Creating Knowledge and Considering Power

– A Frame Analysis of Science-Policy Communication

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Abstract

The environmental science and policy literature understands science-policy communication mainly as the communication between scientists and political decision-makers. Most of the literature points out that decision-making is not science-based enough due to problems in the communication between scientists and politicians, such as scientific results not being understandable for policy-makers. The literature suggests that to solve these communication problems, scientists and political decision-makers should co-create knowledge, for example, through working together on reports.

Being part of the field of environmental communication, I take a constructivist approach to studying science-policy communication. A constructivist worldview implies that, depending on a person's background, experiences, and context, there can be different understandings of science-policy communication. Through my research, I aim to address the question: What can a constructivist approach contribute to the understanding of science-policy communication?

To do so, I use frame analysis to gain access to different understandings of science-policy communication. Frames highlight certain aspects of science-policy communication and downplay others. That means, depending on which aspects the frame emphasizes, science-policy communication is understood differently. The analysis focuses on a narrative of a science-policy communication practitioner and on scholarly literature that conceptualizes knowledge co-creation between science and policy-making and between science and society.

The results depict different science-policy communication frames and the discussion illustrates that these frames are based on different assumptions. Some frames include the assumption that knowledge creates change, whereas, another frame challenges the basic idea that knowledge alone leads to change by emphasizing that science-policy communication takes place in a power context. These differing assumptions are the basis for diverse understandings of science-policy communication.

Differing understandings have implications for when science-policy communication takes place. For example, depending on the understanding, actors will act in different ways in the science-policy communication process and they will consider differently who is a science-policy communication participant. Also, when actors draw on diverse understandings of science-policy communication, communicating about it will prove to be difficult.

In sum, this thesis shows that there are different science-policy communication frames and discusses the implications that different understandings have for when science-policy communication takes place. Thus, it contributes through a constructivist approach to a more comprehensive understanding of science-policy communication.

Keywords: science-policy communication, frame analysis, boundary organization, mode 2 knowledge production, practitioner profile

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Abbreviations

SEI	Stockholm Environment Institute
NGO	Non-Governmental Organization

Foreword

> "[A]lthough we begin the interview with certain presumptions about our interviewee's work […], we are not simply trying to get our interviewees to confirm beliefs or theories that we already hold. Rather, we are seeking to complicate our ideas, to make them more complex, to understand more deeply aspects of professional work that are often unstated" (Forester, Peters, & Hittleman, 2005d).

This quote nicely describes my interview experience regarding science-policy communication. My point of departure for this thesis was that I felt that scientific results regarding environmental sustainability are not taken into enough consideration in policy-making and implementation. I considered the cause for that to be insufficient science-policy communication. Therefore, I intended to study that communication to improve it, mostly focused on how science on environmental issues can be more considered in policy-making and implementation.

However, especially when interacting with the interviewee, my understanding of science-policy communication got challenged. I learned from him that science-policy communication is often, unspokenly, assumed to be science-to-public policy-communication. This assumption maintains that science should create knowledge that is then used to influence political decision-makers and public policies to create changes in the world. In contrast, for my interviewee science-policy communication can take a governance approach, meaning, researchers directly engage with society/societal actors to create change.

Becoming aware that I had the same unspoken assumption about what science-policy communication is and that there are other ways to understand it, I became interested in learning more about different understandings. Thus, during my research, I moved away from an initial realist intent to find a "fix", to a constructivist approach focused on understandings of science-policy communication.

1 Introduction

Scholars who write about connecting and integrating environmental science and policy-making have identified a problem regarding science-policy communication. These scholars understand science-policy communication mainly as the communication between science and politics. In later chapters, this thesis will illustrate that science-policy communication can also be understood/defined differently. The science-policy communication problem that the scholars have identified is often understood by using the metaphors of a 'gap' between science and policy-making (Hickey, Forest, Sandall, Lalor, & Keenan, 2013, p. 532; Holmes & Clark, 2008, p. 707; Weichselgartner & Kasperson, 2010, p. 267) and of 'barriers' hindering the communication process (Hauck et al., 2014; Hickey et al., 2013; Holmes & Clark, 2008; Quevauviller et al., 2005; Weichselgartner & Kasperson, 2010).

Both metaphors, the gap and the barriers, are used by environmental science and policy scholars, who express a realist worldview on science-policy. "Realism […] takes seriously the existence of the things, structures and mechanisms revealed by the sciences at different levels of reality" (House, 1991, p. 3, referring to Outhwaite, 1987, pp. 19, 21). This means that according to a realist perspective, there is one reality that exists even without being observed, which can be studied precisely as it is and everyone understands it in the exact same way (Campbell, 1998, paragraph 4). Also, "[r]eality is not altered by human perception, thought, or interaction" (Campbell, 1998, paragraph 5, referring to Osborne, 1996; Matthews, 1994; Klemke, et al., 1980).

Consequently, when analyzing reality, realists search for causalities between things as they are, investigating "structures and mechanisms" instead of "phenomena and events" (House, 1991, p. 3, referring to Outhwaite, 1987, pp. 19, 21). In short, realism assumes that there is one reality that is accessible and understandable by humans and that is not altered by a human's experience or through their interaction with that reality. Based on this worldview, a realist tries to understand reality by looking at cause-effect relationships.

This realist assumption can be found in the environmental science and policy literature. That is, the literature proposes one understanding/reality of what science-policy communication is and searches for and has identified specific causes for why this science-policy communication does not happen as expected (further outlined in Chapter 2). These causes are named and categorized using the metaphors of a "gap" and of "barriers". Behind identifying the causes lies the assumption that once the gap and barriers are addressed science-policy communication will happen as intended.

Hence, the environmental science and policy literature expresses a realist worldview by presenting one understanding of science-policy communication and identifying a 'gap' and several 'barriers' that cause the communication to not ensue as expected. However, the field of environmental communication has a constructivist view on the world and would argue that there are different understandings of science-policy communication.

'Constructivist', in the context of this thesis, refers to the development and existence of different understandings and meanings of an object (cf. Creswell, 2014, p. 46). The constructivist worldview of the environmental communication field is illustrated in Cox' (2010) definition of environmental communication as "*the pragmatic and constitutive vehicle for our understanding of the environment as well as our relationships to the natural world; it is the symbolic medium that we use in constructing environmental problems and negotiating society's different responses to them*" (p. 20, emphasis in original). Similarly, the constructivist worldview can be found in the works of other environmental communication scholars (Hallgren & Ljung, n.d.; Wibeck, 2014).

Especially frame theory emphasizes that there can be multiple understandings of the world. "[F]rames select and call attention to particular aspects of the reality described, which logically means that frames simultaneously direct attention away from other aspects", notably, "[m]ost frames are defined by what they omit as well as include" (Entman, 1993, p. 54). Thus, different frames highlight different aspects of reality and

depending on which frame an actor draws on, the actor employs a different understanding of the world or a situation such as science-policy communication.

Moreover, when people draw on different frames about an issue of conflict they try to communicate about, holding different frames can make the issue into an intractable conflict (Lewicki, Gray, & Elliott, 2003). Accordingly, when people engaging in science-policy communication employ different frames regarding what science-policy communication is about, then the communicative process could prove to be difficult. Therefore, there is value in detecting and describing frames about science-policy communication.

Consequently, situated in the field of environmental communication, the aim of this thesis is to contribute to a more comprehensive understanding of science-policy communication. I will reach the aim by identifying and discussing different understandings of science-policy communication, using frame theory.

To achieve this, I will reconstruct science-policy communication frames from scholarly literature as well as from a practitioner's narrative. Concretely, I will focus on literature on the concept of boundary organizations and the concept of Mode 2 knowledge production. For clarity, I will briefly define both concepts here and Chapter 4 will include are more detailed account of them. Boundary organizations are organizations that sit in between the realms of science and politics and should produce knowledge that is useful to both. Also, they make the flow of knowledge between science and politics easier.

Mode 2 knowledge production is a way of producing knowledge that refers to a research process based on the negotiation of different interests and knowledges of various societal actors, meaning that society actively participates in the research process. I chose to analyze the literature on these two concepts as the concepts have been influential in the discussion about science-policy communication and contain suggestions as to how to address science-policy communication challenges, which I will outline more in Chapter 2.

Additionally, I will reconstruct science-policy communication frames based on a practitioner's narrative. This choice was made since analyzing experiences from the practice of science-policy communication might reveal alternative frames to those identified through analysis of theory.

Based on the research aim, there is one overarching question guiding my research and two sub-questions to help to answer that overarching question:

What can a constructivist approach contribute to the understanding of science-policy communication?

1) Which science-policy communication frames can be reconstructed from the Mode 2 knowledge production and boundary organization literature and from a practitioner's narrative?

2) What assumptions do these frames include about how science-policy communication works?

2 What is the Problem with Science-Policy Communication?

The context of this study is science-policy communication in the field of environmental sustainability. Understanding science-policy communication in this context is important because "many environment related challenges […] involve highly complex, adaptive, multi-scalar and unpredictable interactions between economic, social and environmental factors, with uncertain relationships between policy interventions and desired outcomes that may take many years to realize" (Hickey et al., 2013, p. 540). Hence, "the characteristics of biodiversity and environmental issues may make them particularly problematic to understand, communicate and resolve" (Young et al., 2014, p. 390). Therefore, the context of this study is science-policy communication in the field of environmental sustainability because sustainability problems are challenging to address and communicate about.

The environmental science and policy literature understands science-policy communication to be primarily between researchers and political decision-makers and agrees that this communication should focus on getting more scientific knowledge into decision-making. To elaborate, the literature understands science-policy communication to be communication between researchers and political decision-makers about the research needed for decision-making (Hickey et al., 2013; Holmes & Clark, 2008; Quevauviller et al., 2005; Weichselgartner & Kasperson, 2010). In rare cases, there is an awareness that this communication "involves knowledge sharing and exchange among a wide range of disciplines and actors" (Quevauviller et al., 2005, p. 203).

Furthermore, the literature maintains that science-policy communication does not occur as anticipated because "[i]n many instances, knowledge is available but is either not widely known or is insufficiently transferred from the scientific community to the other relevant parties" (Quevauviller et al., 2005, p. 205), such as political or private decision-makers or the wider society. Environmental policy-making is no exception (Holmes & Clark, 2008, p. 702). There is increasing knowledge about environmental issues, yet, there seems to be missing action to do something about environmental risks (Weichselgartner & Kasperson, 2010, p. 266).

Thus, expressed in the literature, there is a specific expectation on how science-policy communication should take place: Research creates knowledge regarding environmental issues and this knowledge should then be transferred to and be used in, primarily political, decision-making. Yet, the literature points out that this communication often does not happen as expected.

This presentation of the science-policy communication problem, science is not used enough in decision-making, is part of a realist understanding of science-policy communication; metaphors such as 'gap' and 'barriers' in the communication process make that visible. The science-policy 'gap' (Hickey et al., 2013, p. 532) is varyingly described as a gap between researchers and policy-makers (Holmes & Clark, 2008, p. 707) or "between scientists (the knowledge users) and decision makers in policy and practice (the knowledge users)" (Weichselgartner & Kasperson, 2010, p. 267).

Also, the environmental science and policy community has identified several 'barriers' hindering the communication process. These barriers include missing incentives for scientists to produce policy relevant science (Holmes & Clark, 2008, p. 705; Quevauviller et al., 2005, p. 205; Weichselgartner & Kasperson, 2010, p. 273), mismatches in research and policy cycles (Hauck et al., 2014, p. 387; Hickey et al., 2013, p. 534; Weichselgartner & Kasperson, 2010, p. 273), which hampers scientific results to be ready when decision-makers need them, insufficient translation of scientific results into understandable language for policy-makers (Hickey et al., 2013, p. 535; Quevauviller et al., 2005, p. 204; Weichselgartner & Kasperson, 2010, p. 273), difficulties for policy-makers to assess the reliability and credibility of scientific results (Holmes & Clark, 2008, p. 706), and missing trust between scientists and policy-makers (Hickey et al., 2013, p. 535). This is not an

exhaustive list but presents some of the causes identified by the environmental science and policy literature for why science-policy communication does not lead to sufficient consideration of scientific knowledge in decision-making.

To tackle the science-policy communication problem, some scholars suggest that researchers and policy-makers should collaborate and co-create knowledge. To co-produce knowledge means, for example, "the joint production of assessment reports by experts and decision makers" (Weichselgartner & Kasperson, 2010, p. 267). The suggestion to co-create knowledge is made visible in the demand for transdisciplinary research. Transdisciplinary research is considered a framework in which "integrative collaborations between academics and non-academics, such as local communities and/or policy-makers, as a core part of the scientific work" can be realized (Young et al., 2014, p. 397; referring to Farrell et al. 2013, p. 36 originally in italics). Also, Hickey et al. (2013) emphasize "building collaborative relationships based on trust, opportunities to network, and participatory and multi-disciplinary knowledge production processes" (p. 539).

There is demand for collaboration because collaborative efforts should be able to produce useful knowledge: "the collaborative production of knowledge [has] […] the purpose of generating actionable scientific knowledge" (Weichselgartner & Kasperson, 2010, p. 267). In brief, a collaboration between scientists and decision-makers is suggested to address the science-policy communication gap because collaborative efforts will create knowledge capable of informing policy-making, for example, to address environmental problems.

Co-production of knowledge can also be named interactive knowledge production and "[r]ecent scholarly discussions have two different ways of conceptualizing the means through which interactive knowledge production takes place" (Pohl et al., 2010, pp. 267–268). According to this scholarly discussion, "a new kind of organization is seen as emerging: 'boundary organizations'" and "a new kind of research is said to evolve […] 'Mode 2 knowledge production'" (Pohl et al., 2010, pp. 268–269), which are considered ways to co-produce knowledge.

Hence, both concepts, boundary organizations and Mode 2 knowledge production, are suggestions for how to address the science-policy communication problem. Therefore, I think it is interesting to investigate how the literature on boundary organizations and the literature on Mode 2 knowledge production frame science-policy communication. Thus, I will analyze these two theoretical bodies of literature to reconstruct science-policy communication frames.

As mentioned, I will also reconstruct science-policy communication frames from a practitioner narrative. I decided to do that because practice based science-policy communication could help to gain insight into science-policy communication that is not possible through analyzing the theoretical literature. That is, the scholarly literature could be detached from what is happening in the field and the context of writing about science-policy communication differs from experiencing it.

Also, a practitioner might have a more critical stance toward science-policy communication than the theoretical literature. By 'critical' I mean being reflective regarding the practice of science-policy communication which potentially challenges assumptions about science-policy communication that the scholarly literature is based on. All this will influence the sense-making of science-policy communication and, hence, the frames that can be reconstructed from the practitioner narrative.

A practitioner narrative can be captured in a practitioner profile, which is based on a story-focused interview. Forester et al. (2005g) argue that "[practitioner] profiles provide phenomenologically rich qualitative data that […] can help us clarify theoretical problems in our fields", i.e. the field of science-policy communication. That is because profile interviews focusing on "'practice stories' offer intimate windows onto the richness, messiness, and complexity of work "in the field"" (Forester et al., 2005e). Additionally, as the quote in the Foreword illustrates, interviews with practitioners can help challenge views that one as interviewee has about the practice of interest (Forester et al., 2005d), here science-policy communication.

Furthermore, a practitioner profile's focus on stories fits well together with my theoretical approach, frame analysis. A profile interview is a story based interview style focused on "specific, memorable projects or cases" (Forester et al., 2005e). Notably, framing and storytelling share similarities in how they make sense of things, that is, how they weave "elements together into a text that makes sense as a whole" (van Hulst & Yanow, 2016, p. 101, referring to Stone, 1988/2002; van Hulst, 2012). Therefore, having an interview in story format will likely make the reconstruction of science-policy communication frames easier.

In sum, understanding science-policy communication around environmental sustainability is important. The environmental science and policy literature has identified a problem in this communication: policy-making is not sufficiently science-based, and has found a metaphorical 'gap' and 'barriers' to communication as causes for this problem. Thus, the literature expresses a realist view on science-policy communication.

To address the problem, science and political decision-making should collaborate and co-create knowledge through boundary organizations and Mode 2 knowledge production. Therefore, the literature on these two concepts will be analyzed to reconstruct science-policy communication frames.

Furthermore, I will analyze a practice informed understanding of science-policy communication as it can offer alternative frames of science-policy communication compared to the theoretical literature. Also, a practitioner narrative in form of a practitioner profile is suitable material to reconstruct these frames.

By reconstructing science-policy communication frames from the theoretical literature and from a practice embedded narrative, I can contribute through a constructivist analysis to the understanding of science-policy communication.

3 Research Design

3.1 The Iterative Process

During my research, I followed an iterative way of working. I conducted small steps, I tried out things, I concluded what I had learned, then I took the next steps, thus moving in cycles between data collection and theoretical interpretation (cf. Reason & Bradbury-Huang, 2000).

I started my research with reading about science-policy interactions and what role communication plays and I engaged with the boundary organization literature. To learn more about science-policy communication, I went to a practitioner and conducted an interview. After I had done a first frame analysis of the practitioner narrative, I realized that I was confronted with a different understanding of science-policy communication than the one I was presented with in the theoretical literature.

Based on this learning, I decided to investigate different understandings of science-policy communication and I engaged with the literature on Mode 2 knowledge production, still in the form of a literature overview, where I was confronted with yet another understanding of science-policy communication.

Then, I realized that to study the different understandings of science-policy communication that the theoretical literature and the practitioner profile draw on, I needed to reconstruct frames not only from the practitioner narrative, but also from the Mode 2 knowledge production and boundary organization literature.

Similarly, Entman (1991, p. 6) writes that frames become most salient when comparing different narratives. Accordingly, differences in the understanding of science-policy communication between frames should become most visible when the frames are discussed in relation to each other. Consequently, I used the literature review on the boundary organization and Mode 2 knowledge production concepts a basis for the frame analyses.

Conducting the frame analyses also followed iterative steps. When I conducted the first frame analysis, I needed a systematic approach to be able to reconstruct frames regarding science-policy communication from the practitioner narrative. Therefore, I followed a codebook focused on reconstructing science-policy communication process and identity frames (Appendix 1).

Based on what I had learned from the systematic frame analysis, I conducted the analyses of the theoretical literature more intuitively. I took into consideration my focus on process and identities while reconstructing the science-policy communication frames.

After writing down and discussing the results from the frame analyses, a deeper level of analysis could be reached and I engaged in more cycles of writing and discussing results. Through this iterative process, I arrived at one science-policy communication frame that I could reconstruct from the practitioner narrative and constantly refined my understanding of the theoretical frames.

Also, through this iterative process of relating the frames to each other and to theory, I gained an understanding of the different assumptions about science-policy communication that the theoretical and practice embedded frames include.

3.2 Case selection

In this section, I will present the reasons for choosing the theoretical literature on Mode 2 knowledge production and on boundary organizations and Rasmus Kløcker Larsen and his project as cases to reconstruct science-policy communication frames.

3.2.1 The Literature

I chose the theoretical literature on Mode 2 knowledge production and boundary organizations for two reasons. First, as outlined in Chapter 2, both the concept of boundary organizations and concept of Mode 2 knowledge production are discussed and suggested in the science-policy communication literature as potential ways to handle the insufficient uptake of science into political decision-making, making the literature relevant to study understandings of science-policy communication.

Second, the literature exemplifies understandings of science-policy communication resulting from theoretical reasoning about science-policy communication. Hence, the boundary organization and Mode 2 knowledge production literature can serve as example for how scholars understand science-policy communication. Thus, the literature "provide[s] a suitable context" (Bryman, 2012, p. 70) for reconstructing science-policy communication frames to address my research question about what a constructivist approach can contribute to the understanding of science-policy communication.

3.2.2 The Practitioner

Rasmus Kløcker Larsen as a science-policy communication practitioner and his project were chosen based on several considerations. One, to find a suitable practitioner to interview, I selected an easily accessible organization that could be considered a critical case for my study. "[A] *critical case* can be defined as having strategic importance in relation to the general problem" (Flyvbjerg, 2006, p. 229, emphasis in original). In the context of my study, a critical case was an organization working with science-policy communication, such as a boundary organization.

I identified the Stockholm Environment Institute (SEI) as a boundary organization (cf. Guston, 2001) because its objective is to bridge the gap between science and policy and it engages in boundary organization tasks (SEI, n.d.-a). In a boundary organization, I would be able to find a suitable practitioner because people working there are experienced in science-policy communication.

Furthermore, SEI in Stockholm was also chosen as research site based on its accessibility, and thus not many resources (time, money) needed to be spent on collecting data. Also, SEI in Stockholm is the headquarters of all other SEIs, thus, probably has the most experience with science-policy communication, which could be an advantage over a more recently established SEI. In brief, I chose SEI as a critical case for my study due to its experience with science-policy communication and as research site based on its accessibility.

Two, I decided to interview Rasmus Kløcker Larsen as exemplifying and critical case for my research, and due to method-based reasons. Firstly, I wanted to find an interviewee who can exemplify a practitioner working with science-policy communication. Exemplifying cases provide "a suitable context for certain *research* questions to be answered" (Bryman, 2012, p. 70, emphasis in original). A practitioner working with science-policy communication extensively will have gained knowledge from that experience. These gained knowledge structures will inform the frames the practitioner draws on regarding science-policy communication. Consequently, a practitioner working with science-policy communication will be a good context for my research question about which frames can be reconstructed from a practitioner's narrative.

Furthermore, the practitioner is also a critical case. Similarly to the previous argument regarding the organization, the practitioner as someone engaging in science-policy communication is of "strategic importance in relation to the general problem" (Flyvbjerg, 2006, p. 229), the general problem being the understanding of science-policy communication. Especially, if the practitioner has a more critical reading of science-policy communication than the theoretical literature expresses, then a frame analysis of the practitioner's narrative could help me access a different understanding of science-policy communication.

Secondly, Rasmus Kløcker Larsen was chosen due to method-based reasons. As mentioned, I intended to create a so-called practitioner profile to be able to reconstruct a science-policy communication frame from a practitioner narrative. To generate a practitioner profile, a profile interview needs to be conducted, and to conduct a useful profile interview, the interviewee should fulfill certain criteria (Forester et al., 2005a).

Rasmus Kløcker Larsen fits most of the criteria for a suitable interviewee, such as long engagement in the practice I am interested in, science-policy communication, and being reflective. I learned from scoping work that he is known to be a reflective practitioner and has long experience with science-policy communication. As a reflective practitioner, I considered that he could have a critical view on science-policy communication.

Lastly, to generate a helpful practitioner profile that contains the practitioner narrative, the profile interview needs to evolve around a specific case. Forester et al. (2005a) give advice on what constitutes a good case. Hence, in my email contact with the practitioner, I asked him to choose a case, i.e. a project, where he was actively engaged in, which he learned a lot from, that showed challenges of science-policy communication, which had taken place within the last three years (even though during the interview, it turned out to be older than that), and that had been finished. Based on these criteria, the practitioner and I decided to talk about a project regarding oil palms that took place in the Philippines.

In short, Rasmus Kløcker Larsen as a practitioner of science-policy communication was chosen as an exemplifying and critical case for answering my research question about different understandings of science-policy communication. Furthermore, I decided to interview him because he fulfilled most criteria for a good interviewee for a profile interview and might potentially have a critical stance to the practice of science-policy communication. The project we decided to talk about fulfilled the criteria for a good case.

3.3   Data Collection and Data Generation

One, I collected and generated data to be able to analyze a practitioner narrative. First, I collected data by conducting a profile interview. Part of the interview preparation was to choose a good case, i.e. project, to talk about during the interview. That is because practitioner profiles are "[c]rafted from edited transcripts of interviews with experienced practitioners speaking about how they handled specific, memorable projects or cases" (Forester et al., 2005f). As mentioned, I decided on a case with the interviewee through email contact.

Then, I prepared an interview guide (Appendix 2) "according to the three main sections of a profile interview (background first, then the practice story, then reflections)" (Forester et al., 2005c). To prepare questions, I went through the SEI website, the website about profile interviewing, and I read a working paper on the Philippine case that was suggested to me by the interviewee.

During the interview, it was important to stick to the mentioned three sections, however, within the sections I sometimes changed the order of the questions I had prepared because in a profile interview "questions should follow the flow of the conversation as naturally as possible" (Forester et al., 2005c).

I conducted the interview with Rasmus Kløcker Larsen, who has the position of a research fellow at SEI and specializes in natural resource management (SEI, n.d.-c). The interview took place at SEI in Stockholm, on the 22nd of February 2018 and was audio recorded. Recording increases the reliability of research results (Silverman, 2015, pp. 87–88). The interview was held in English, which both interviewee and interviewer speak fluently, but is neither's mother tongue.

Second, to generate the data for the frame analysis, I created the interview transcript and then the practitioner profile from the transcript. I made the transcript following the advice given by Forester et al. (2005e) about what to transcribe and where to insert paragraphs, and how I should mark inaudible parts. I transcribed the interview verbatim, leaving out

fillers like "um". I used VLC media player to play the recording. I listened to the recording three rounds to correct mistakes and trying to understand inaudible parts. I inserted pauses in his speech only in the third round of transcribing. While transcribing, I realized that I should have put the phone closer to him. It is easy to understand me, but what he says is sometimes hard to hear.

After creating the transcript, I generated the practitioner profile, following Forester et al.'s (2005b) guidelines. Essentially, the practitioner profile should only consist of the practitioner's words. The guidelines suggest to first work on formatting issues, moving on to basic editing and finish the profile with a bit more complex editing. In the complex editing phase, I moved a few text parts around to create a better flow of the story. During this stage, I had to listen again to the practitioner's speech patterns to represent correctly what he wanted to say.

The practitioner profile requires that the interviewee checks the profile, which was not possible due to the time constraints of the interviewee. Also, I tried to follow up with a question and asked for some clarifications, which could not be answered by the practitioner due to time constraints. Therefore, I had to make decisions about things I wanted to leave out and words that I put in to improve sentences and the story flow. Later, the practitioner confirmed that nothing is incorrect. The practitioner profile contained the practitioner narrative and was the material on which I applied the frame analysis.

Two, I collected and generated data to be able to analyze the boundary organization and Mode 2 knowledge production literature. I collected data by finding relevant articles to write a literature review on the concepts of boundary organization and Mode 2 knowledge production. Thus, I generated data by writing literature reviews on these two concepts (Appendix 3 contains a list of literature that was used in the literature reviews). These literature reviews served then as the material to reconstruct the theoretical science-policy communication frames.

3.4   Frame Theory

My research question focuses on how a constructivist perspective contributes to a more comprehensive understanding of science-policy communication. In this theory section, I will argue that frame theory is a suitable theoretical framework to investigate this question because its conceptual background falls within the constructivist tradition: both, the process of frame creation, framing, and what frames do express the constructivist worldview. Also, adapted from the work of van Hulst and Yanow (2016), frame theory can be used to analyze dynamic processes, such as science-policy communication.

3.4.1   Frame Theory's Constructivist Background

To begin, framing represents a constructivist worldview because it highlights that the background and experience of the actor who engages in framing influences the framing/understanding of the issue or situation. Framing happens in "highly situated interactional processes of communication" (van Hulst & Yanow, 2016, p. 95). Notably, "actors bring their own prior knowledge (from experiences, education, and other sources) to situational sense-making" (van Hulst & Yanow, 2016, p. 99), meaning, different actors can frame the same situation differently.

The origin of the frame/framing concept exemplifies how the same situation can be understood differently. Van Hulst and Yanow (2016, p. 94) trace it back to Bateson's (1955/1972a) work, who understands framing as a way to meta-communicate among monkeys whether or not a situation should be considered playing or fighting.

Furthermore, framing is the "interactive, intersubjective process through which frames are constructed" (van Hulst & Yanow, 2016, p. 93, referring to Weick, 1979). This means, because the framing process is influenced by different experiences, backgrounds,

educations, and other sources, the resulting frames will hold different understandings of a situation or an issue, such as science-policy communication.

In brief, the process of frame creation, framing, is influenced by an actor's experience, background, and other sources, meaning, each actor likely creates their own understanding of the issue or situation. Consequently, the frames coming out of the individual framing processes will employ different understandings of the same situation or issue. This illustrates the constructivist worldview behind framing/frame theory.

To continue, the constructivist background of frame theory is elucidated by how frames work and what they do. "[F]rames work to make some ideas more salient […], others less so – and others entirely invisible" (Entman, 1991, p. 7). Salience means "making a piece of information more noticeable, meaningful, or memorable to audiences" (Entman, 1993, p. 53). Because frames highlight certain aspects and downplay others "[f]rames, like metaphors […], are implicit theories of a situation […]. What gets produced in the framing process is both a model *of* the world – reflecting prior sense-making – and a model *for* subsequent action in that world" (van Hulst & Yanow, 2016, p. 98, emphasis in original).

There are several definitions of what frames are and what they do (Benford & Snow, 2000, p. 614; Björnehed & Erikson, 2018, p. 110; Entman, 1993, pp. 52–54; Inglis, 2013, p. 124; Nisbet & Scheufele, 2009, p. 1770, referring to Ferree et al., 2002; Perri 6, 2005, pp. 94–95; Scheufele, 1999, p. 106), which can be summarized in that frames contain a diagnosis of a situation and a corresponding action bias. A frame's diagnosis of the situation describes the issue and a frame's action bias suggests what ought to be done about the issue. In this thesis, the diagnosis of the situation describes what it is that science-policy communication should address and the action bias suggests how science-policy communication ought to address it.

In short, "frames help simplify complex issues by lending greater weight to certain considerations and arguments over others, translating why an issue might be a problem, who or what might be responsible, and what should be done" (Nisbet & Scheufele, 2009, p. 1770, referring to Ferree et al., 2002), i.e. offering a definition of a situation and a bias for action.

In conclusion, different science-policy communication frames will highlight different aspects of science-policy communication and downplay others, that is, different frames are based on different understandings of the science-policy communication (which highlights the constructivist worldview behind frame theory). Consequently, frame theory is useful to identify and relate different understandings of science-policy communication to each other. Hence, frame theory as a constructivist approach can contribute to a more comprehensive understanding of science-policy communication.

3.4.2   Frame Theory and the Study of Dynamic Processes

Frame theory is a suitable framework to study dynamic processes, such as science-policy communication. According to van Hulst & Yanow (2016, p. 94), two social science disciplines took up Bateson's ideas about frames, policy analysis and social psychology. The social psychology branch led to how social movements use the frame concept and they follow a concept of frame theory according to Goffman's understanding that frames are constructed in social interaction (van Hulst & Yanow, 2016, p. 94).

Parallel to Goffman, Schön, following Bateson's (1972b) work (not referenced in this thesis), developed his own concept of framing (van Hulst & Yanow, 2016, p. 95), and together with Rein, they developed a theory about framing applicable to analyzing policy processes (van Hulst & Yanow, 2016, p. 93). Van Hulst and Yanow (2016) developed Schön and Rein's approach to make it more suitable to study dynamic policy processes. According to them, "[i]n policy-making, framing is a process in and through which policy-relevant actors intersubjectively construct the meanings of the policy-relevant situations with which they are involved, whether directly or as onlookers and stakeholders" (van Hulst & Yanow, 2016, p. 97).

Furthermore, van Hulst and Yanow (2016, p. 93) emphasize analyzing the framing of policy-making because they consider a framing approach more suitable to study dynamic processes. Even though also science-policy communication is a dynamic process, I will focus on frames because I aim to reconstruct the understandings that are embedded in science-policy communication theory and practice, not how these understandings come into being. Therefore, I will adapt van Hulst and Yanow's (2016) work to the context of my study and use their approach to framing in policy processes as a basis for how I use frame theory and frame analysis to reconstruct different science-policy communication frames.

3.5 Frame Analysis

3.5.1 Frame Analysis as Tool

Frame theory informs a tool for data analysis, namely, frame analysis. In the following, I will describe how the frame theory literature suggests a frame analysis should be conducted, and I will outline what I focused on in my frame analysis, based on the work of van Hulst and Yanow (2016). Afterward, I will present how I reconstructed the science-policy communication frames from two types of material, a practitioner profile and literature reviews on the concepts of boundary organizations and Mode 2 knowledge production.

To start, the frame theory literature points out that a frame analysis reconstructs what is made salient about something, i.e. science-policy communication. By focusing on what is made salient, the frame analysis yields a diagnosis of the situation and an action bias, here, regarding science-policy communication.

Concretely, to find out what is made salient, frame analysis focuses on language or particular words, such as metaphors. Entman (1993), focusing on media frames, writes that "*text* contains frames, which are manifested by the presence or absence of certain keywords, stock phrases, stereotyped images, sources of information, and sentences that provide thematically reinforcing clusters of facts or judgements" (p. 52, emphasis in original). Similarly, van Hulst and Yanow (2016) state that "features that are selected for attention have to be named. Such policy naming at times invokes metaphors" (p. 99).

Hence, "frames can be detected probing for particular words and visual images that consistently appear in a narrative and convey thematically consonant meanings across media and time" (Entman, 1991, p. 7). Consequently, frame analysis is focused on extracting recurring themes as well as the language used in the material, such as metaphors, to draw out the salient features of a frame.

To continue, by drawing out salient features the diagnosis and the action bias that a frame contains can be reconstructed. These analytical tools, diagnosis of the situation and action bias, are used in the frame analysis "to describe the problems and solutions associated with the various frames at stake within a given context" (Björnehed & Erikson, 2018, p. 111). Thus, I will use them to reconstruct science-policy communication frames.

To end, the focus of my frame analysis regarding science-policy communication will be based on the work of van Hulst and Yanow (2016). As mentioned, their focus is on framing, whereas I focus on the reconstruction of frames. Therefore, I will adapt their work to fit it to the purpose of my thesis. According to van Hulst and Yanow (2016, p. 102), framing in policy processes happens on three entities: the content of the policy issue, the identities and relationships connected to the policy process, and the policy process itself.

Since the aim of this thesis is to reconstruct how *science-policy communication* is understood, one focus of the analysis is on the science-policy communication *process*. This means that I will concentrate on reconstructing the understanding of how and when science-policy communication is conducted. I can investigate the process through analyzing the "story about the storytelling and other policy activities. That is [the] […] notion of meta-communication: the ways in which people communicate about what is being

communicated" (van Hulst & Yanow, 2016, p. 103), here science-policy communication, which also says something about the "social, cultural, political, and/or other context" (van Hulst & Yanow, 2016, p. 103) of science-policy communication.

Additionally, the frame analysis will focus on the *identities* of the participants in science-policy communication because their identities are intertwined with the framing of the science-policy communication situation. Van Hulst and Yanow (2016) argue that looking at the identities of frame-makers is relevant because "[c]onflicts over the meaning of policy situations […] may also be located in policy-relevant actors' sense of their own and other actors' identities and the relationship between or among them" (p. 102). Hence, focusing the frame analysis on the identities of science-policy communication participants enables more insight into the salient features of the different science-policy communication frames. I will analyze the identities of science-policy communication participants by looking at how their role in the science-policy communication process is described.

To summarize, the frame theoretical literature suggests that a frame analysis should focus on salient features such as recurring themes and metaphors to reconstruct a diagnosis of the situation and an action bias from the material. Both together, diagnosis of the situation and action bias constitute a frame. Based on the work of van Hulst and Yanow (2016), I will focus on salient features regarding the science-policy communication process and the identities connected to that process to reconstruct science-policy communication frames.

3.5.2 Conducting the Frame Analyses

Here, I will present the frame analyses I conducted to reconstruct the practice embedded frame and the theoretical frames. One, I conducted a frame analysis on the practitioner profile following an iterative process and based on the work of van Hulst and Yanow (2016), as described earlier. Concretely, to reconstruct the salient features from the practitioner profile, I conducted a content analysis focused on the science-policy communication process described in the narrative and the identities connected to that process. It is important that the content analysis is informed by the frame analytic focus to yield relevant results (cf. Entman, 1993, p. 57).

Following roughly the suggestions for content analysis by Mayring (2010, pp. 601–611), I created a codebook (Appendix 1) to guide the analysis. To code all text passages relevant to the science-policy communication process and identities, I needed to be aware of the practitioner's understanding of science-policy communication as well as of my understanding of science-policy communication (both are outlined in the Foreword). The unit of coding was as much text as I considered necessary to understand the relevance of the text passage. As I was only one person doing the study, I did not use intercoder reliability to test the validity of the results gained from the coding.

After the coding, I reduced the material of both analysis foci, science-policy communication process and identities, until I arrived at key terms. During paraphrasing, I used "the researcher" or "the researchers" whenever the practitioner used "I" or "we". From the key terms, I intended to reconstruct the diagnosis of the situation and the action bias regarding science-policy communication, concretely, the science-policy communication frames. However, I realized that some of the keywords that came out of the content analysis appeared in both categories, D and A. Hence, I focused on the underlying thought styles and assumptions behind what I had coded as diagnosis and action bias to reconstruct the frames.

Two, I conducted a frame analysis on the literature reviews on boundary organizations and Mode 2 knowledge production. During the analytic processes, I searched for recurring themes and metaphors about the science-policy communication process and identities to reconstruct the diagnosis of the science-policy communication situation and the corresponding action bias. These analyses yielded the science-policy communication frames the boundary organization and Mode 2 knowledge production literature draw on.

Hence, using the method of frame analysis, I reconstructed different science-policy communication frames, which will be presented in Chapter 4. In Chapter 5, I will discuss the different frames in relation to each other to access the assumptions these frames are based on regarding how science-policy communication works. Thus, the frame analysis as constructivist approach can illuminate aspects of science-policy communication not highlighted by the realist view and can contribute to a more comprehensive understanding of it.

3.6   Methodological Reflections

In the following, I will discuss how my initial realist worldview and understanding of science-policy communication influenced the early stages of my research, I will elaborate on my decision to conduct one interview, an alternative method of data collection, and a potential caveat of my results regarding robustness and validity.

One, as outlined in the Foreword, going into my research I had a realist worldview and the understanding that science-policy communication was about getting more scientific findings into policy-making; therefore, I wanted to find improvements for how scientists and policy-makers communicate. This understanding and my initial worldview influenced which literature on science-policy communication I engaged with, and it affected me when preparing for and during the interview.

Because I considered science-policy communication as science-to-public policy-communication, the literature on boundary organizations was very appealing to me so that my project was long focused on what the boundary organization literature has to say about science-policy communication. Only after the interview, when I realized that there are also other understandings of science-policy communication, did I engage with the Mode 2 knowledge production literature. Therefore, I am more familiar with the literature on boundary organizations than with the Mode 2 knowledge production literature.

Preparing for the interview, my initial understanding of science-policy communication influenced the creation of the interview guide, so that I mainly focused on questions about the interviewee's interaction with the local government.

During the interview, my realist worldview made it hard for me to realize that my interviewee's understanding of science-policy communication differed from mine. Hence, it was challenging to realize when we were talking about science-policy communication and I would try to steer the conversation towards my understanding of science-policy communication, while my interviewee probably felt that we were already talking about science-policy communication, wondering why I wanted to talk about his interaction with the local government as he considered his interaction with other actors more important.

Two, I decided to conduct only one interview because it fits my research design. Conducting one interview could be a limitation regarding the validity of the results obtained from the practitioner narrative because I will not have other practice embedded frames to compare my results to.

However, the frame embedded in the practitioner narrative is a collective frame. Part of frame theory is the claim that frames are embedded in practices (cf. Dougherty, 2004, p. 47) and, thus, not "invented" by one practitioner. Hence, through the practitioner's story, I could gain access to this practice embedded collective frame, which adds to the validity of my practice embedded frame results.

Also, my approach to studying different understandings of science-policy communication included a frame analysis into the scientific literature on boundary organizations and Mode 2 knowledge production, a narrative from a practitioner, and a frame analysis of this narrative. Thus, the interview on a practice-based story about science-policy communication provided one set of data in addition to the other data that allowed me to reconstruct frames and gain access to different science-policy communication understandings.

Furthermore, the decision to conduct one interview gave me the time to be guided by the material during the analysis and follow my iterative research approach. For example, early in the analysis process, I only focused my analysis on the science-policy communication process. However, going back to van Hulst and Yanow's (2016) work, I realized the importance of analyzing identities connected to that process. Because I had time available, I could conduct this second frame analysis on my material, which contributed greatly to reconstructing the science-policy communication frames.

Also, the profile interview is a rather time-consuming method of data collection in terms of preparation as certain prerequisites need to be fulfilled (see sections 3.2.2 and 3.3), and the generation of the material needs the additional step of creating a practitioner profile (see section 3.3). Hence, having several interviews might have increased the validity of my findings regarding the practitioner narrative, but it would have been at the cost of not having enough time for my iterative research process.

Three, an alternative method to qualitatively collect data would be a semi-structured interview. I could have done a frame analysis on the transcript instead of conducting a profile interview and creating the practitioner profile. However, as already explained in Chapter 2, the practitioner profile is heavily story focused and because frames and stories have similar ways of making sense of the world, the practitioner profile was well-suited data for a frame analysis.

Last, some reflections on the validity and robustness of my results connected to the chosen case and the practitioner profile. One of the requirements for a profile interview is to talk about a project that has happened within the last three years (Forester et al., 2005a). I thought that the project I had agreed on with the interviewee fulfills that criteria since it is running from 2013-2017 (SEI, n.d.-b). However, during the interview, it became clear that the practitioner had been actively engaged on site only during 2013, which made the project we talked about much older than the recommended three years. This might have affected what the practitioner remembered from the project regarding interactions with other stakeholders, which is essential when analyzing the understanding of science-policy communication expressed in the narrative, and thus might affect the validity of the frame result obtained from the practitioner narrative.

Regarding the robustness of my results, I asked the interviewee to make his practitioner profile publicly available, however, he did not agree to that to exclude potential misunderstandings. Therefore, the practitioner profile cannot be found in the Appendix of this thesis. This might affect the robustness of my research result since parts of the material that I used might not be available for others to repeat the study. Yet, as the practitioner draws on a collective frame in his narrative, interviewing another practitioner with a critical reading of science-policy communication following the profile interview guidelines and focusing on reconstructing his/her understanding of science-policy communication can yield similar results compared to this study.

4 The Science-Policy Communication Frames

The analysis results in three science-policy communication frames, two theoretical and once practice embedded frame (Table 1). I use the labels 'theoretical frame' and 'practice embedded frame' to clarify which frames I reconstructed from the scholarly literature and which from the practitioner narrative, while being aware that the frames that I reconstructed from the scholarly literature are potentially informed by theoretical considerations as well as the practice of science-policy communication.

In the following, I will first present the theoretical frame reconstructed from the boundary organization literature, second, illustrate the theoretical frame reconstructed from the Mode 2 knowledge production literature and, third, outline the practice embedded frame. I will begin each section by describing the frame's diagnosis of the situation followed by the frame's action bias and end with which roles the frame highlights for the science-policy communication participants. In the practice embedded frame, the action bias and the role of the researcher are interconnected.

4.1 The Knowledge Intermediary Frame

The 'knowledge intermediary' frame was reconstructed from the boundary organization literature. The frame diagnoses that there is a difference between science and non-science, highlighted by the metaphor 'boundary'. Science-policy communication blurs that boundary, emphasized in the metaphor 'boundary work' (which refers to the interaction between science and nonscience (cf. Guston, 2001, p. 399, referring to Gieryn 1995, 1999)), because the communication process is non-linear and complex. Boundary blurring might jeopardize the integrity of science and politics, yet it is beneficial for political decision-making.

Consequently, the frame suggests boundary organizations as intermediaries between science and policy-making. They ought to maintain the integrity of both science and politics, made visible in the metaphor of 'dual accountability', and help the process of information flow between science (knowledge producer) and politics (knowledge user) as well as create knowledge that is both useful to and usable in political decision-making.

Thus, the frame highlights the role of science as knowledge/information producer and politics as knowledge/information user while emphasizing boundary organizations as intermediaries aiding the flow of information/knowledge which produce useful and usable knowledge. This knowledge intermediary frame will be outlined in the following, illustrated with examples from the boundary organization literature. The words 'knowledge' and 'information' will be used interchangeably because the literature sometimes refers to knowledge production/use and sometimes to information production/use.

To begin, I depict the knowledge intermediary frame's diagnosis of the situation. The frame emphasizes a difference between science and non-science, which is made salient in the boundary organization literature through the metaphor 'boundary': there is a "boundary between what does and does not count as science" (Guston, 1999, p. 87).

Also, the frame highlights that science-policy communication blurs that boundary because the communication between science and policy-making is non-linear. The literature emphasizes this by using the metaphor 'boundary work' (Guston, 2001) and by pointing out the complexity of science-policy communication as "decision-makers have to adjudicate between a wide range of interests, values, and perspectives – whether social, economic, or environmental – and determine which are the most compelling in a given situation" (Bednarek, Shouse, Hudson, & Goldburg, 2016, p. 291).

The frame draws attention to that the complex interaction between science and policy-making can create problems for the integrity of science and of politics. Guston (2001, p. 399) emphasizes this in his work by pointing out that

> "the flexibility of boundary work might lead to confusion or even dangerous instabilities between science and nonscience. These risks could be conceived, perhaps, as the politicization of science or the reciprocal scientification of politics. […] [B]oth should be understood to mean the rendering of norms and practices in one enterprise in a way that unreflexively mimics norms and practices in the other. These concerns have been central to the so-called science wars, and to the extent that they are implicated in public discussions of such policy issues as health and safety regulations, climate change, or genetically modified organisms, they are real problems for policy makers and publics alike".

At the same time, the frame makes visible that the blurring of boundaries can help political decision-making. Guston (2001, p. 399) highlights that by point to that "the blurring of boundaries between science and politics, rather than the intentional separation often advocated and practiced, can lead to more productive policy making" because "when those boundaries were initially blurred, policy-making was easier" (Guston, 1999, p. 89, referring to Jasanoff, 1990). Additionally, Guston (1999, p. 89) points out that boundary blurring "can improve the position of science in society, for society's ultimate benefit".

In short, the knowledge intermediary frame diagnoses that there is a boundary between science and politics and that science-policy communication blurs that boundary, which may jeopardize the integrity of science and of politics, but at the same time is helpful for political decision-making.

To continue, the frame suggests boundary organizations as a way to institutionalize science-policy interactions. The literature points out that boundary organizations allow for the blurring of boundaries while providing protection from the dangers inherent in the blurring by using the metaphor 'dual accountability'. Guston (2001, p. 401) points out that boundary organizations have "distinct lines of accountability" to both science and politics.

Concretely, the literature emphasizes that "[b]oundary organizations appear to need the approval of science for the credibility of their knowledge claims, as well as the approval of political institutions for the legitimacy of their policy orientations" (Miller, 2001, p. 483; similarly cf. Bednarek et al., 2016, p. 292).

A boundary organization can have "its own goals and strategies to maintain its legitimacy in the eyes of both audiences" (Hage, Leroy, & Petersen, 2010, p. 275). Thus, the metaphor dual accountability highlights that boundary organizations as separate organizations "can operate on both sides of the boundary while maintaining their credibility and independence" (Cook, Mascia, Schwartz, Possingham, & Fuller, 2013, p. 673).

Using the metaphor of dual accountability, the literature emphasizes that boundary organizations do not endanger science' and politics' integrity because they stabilize and blur the boundary between science and politics at the same time:

> "[S]uccessful boundary organization will thus succeed in pleasing two sets of principals [i.e. science and politics] and remain stable to external forces astride the internal instability at the actual boundary. The success of the organization in performing these tasks can then be taken as the stability of the boundary, while in practice the boundary continues to be negotiated at the lowest level and the greatest nuance within the confines of the organization." (Guston, 2001, p. 401)

In brief, the knowledge intermediary frame suggests boundary organizations to address the diagnosed complex interaction between science and policy-making and its inherent problem and benefit. Using the metaphor of dual accountability, the literature makes salient that boundary organizations stabilize the boundary between science and politics, i.e. ensure each's integrity, while blurring it.

Furthermore, the frame emphasizes that science has the role of knowledge producer and policy-making of knowledge user. Boundary organizations are intermediaries between science (as knowledge producer) and politics (as knowledge user) as well as knowledge

producers. The boundary organization literature makes the role of science as knowledge producer and the role of politics as knowledge user salient when emphasizing that boundary organizations link "the producers of knowledge" and "decisionmakers" (Buizer, Jacobs, & Cash, 2016, p. 4597) to reconcile "the supply of scientific information with users' demands so that scientists produce information that decision makers need and use in policy decisions" (McNie, 2007, p. 17).

Next, the literature draws attention to two roles of boundary organizations: intermediaries between science and politics and knowledge producers. One, the literature emphasizes boundary organizations' intermediary role when pointing out that those organizations stand in between the realms of science and politics (Pohl et al., 2010, p. 269), working at the border between them (Hauck et al., 2014, p. 380; Pietri et al., 2011, p. 300). Thus, "[b]oundary organizations act as intermediaries between scientists who produce information, and decision makers who use the information" (McNie, 2007, p. 28).

The literature highlights that as an intermediary, boundary organizations "can help improve the end-to-end process of knowledge co-production and application by enabling scientists and decision-makers to increase mutual understanding of capacities and needs" (Tribbia & Moser, 2008, p. 317, emphasis in original, referring to several authors). Also, boundary organizations facilitate "a two-way flow of information" (McNie, 2007, p. 28) and "improve the flow of information to end-users" (Graham & Mitchell, 2016, p. 383).

(Cash, Borck, & Patt, 2006, pp. 465–466, 468–470) point out that boundary organizations aid in the flow of information between science and policy-making by engaging in convening, translating, collaborating, and mediating, which are practices that can "effectively harness science and technology for sustainability by ensuring salience, credibility, and legitimacy across boundaries" (p. 468). These practices are highlighted also in other boundary organization literature (Buizer et al., 2016, p. 4597; Cook et al., 2013, p. 669; Weichselgartner & Kasperson, 2010, p. 275).

Two, the frame draws attention to the boundary organizations' role as knowledge producers, using the metaphor 'boundary objects'. Guston (2001) points out that boundary organizations produce knowledge in the form of "boundary objects". Also, McNie (2007, p. 28) highlights that "[b]oundary organizations produce boundary objects, such as reports, conferences and the like".

Additionally, the boundary organization literature emphasizes that as knowledge producers, boundary organizations generate useful knowledge (McNie, 2007, p. 28). Concretely, boundary organizations ought to work on "creating salient, credible, and legitimate information simultaneously for multiple audiences" because "information requires three […] attributes – saliency, credibility, and legitimacy" to be useful (Cash et al., 2003, p. 1).

To conclude, the knowledge intermediary frame diagnoses that the blurring of the boundary between science and politics through science-policy communication, on the one hand, is helpful for policy-making, and, on the other hand, might jeopardize the integrity of science as well as politics. Therefore, the frame suggests boundary organizations to address the challenge of allowing for boundary blurring that does not jeopardize the integrity of either realm. Boundary organizations can fulfill this task, which is highlighted in the metaphor 'dual accountability'. Concretely, boundary organizations aid the flow of knowledge between science and politics through the tasks of convening, translating, collaborating, and mediating. Also, boundary organizations are knowledge producers, focused on creating useful knowledge for science and policy. Boundary organizations are intermediaries between science, in the role of knowledge producer, and political decision-making, in the role of knowledge user.

4.2 The Co-Creating Knowledge Frame

From the literature on Mode 2 knowledge production, I reconstructed the science-policy communication frame 'co-creating knowledge'. In the following, I will outline that the frame diagnoses changes in society and suggests Mode 2 knowledge production to act upon these changes, emphasizing that science ought to become a governance actor and society ought to actively participate in the knowledge production process.

To begin, I will present that the frame diagnoses changes in society: (1) the public puts demands on science and decision-making, (2) knowledge production is socially distributed, (3) the concept of expertise has expanded, and, (4) complex issues have emerged.

One, the frame highlights that society puts demands on science and (political) decision-making. This is made salient in the literature when Nowotny (2003, p. 151) points out that "citizens [should] […] express their views and articulate their demands" and that "[t]oday, there is a widespread expectation that science not only ought to listen to these demands, but also can satisfy them". Also, Engels (2005, p. 14) draws attention to that "the research process should be open to the broader public", highlighting science that is "problem-driven, context-sensitive, trans-disciplinary, interactive, and participatory", meaning, knowledge production is considered "to be useful to someone" within wider society, be it the public, economic sector or academia (Gibbons, Nowotny, Schwartzman, Scott, & Trow, 1994, p. 4).

Similarly, society puts demands on decision-making. Gibbons et al. (1994, p. 7) highlight that "[a]n expanding number of interest, and so-called concerned, groups are demanding representation in the setting of the policy agenda as well as in the subsequent decision making process".

Two, the frame brings to the foreground that society has changed regarding knowledge production, which is emphasized in the metaphor of 'socially distributed knowledge'. Engels (2005, p. 14) points out that the "institutional separation between the production and the use of knowledge is regarded as inappropriate in the face of […] changing expectations [on science]". Concretely, Gibbons et al. (1994, p. 11) draw attention to that there is no single source of knowledge anymore because universities do no longer hold a monopoly on knowledge production as they produce students who are able to judge university research and who are able to create knowledge in other organizations. Also, "sources of [knowledge] supply are increasingly diverse, as are the demands of differentiated forms of specialist knowledge", therefore, "we also speak of socially distributed knowledge" (Gibbons et al., 1994, p. 4).

Three, the frame makes visible that the concept of expertise has extended. This is made salient in Nowotny's (2003) work. She points out that specialized knowledge is not the only form of expertise anymore but includes different knowledge dimensions (p. 155). Therefore, all members of society are now experts (p. 156). Additionally, she draws attention to that the role of experts has changed; they are now expected to be ""key actors of governance: either as proactive agendasetters in their own right or, more often, as resources for actors in government, business and civil society"" (p. 152, referring to EC, 2001).

Four, the frame highlights that new complex issues have emerged that society has to deal with. This is visible in that "the issue on which research is based cannot be answered in scientific and technical terms alone" (Gibbons et al., 1994, p. 7) and that

> "research towards the resolution of these types of problem has to incorporate options for the implementation of the solutions and these are bound to touch the values and preferences of different individuals and groups that have been seen as traditionally outside of the scientific and technological system" (Gibbons et al., 1994, p. 7)

In short, the co-creating knowledge frame's diagnosis of the situation highlights the following changes: (1) Citizens demand that scientific processes should be participatory, and they demand to be part of the decision-making process. (2) Knowledge production has changed, which is made visible through the metaphor of socially distributed knowledge. (3)

The concept of expertise has extended beyond specialized knowledge and includes other types of knowledge, and is made salient in that experts should become governance actors. (4) Issues have come up in society which cannot be solved through purely scientific solutions anymore, instead, solutions need to include ways of implementation and consider the values of those affected by it.

To continue, the frame suggests Mode 2 knowledge production to address the diagnosed changes. The literature highlights the suitability of Mode 2 knowledge production using the metaphors 'context of application', 'social knowledge', and 'agora'. Context of application emphasizes that "[k]nowledge is always produced under an aspect of continuous negotiation and it will not be produced unless and until the interests of the various actors are included" (Gibbons et al., 1994, p. 4).

The metaphor also draws attention to that "problem solving […] is organised around a particular application" (Gibbons et al., 1994, p. 3), meaning, the knowledge that is produced needs to be useful to someone in society (Gibbons et al., 1994, p. 4). Hence, the metaphor context of application used by Gibbons et al. (1994) makes visible the suitability of Mode 2 knowledge production as a way to handle the diagnosed changes.

Similarly, Nowotny (2003, p. 155) uses the metaphor of "social knowledge", which emphasizes that knowledge "remains contextual in the sense that it will take on different forms on the epistemological, institutional and political level" and that scientists "are aware of the societal context for their work".

Another metaphor used by Nowotny (2003) is "agora". This metaphor draws attention to the need to

> "embrace the political arena and the market place, and to go beyond both. The 'agora' is the problem-generating and problem-solving environment in which the contextualisation of knowledge production takes place. It is populated not only by arrays of competing 'experts' and the organisations and institutions through which they bring their knowledge and experience to bear on decisions taken, but also variously jostling 'publics'. The 'agora' is in its own right a domain of primary knowledge production, through which people enter the research process and where knowledge (Mode 2 knowledge) is embodied in people, processes and projects. If we all are experts now, the order and ordering of the regime of pluralistic expertise will be played out and negotiated in this public space" (Nowotny, 2003, pp. 155–156).

In brief, the co-creating knowledge frame suggests Mode 2 knowledge production to handle the diagnosed changes in society. The literature highlights this by pointing out that Mode 2 knowledge production is "a reaction to the growing complexity of environmental issues, to new forms of uncertainties, and to changing public expectations towards science" (Engels, 2005, p. 13), and through the metaphors "context of application", "social knowledge", and "agora". These metaphors make salient that Mode 2 knowledge production emphasizes a research process based on negotiating different interests and that aims at producing knowledge that is useful to societal actors.

Last, the frame highlights that the participants in science-policy communication are science and society, with science taking on the role of a governance actor and society becoming an active participant in the research process. The role of science has changed from just being a scientist or an expert to governance actor. This change is visible when Nowotny (2003, p. 152) points out that scientists ought to exercise "comparative judgement and the ability to move back and forth, that is, to transgress the boundaries between specialised knowledge and its multiple, many-layered (and often unforeseeable) context of implication". Thus, scientists become experts in being governance actors (Nowotny, 2003, p. 152; referring to EC, 2001).

Similarly, Gibbons et al. (1994, p. 7) draw attention to that scientists should suggest implementations for the knowledge they provide as well as actively partake in the definition of problems, the finding of solutions, and their evaluation. Likewise, in "policy-making, for example, the role of science changes from simply providing technical

information to the 'much more diffuse activity' of 'assisting in the process of governance'" (Pohl et al., 2010, p. 169, referring to Funtowicz et al., 2000, p. 335).

Moreover, the frame brings to the foreground that the role of society has changed, which is made salient by Nowotny (2003, p. 155) writing that "society is no longer only an addressee of science, but an active partner participating in the production of social knowledge".

To conclude, the Mode 2 knowledge production literature draws on a science-policy communication frame, co-creating knowledge, that diagnoses four changes: (1) society puts demands on science and decision-making, (2) knowledge is socially distributed, (3) the concept of experts has broadened, and (4) complex issues have arisen that can neither be dealt with purely scientific methods nor with an interaction between science and society where society is excluded from the research process and science does not focus on societal issues.

Hence, the frame suggests that Mode 2 knowledge production should handle these new challenges through negotiations of interests and co-production of knowledge, which is made salient in the metaphors of the 'context of application', 'social knowledge', and 'agora'. Mode 2 knowledge production includes a change in the roles of society and science, thus, the frame highlights that society becomes an active participant in the knowledge production process and scientists are becoming experts in being political actors.

4.3 The Critical Frame

I reconstructed the 'critical' science-policy communication frame from the practitioner narrative. The frame diagnoses a situation where the local community is negatively affected, but the government does not give support to change their situation. Based on that diagnosis, the frame suggests that the researcher ought to take on the role of a critical facilitator. The critical facilitator should put pressure on local and international governments as well as the private sector and support the local stakeholders and empower them.

To begin, the frame diagnoses that the local community is negatively affected. This is made salient in the narrative pointing out that "through interviewing, talking to people in localities, we found that there were a lot of negative impacts on the smallholders who were not being paid what they were promised and indigenous groups who lost their lands".

Furthermore, there is no support for the local community from the government to change their situation. This diagnosis is made visible when the narrative draws attention to that "in the localities where the oil is produced, often governance breaks down or there's a weak state, or institutions do not work as we are used to in Europe". "Many people have their hands tied and there are lots of reasons why governments don't work the way they work here [in Europe]", "[a]nd then, there were others who clearly didn't really care that much".

To continue, based on the diagnosis that negatively affected local communities are not supported by the government, the frame suggests that the researcher ought to take on the role of a critical facilitator and ought to support the local community and put pressure on the government and the private sector. The frame's action bias is highlighted in the metaphor of 'governance impact':

> "[Y]ou need to think about […] *governance* impact, how you can impact the private sector, the Malaysian company. The smallholders were a key actor: we influenced them in a tiny bit, we supported them in their negotiations. The indigenous groups – empowering them in their struggle for recognition of their rights. So, you need to think about impact in those various levels or different sectors, different ways".

To achieve this impact, the frame highlights the researcher's role as critical facilitator, which is made visible in the narrative when the researcher fulfills facilitation tasks and puts pressure on the local government, international political decision-making, and the private

sector. I will now outline the facilitation tasks and later illustrate the emphasis on the role as *critical* facilitator.

The narrative points out that the researcher engages in several facilitation tasks. One, the researcher learns about the local situation. This becomes salient from the story about how the researcher investigates the area where oil palms grow, when he talks with the government and listens to the people belonging to the affected stakeholders.

Two, the researcher is aware of different viewpoints and tries to represent them correctly. "[T]he task as a practitioner, as a researcher, is to try and understand the positionality of each actor or why they behave as they do". Also, "the purpose was really to try and shed light on the issues from various perspectives. There was no intention of limiting it to any particular group of actors". Additionally, "that process of verification, or what you may call social validation, that I did with people, is very important".

Three, the narrative points out that the researcher makes available the opportunity for stakeholders to meet:

> "And then ultimately, all of the offices, the agencies, actors, we met with were invited to a stakeholder workshop in the end of the project. […] It might have been the first time that all those different actors actually met in such a situation to discuss the oil palm project and the problems created by it".

Last, the researcher provides resources:

> "I was acting as a project leader and provided the funding, through the Swedish grant. So this activity, this project happened because I took that initiative and then contacted the Palawan State University […] They took an interest and they made a substantial effort to the project and it would never have happened without them. Often that's the case, the local partner most often is more important than the international partner, but sometimes there is a need for resources or a specific initiative for things to happen".

The researcher also provides resources in form of the study: "I think, some of the actors there, some of the government offices, and some of the NGOs used our study and said, "Hey, it's not just something we say, actually, this is …", it became leverage for that discussion too".

Specifically, the frame emphasizes the role of a *critical* facilitator. This attribute is made salient in the narrative when the researcher questions the work of the local government:

> "I would come back and say, "But you told me that your office had done this and that, but the cooperatives still tell us that it's just a mess in the field still. Why…It hasn't helped with the support you provided. Do you know why this is the case?" And then they would try and answer that question. I am sure some have been annoyed, but I think others might have found it useful to stimulate reflection and help them […] reflect on their own practice".

Furthermore, the frame makes salient that as a critical facilitator, the researcher ought to put pressure on the local government (seen in the previous quote), but also on the international decision-making, and the public sector. The narrative highlights this when the researcher tries to get the research results into international decision-making:

> "I was engaged with different people and colleagues and NGOs, here in Europe, to try to feed in some of the insights, giving them research evidence, the report, and participating in a few meetings. Often those actors were NGOs, they are lobbying towards the European Parliament",

and when the researcher raises awareness about the situation in an international company:

> "[W]hen we finished the SEI report, I also followed-up with […] the company Hongkong who purchases some of the oil, or that we thought was purchasing oil from Palawan, so I send the report to them and said, "Hey, do you know what's happening? Do you know what damage it causes?"".

Also, the narrative points out the role of the critical facilitator when drawing attention to that the researcher puts pressure on the local company by asking uncomfortable questions:

"by nature of the questions we asked, the [Malaysian] company, naturally, became more hesitant because we were looking into things that was not in their interest"; and when he supports the local stakeholders to change the position of the Malaysian company during negotiations.

Moreover, the frame emphasizes that as a *critical* facilitator the researcher ought to support the local community to change their situation. That is, in the narrative, the researcher does not take governmental support for granted:

"[O]f course, it would have been nice, wonderful, to see a provincial leadership or government say, "Oh, is that the case, let's get this right, now. Now we'll intervene. Now we'll sort this out and make sure laws are followed and...". But that's not the case. […] I, sort of came to accept that it's just different in reality. Now, when I did this project (because I had worked in similar projects in South-East Asia before) it wasn't so much of a surprise".

Thus, the researcher takes on the role of the critical facilitator to support the marginalized stakeholders, which becomes apparent in the narrative when the researcher focuses on local opportunities:

"What I tried to do was to focus on the opportunities that are there. And one key opportunity was the momentum that was created by the cooperatives of smallholders themselves in banding together in that federation and initiating a renegotiation of their contracts with the Malaysian company. That was an opportunity: to support them in mobilizing one or two meetings, and giving them inputs, and joining a meeting with the company, and giving them so support".

"[T]hat's something that you learn over time and always have to remind yourself of: not getting stuck on a preconceived idea about how to change things but finding, using the opportunities that actually exist or that others create for you or create for themselves".

"[I]f you want to contribute to a long-term, just transition in society, then, basically, all research needs to support actors who are already embedded and are engaged in those negotiations or relations. […] In Palawan it was the smallholders or indigenous tribal groups. Because they know what change is needed. The researchers rarely really know".

Additionally, the narrative highlights that if the researcher wants to support the local actors, he/she needs to create relationships with them:

"[I]f you would like to actually contribute in a more substantial way, then it's better to […] do your work […] where you can build up relationships […]. Otherwise, it's a risk that it's too transient to be a meaningful actor".

To end, the critical frame also highlights which roles the other actors as participants in science-policy communication take on. The narrative emphasizes that the local stakeholders are primarily informants and collaborating with the researcher. For example, the government's "role was as a stakeholder or an informant". The affected stakeholders collaborate in the research, which is made visible in the narrative about the researcher "working with the different actors, the indigenous groups, and stakeholders – to study the impacts and trying to identify improvements in governance and through regulations or negotiations between the parties", and are informants: "through interviewing, talking to people in localities, we found that there were a lot of negative impacts on the smallholders who were not being paid what they were promised and indigenous groups who lost their lands". The local university is emphasized as a collaborator in the research process.

Conversely, the frame makes visible the roles of the local (Malaysian) company, the international company, and the international decision-makers as negotiation partners as well as knowledge receivers. This is made salient in the narrative when the researcher sends the report to the company Hong Kong and calls them to raise awareness about the negative situation and when he tries to get the knowledge into European decision-making. The role of the local company is highlighted as negotiation partner who talks with the affected stakeholders that want to change their situation.

To summarize, the critical science-policy communication frame diagnoses that negatively affected local stakeholders do not receive support from the government to change their situation. Consequently, the researcher ought to take on the role of a critical facilitator who supports and empowers the local community and puts pressure on the local and international government and the private sector, made salient through the metaphor governance impact. The frame highlights that affected stakeholders, the local government, and the local university are collaborators and informants in the research process. The private sector and the international decision-making arena is a participant in science-policy communication as a negotiation partner and as a recipient of scientific knowledge.

4.4 Summary Table

Table 1. Reconstructed science-policy communication frames. The theoretical and practice embedded frames showing diagnosis of the situation and action bias.

Frame	Diagnosis of the Situation	Action Bias
Knowledge Intermediary	There is a boundary between science (knowledge producer) and politics (knowledge user) and science-policy communication blurs that boundary, which jeopardizes the integrity of science and politics, but also helps political decision-making	Boundary organizations ought to blur the boundary without jeopardizing the integrity of science and of politics. To do so, boundary organizations ought to aid the flow of knowledge between science and policy-makers and create useful and usable knowledge themselves
Co-Creating Knowledge	Society has changed: the public put demands on science and policy-making, knowledge is socially distributed, the expert concept and role have extended, new complex issues cannot be answered with science alone	Mode 2 knowledge production ought to handle these challenges by negotiating different knowledges and interests and creating knowledge that is useful for societal actors. In Mode 2 knowledge production the researcher ought to become a governance actor and society an active participant in producing knowledge
Critical	The government does not support the negatively affected local community	The researcher ought to become a critical facilitator who supports and empowers the local stakeholders and puts pressure on local and international governments and the private sector

5 Science-Policy Communication Assumptions and the Constructivist Contribution

5.1 What assumptions do the frames include about how science-policy communication works?

The results show that the theoretical frames and the practice embedded frame are based on different assumptions about how science-policy communication works. These assumptions will be outlined by discussing the different science-policy communication frames in relation to each other.

The two theoretical frames highlight that science-policy communication needs to be changed and give suggestions for how to change it. Furthermore, the frames emphasize creating knowledge that is useful for science, politics, and society. That is because the frames include the assumption that science-policy communication is about good communication and that (useful) knowledge leads to change. Also, the environmental science and policy literature presented in Chapter 2 employs this assumption.

Both theoretical frames, knowledge intermediary and co-creating knowledge, point out that science-policy communication needs to change and suggest how. The knowledge intermediary frame emphasizes that the complex science-policy communication situation endangers the integrity of science and politics, yet is helpful for political decision-making. Therefore, science-policy communication should go through an intermediary, boundary organizations, that is accountable to both science and politics.

Conversely, the co-creating knowledge frame draws attention to changes in society that puts demands on and poses challenges to the science-policy/society interaction. Hence, the frame suggests Mode 2 knowledge production as a research process that includes society and negotiates the interests and knowledges of societal actors.

Moreover, the theoretical frames make salient that science-policy communication is about creating knowledge that is useful for science, policy-making, and societal actors. The knowledge intermediary frame makes visible that science-policy communication is about creating useful knowledge. It highlights boundary organizations as responsible for this, in that they should aid the flow of knowledge as intermediaries between knowledge production and knowledge use as well as create knowledge that is usable by both science and politics.

Similarly, the co-creating knowledge frame highlights creating useful knowledge for society. This is visible in that knowledge production should happen in the context of application, meaning that in the research process, different types of knowledge should be negotiated and society should actively contribute to the knowledge production process.

The theoretical frames emphasize knowledge production and changes in science-policy communication because they are based on the understanding that science-policy communication works through communication and that knowledge leads to change. Communication in the context of the knowledge intermediary frame means that boundary organizations engage in the practices of convening, translating, and mediating knowledge as well as of collaboration between knowledge producers and knowledge users. Concretely, boundary organizations enable "scientists and decision-makers to increase mutual understanding of capacities and needs" (Tribbia & Moser, 2008, p. 317).

In the context of the co-creating knowledge frame, communication is emphasized as negotiation of different types of knowledge and interests as well as in citizens expressing their demands and needs for science. Hence, the frame includes the assumption that science-policy communication encompasses communication with wider society. Thus, both frames are based on the assumption that science-policy communication works through communication.

Furthermore, the frames include the understanding that knowledge leads to change. In the knowledge intermediary frame, this is visible in that boundary organization literature emphasizes boundary organizations as "bridge between actors and their knowledge sources" (Buizer et al., 2016, p. 4597) and as organizations that facilitate connecting science to "policy and management approaches" and "help to promote the use of the best available science to inform complex policy decisions" (Pietri et al., 2011, p. 313). These quotes and the previously outlined emphasis on knowledge production and knowledge transfer make salient that knowledge should arrive at political decision-makers, who induce change through suggesting policies and policy implementations.

Also, the co-creating knowledge frame includes the 'knowledge-leads-to-change' assumption. Nowotny (2003, p. 156) emphasizes the agora as "problem generating and problem-solving environment" where Mode 2 knowledge production takes place. Thus, the co-creating knowledge frame makes visible that knowledge production and creating change, i.e. solving problems, are strongly interconnected through Mode 2 knowledge production.

Moreover, the basic idea that science-policy communication is about communication and that knowledge can create change is employed by the environmental science and policy literature presented in Chapter 2. This assumption is visible in the metaphor of "barriers" in science-policy communication to explain why science is not used in decision-making. Furthermore, that knowledge creates change is salient in the expectation expressed in the literature that science should be used in political decision-making.

However, the critical frame challenges the understanding that knowledge alone can create change by emphasizing that power relationships need to be taken into consideration to create change. The critical stance to knowledge as a key factor for change is made visible in the narrative. "Sometimes you can be hard hitting, you have a paper, you have a report, you have an argument that you can put up, and a minister might say, "Oh, OK, I'll pass this new law." Sometimes that happens". But, *sometimes* is not enough if the goal is "to contribute to a long-term, just transition in society". This brief story highlights that getting science into political decision-making has only limited chances of creating change.

Based on the basic idea that science-policy communication happens in a context of power and that change can only happen when taking that into consideration, the critical frame emphasizes that science-policy communication should be about empowering and supporting marginalized groups, who do not have access to policy-making processes. The emphasis on supporting marginalized groups is expressed in the metaphor of governance impact (see section 4.3).

Also, the narrative highlights the missing access of marginalized groups when drawing attention to that the local government does not give support to the negatively affected community. Additionally, the knowledge that the marginalized community possess is not taken into consideration. This is emphasized in the narrative when the research study is needed to support the local's claim that the situation is bad: "some of the actors there, some of the government offices, and some of the NGOs used our study and said, "Hey, it's not just something we say, actually, this is …", it became leverage for that discussion too". That the local actors' knowledge is not considered sufficient in the discussion about the bad situation can be considered missing access to policy-making.

Furthermore, the frame emphasizes that the local government is also affected by power relationships. This is highlighted in the previous quote, when also the local government needs support from science to point out that the local situation is bad, as well as in other parts of the narrative:

> "The cooperatives department, for instance, is the one in the provincial government responsible for supporting the cooperatives in their economic activities, so it was with them we discussed what support they had given, how they had tried to help the smallholders when they faced issues, and why the situation was still unresolved. I met a lot of really nice, very committed people there, who were trying to do their best but with limited resources and with difficult conditions, lack of political interest, perhaps".

"Some people in some offices clearly had an interest in supporting our work, being very frustrated themselves, probably much more than I was frustrated as a foreigner, about this project developing in this unfortunate way in their province; and they would like to provide information. Some taught us not to mention their names but gave us information in confidence".

Thus, "in the localities where the oil is produced, often governance breaks down or there's a weak state, or institutions do not work as we are used to in Europe" because "[m]any people have their hands tied and there are lots of reasons why governments don't work the way they work here [in Europe]". By pointing out that also the local government can be affected by power relationships, the critical frame draws attention to its inherent assumption that science-policy communication happens in a context of power and that to create change, the communication process needs to take power relationships into consideration.

Science-policy communication in the context of power is also discussed by Pohl et al. (2010). Studying sustainability research, the researchers "identified an overall challenge for sustainability researchers: that of structuring the *agora* during the co-production of knowledge" (Pohl et al., 2010, pp. 270–271, emphasis in original). Pohl et al. (2010) identified power as one part of that challenge and point out that

"[w]ith regard to power, the challenge for sustainability researchers is to prevent the process from being 'highjacked by local elites, companies or government agencies' (Wiggins *et al*., 2004: 1952), which can happen when one of the scientific disciplines or social actors involved in the co-production of knowledge imposes its perspective as the only valid one" (p. 271).

Also, the critical frame includes the understanding that science-policy communication works through building relationships. This is visible when the narrative emphasizes the importance to create relationships between the research and the affected stakeholders so that the researcher is able to empower them:

"[A] learning for me was that if you would like to actually contribute in a more substantial way, then it's better to […] build up relationships […]. Otherwise, it's a risk that it's too transient to be a meaningful actor".

In sum, the results highlight that the theoretical and the practice embedded frames include different assumptions about science-policy communication. Most notably, the knowledge intermediary and co-creating knowledge frames emphasize that science-policy communication should create knowledge because they are based on the basic idea that knowledge leads to change, whereas, the critical frame challenges the understanding that knowledge equals change. Instead, the frame includes the assumption that science-policy communication takes place in a power context and that change only happens through taking that into consideration.

5.2   What can a constructivist approach contribute to the understanding of science-policy communication?

The discussion of the science-policy communication frames illustrates that each frame is based on a different assumption regarding how science-policy communication works. The frames reconstructed from the boundary organization and Mode 2 production literature include the basic idea that science-policy communication is about communication and that knowledge leads to change. This assumption is also visible in the environmental science and policy literature. However, the understanding that knowledge alone leads to change is challenged by the critical frame, which is based on the assumption that science-policy communication is situated in a power context and should create change by taking that context into consideration. Also, Pohl et al. (2010) refer to power as a challenge in science-policy communication.

These different understandings of science-policy communication can have implications for when science-policy communication takes place and is talked about. One implication results from the biasing for action function of frames, namely, depending on the understanding of science-policy communication, participants act in a certain way. To elaborate on this, I will briefly return to van Hulst and Yanow's (2016) focus on framing. They maintain that "frames develop through highly situated interactional processes of communication" (p. 95) and that "actors bring their own prior knowledge (from experiences, education, and other sources) to situational sense-making" (p. 99). Accordingly, also the context which participants of science-policy communication find themselves in affects the framing of the science-policy communication process.

From the practitioner narrative, it becomes clear that the practitioner had previous experience in similar contexts. Therefore, talking about himself in the narrative, the practitioner accepted that the local government cannot support the local stakeholders to change their difficult situation. Consequently, the practitioner employed a critical science-policy communication frame, biasing him to become a critical facilitator who does not take government for granted and supports and empowers marginalized stakeholders.

Thus, van Hulst and Yanow's (2016) focus on framing makes visible that depending on context and based on experience, practitioners taking part in science-policy communication frame science-policy communication in a certain way, which influences how they act.

Another implication derives from that actors frame the same (science-policy communication) situation differently. As a result, actors taking part in the same science-policy communication process might misunderstand each other when talking about science-policy communication. The quotes by van Hulst and Yanow (2016) cited in the previous paragraph support that actors participating in the same the science-policy communication process can frame that process differently.

Accordingly, actors frame differently who is considered a participant in science-policy communication, which and how knowledge gets created, where science-policy communication takes place and who has which role in the science-policy communication process. Hence, actors engaging in science-policy communication who draw on different frames regarding science-policy communication might have difficulty understanding each other (cf. Lewicki et al., 2003) and communicating what they want to talk about.

These implications show that a constructivist approach to science-policy communication contributes to a more comprehensive understanding of science-policy communication. Through frame theory, a constructivist approach highlights that actors can draw on different understandings of science-policy communication and might even act differently in the communication situation depending on the frame they employ. Additionally, when engaging in the same science-policy communication process, employing different frames about that process might make communicating about it difficult.

6   Conclusion

The overarching question behind my research is: What can a constructivist approach contribute to the understanding of science-policy communication? Based in the field of environmental communication, this question reacts to the realist view on science-policy communication discovered in the environmental science and policy literature.

To answer the research question, I used frame analysis to gain access to the understanding of science-policy communication that the scholarly literature draws on, and to a practice-based understanding that expresses a more critical reading of science-policy communication. The frame analyses yielded two theoretical frames, knowledge intermediary and co-creating knowledge, and one practice embedded frame, the critical frame.

The discussion shows that the theoretical frames include the assumption that science-policy communication works through communication and that knowledge leads to change, whereas, the practice embedded frame is based on the understanding that science-policy communication is situated in a power context and that science-policy communication works through building relationships. Thus, the critical frame draws attention to that knowledge production in agoras and boundary organizations should be part of a broader process that includes the consideration of power relationships to create change.

Furthermore, the discussion highlights that actors who participate in science-policy communication can have different frames of the same communication process, and hence might act differently and might misunderstand each other when talking about it. Therefore, a constructivist approach that uses frame theory can contribute to a more comprehensive understanding of science-policy communication.

Also, this thesis is a valuable contribution to the field of environmental communication. Hallgren and Ljung (n.d., p. 2) argue that "communication is an essential part in all management of environmental issues and natural recourses". Hence, knowing more about science-policy communication in the field of environmental sustainability will ultimately help in the management of natural resources.

The research presented in this thesis points to interesting areas of further investigation. Based on the implication that actors act differently depending on the frame they draw on, important questions for further investigations would be: In a concrete science-policy communication situation, how do the participants frame the science-policy communication process they are part of? Who do they frame as participants of the science-policy communication process? Are they aware of potential differences in understanding of the same process?

Also, the implication of potential misunderstandings due to different science-policy communication frames could be further studied. Frame theory suggests that to address misunderstandings due to differences in frames, actors should engage in reframing of, for example, science-policy communication. Hence, the following question could be asked: Do actors taking part in the same communication process engage in reframing regarding the process?

Additionally, the critical frame emphasizes that science-policy communication is situated in a power context. Concretely, the frame draws attention to that the presence of a weak government can influence the framing of science-policy communication in such a way that the researcher takes on the role of a critical facilitator. Hence, it would be interesting to find out what power relations exist between scientists and politicians, for example in a context where there is a weak or a strong government, and how those relations affect science-policy communication.

Lastly, and maybe going a bit away from the focus of this thesis, the critical frame highlights the importance of building relationships between the researcher and the other stakeholders. This raises the question: How does relationship building look like between actors participating in science-policy communication? And what importance does trust play in these relationships?

To end, realism and constructivism are different worldviews and each contributes to the understanding of science-policy communication with something that is not visible form the other perspective. Thus, the research in this thesis adds to the realist approach of the environmental science and policy literature to broaden the knowledge about science-policy communication.

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Appendix 1 Codebook

Example codebook. The codebook guided the analysis for the science-policy communication process frames and the identity frames in relation to the science-policy communication process.

Frames	Frame category	Definition	Example	Coding rule
Science-policy communication process	Diagnosis of the situation (D)	Language used to describe the science-policy communication process, e.g. through metaphors, verbs, adjectives	"So what I mainly did was to work in one island, Palawan, which is also a province: working with the different actors, the indigenous groups, and stakeholders – to study the impacts and trying to identify improvements in governance and through regulations or negotiations between the parties and so on. There were many parties".	I think that there is a reference to the process of science-policy communication*
	Action bias (A)/ suggested solution(s)	explanations/ descriptions/ suggestions are given to improve science-policy communication	"But a learning for me was that if you would like to actually contribute in a more substantial way, then it's better to be a bit more rooted somewhere and do your work where you are, locally, where you can build up relationships over a much longer time. You can be in place for not just a couple of months, but actually be part of the everyday. Otherwise, it's a risk that it's too transient to be a meaningful actor".	I think that metaphors or other descriptions are used that describe how science-policy communication* should be done
Identity	Diagnosis of the situation (D)	Language used to describe the researcher in relation to	"The provincial government, their role was as a stakeholder or an informant. –	I think that there is a reference to the researcher in relation to

		science-policy communication	The formal collaboration was with the state university. – I met them many times in interviews and in meetings and they joined the workshop in the end. I suppose, I did, or we did initiate the meetings with them, saying, "Hey, we do this study, can we come and talk to you?" And they said, "Yeah, why not." And then we had a chat".	science-policy communication*
	Action bias (A)/ suggested solution(s)	Language used to refer to how the researcher behaves in relation to science-policy communication	"I don't know how much I contributed to those meetings. I guess, in the beginning, I was mainly asking questions, trying to understand. Maybe that's a contribution: I would come back and say, "But you told me that your office had done this and that, but the cooperatives still tell us that it's just a mess in the field still. Why…It hasn't helped with the support you provided. Do you know why this is the case?" And then they would try and answer that question".	I think that there is a reference to the researcher's behavior as a participant in science-policy communication*

Note: Science-policy communication regarding my initial understanding of and the practitioner's understanding of science-policy communication (see Foreword).

Appendix 2 Interview Guide

Hi, I'm Lara, I am a Master student at SLU in Uppsala and I am working on my Master's thesis right now that focuses on science-policy communication.
Maybe you can introduce yourself briefly
Are you still okay with doing the interview today?*
I am happy to talk with you today about your experience with how you communicated and interacted with political decision-makers, such as politicians and civil servants, within the Philippine project. I am interested in what makes that communication and interaction rewarding and challenging and what you've learned a lot from.
Before we begin the interview, I just want to record the day and place and who is talking.

Interview
Interview with Rasmus Kløcker Larsen and interviewer Lara Hensle at Stockholm Environment Institute on the 22nd of February, 2018.

Let's begin, first I will ask some personal, work related questions.
Part 1: Life Story and Experience
I want to understand how and why you ended up working at SEI, so what led you to work at SEI?*
   What have your positions at SEI been? (facilitator? Researcher?)*
What kind of literature are you inspired by in relation to the communication and interaction between researchers and decision makers?*
Extra useful articles?
[Can you briefly explain the concept of participatory action research?]*

Part 2: The Practice Story
Let's move on to the Philippine project. Can you give me a short summary?*
   Where in the Philippines is it located?
   How many people live there?
   Who are the main actors?*
   How are the scientific actors involved in the project?
   How are the political actors involved in the project?
      What was the issue?
      How did you get involved?
[And that's when most of the action that you were involved in was happening?]*
[What were your contributions to those meetings?]*
When did you first get into contact with the municipal and provincial government? How did you do that?
Was there a moment where you have been emotionally engaged? For example, where you were upset?*
Was there a moment that was particularly significant for you?
How did you work together with the municipal/local and provincial government?
[How was your work as a researcher connected to the provincial government, was there some connection there?]*
   When and how did you get in contact with them?*
Where there moments when you handled the communication with them well?*
How did you handle challenges in your interaction with them?
How did you make sure that you followed your own research interest?*
How did you make sure that you followed the interest of the local/municipal government or the provincial government?*
Did the communication between you and the municipal government/provincial government fail in some ways?* How?

What might you have done to prevent those areas of partial failure?
What was most rewarding?
How did you contribute to making it rewarding?
What kind of results did the project produce regarding science-policy communication?* (research used? Co-create knowledge?)

Helping questions:
How was it that you …? How did you come to …?
"We" means whom?
So what did that mean for your project?
What did you do?
How did you handle/how did you respond to?
Do you believe what they say? Sounds like everything fell into place
You mean they were angry/confused? Can you put that in words? I can't capture that on audio.
Can you give an example?
Flexible questions:
What were the key relationships that mattered most?
Tell me about your specific role and contributions in this project. Let's start with the first thing you did. What was it?
Were there any key turning points in this project?
Were there any surprises?
What were the key sources of support or resistance you encountered?
Tell me about some of the memorable characters in this story (the ones that give this story color, or brought in drama, comedy, conflict, etc.)
What was most difficult or challenging?
How did you deal with challenges?
If not yet answered:
Tell me about your specific role* and contributions in this project. Let's start with the first thing you did. What was it?

Turning to reflective questions
Part 3: Reflections and Lessons
If you could do this project over again, would you do anything differently? Why, and what would you do?
Was the relationship between researchers and policy makers different at the beginning of the project and after the project?* → helps to know what he was striving for, might help to see the diagnosis and action bias
What does the project you've just talked about tell us about the central benefits and challenges of science-policy communication?*/communication between researchers and political decision makers? → only ask about that if that is an important metaphor for him, if he has used that in his story
What does communication between researchers and political decision makers mean to you?
What was your most valuable lesson learned?
What's next for you in your work? What are you looking forward to?

> What are the lessons for someone like me, or for a junior colleague, who might be embarking on a project similar to this one?
> Do you view your contributions as successful? In what ways? What specifically was accomplished?
> Do any metaphors come to mind to describe the kind of work you do, especially in this project? (If needed, give examples like "orchestra conductor," "coach," etc.)

What does the project you just talked about tell us about bridging research and policy-making? (should I use bridging? That's the language the SEI website uses, but not necessarily the language I agree with)
When you think of the future of the kind of work you've talked about here, what gives you a sense of hope? What makes you concerned or worried?

[What do you, in your own words, what do you understand as policy impact?]*

End
Thank you very much for your time and your story and I will let you know once I have edited the transcript and then we can set up a time over the phone or in person, to go through it.

Note: The questions marked with a star* were the questions I asked during the interview. I slightly reformulated some of them during the interview to fit them to the context. I also added some of my follow-up questions [in brackets] that were not part of the interview guide, however, I wanted to include them here because I consider them relevant for how the interview had developed.

Appendix 3 Theoretical Concepts Literature

Literature that was used to create the literature reviews on the concept of boundary organizations and Mode 2 knowledge production.

Boundary Organization Literature

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Mode 2 Knowledge Production Literature

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