descriptions of knowledge brokerage: RQ1 was operationalized on the basis of Turnhout et al. (2013), RQ2 on the basis of Weiss (1979) and RQ3 on the basis on Mitton et al. (2007). The descriptions of utterance types coded, i.e. the operationalization, is an ‘empirical translation of the theoretically meaningful categories' (Poole & Folger, 1981). Operationalization guides the coding process throughout.

After this, coding was done by selecting expressions (sentences or paragraphs displaying a specific meaning) which withheld meanings interesting or relevant to the research questions, based on the operationalization. (e.g. Tuomi & Sarajärvi, 2003)

RQ1 was analyzed deductively by tracking meaning units describing knowledge brokering instances in the transactional framework by Oldham and McLean (1997, see section 2.2.1.). Meaning units were phrases no longer than one sentence, in which the decision-maker describes a knowledge brokering action. Because of the nature of the interview questions, most meaning units were positive in nature and described an instance the interviewee had somehow found useful for their work. Critical in the operationalization and, thus, also in coding, was that the knowledge broker had done something in order to deliver the information to the interviewee in the role of a decision-maker. In other words, knowledge brokering was analyzed through Oldham and McLean's (1997) transactional framework. This means that i.e. a description of the importance of university education for a decision-maker was not coded as a meaning unit, but a lecture series about law provided by a third party targeted to civil servants, i.e. decision makers, was. The expressions, or meaning units, of knowledge brokering methods, were classified according to a framework of knowledge brokering repertoires by Turnhout et al. (2013).

RQ2 was analyzed deductively, relying on the framework of research utilization by Weiss (1979), following the same steps as described above. The expressions searched for were expressions of research utilization and of its aim. The third question concerning promoting and hindering factors was analyzed abductively, as main categories were acquired from Mitton et al. (2007), but sub-categories i.e. codes rose from the data, a model quite typical to abductive analyzes (Tuomi & Sarajärvi, 2003). The coding scheme consisted of positive or negative remarks about knowledge brokerage and of a factor, hindering or promoting, leading to it. The definition of a ‘knowledge brokering action' is described above.

As e.g. Eskola (2010) points out, reporting of a qualitative content analysis often entails a moment of decision: Which results should I focus on? Which part of the analysis is it important to report? Eskola (2010) simply suggests focusing on the most interesting parts of the analysis, in accordance with the purpose of the study. In this study, the results are directly utilized in increasing the impact of the Forum. As the impact grows when more decision-makers find the knowledge

brokering efficient, the most important categories were chosen according to the number of mentions in the data per category. If the decision is reached this way this, qualitative content-analysis can be said to entail features of a quantitative content analysis, as also suggested by Eskola and Suoranta (1998).

To summarize, in this process the different expressions were marked using specific codes in relation to the categories (Tuomi & Sarajärvi, 2003.) This phase was done with help of a computer-assisted qualitative data analysis program (CAQDAS) Atlas.ti 8.0 (Scientific Software Development GmbH). The program saves time and adds to the validity and reliability of the study by reducing the possibility of human errors.

3.3. Validity, reliability, and credibility of the research

The quality of a qualitative content analysis is assessed through validity, reliability, and credibility of the study. Qualitative content analysis often raises questions of the scientific value of the study because its emphasis is on the personal inference of the content. Yet, a systematic content analysis can be valid, reliable and credible.

3.3.1. Validity

The validity of a qualitative content analysis is a two-step process and depends on the type of the content analyzed. First, the validity depends on the creation of a valid coding scheme. Second, the validity depends on some kind of a standard which is created, against which the coded units are tested. Both are elaborated on below.

The content in my study is latent pattern content, as the meaning units are not physically present in the material but sought after and interpreted. The meaning units are not intuitive, as for example ´furniture´ or ´plants´, that anyone with common knowledge could recognize from the data. The coding scheme is derived from theory and coding requires that the researcher has competence and understanding of the phenomena. The coding scheme is derived from the theory on definitions of knowledge brokerage and research utilization, which adds to the

importance of a transparent coding scheme. A good coding scheme is both logical in relation to the theory it aims to operationalize and meaningful in the social context of the interviewees. (Potter & Levine-Donnerstein, 1999.).

As Poole and Folger (1981) suggest, a valid coding scheme is ‘a translation device that allows investigators to place utterances into theoretical categories', and the significance of a good coding scheme is highly important for the whole process of coding. A good coding scheme deduces important characteristics from the theory and helps to answer the research question on the basis of the data. As is quite typical to latent pattern content, the coding scheme for this study was conducted on the basis of theory. (Potter & Levine-Donnerstein, 1999).

To assure validity, the coding scheme for this study was based on the most prominent theories of knowledge brokering literature. Since knowledge brokering is a complex and multifaceted phenomenon, different attributes do not have to co-exist to answer my research question. Yet, only units fitting into Oldham and McLean's (1997) transactional framework were coded.

Potter and Levine-Donnestein (1999) suggest that when considering latent pattern content, the standard against which the coded material is tested would be created by experts. Yet, no such existing standard was available for the resources of this study. To make up for this, the material was reread and coded many times, and the thesis supervisors were frequently consulted.

3.3.2. Reliability

Krippendorff (1980) assesses reliability by three dimensions: stability, reproducibility, and accuracy. To assure the stability of the analyses, Krippendorff (1980) suggests coding the same sections repeatedly and see if the later judgments match the earlier ones. This was done in this study, and a high percentage of the judgments were the same as in the previous rounds. This shows that stability was high, i.e. the process did not change over time. To assure reproducibility, Krippendorff (1980) suggests that the same content should be coded by many

different coders over time. The resources of this study did not allow this, but the reproducibility was pursued by a detailed description of the coding process and of the operationalization. Both Krippendorff (1980) and Potter & Levine-Donnerstein (1999) agree that accuracy test, in which the code is tested against a standard set by an expert, is the strongest reliability test available. Via accuracy test an expert assesses if the coding scheme, and through it the results of the study, really measure what they are meant to measure. Yet, standards set by experts were not available for this study, but an agreement was sought from supervisors and experts, as suggested by i.e. Graneheim and Lundman (2004).

3.3.3. Credibility

Tuomi and Sarajärvi (2003) present the third concept to assess qualitative research: credibility. As factors, such as data collection and processing, affect credibility, it is not only an attribute of the analyses but of the whole study.

It is possible, as always when studying people, that the interviewees described their own and their colleagues' behavior in a falsely positive light and highlighted the utilization and access to knowledge, to please interviewers who represented an intermediate organization. Yet, the interviewees did not have such an incitement to lie or bend the truth, for the Forum and the interviewers are somewhat outside their working environment; the interviewers were not representatives of an authority. Also, as the research question concerns perceptions rather than naturalistic truths, the possible bending of the truth does not affect the credibility of the study as dramatically.

The transcription of the data was ordered from an outside party specialized in transcription, which adds to the credibility. Also, I compared the transcriptions to the interview tapes in all instances where the transcription did not seem completely clear. For the credibility of the coding, utterances coded were kept quite short, to assure that they do not contain various meanings. When reporting the findings, representative quotations from the transcribed text were added, to

show how the categories and themes cover the data (Graneheim & Lundman, 2004).

To summarize, the validity of this study was assured by following the coding scheme in a careful and transparent manner and discussion with the instructors. The reliability was affected by the lack of resources, which led to the absence of reproducibility and accuracy testing. Yet, this was compensated by a strong focus on the stability of the coding. The credibility of interview data is always an open question, but a research question focusing on perceptions rather than ‘facts' gives more room for credibility.

4. Results

In this chapter, the results of the three research questions are presented separately. First, at 4.1. I look at what decision-makers perceive as efficient knowledge brokering. Next, in 4.2, I present how according to my analyses decision-makers perceive research utilization in policy. Finally, in 4.3. I present which factors, from decision-makers point of view, either hinder or promote the success of knowledge brokering. This chapter is followed by discussion, after which I present the conclusions.

4.1. Perceptions of knowledge brokering actions

In the interviews, decision-makers discussed widely which kind of knowledge brokering actions they have taken part in, how beneficial they see these actions and what they wish to engage in more. The answers do not only reveal their perceptions of the types of the brokering actions, but also what they actually perceived as knowledge brokering. It is important to notice, that the repertoires by Turnhout et al. (2013) were created based on empirical findings of scientists highly interested in knowledge brokering and enhancing evidence-informed policy. This way, this analysis also serves as a comparison between the viewpoints of knowledge brokers within the science domain and decision-makers. Also, different repertoires reflect different perceptions of the science-policy interface: whether they are seen as clearly separated, bridged or separated by a blurred line.

According to the analysis, the decision-makers mostly see knowledge brokering under the bridging repertoire (see Table 2). The most common actions of the broker mentioned fell in the category ‘mediating and translating answers and solutions' (see Citation 1) and in the category ‘persuade interactions', both in the bridging repertoire. In the supplying repertoire, the category ‘providing experts' was brought up multiple times.

> "Professional lobbyists use so much time to formulate sentences that would fit into a politician's mouth in a debate – if a researcher can formulate their message as a simple slogan, that's most efficient." – Politician (Citation 1: Mediating and translating answers and solutions). [2].

Also, some actions in the supplying repertoire, such as 'providing knowledge users with appropriate experts' were often brought up in the interviews. The actions of the broker in the facilitating repertoire were altogether discussed far less than actions in the supplying and bridging repertoires. Of these, the category 'designing a good process of interaction' was most widely discussed.

According to the analysis, the decision-makers mostly saw knowledge brokering actions as the responsibility of the knowledge producers and the broker, not as the responsibility of the knowledge user, i.e. the decision-makers. Actions such as 'broker persuades knowledge users to articulate their questions' or 'interacting with knowledge users to know what questions need to be answered' gained far fewer mentions than the actions highlighting the role of the broker or the knowledge producer, such as the 'broker mediating answers and solutions' or 'broker persuades knowledge producers to interact with knowledge users'. This raises questions of the division of responsibility in evidence-informed policy in general. To what extent is the perceived lack of utilization of scientific environmental information in policy, found in a report from the same process as

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[2] In Finnish, from the transcription: "Ammattilobbarithan käyttää hirveesti aikaa muotoillakseen sellasia lauseita, mitkä sopii poliitikon suuhun väittelyssä – jos tutkijat pystyy sitä omaa sanomaansa pystyis yksinkertaiseksi slogan tasoiseksi muotoilemaan, niin se on tehokkainta."

this study[3] blamed on the research community? It seems that decision-makers do not have a clear view on their own role in the science-policy interface and in the successful knowledge brokering process.

At least three reasons can be found for the importance of the bridging repertoire. First, the actions falling under the 'facilitate' repertoire (see Table 1), are somewhat vaguer and harder to grasp than the rather concrete actions in the supplying and bridging categories. It is possible that even though the decision-makers are, on some level, aware of the importance of these actions in a knowledge brokering process, they just fail to mention them. Second, many of the actions in the facilitation category highlight the importance of a solution. Even if e.g. inclusion of different types of knowledge and the integration of different actors was frequently brought up in the interviews, the interviewees rarely saw the knowledge brokering process as leading to any specific solution.

Third, it is possible that the value of these actions is simply not recognized. The results of the actions in this category can be viewed as obvious, or as personal or context related factors that simply lack from the process or not (motivation, functioning interaction process) and not as results of the brokers concrete actions.

The repertoires are not only descriptions of different knowledge brokering actions, but also describe the different positions towards the relationship between science and policy domains. As more broadly discussed in the section 2.2.1, supplying and bridging repertoires reflect a linear relationship between science and policy, where information created in the science domain alone is utilized in the policy domain. In the bridging repertoire, the border is bridged with active interaction crossing it, but the border is clearly visible, and actors operate merely in their own domains. Only in the facilitating repertoire, the border is blurred and

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[3] Silfverberg, O., Huotari, E., Kolehmainen, L. (2019) *Ympärisötutkimuksen ja päätöksenteon saumakohdassa – Miten parantaa tieteellisen ympäristötiedon vaikuttavuutta?* Unpublished report [Will be published spring 2019].

both science and policy domain take part in knowledge production. According to my analysis, decision-makers do not see their role in knowledge production and see science and policy domains as clearly separated. Even if instruments such as VNTEAS[4] were brought forward in the interviews, the decision-makers described their role exclusively as knowledge users and in charge of monitoring that the researchers produce the knowledge the users need.

[4]Research and study funding instrument coordinated by the Prime Ministers Office, which aims to produce knowledge 'to support decision-making, business intelligence and practices'. Interaction between the producers and users of knowledge is highlighted in the instrument. https://vnk.fi/valtioneuvoston-selvitys-ja-tutkimustoiminta

Table 1: Knowledge brokering repertoires from Turnhout et al. (2013) and number of mentions per a repertoire in the data

What do decision-makers perceive as efficient knowledge brokering? (Framework derived from Turnhout et al. 2013)		
Repertoires (Number of mentions per a repertoire)	**Actions of the broker**	**Number of mentions per a repertoire** (the densest is marked with (1.) in the brackets, second (2.) etc.)
Supplying (194)	Providing knowledge users with appropriate experts	110 (3.)
	Interacting with knowledge users to know what questions need to be answered	47 (6.)
	Providing knowledge users with relevant knowledge in its' original form.	37 (7.)
Bridging (416)	Mediating and translating answers and solutions	170 (1.)
	Broker persuades knowledge producers to interact with knowledge users	120 (2.)
	Summarizing and synthesizing research and policy	107 (4.)
	Broker persuades knowledge users to articulate their questions	18 (10.)
	'Stepping over' of uncertainties involved in scientific knowledge	1 (12.)
Facilitating (150)	Designing a good process of interaction	83 (5.)
	Includes or accepts other forms of knowledge which are found to be important in order to find the solution.	36 (8.)
	Integration of knowledge production and use in order to create solutions for the problem at hand	24 (9.)
	Motivating participant	7 (11.)

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4.2. Perceptions of research utilization

The second research question of this study concerns analyzing how the decision-makers perceive models of research utilization in policy. The quotations were derived from different parts of the interview, where the interviewees reviewed their knowledge utilization, efficient knowledge brokerage, and evidence-informed policies.

According to the analysis, the interviewees mostly see research utilization as described by the problem-solving model by Weiss (1979) (see Table 2, see Citation 2). The interviewees described how existing knowledge should be adapted in new ways to answer the problem at hand, how efficiently different funding instruments answer to specific problems arising from the policy domain, and how politicians sometimes become frustrated if their specific questions are not answered in a knowledge brokering process.

In the context of the first research question, the strong dominance of the problem-solving model of research utilization can be in relation with, or a root-cause for, the small role of facilitating repertoire discussed in 4.1 The value of facilitating actions focusing on motivation, trust, and change of attitudes can portray themselves as irrelevant, if knowledge brokering is seen only within the problem-driven model, mainly as a tool to solve a specific problem.

> ” It doesn’t matter how interesting or easy to grasp something that you deliver is – if it has nothing to do with a decision-making process where you have to take a stand, it is skipped easily. If it comes right at that time when you’re dealing with those things, then it goes to that section that you look more closely at.” – Politician (Citation 2: Problem-solving model) [5]

[5] In Finnish, from transcription: ”-vaikka kuinka mielenkiintoisesti ja helppotajuisesti saa tarjoiltua tietoa asiasta joka ei liity mihinkään päätöksentekoprosessiin, missä joutuu

Also, the interactive model is often recognizable from the decision-makers way of discussing research utilization (see Citation 3). ‘After all it's a political process’ was a phrase often used to describe how even if the scientific input is available and utilized, the decision reached sometimes lack a scientific base. Also, different drivers behind the decision reached, such as economic viewpoints, values, parties' preferences, and tacit knowledge were often brought up.

> “The scientific knowledge was used and utilized, but what actually ends up there (*the official document)* is, in the end, up to political steering”. – Civil servant[6] (Citation 3: Interactive model)

These two, the problem solving and the interactive model, are by far most relevant in the interview material. It is important to note that even in the interactive model, research utilization can be problem driven, i.e. there is no reason why these two could not coexist in the same case. An illustrative example from the interview material is a knowledge brokering process, where government officials gathered a group of scientists and other experts from different fields to discuss a certain policy proposal that was on the agenda. The research utilization was both problem-solving, i.e. aimed to solve a specific policy problem, but also interactive, i.e. different branches of science and non-academical actors were gathered to form a common understanding.

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ottaan kantaa, niin se menee helpommin sivuun. Jos se tulee sellasella hetkellä, kun just niitä asioita käsittelee – niin silloin se helpommin tulee siihen, osastoon, jota katsotaan tarkemmin.”

[6] In Finnish, from the transcription: ”Et kyllä tutkimusta käytettiin ja hyödynnettiin, mutta mitä sinne sitten tulee, menee vähän poliittiseen ohjauksen tietenkin loppumetreillä.”

The knowledge-driven model, in which a new matter is placed on the agenda by the academic community, raised only a few mentions, even if it is evident that policy problems such as climate change, biodiversity loss and plastic in the oceans have first been recognized in the scientific community before they were raised to the agenda in politics. One important role of science in society is to bring forward new openings to the agenda and shift focus to previously unknown issues, concepts, and policy themes. How can this be achieved, if decision-makers mostly operate in the problem-driven model and find timeliness of the research to be an important promoting factor (see 4.3.2.1.)? This brings attention to other findings within the same project[7] where media was found to be an important arena for knowledge brokering. A possible explanation could be that agenda building and new openings mostly happen through mainstream media but deepening of that information happens through other means of knowledge brokering. This ought to be researched in the future.

Even if not discussed so frequently, the political model offered some interesting viewpoints to the results of the study. Even if it was frequently brought up in the interviews that research is utilized in order to further one's own political endeavor, none of the interviewees saw that neither themselves nor members of their party or colleagues (among the public servants) utilized research in this political way. Still, it was highlighted that some, even many, others do so. This was even though the aim was to cover the vast political field and different ministries by the selection of the interviewees (see Appendix 1). Political utilization of research is hardly ever praised, and it is no surprise that policymakers do not admit to utilizing research politically. Yet, this demonstrates the position in which the interviewees saw themselves in the interview. It can be argued that this brings forward how they were determined to show their "best" side in the interview. This

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[7] Silfverberg, O., Huotari, E., Kolehmainen, L. (2019) *Ympärisötutkimuksen ja päätöksenteon saumakohdassa – Miten parantaa tieteellisen ympäristötiedon vaikuttavuutta?* Unpublished report [Will be published spring 2019].

shows the results in a new light: it is possible that the results do not describe the actual state of the research utilization, but what the decision-makers believe to be the desirable state of research utilization in policy.

Table 2: Models of research utilization and the number of mentions per a model in the data

	Models of research utilization (Weiss, 1979)	**Number of mentions in the data**
How do decision-makers perceive research utilization in policy?	Problem-solving model	63
	Interactive model	57
	Political model	27
	Enlightenment model	14
	The knowledge-driven model	4
	Tactical model	2
	Research as Part of the Intellectual Enterprise of the society	0

4.3. Promoting and hindering factors

Promoting and hindering factors were analyzed both as individual factors (see section 4.3.2.) and, as presented in the following chapter, as categories of factors mainly based on Mitton et al. (2007).

4.3.1. Categories of promoting and hindering factors

Promoting and hindering factors are categorized to factors related to individual or organizational level, or related to communication, organization, time or timing or process according to Mitton et al. (2007). One category, factors related to knowledge, rose from the data. In this category, the decisionmakers described factors influencing knowledge brokering that were mostly related to the actual knowledge brokered. For the full list of categories and mentions of each factor see Appendix 3.

4.3.1.1. Categories of promoting factors

Of the promoting factors, the most relevant factors were related to communication, such as a journalistic style and the suitable formulation of the message (see Citation 4), more specifically compact formulation. Genuine interaction and face to face communication were also called for. Decision-makers highlighted the importance of presence in daily media as a promoting factor for knowledge brokering.

> ‘The compactness and plainness of the expressions. I’m telling you, two pages is almost already too long. And preferably two pages as the main message bolded from each section. So that with one glimpse you can get six points about the matter and if you have time

you read the whole two pages, but no longer' – Civil servant (Citation 4: Formulation)[8]

Also, an important result was the importance of factors relating to the process (see Table 3). These were e.g. the diversity of different kinds of knowledge types and the diversity of branches of science and experts, customization of the information to the needs of the specific knowledge user, solution-focused process and involvement of all taking part in the process to take part in the planning.

Almost as relevant were the factors on the individual level, such as networks, capabilities of the knowledge broker, knowledge user, and the knowledge producer, and the attitudes of the participants.

4.3.1.2. Categories of hindering factors

The relevance of the different categories altered when they were discussed from the point of view of hindering, not promoting.

Many relevant hindering factors were identified at the individual level (see Table 3). Specific factors at the individual level were for example capabilities and attitudes (see Citation 10 in 4.3.2.2) of the participants. Also, lack of experts rose as an issue: the interviewees were not able to find specific experts that would fit their needs. Too strong specialization of the experts was seen as a hindering factor: the experts were irrelevant from the point of view of the decision-makers since they could only speak from one, quite limited viewpoint (see Citation 5)

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[8] In Finnish from the transcription: "Se esitystavan tiiviys ja selkokielisyys. Et mä sanon et kaks liuskaa rupee olee jo siinä rajalla. Ja mieluummin se kaks liuskaakin niin että sieltä ois helppo boldattuna niinku joka kappaleessa se pääviesti et sä pystyt niinkun yhellä silmäyksellä saamaan 6 pointti asiasta tai jos sul on aikaa niin sä luet sen kaks sivuu , mutta niinkun sen pidempää ei"

> ‘You can see clearly that you should have more of that crossdisciplinarity. Probably there (*the academia)* it is highlighted that you have to specialize in something and then you go so deep into your own field that you don’t remember other dimensions anymore’ – Civil servant (5: Fixed on one viewpoint) [9]

Also, factors at an organizational level, such as too strong political steering and biased boundary organizations were discussed widely as hindering factors. Also, the difficulty of knowledge brokerage as " no-ones and everyone's responsibility" was brought forward as a hindering factor for the efficiency of a knowledge brokering process (see Citation 6).

> “To a certain degree it is the role of the researchers and research institutes, but I understand that they can’t, like, fulltime be in that broker-role. And among civil-servants and in decision-making there just is not time to look for (*information)*”[10]. – Civil servant (Citation 6: No-one’s responsibility)

Many perceived hindering factors concerned the knowledge brokered, such as the unrobustness or oversimplification of the information provided. Many mentioned hindering factors concerned the depth of knowledge: how deep into a specific theme is it wise to dig into in a knowledge brokering process. The analysis shows

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[9] In Finnish from the transcription: ”Sen selkeesti näkee että sitä pitäisi olla enemmin tätä poikkitieteellisyyttä. Varmaan sielläkin sitä korostetaan että täytyy erikoistua johonkin niin sit mennään niin syvälle sinne omaan alaan et ei paljon muita ulottuvuuksia sitten muisteta enää.”

[10] In Finnish, from the transcription: “Et jos se on niinkun tiettyyn rajaan asti niinkun tutkimuslaitosten ja tutkijoiden roolia mut mä ymmärrän sen myös et ei he voi niinkun täyspäiväsesti niinkun tehdä sitä välittäjärooliakaan. Ja sitten virkamieskunnassakaan tai päätöksenteossa niin ei vaan oo sitä aikaa et haettais (*tietoa).”*

that it is highly context related: some decision-makers complained of too shallow information, where others saw that the information from researchers was too theoretical and detailed to be relevant for the time being.

Table 3: Four most common promoting and hindering factors per a category, and the total amount of mentions per a category.

Hindering factors		**Promoting factors**	
Individual level	**124**	**Communication**	**174**
Attitudes and trust	50	Formulation	48
Lack of capacities	32	Compact communication	29
A missing expert	26	Genuine interaction	27
Fixed on one viewpoint	16	Presence in daily media	26
Organizational	**85**	**Process related**	**147**
Resources	49	Diversity	82
Strong political steering	13	Direct contact to the relevant decision-maker	21
Partiality	13	Solution-focused	17
No-one's responsibility	10	Involvement of all participants to the process	14
Knowledge product	**65**	**Individual**	**123**
Unrobustnes	28	Networks	34
Depth of the knowledge	9	Capacities	31
Complexity	8	Attitudes	24
Lack of synthesis	7	Close contact to policy domain	15
Communication	**64**	**Knowledge product**	**47**
Formulation	36	Synthesis	18
Quantity	16	Depth of knowledge	8
Monolog	7	Research setting is visible	7
Length	5	Quality of the research	5
Timing	**38**	**Organizational**	**69**
Wrong timing	38	Impartial organization	23
		Institutionalized knowledge brokerage	21
		Trust	14
		Reputation	7
Process	**8**	**Timing**	**68**
Delay between the demand and the supply	7	Current questions	39
Physical space	1	Right timing	19
		The matter is making its way to the agenda	10

4.3.2. Single promoting and hindering factors

In addition to analyzing the different categories of promoting and hindering factors, the relevance of the factors was also analyzed according to single factors.

4.3.2.1. Single promoting factors

For the promoting factors, diversity of branches of science, types of knowledge and of experts is seen as the most relevant promoting factor (see Table 4 and Citation 7).

> "It could be quite good to make sure there is a little bit discussion there. If there are too many like-minded people there, from the same point of view, they don't - they only strengthen that. And for the whole – it might not be just the right (way)." – Civil servant (Citation 7: Diversity)[11]

Following is the factor 'formulation' of the message: a structure that summarizes the most relevant findings and their interlinkages to the policy questions, compactness and journalistic style were seen important (see Citation 4 in 4.3.1.1. and Citation 8).

> "One thing that researchers ought to forget is the idea that you would somehow look down at the recipient if you'd try to crystallize a few main points, as it would be polite to offer a

[11] In Finnish from the transcription: "Se vois olla ihan hyvä että tulee aina sitä keskustelua sitten, vähän laajempia ja vähän eri näkökulmia. Et jos on liikaa samanhenkisiä ihmisiä, samasta näkökulmista niin ei ne kun vaan vahvistaa niitä. Ja se voi olla kuitenkin kokonaisuuden kannalta ei välttämättä oo ihan se oikee."

> goddamn bundle of abracadabra" – Politician (Citation 8: Formulation) [12]

Also, right timing is seen as a relevant promoting factor (see Citation 9). Examples of timeliness included i.e. knowledge brokering where questions elaborated are relevant and acute to the decision-makers and pursuing knowledge brokering when the policy questions such as laws or strategies are still open for impact.

> "– from the impact point of view, it is necessary to be on the move very early on. Probably you should take the information to the government to some circles early on, so that the government's proposal has not been written but it's in their heads. In the parliament the matters are often kind of locked, that they are not changed anymore." – Civil servant (Citation 9: Right timing) [13]

4.3.2.2. Single hindering factors

Of the hindering factors, most relevant according to the analysis are attitudes and trust, resources, timing and formulation (for more, see Table 4 and Appendix 4). For the trust and attitudes, the decision-makers mentioned overall negative attitude towards science as an institution (see Citation 10), arrogant attitude of

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[12]In Finnish, from transcription: "Yks mikä tutkijoiden kannattaa unohtaa se ajatus että se on jotenkin tiedon vastaanottajan halveksimista koettaa kiteyttää muutama pääasia, ikään kuin se ois kohteliasta tarjota sellanen helvetin moinen nivaska abrakadabraa."

[13] In Finnish from the transcription: " -vaikuttavuuden kannalta on tarpeellista olla hyvin varhain liikkeellä. Varmaan tarvitsisi viedä se tieto valtioneuvostolle johonkin piiriin varhain niin, että siellä ei vielä ole hallituksen esitystä kirjoitettuna vaan se on vasta ajatuksissa. Eduskunnan päässä asiat on usein sillain lukittu, että niitä ei enää muuteta."

both the decision-makers and scientists and lack of mutual trust between the decision-makers and the scientists.

> ” And also, there has been trust in research and, overall, that trust in research, that legitimacy has gotten weaker in this society and that is also a fact.” – Civil servant (Citation 10: Attitudes) [14]

Of the resources, time, money and access were mentioned repeatedly. In the context of timing, like in the promoting factors, the currency of the matter to the decision-makers was highlighted. Also, the same matters as in the promoting factors section were brought up when discussing the formulation of the knowledge brokering message.

[14] In Finnish, from the transcription: “Ja myöskin tieteeseen uskottu ja kyllähän se on yleisesti niinku se tieteen usko, se legitimiteetti on heikentynyt tässä yhteiskunnassa ja se on myöskin fakta.”

Table 4: Ten most relevant promoting and hindering factors to a knowledge brokering process. For the full list, see Appendix 4.

Hindering factors		**Promoting factors**	
Attitudes and trust (individual)	50	Diversity (process)	82
Resources (organizational)	49	Formulation (communication)	48
Wrong timing (timing)	38	Current questions (timing)	39
Formulation (communication)	36	Networks (individual)	34
Lack of capacities (individual level)	32	Capacities (individual)	31
Un-robustness (knowledge product)	28	Compact (communication)	29
A missing expert (individual)	26	Genuine interaction (communication)	27
Fixed on one viewpoint (individual level)	16	Presence in daily media (communication)	26
Quantity (communication)	16	Face to face communication (communication)	24
Strong political steering (organizational)	13	Attitudes (individual)	24

4.4. A summary of the promoting and hindering factors

The analysis of the three research questions revealed many findings, which are elaborated in this section.

First, even if the quantitative analysis does not explicitly highlight it, the utter importance of personal contact between the knowledge user and producer should not be neglected, as it contributes to networks, timing, and capacities, all found important in this analysis. Networks are an important promoting factor, but also, according to the analysis, personal contacts promote another main finding of the analysis: the importance of correct timing (see Citation 11). Personal contacts can be long-lasting and generate more contacts in the future: a great number of decision-makers highlighted how the easiest way to information is through friends and former colleagues. In networks, knowledge producers gain information on

relevant questions, and maybe even more importantly on questions which are rising to the agenda in the near future. This gives the scientific community time to gather evidence, form synthesis and summaries and create arenas for discussion.

> ” – stay in our rhythm and try to get to as close as possible and breathe the same air, in that sense that they know and try to grasp what do we have in mind, so that they can push the right information from their brains just at the right time”. – Civil servant (Citation 11: Personal contact and timing)[15]

Second, it seems intuitive that there is also a relation between the two findings of the importance of personal contact and of attitudes and trust. The results highlight the significance of personal attitudes, trust, and understanding of the other parties' domain. Would more frequent and better-quality interaction between researchers and politicians hinder the apparent mistrust and lack of understanding? Could the promoting factor (personal contact) actually be the solution to the hindering factor (mistrust)? Could this, apparently personal hindering factor -mistrust- actually be countered with changes in the governance system, by altering the format of e.g. committee hearings?

Third, like in the context of categories, my analyses showed that most relevant hindering factors were related to individuals, organizational factors or to the knowledge product. Most relevant promoting factors were related to communication, process, and individuals. Even though this result raises some interesting questions, it is noteworthy that the analysis was not aimed to compare the differences in categories of promoting and hindering factors, but to see the

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[15] In Finnish from the transcription: “Pysymään meidän rytmissä ja koettaa päästä mahdollisimman lähelle ja hengittää samaa ilmaa, siinä mielessä että ne tiettä ja yrittää hahmottaa mikä meillä on mielessä, jotta he pystyy työntämään sen relevantin tiedon omasta mielestään just oikeassa hetkessä.”

relevant factors in both categories.[16] So, I suggest future research on the difference between perceived promoting and hindering factors, in which this thesis and its somewhat uncertain results can serve as a reference.

Given these limitations, the finding raises interesting questions. According to the analysis, hindering and promoting factors are assessed differently, as the most important hindering factors were found on the individual or organizational level, and the promoting factors related to communication and process. Is a failure of a knowledge brokering process often seen as a result of a failing individual, rather than as something that could be improved through facilitation and effort to improve the process? Is bad communication easier to pinpoint than successful, and is poor communication a consequence of the lack of capabilities of an individual?

Fourth, the findings of the knowledge brokering actions and repertoires are more highlighted when combined with the results on promoting and hindering factors. As described, trust and understanding between the domains, timeliness of the information provided, and personal contact between the researcher and the decision-maker are important factors that affect the success of knowledge brokering actions. Yet, concrete actions in the facilitating repertoire[17], which counter just these problems, were raised by the decision-makers in the interviews less than actions belonging to other repertoires. The decision-makers are clearly aware of the problems, but possibly not aware of the solutions that a well-

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[16] The difference was at times hard to track from the data, in situations as ‘There’s no use in information that only concerns the environment, other branches should be included as well.’. Is diversity a promoting factor, or lack of diversity a hindering factor?

[17] Designing a good process of interaction, integration of knowledge production and use in order to create solutions for the problem at hand, motivating participants.

facilitated process and blurring the lines between decision-making and science could provide.

Fifth, the findings on models of research utilization can be elaborated together with other research questions. The results from RQ2 and the models of research utilization imply that the decision-makers are mostly not interested in gaining information merely for common knowledge or sophistication but operate in the problem-solving model. As one interviewee pointed out, it must be a question that ‘is already on my desk’. The analysis on promoting and hindering factors highly support this finding, since the timeliness of the information brokered is among the most relevant promoting and hindering factors. As, according to my analysis, research utilization takes place first and foremost in the problem-solving model, i.e. research is utilized to solve an already existing problem, it is logical that mainly well-timed openings that fit the political sphere gain interest. It is easiest to grast this via an opposite example: if politicians saw research utilization mostly as a way to open new discussions and bring new openings to the agenda, best-suited knowledge would be novel and differ from day-to-day politics.

Also, lack of resources as a hindering factor might be related to the problem-driven model of research utilization. As the interviewees described a constant lack of time and other resources, the little time must be put to things where the benefits are immediate for the work at hand. Some interviewees, mostly civil servants, pointed out work ethics: they saw that collecting scientific information ‘just for the sake of information' is not a justified way to spend working hours. The findings on the interaction model of research utilization were also highlighted by the analyses on promoting and hindering factors since diversity was found to be the most important promoting factor for an effective knowledge brokering process. The interaction model of research utilization highlights the nature of decision-making as a ‘hot pot', where information, values, beliefs, and knowledge from different disciplines are brought forward. The decision-makers want the "full picture": leading a process focused merely on environmental information might not be enough.

5. Discussion

In this study, knowledge brokering process was elaborated from three perspectives: the actions of the knowledge broker, the models of research utilization of the decision-makers to which the knowledge brokering process should fit and different promoting and hindering factors which affect the efficiency of the knowledge brokering process. As a novel theoretical opening, the discussion on types of research utilization and knowledge brokering were combined to paint a more holistic picture of the knowledge brokering system. This is typical to transdisciplinary research, which does not rise for a single discipline but rather a single real-life problem: the need for further enhance impact of the Forum and other boundary organizations. (Lang et al., 2012).

Even if the aim of the research was to move the discussion to a more holistic direction, it should be noted that interviewing only official decisionmakers does not paint a whole picture of the role of scientific information in decision-making. In a multilevel policy process, both power and scientific research are utilized by many official and unofficial actors in different stages of the process, and more process-tracking is needed to grasp a more realistic understanding of the knowledge-system. (Cairney et al., 2016.)

The main results of this thesis showed that the decision-makers' understanding of both research utilization and of knowledge brokerage actions are quite limited when compared to scientific literature. Decision-makers mostly see knowledge brokering as actions in the bridging repertoire by Turnhout et al. (2013), which bridge the border between science and policy, but allows the actors to stay merely in their own domains. The framework offered a useful tool for analyzing and recognizing knowledge brokering actions which often can be vague and hard to grasp. The strength of the framework is in its adaptivity: the repertoires are not limited to practical actions, but also include aims. Yet, the adaptivity poses a special challenge to the analysis, as the data from the interviews can be hard to set to ambiguous repertoires. This sets demands on the analysis and of the researcher's understanding of the phenomenon.

Also, the framework allows studying perceptions of the science-policy interface through the repertoires of actions. The perceptions of science-policy interface could be hard to grasp in interview questions since the mere concept can be difficult to understand for people not specialized in the field. The framework by Turnhout et al. (2013) allows elaborating on this conceptual phenomenon on a practical level. This study showed, as also stated by Cornell et al. (2013), that decision-makers do not see themselves as active members of knowledge production and that they see a clear and strong border between science and policy domains. This raises concerns, because at least Nowotny et al. (2001) highlight that closer contact with the knowledge users in the rest of the society increases the possibility of the research to be believable and useful for the knowledge users.

The models of research utilization by Weiss (1979) have served as a framework for analyzing research utilization in decision-making. The utilization of research in policy is mostly limited to problem-driven and interactive models of research utilization, and e.g. the new policy issues arising from the science domain to the policy domain are not widely recognized. This leaves science and scientific environmental information quite a limited scope for action within the policy domain. No new models rose from the data, and framework filled its purpose to allow for closer examination of the ways in which knowledge brokered is utilized in the decision-making. The findings in this study are supported by Nutbeam (2003) and Short (2002, according to Nutbeam 2003) as they highlighted the dominance of problem-solving and interactive models of research utilization. Lomas and Brown (2009) also found the problem-solving model to be relevant in their study of civil servants.

The promoting and hindering factors were examined according to a framework by Mitton et al. (2007). One category, factors related to knowledge brokered, rose from the data, but finally, according to the analysis, it was not as relevant as other factors. The findings of this study were mostly supported by existing literature.

According to this analysis, attitudes and trust, resources, timing (in accordance with a systematic review by Oliver et al. 2014) and formulation (supported by

Stringer & Dougill, 2013) are perceived to influence the success of a knowledge brokering process. For the promoting factors, diversity, formulation, and timing are seen as important. Many relevant hindering factors are found at the individual or organizational level, whereas most promoting factors are found to be related to communication, process or individuals. Other relevant factors, according to this analysis, were networks (as also highlighted by Lomas and Brown, 2009) and capacities of all participants, both highlighted also by Oliver et al., (2014).

The results of this study are somewhat in accordance with the review study of health policy-makers' perceptions of their utilization of evidence by Innvær et al. (2002) which concluded that the most relevant promoting factors were personal contact between researchers and policy-makers, timeliness and relevance of the research, research that included a summary with clear recommendations, good quality research, and attitudes and trust (also found relevant by Choi et al. 2005). It should be noted that since the framework of this study was knowledge brokering and therefore the work of boundary organizations, actual research papers were quite seldom mentioned in the interviews. Instead, seminars, policy briefs, meetings, and other secondary products were more often discussed. This might explain the difference in results to Innvær et al. (2002), as factors including the actual research papers were not frequently mentioned in this study.

Diversity was found to be the most important promoting factor for an efficient knowledge brokering process in my analysis, but not mentioned by similar studies such as Oliver et al. (2014), Mitton et al. (2007),Innvær et al. (2002) or Choi et al. (2005) and deserves a closer look. First, it should be noted that the setting of this study was environmental policy, unlike in the other studies. Is it possible that environmental questions are seen as such a cross-cutting theme that other disciplines should always be included as well? On the other hand, are environmental questions seen as an inferior political question, always subsidiary to other interests?

There are also connections between the impacting factors, e.g. personal contacts promote another main finding of the analysis, the importance of correct timing.

This finding is also supported by Innværs (2002) and Cairney et al. (2016), who point out that personal contact and networks between the decision-makers and knowledge producers create and enhance the timeliness of processes.

The analysis and results of this study raise the question of whether it is useful to discuss promoting and hindering factors as separate issues, as in the framework of Mitton et al. (2007). As said, it is mostly a question of interpretation whether a factor promotes a good process, or lack of it hinders the process, and vice-versa. A framework simply assessing influencing factors could have been more useful, but dividing the factors to promoting and hindering seems to be an established practice in research on knowledge brokering (e.g. Brown et al., 2017; Innvær et al., 2002; Oliver et al., 2014).

As a new opening, this study explored how models of research utilization could contribute to the discussion on knowledge brokering. The results of the three research questions complemented and strengthened each other, and it is noticeable that underlying models of research utilization often served as an explanatory model for perceptions on knowledge brokering and perceived promoting and hindering factors. I suggest that exploring how other models of research utilization can contribute to the discussion offers boundary organizations new information useful in achieving stronger impact.

6. Conclusions

This study was most strongly motivated by the urgent need to mitigate or adapt to the major sustainability crisis and wicked problems facing societies globally. As scientific knowledge brings forward the most accurate and objective description of the human societies and the rest of the nature affected by the crisis, stronger link between decision-making and scientific knowledge is needed to find the right policies for the sustainability transformation. As typical to transdisciplinary research, the overall goal of the study is not limited to knowledge creation, but this study aims to create robust knowledge which can serve in sustainability transformation (Kates et al., 2001), by further improving the impact of the Forum in Finnish environmental policy.

In this study, I aimed to create a more comprehensive understanding of the decision-makers' perceptions about knowledge brokering and of the utilization of research in their decision-making process, and through this create a clearer understanding of the science-policy system in environmental policy. This is done to help increasing the impact of boundary organizations and the Forum for Environmental Information. As a theoretical background for this study, the knowledge brokering-framework was chosen because of its flexibility as a framework – it does not frame the observations too tightly to single actions or interactions between actors but rather assesses functions through goals and aims. This left enough room for new, even surprising, factors to rise as the analysis proceeded.

The main findings suggest that the research utilization of decision-makers is mostly problem-solving, i.e. the knowledge should solve a certain policy problem on the decision-makers agenda. Almost as relevant is the interactive model of research utilization, where scientific information is seen as a factor amongst many that operate on the background of a decision reached in a decision-making process. Of the knowledge brokering actions, most important are in the bridging repertoire, which consists of different actions that aim to cross the border between the science and policy domains, but do not blur the border altogether, and allow

actors to stay within their own domains. Most relevant single actions are from the bridging repertoire are e.g. 'the broker mediating and translating answers and solutions', 'persuading knowledge producers to interact with the knowledge users' and 'summarizing and synthesizing', and from the supplying repertoire, such as 'providing knowledge users with appropriate experts'. The facilitating repertoire is not seen as an important part of efficient knowledge brokering, which raises many questions.

Of the many impacting factors, the most important promoting and hindering factors affecting the process (not in order) are 'formulation of the message', 'attitudes and trust', 'resources (such as time and money)', 'timing' and 'currency' of the phenomena discussed, 'networks', 'the capacities of the participants', and 'the diversity of types of knowledge, branches of science and experts'. Most common hindering factors were found at the individual or organizational level, whereas most important promoting factors were found to be related to communication or process.

6.1. Future research

Knowledge brokering, or similar functions described with different terms, is currently, and most likely in the future as well, actively studied and conceptualized. Yet, there is a lack of empirical evidence, as also stressed by e.g. Oliver et al. (2014) and Bornbaum et al. (2015). This being easy to understand since complex phenomena with no measurable aims or goals are hard to study empirically, I hope to see more evidence and concrete suggestions of action in the future.

As one of my main findings was the importance of trust and attitudes, a fruitful field of study could be interventions to enhance trust between decisionmakers' and the academia. Where interesting experiments have been executed, scaling up and further research should be carried out.

Also, the differences in knowledge brokering between the branches of science should be researched extensively, since most of the knowledge brokering

literature currently is produced within the health-science sphere. Which are the differences and similarities of an effective knowledge brokering procedure consisting of environmental science or economics? How could my hypothesis that the call for diversity is a specific trait of environmental knowledge brokering be tested?

6.2 Recommendations for boundary organisations

As this thesis is anchored in a real-life problem of further improving the impact of boundary organizations such as the Forum for Environmental Information, the main findings are translated to action suggestions in the following paragraphs.

1. Special attention should be paid to timeliness, formulation, and diversity when planning knowledge brokering actions for environmental policy.

   If the knowledge created or provided is not clearly linked to on-going policy-processes, special attention must be paid to motivate the participants from the policy-domain. Also, comprehensive processes through which decision-makers gain knowledge from more than one perspective should be favored.

2. New ways to highlight the shared responsibility of both the decision-makers and the researchers in an efficient and adequate knowledge brokering process should be created and tested.

   This research has shown that policy-makers perceive science and policy as two, strongly separated domains and do not recognize or see value in bringing them closer together through their own actions. I, as other researchers, see that closer contact between the two domains, in i.e. framing research problems and questions together, should be encouraged to help solve the sustainability crisis. Boundary organizations are a promising actor in achieving this.

3. Boundary organizations should find ways to create long-lasting networks to the interface between science and policy to build capacities and alter attitudes on both sides of the interface.

    Networks can enhance face to face communications and real dialogue, alter attitudes, create trust, and through providing knowledge brokers and producers insights on political processes, enhance the timeliness of knowledge brokering actions. The many roles science can play during the decision-making process ought to be elaborated to expand from solely the problem-driven model of research utilization. This has the potential to enhance efficient and successful knowledge brokering and through that also evidence-informed policy.

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[18] Global warming of 1.5 °C – an IPCC special report- Summary for Policymakers. 2018 IPCC Intergovernmental panel on climate change. IPCC SR1.5. 33p.

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Appendix 1: List of interviewees

Time	Name	Organization	Length
8.1.	Laura Höijer	Ministry of the Environment	61min
12.1.	Mika Honkanen	Ministry of Economic Affairs and employment	66min
17.1.	Sari Löytökorpi	Prime Minister's Office	85min
1.2.	Tuomas Rautanen	Ministry for Foreign Affairs of Finland	58min
19.2.	Maria Ekroos	Environment committee	58min
20.2.	Riitta Rönn	Ministry of the Environment	64min
27.2.	Kimmo Tiilikainen	Minister of the Environment, Energy and Housing	54min
27.2.	Tuula Varis	Ministry of the Environment	69min
28.2.	Satu Hassi	Member of the national parliament	54min
15.2.	Hannele Pokka	Ministry of the Environment	45min
12.3.	Maria Höyssä	Parliament of Finland	72min
20.3.	Merja Mäkisalo-Ropponen	Committee for the Future	53min
3.4.	Group interview: Riitta Rahkonen	Ministry of agriculture and forestry	62min
3.4.	Group interview: Katja Matveinen	Ministry of agriculture and forestry	62min

3.4.	Group interview: Eero Pehkonen	Ministry of agriculture and forestry	62min
3.4.	Harri Jaskari	Member of the national parliament	65min
6.4.	Tarja Haaranen	Ministry of the Environment	65min
9.4.	Ville Niinistö	Member of the national parliament	59min

Appendix 2: Interview questions

Answers will be used anonymously, and the interviewees cannot be recognized. The data will be used in two pro gradu-thesis in the University of Helsinki and in the impact assessment and development of The Forum for Environmental Information. If the interviewees are cited, only information on the group that the interviewee represents (knowledge producer or broker, politician, civil servant) will be attached. In Pro gradu-studies, an appendix with a list of interviewees will be attached. If the interviewee does not want their name to the appendix, only the organization the interviewee represents will be presented.

Theme 1: The activities of the Forum for Environmental Information

1. Are you familiar with the Forum for Environmental Information?
   1b. If yes: In which circumstances have you been in contact with the Forum?
   1c: If yes: Which topics/events/publications do you remember specifically well?
2. Have you familiarized yourself with Statements-series (Puheenvuoroja-sarja) by the Forum?

The Forum is described

The Forum promotes the use of scientific environmental information in societal decision-making and intermediates the newest environmental information in a clear way to answer the needs of decision-makers and administration. The most important target groups are decision-makers in the government, the parliament, the municipalities and civil servants in charge of the preparations of the decisions.

The most important functions are to organize high-level events, in which the producers and users of scientific information meet and are able to have

dialogues of current matters in the field of environmental information. The Forum also publishes a publication called" Statements from the events of Forum for environmental information", which is provided as electric publish.

In the Forum the producers and users of knowledge are represented, and the demand for knowledge from legislative and administrational perspective and the supply of knowledge from the research domain are balanced.
The Forum is founded in 2010, and its members are the University of Helsinki, the University of Turku, the Ministry for the Environment, Finnish Environment institute and the association of Finnish local and regional authorities. It is funded by Maj ja Tor Nesslingin säätiö and Kone foundation.

3. Are functions such as the Forum needed to support the dialogue between decision-making and research?
3b. The Forum operates as an intermediator in the border between the research and decision-making. Are other forms of action more needed to support the dialogue between the decision-making and research?

4. The main functions of the Forum are regular seminars and Statements-publications based on the seminars. Are these a good way to reach the target-groups of the Forum?
5. What could the Forum do differently to increase their impact?

<u>Theme 2: The relation between scientific information and political decision-making</u>

6. Is scientific environmental information sufficiently considered in decision-making? Both in the administration which prepares the decisions, and in the political decision-making?
7. Can you give an example of a situation where you've needed scientific information to prepare for or reach a decision?
7b. If not mentioned: Where have you searched for and gotten information from?
7c. Concretely: Where do you search information from?

8. Have there been situations where you have not found the scientific information you would have needed? Why do you think that has happened?
9. Is scientific environmental information available in a suitable form?
9b. What makes you look closer into information available?
10. What do you think are the biggest problems in the relationship of scientific environmental information and the societal decision-making?

10b. (after the answer) Problems previously observed are for example:

- *A flood of information; relevant and reliable information is hard to detect.*
- *Rush: The timeframes of decision-making and legislative work no don't allow on the familiarize their selves properly.*
- *High-quality synthesis and information in a suitable form is not available.*
- *Scientific information does not stand out from competing language (such as reports composed by interest groups).*
- *The utilization of information is tendentious; the pieces of information which support one's own stands are selected.*

10c. The contradiction between the in-built uncertainty of science and call for certainty in policy is commonly seen as a challenge in knowledge brokering. Science can seldomly offer univocal truths, which are applicable to decision-making as such. High-quality scientific knowledge is not always the most relevant information for utilization in policy. What are your stands on this?

11. How could one improve the dialogue between science and decision-making?

12. In which ways, in which channels and in which form should scientific environmental information be offered to the decision-makers to make it impactful?

13. *Knowledge brokering actions can be organized from lighter to more intense. In the lighter end actions include actions such as producing websites and policy-briefs. When answering questions already existing in policy, knowledge brokering can include match-making and organizing meetings. Examples of more intense cooperation can be longer commitments to e.g. panels to support decision-making in longer processes.*

13b. In the light of your own experience, which of these are currently in use?
13c. Which forms would you personally call for?

14. *It has been noted, that the impact of science increases when researches and users of knowledge (like politicians or civil servants) formulate in long processes the demand for information, how should it be produced, and how should it be used to solve a certain problem. This is called co-production of knowledge.*

14b. Have you taken part in this kind of processes? Are the resources you have invested in a suitable relation to the benefits you have gotten from the process?

14c. If not, would you possibly be interested in this? Do you believe that the resources demanded would correlate with the benefits you could gain?

15. Who, or which actors should be more active to make the relationship between science and decision-making more functional?

16. Who should fund these actions?

Appendix 3: Full list of promoting and hindering factors according to categories

Hindering		**Promoting**	
Individual level	**124**	**Communication**	**174**
Attitudes and trust	50	Formulation	48
Lack of capacities	32	Compact communication	29
A missing expert	26	Genuine interaction	27
Fixed on one viewpoint	16	Presence in daily media	26
		Face to face	24
		Multichannel	9
		Visual communication	6
		Use of social media	3
		Performing skills	2
Organizational	**85**	**Process related**	**147**
Resources	49	Diversity	82
Strong political steering	13	Direct contact to the relevant decision-maker	21
Partiality	13	Solution-focused	17
No-one's responsibility	10	Involvement of all participants to the process	14
		Long continuity of the	5
		Future orientation	4
		Phenomenon centered	2
		Physical space	2
Knowledge product	**65**	**Individual**	**123**
Unrobustnes	28	Networks	34
Depth of the knowledge	9	Capacities	31

Complexity	8	Attitudes	24
Lack of synthesis	7	Close contact to policy domain	15
Over-simplified knowledge	6	To have a wider view	14
Conflictions between the sources of information	4	Prestige	5
Research setting not presented	3		
Communication	**64**	**Knowledge product**	**47**
Formulation	36	Synthesis	18
Quantity	16	Depth of the knowledge	8
Monolog	7	Research setting is visible	7
Length	5	Quality of the research	5
		Robustness	5
		Trackability	4
Timing	**38**	**Organizational**	**69**
Wrong timing	38	Impartial organization	23
		Institutionalized knowledge brokerage	21
		Trust	14
		Reputation	7
		Agility	3
		Incentives	1
Process	**8**	**Timing**	**68**
Delay between the demand and the supply	**7**	Current questions	39
Physical space	**1**	Right timing	19
		The matter is making its way to the agenda	10

Appendix 4: Full list of promoting and hindering factors. The 10 most relevant highlighted

Hindering factors		**Promoting factors**	
Attitudes and trust	**50**	**Diversity**	**82**
Resources	**49**	**Formulation**	**48**
Wrong timing	**38**	**Current questions**	**39**
Formulation	**36**	**Networks**	**34**
Lack of capacities	**32**	**Capacities**	**31**
Unrobustnes	**28**	**Compact communication**	**29**
A missing expert	**26**	**Genuine interaction**	**27**
Fixed on one viewpoint	**16**	**Presence in daily media**	**26**
Quantity of information	**16**	**Face to face communication**	**24**
Strong political steering	**13**	**Attitudes**	**24**
Partial organization	13	Impartial organization	23
No-one's responsibility	10	Institutionalized knowledge brokering	21
Depth the of knowledge	9	Direct contact to the relevant decision-maker	21
Complexity	8	Right timing	19
Monolog	7	Synthesis	18
Lack of synthesis	7	Solution-focused	17
Delay between the demand and the supply	7	Close contact to policy domain	15
Over simplified knowledge	6	Trust	14
Length	5	To have a wider view (individual)	14
Conflictions between the sources of information	4	Involvement of all participants to the process	14
Research setting is not presented	3	The matter is making its' way to the agenda	10
Physical space	1	Multichannel communication	9
		Depth of the knowledge	8
		Research setting is visible	7

		Reputation (organizational)	7
		Visual communication	6
		Robustness	5
		Long continuity of the process	5
		Quality of the research	5
		Prestige (individual)	5
		Future orientation	4
		Trackability (knowledge product related)	4
		Agility (organizational)	3
		Use of social media	3
		Phenomenon centered (process related)	2
		Performing skills	2
		Physical space	2
		Incentives (organizational)	1