The role of weather and sea-ice information in Arctic Expedition Cruising

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For quality of life

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This study has been a learning process for me. It helped me to realize what is most important for me in a research project but also what the strongest motivational factors were that kept me working with a good spirit.

When I look back to the beginning, the ambitious goals we had and the product that emerged, I can clearly say that I learned how important it is to focus and that it is not necessarily of advantage for such a study if one wants to save the world with one Master thesis.

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This study was not only a learning process but also a milestone in my life and without it I would not, at this moment, be sitting in an office, looking at the fjords and mountains of the Arctic.

Abstract

Climate change is making navigation in Arctic waters more unpredictable, for example when it comes to sea ice conditions, weather, wind and waves. To enable responsible and safe expedition cruise practices a range of weather and ice information sources and systems are currently available, and there is a continuing drive of public and private sector institutions to further develop such environmental information services (e.g. SAON, YOPP). However, what and how information sources and systems are currently used by expedition cruise operators in various decision-making contexts (e.g. planning, operations) is not known, let alone what the weather and ice information needs of operators are to continue satisfying customer expectations in a responsible and sustainable way in the future. Further, little is known about the role of weather and ice information in the Arctic, its actors and the production and distribution processes of different types of weather and ice information. The focus of this study is on the particular role of these information and information systems in expedition cruise practices in the European Arctic and its connection to the society it is placed in. The aim was to obtain a sound understanding of which weather and ice information sources and systems are used, why and how. For this purpose, interviews were conducted with representatives of expedition cruise companies, with different positions, as well as with relevant actors in the Arctic. The findings showed that weather and ice information and information systems play a central role in expedition cruise practices. The unstable conditions determine which actions need to be taken in order to guarantee safety and tourist satisfaction. Further, the results made clear that the role weather and ice information, risks and safety play in this industry are deeply connected to and determined by the role they play in the Arctic, as a whole. In addition, it became clear that overall better internet and more updated ice information are necessary to enhance expedition cruising in the Arctic.

Keywords: Climate Change, Expedition Cruise, Arctic, Tourism, Information, Risk Society

Contents

1. Introduction

In the last decades, society has been increasingly faced by complex environmental risks with uncertain consequences. One of these systemic risks with global significance is climate change. An area where this new phenomenon is most noticeable is the Arctic. It is among the most rapidly warming areas of the planet and has been facing considerable changes over the last decades (Dawson et al., 2014). Expedition cruise tourism is among the first industry's that is to seize the opportunities and face the challenges arising from these changes. Johnston et al. (2012, p. 70) define expedition cruise tourism as involving "*small ships, with a capacity for perhaps 40 to 100 passengers, and thus the ability to access landscapes and settings that defy the larger ships more common elsewhere"*. For this sector, among the many aspects determining climate change, the one being most influential is the melting of sea ice (Dawson et al., 2014). It makes former inaccessible areas available for arctic cruise tourism as well as extending the season in which they can operate in these areas (Stewart et al., 2007, 2012; Pizzolato et al., 2013 in Dawson et al. 2014, p.88). However, the thinning of the Arctic sea ice cover is not only creating opportunities for navigation but also hazards because waters become less predictable (Hall and Saarinen, 2014; Stewart et al. 2011; Lamers and Amelung, 2010). New challenges will also emerge through increasing extreme weather events (Harsem et al., 2011). A study by Kolstad and Barcegirdle (2008) found that hurricanes and polar storms will increase in the future which could have significant impacts on expedition cruising. Consequently, climate change will influence the weather and ice conditions under which cruise companies operate, in multiple ways.

Navigating vessels through polar waters has always been determined by complex, unpredictable and uncertain weather, wind, wave and ice conditions (which we will refer to as weather and ice information in this study). Because of climate change the unpredictability further increases and navigation is becoming even more dependent on accurate and effective information delivery (AMSA, 2009). For the planning as well as for operational decision-making, expedition cruise operators need reliable information systems providing up-to date services to be able to meet tourists' expectations regarding experiences of ice and wildlife. There is a variety of sources and systems available providing different types of information on different temporal and spatial scales

(Lamers et al., 2014). What sources of information exist and which ones are used by operators and how, is currently not known, which could result in implications for safe navigation practices and sustainability. What however is certain is the fact that current information services are not adequate to support activity in the changing Arctic in a safe manner (Haavisto et al., 2016; AMSA, 2009; Smith and Stephenson, 2013). To enable effective and sustainable decision-making, accurate and reliable information systems are needed. In order to develop such enhanced services, information is needed about the current use of existing sources and systems in different decision-making contexts. Further, to enhance the understanding of why certain information systems are used and others not, it is relevant to take a close look at the context expedition cruising is placed in. An investigation of the role of main actors around the expedition cruise sector will provide an insight into the role weather and ice information plays in the Arctic, as a whole. This might explain certain behavioral patterns in expedition cruising, their underlying reasons and how everything is connected.

Therefore, the focus of this study will be on the role of weather and sea ice related information and information systems in operational expedition cruise practices in the Arctic. The aim of the study is to provide in a first step a sound baseline understanding of what practices related to the use of weather and ice information and information systems are. Further, the relevance of such information for expedition cruise operators will be investigated. In a second step, the broader environment in which the expedition cruise sector is based, will be studied. It is anticipated to understand how the role that information plays in the expedition cruise sector is connected to or influenced by the society and context it is embedded in. Further, the connection between risks, safety and information shall be investigated. Thereby a close look will be taken at other actors, especially the information supply sector. The aim is to identify which information are out there and why, in which form they are presented and what role these information play in order to reduce risks and provide safety in an uncertain environment. This will provide a fundamental understanding of the role of information in decision-making in the context of expedition cruising in the Arctic and thereby foster creating a safer and more sustainable industry.

1.1. Research Objectives

The aim of this research is to get a better understanding about the different information systems for weather, wind, wave, fog and sea ice (weather and ice information) and the role this information plays in expedition cruise practices. Understanding which systems and what types of information are used by different expedition cruise operators, for operational decisions, is a preliminary asset. Further, it is necessary to take a look at the role of different actors in the broader context of expedition cruising, especially the weather and ice information supply network. It will help providing answers to the questions of why certain information is used and others not, as well as information accessibility, the main challenges and limitations. Further, a look at the workings of the environment of the expedition cruise sector will help to explain what role information play in terms of minimizing risks and underlying reasons that are behind decision-making practices. The answers will in a long run enable creating safer navigation practices, help satisfying tourist's expectations and allow establishing more sustainable operating practices.

1.2. Research Questions

1.2.1. How is weather and sea ice information used in expedition cruise practices in the Arctic?

1.2.2. How does the advancement of weather and sea ice information affect the characterization of the Arctic as a risk zone?

1.3. Subquestions

1.3.1. How do practices differ among different professional groups within Arctic expedition cruising?

1.3.2. What, how and why are particular weather and sea ice information systems used?

1.3.3. What are the information needs of expedition cruise operators for operating in a safe and responsible way in the future?

1.3.4. What role do risks and safety play in the Arctic and how is this connected to the role of weather and sea ice information in expedition cruise practices?

1.4. Reading guide

This study is structured as following: we start with a description of the theoretical framework applied, discussing the theories chosen and their use for this study. In the third chapter, we describe my methodology, data collection and analysis. The next chapter is an analysis of the findings regarding the role of information in the expedition cruise sector. This is proceeded by a chapter on the findings regarding the relationship between weather and ice information and risk creation in the Arctic. Chapter six, contains the discussion with reflections on the research and last the conclusion is presented stating the main results and answers to the two main research questions.

2. Theoretical framework

In this study, Ulrich Becks concept of reflexive modernity will be used as a theoretical baseline for schematizing the role of environmental information and reflexive decision-making in the Risk Society. Further, practice theory as developed by Elizabeth Shove et al., will be applied to look at the usage of weather and ice information in operational practices of expedition cruise operators in the Arctic. This theoretical framework will enable understanding what, how and why certain weather and ice information and information systems are used, the role of risks and safety, and allows making suggestions for enhanced weather and ice information provisioning.

2.1. Risk Society

"By 'Risk Society', Beck refers to an epoch in which the dark sides of progress increasingly come to dominate social and political debate." (Beck, 1992 in Fischer 2001, p. 49) This sentence describes precisely climate change as one of the new systemic risks that society and in this example, expedition cruise operators are facing today. However, before we dive into the topic let us outline what exactly Beck refers to when he talks about Risk Society.

Beck's concept describes how society is facing a new era of risks. These risks are increasingly intangible, invisible, uncertain, unpredictable and complex and lead to society being more dependent on experts to solve them (Beck, 1992). According to Beck, we are now in an epoch called reflexive modernity. This concept stands for a society becoming increasingly aware of their dependence on scientists and knowledge institutions to solve the new risks that they sense. Further, it pictures how this awareness as well as noticing that these institutions are failing in effectively dealing with those new risks, leads to people losing trust in policy and science. As trust in science is decreasing, it becomes more dependent on public support, which leads to it being increasingly politicized. This politicization then entails that people do not know whom to trust anymore. As a result, more actors are involved in knowledge production processes, which consequently end in an information overload. It will be based on complex decision-making processes based on diverging perceptions of different

stakeholders and their knowledge domain. Therefore, this concept enables us to schematize the broader context in which this study takes place. It allows us to take a look at the role that weather and ice information play for different actors at different levels of society, as well as the role risks and safety play and what influences this might have on practices in the expedition cruise sector. Therefore, a look at the broader context could deepen the understanding of why practices in expedition cruising are the way they are and what implications this would have for creating a safer and more sustainable industry.

In the case of expedition cruising in the Arctic, Beck's concept is well applicable for the purpose of schematizing a theoretical framework. As mentioned above, climate change is one of these new unpredictable risks he is talking about. It affects all nations, its consequences are unclear and even more uncertain is how to solve them. In the Arctic one group of actors majorly intertwined in the changes occurring, are the expedition cruise operators. As Johnston et al. describe, "*Expedition cruising is at the forefront of one of the major changes affecting the Arctic related to climate change: the reduction in the extent of sea ice and changes in its distribution*." (Johnston et al., 2012, p. 70). Apart from benefiting from new areas opening up, they also have to face the increasing uncertainties regarding weather and weather and ice conditions created through climate change. This new risk thereby deletes boundaries between different social groups as they are all equally affected. It is well demonstrated in the expedition cruise sector where a high level of cooperation exists. The difficult environment in which they operate and the high risks they face makes them unite, as they are stronger together. Another reason for this cooperation is that governments and other authorized institutions are not capable of solving the problem of creating a safe environment for vessel navigation. Under these circumstances, new actors emerge. One of these actors is the Association of Arctic Expedition Cruise Operators (AECO), which unites companies undertaking expedition cruises in the Arctic. Its purpose is "t*o ensure that expedition cruises and tourism in the Arctic is carried out with the utmost consideration for the vulnerable, natural environment, local cultures and cultural remains, as well as the challenging safety hazards at sea and on land."* (AECO website). These and many other new emerging actors take on the role of gathering and providing information about the Arctic environment, navigation, tourism and so on. This phenomenon of international

actors uniting is explained by Beck as following, global risks "*tear down national boundaries*" (Beck, 2006, p. 331) as they are perceived as "omnipresent" and lead to an increasing interdependency between global actors.

Next to the institutions generating expertise knowledge, also a variety of private actors exists that is involved. One of these actors is the weather and ice information supply sector. They are the ones producing and providing weather and ice information and information tools. As it is uncertain how to best foresee weather and sea ice in the face of climate change, different companies provide different information, predictions are based on different assumptions and different tools and sources are being used. It leads to different and maybe contesting information being provided to cruise operators that base crucial decisions upon this data. How do they know which system is most accurate or most suitable for their purposes? Which information provider do they trust and use for planning and operating a route that needs to be safe and satisfy tourists' expectations?

These are questions that cruise operating companies face and regarding the complex environment in which these decisions are taken Becks statement that "*Risks always depend on decisions – that is, they presuppose decisions"* (Elliott, 2002, p.295) describes the situation perfectly. Following, we can look at any decision taken in the operational phase of expedition cruising as a production of a risk. For example, the decision to take a specific route creates the risk of encountering floating multi-year ice or hitting an ice block hidden under the surface. With this in mind, the emergence of more choice within the Risk Society, as a consequence of diminishing traditions and fixed structures, can be seen in the expedition cruise sector. Here, with the emergence of the possibility to navigate in Arctic waters and undertake expedition cruises in these regions new choices were created. Especially the question of choice regarding weather and ice information systems is of relevance for this study. With more actors involved in the knowledge production and more ways to produce this knowledge, multiple suppliers of information systems provide these services, thereby making the decision-making process complex and complicated. This leads again to a situation in which the question of who to trust becomes apparent.

Another aspect of the Risk Society concept is that modernization is producing new risks that society is often not aware of. With this in mind, expedition cruise tourism can be seen as an invention of modernization thereby portraying a new risk. Namely, as undertaking such a cruise is a risk in itself due to the uncertain environmental conditions but also as creating a potential harm for the environment, for native inhabitants and wildlife. This is particularly true, as of the long-term consequences of expedition tourism not much is known yet. Another area in which this concept is visual is of course climate change as a new systemic risk steering decisional processes in expedition cruising. This is due to the fact that decisions need to be adapted to this new environment. The degree of awareness of this new risk within the sector and among tourists is most likely unequally distributed. Therefore, different perceptions exist which leads to complex and conflictual decision-making processes and discourses. However, according to Beck, the Risk Society is determined by an increasing awareness of risks and with that an increased desire for safety (Beck, 1995) which is well portrayed in the expedition cruise sector. Here, safety is most likely one of the fundamental aspects guiding cruise operators' decision-making, as accidents would probably have devastating consequences for the company and the sector. In addition, tourist's will only undertake trips that seem safe to them, so their perception of expedition cruising is highly relevant for the business.

There is not much known about the broader society connected to weather and ice information. What are the main actors in the supply sector and what are other actors in this context. Therefore, it is also of high interest to find out what role this information plays for other actors, how it is placed in the complex environment of climate change and how it might be connected to the expedition cruise sector. Moreover, the question of decision-making and how risks are dealt with in this process, how they are created but also what actors are part of this process, is of key interest. How do they try to reduce risks and what role does information play? In this context, also the question of risk production through science becomes apparent, as they try to manufacture new technologies operative in the new environment of climate change and weather uncertainty. If these new risks have been produced through humankind developing new technologies and industries then there are possibly also negative consequences created

within the broader society. Another point of attention is the role of distrust in science that might play a role in this sector. Distrust might thereby affect the knowledge production and lead to different reactions, like a loss of clients and different methods to guarantee reliability. It is also anticipated to see what the main actor groups are involved in the information production and distribution and what the main differences are between them and their products. Willard (1996) proposes that this is the phenomenon of "*high public ignorance, low level of participation*", meaning that many people do not know how climate change is really developing, what its exact consequences are and how to best handle it but still want to participate in the knowledge production and discussion process. Last, the role of objectivity and reliability in the weather and ice knowledge production process are a key aspect. This is described by Beck as *"the prevailing theoretical self-concept of science implies that the sciences cannot make value judgements with the authority of their rationality. They deliver so-called 'neutral' figures, information, or explanations, which are to serve as the 'unbiased' basis for decisions on the broadest variety of interests. Which interests they select, however, on whom and what they project the causes, how they interpret the problems of society, what sort of potential solutions they bring into view—these are anything but neutral decisions"* (Beck, 1992, p. 174). The way in which this society deals with these issues, communicates them and especially the role of uncertainty, safety and the way of handling risks are points of interest. These and other questions arise regarding the topic of Risk Society and the role of weather and ice information.

To sum up, the concept of Risk Society will enhance the understanding of operational processes within the expedition cruise sector by explaining the role risk and safety play in the broader society concerning weather and ice information production and usage. It will help to clarify the relationship between information, risks and safety.

2.2. Practice Theory

Practice theory is a framework created to enable investigation of social phenomena. Modes of acting and behaving in particular environments are the basis of the model, thereby putting the practice in the foreground and not the individual (Shove et al., 2012). According to researchers like Schatzki (2002) and Rouse (2007) it has a high

explanatory force as it includes multiple dualistic aspects like mind and material, knowledge and action thereby allowing a holistic view at the social world (Nicolini, 2012). As summarized by Nicolini (2012, p.6) practice theory "*emphasize that there is some type of productive and reproductive work (…), forces me to rethink the role of agents (…), foregrounds the importance of the body and of objects (…), sheds new light on the nature of knowledge (…), reaffirms the centrality of interests and power in everything we do*." Multiple practice theories exist with diverging concepts (Nicolini, 2012). One of them is Shove et al.'s model which functions an interesting theory to take a close look at the dynamics of expedition cruising and operators' practices regarding weather and ice information. This is due to the fact that her model distributes practices in three parts whereby each provides an insight into a certain aspect of a practice. The information retrieved by looking at all three of these aspects individually enables the researcher to get a sound understanding of a particular practice and a part of our social world. In their model, they unite key ideas of different practice theorists, like Schatzki, Reckwitz, Giddens or Bourdieu. According to Shove et al., practices are constituted of combinations of three elements: materials, competences and meanings.

Competences describe the skills related aspect of the practice providing the researcher with information about what knowledge and skills are relevant to pursue a specific practice. In this context this means looking at what competences are needed to use different weather and ice information technologies but also at what skill is needed to process a certain information retrieved and to turn it into a purposeful decision.

Meanings stand for the personal relation a practitioner has with the practice and gives insight into why the usage of this practice is relevant for the practitioner. In this case, looking at this aspect of a practice will enable us to understand why a person uses a specific information or information system, what its relevance is for the navigational or planning process.

Materials are all the tangible parts connected to the application or execution of a practice and provide information about the accessibility of a practice to people. In this study, it includes all technologies that are needed, the ship itself, the office, the physical environment as well as the costs of using it.

Looking at each of the three elements and their interrelationship will enable us to obtain a clear picture of the role each element plays in different practices and how they make up decision-making processes. It will tell us something about the relevant aspects of an information, the needs, the decision-making factors and what role an information has in operational activities.
Another interesting point mentioned by Heidegger is that we unreflectively use specific materials in specific practices and we only become aware of them as individual objects when they do not function in their normal way anymore. He explains this by the example of a carpenter and a hammer. He says that the carpenter uses it unthinkingly as it is part of the everyday work environment but becomes reflective of its value and identity when it is broken or lost (Heidegger in Nicolini, 2012). This theory is interesting for my research because in the Arctic the material environment is changing, namely the weather and ice conditions. They are very unstable and decision-making needs to be flexible. Following, in this study it is assumed that there are, on the one hand materials that are used in an unreflective way, as described by Heidegger, like radar-systems. On the other hand, there is the material environment surrounding and part of the practice in form of weather, waves, wind and ice that is constantly changing and forcing the practitioner to act reflectively. This means depending on the weather condition he/she needs to adopt the practice (e.g. apply other skills, change the tool/material).

This fact makes it interesting to analyze what happens to other material entities, such as information and communication systems and ship ice classes, but also to the knowledge and skills needed to use such systems and their relevance for expedition cruise operators. It needs to be investigated how the elements of the practice adapt to the changes in the material environment. Further, Nicolini picked up another interesting idea of Heidegger namely that "*Practices are always oriented and they are performed in view of the accomplishment of the meaning and direction that they carry*" (p. 224). Taking this into consideration, could help us to understand what drives actions in the expedition cruise sector and realizing why things are done the way they are. This is connected to the assumption of Schatzki that people do what seems logical for them to do (Nicolini, 2012, p. 162). If the environment changes, flexible responding is required that is probably led by what seems logic to do which is based on competence, training

and knowledge about what to do in what circumstances but also intuition and personal judgements of the situation.

Part of practice theory are also a couple of other aspects that play a crucial role in understanding practices. To fully grasp a certain practice it is relevant to look at temporal and special attributes as well as possible rules that might play a role.
Time reflects a resource that different practices fight for. Further, a practice is often connected to a specific time of the day thereby being interwoven into the daily rhythm of a person. With this in mind, it becomes interesting to look at temporal arrangements of climate related practices in the operational phase. Do different practices take part at different times of a day but also does one practice always follow a certain other practice? Space, according to Shove et al. (2012) is defined by what goes on within it, in this way space on a ship is determined by the practices followed in a certain area of the ship. It will be important to look at what practices take place in which space and why. According to Shove et al., space and time are different from the elements of a practice as they are part of their structuring. Past practices thereby structured temporal and spatial settings as well as time and space being involved in setting future practices and being present during the enactment of a practice.

In expedition cruising time and place also play an important role in that they are part of the reflexivity. For example, the place a ship is in when certain weather and ice information appear very much determines the following actions. This is then also connected to the aspect of time so for example if the captain receives the information of a storm coming up it is of relevance for the practice in what position the ship is at the moment and how much time there is left till the ship meets the storm. It can be assumed that depending on the urgency to act different actions/practices follow. Thereby, place and time determine the possibilities and what practices can be taken into consideration. Connected to the time and space aspects, also rules play a part in the practice study. It is possible that a rule requires a specific practice to be at a certain temporal sequence, to take place in a particular location or to use a certain material. So for example, if an iceberg is hit, there are most likely procedures that need to be followed. These procedures thereby determine what needs to be done first, which tools need to be used and who needs to be involved. Further, rules can also determine the materiality of a

practice as well as the competences connected to it. With this in mind, it becomes clear that rules may play a crucial role in understanding a particular practice.

In practice theory the question of agency also plays a major role in terms of people being carriers of practices (Reckwitz, 2002) letting the action of an individual become trivial. Accordingly Rouse states "*The focus is thus not on the action of the individual but on the practice (…)*." (Rouse, 2007 in Nicolini, 2012, p. 5). In this case, this is relevant as the focus is not on what a specific person does but on what practice is connected to a specific weather and ice information thereby being irrelevant which person carries it out. However, what does matter is the position the carrier obtains as it is assumed that depending on the profession, e.g. captain, expeditioner, manager, different information are of relevance and with that different practices determine the scene. Reckwitz (2002) further states that if an individual takes over a certain practice he/she gets absorbed in the process of intelligibility, defined by Wittgenstein and Heidegger as the process of interpreting a practice on basis of a specific context and understanding of the situation (Nicolini, 2012). Further they state, that the individual thereby does not determine the meaning and emotions connected to a practice as they belong to the practice and not to the person. This is reflected in this study as it is not trivial why a certain information is important to an individual but why this information is relevant for the practice and for the whole process of expedition cruising. Thereby, each individual might interpret the situation a bit differently but the overall understanding and meaning connected to it should be similar for a specific practice. However, this again might be diverse for different occupational groups as information and the practices play different roles in different sequences of the whole expedition cruise process. For example, encountering sea ice could mean for the captain that he has to change the route whereas for the expeditioner it could mean having the possibility to sea wildlife and satisfying tourists' expectations.

Practice theory has been applied in environmental related research before, for example by Arts et al. (2013) in a project on forest governance. According to them, this approach enables a more holistic view on what is being done and why. It was further applied by them to investigate the relationship between the environment and human beings by looking at how the later responds to the environment. An important aspect he mentions

is the concept of 'situated agency' (Bevir, 2005) "*This concept assumes that actors' ideas, identities and behaviour are shaped in the context of the social practices in which they are situated".* (Arts et al. 2013, p.10). In the context of my research, this would mean that actors' behaviour is to a degree determined by the situation they are in. He states that people in everyday life behave in a routinized way but when they are facing unexpected events, they are able to perform other practices. In this study, we adopt a similar focus as that of Arts et al. (2013) by paying a lot of attention to the situation that the practices take place in. The reasoning for this is that the context in which expedition cruise practices take place is out of the everyday routine and determined by unpredictability. In this research, we will try to identify practices connected to weather and ice information by talking to personnel of this sector and analysing their stories. Practices, therefore, are being identified by what people say they do. According to Arts et al. (2013, p.14) *"the practice based approach accepts a broad range of research strategies and data sources."* amongst which is interviewing.

In order to apply this model, interviews will contain questions regarding all three aspects of a practice connected to the different weather and ice information needed and used as well as questions regarding the structural aspects connected to a practice. Obtaining this information will enable the researcher to gain an in-depth understanding of the current status of the weather and ice information in use and enable providing suggestions for future enhanced information systems.

2.3. Conceptual model

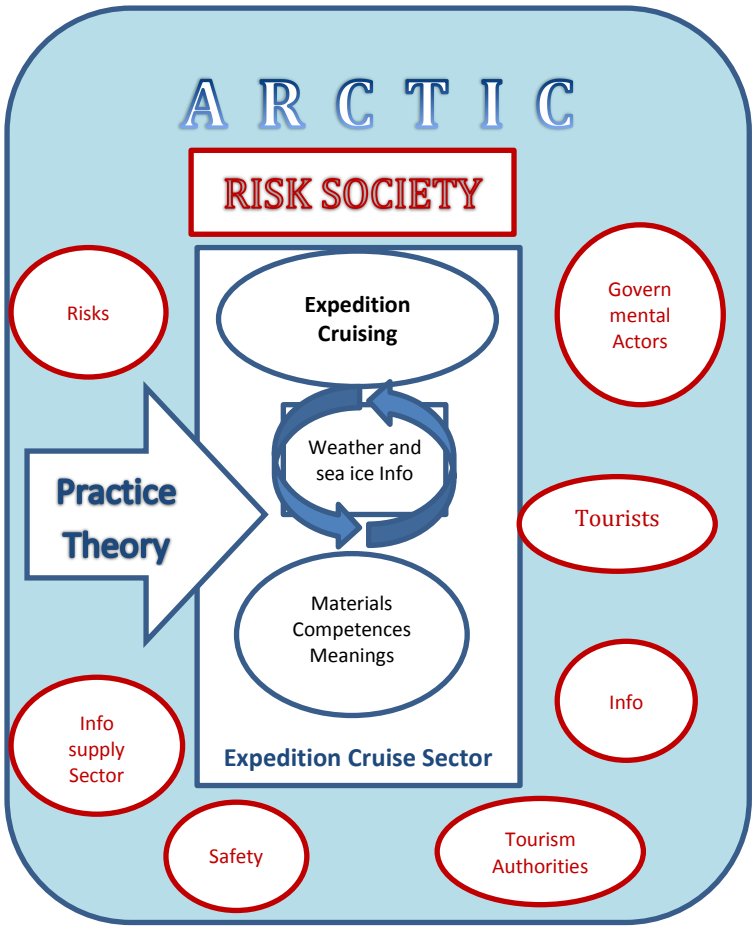

Figure 1Theoretical Framework Outline

The conceptual framework consists of two different domains (*Figure 1*). Nicolini (2012) describes this as a 'theory package' which requires the usage of one theory to zoom in on the details of specific practices in a specific field, followed by a second theory that enables a zooming out in order to see the practices in a broader context and understand their connections within the environment of the study. This method enables getting a holistic understanding of the role weather and ice information play for specific actors in the Arctic. It thereby, first enables us to zoom in and find out what particular role weather and ice information and information systems play in the expedition cruise sector, comparing practices of different actors in the operational phase. In a second step, it allows us to get an overview over the broader context in which these practices take place, informed by the Risk Society framework. It thereby enables us to investigate different concepts introduced in the Risk Society and the role they play as well as at the role of different actors regarding the usage, positioning and production of weather and

ice information. The Figure shows how the different elements of this study fit together. There is the expedition cruise sector that interacts with weather and ice information in different practices consisting of specific materials, competences and meanings. Thereby this interaction is positioned in a specific context. The use of practice theory will following enable us to look at the expedition cruise sector in more detail. However, as this sector is only a small part of this world we will use the Risk Society concept to get an idea of what is happening in the broader context. Therefore, we will take a closer look at the role of risks and safety, information production and so on. With this, we will enhance the understanding of the environment in which this study is embedded, what role different actors play and how everything is connected.

3. Methodology

3.1. Character of the thesis

We chose Ulrich Beck's concept of the Risk Society to clarify the special environment in which this study takes place. Further, we decided to use practice theory to investigate the usage of weather and ice information and information systems in Arctic expedition cruising. For this purpose, we applied the concepts of material, meaning and competence, time and place. The character of this study suggests the application of qualitative research methods. By using qualitative techniques, a more detailed understanding of the working conditions and the practices applied in the expedition cruise sector could be obtained. This was facilitated by doing semi-structured interviews. *Semi-structured interviewing is a very flexible technique for small-scale research* (Drever, 1995, np). This method allows the research to guide the interview and with that make sure that he/she obtains all relevant information while leaving enough space for the interviewee to express himself and explain his/her individual situation.

3.2. Data collection, sample

In order to get the necessary data for this study we decided to contact AECO, which represents about 80% of all expedition cruise operators in the Arctic. Therefore, they represent the biggest population of possible interview partners. To find interviewees all members of AECO, listed on their website, have been contacted, further a list of private contacts of the researchers supervisor where asked to participate. From there on, the snowball-technique was applied. "*A sampling procedure may be defined as snowball sampling when the researcher accesses informants through contact information that is provided by other informants.*"(Noy, 2007, p.330). This allowed us to not only interview representatives of the companies that are member of AECO but also people that work as freelancer in the expedition cruise sector and with that reach out to a broader scope of respondents. This allows the researcher to include more, different viewpoints and with that get a more complete picture. In general, interviewees were chosen according to their position within the expedition cruise sector. As the objective of the study was to get information about the usage of weather and ice information and information systems people interviewed worked either in planning-related or operational professions. These include managers, expedition cruise leaders and guides. Further, four

interviews were conducted with people from the information supply side including Arctic Web, the Alfred Wegener Institut and the Norwegian Meteorological Institute. The researcher used them to better understand processes in information provisioning, discourses and developments. This allows a better analysis of the current situation. Further, some participants answered the questions in form of a questionnaire. This way, data from 6 questionnaires was used, of which with 4 people also conversations in person or via phone followed, to clarify still unclear aspects. A list of the interviewees as well as the questions are attached in the appendix.

Last, interview transcripts from interviews conducted by Linde van Bets were used. She conducted interviews with a broader scope of actors in the Arctic. Next to expedition cruise operators, also ports and political bodies were interviewed. This data was mainly used in the application of the Risk Society concept to look at the role information, risks and safety play in the broader society.

These techniques allowed us to use data from 10 interviewees, 6 questionnaires and 18 additional interviews conducted by Linde van Bets. Interviews were conducted in person, via Skype, phone and online meeting platforms. This allowed the researcher to hold interviews with interviewees in different countries, these being the Netherlands, Denmark, Norway, Germany and France.

3.3. Data analysis

The data analysis was done by using a qualitative approach, which aligns with the data collection strategies. According to Arts et al. (2013, p. 14) *"(...) a practice based approach uses an interpretative perspective, which recognises that research findings are actively produced and interpreted by researchers (...)."*

First all interviews were typed out checked for spelling and grammar, partly translated from German to English and then transcribed. The coding was done according to methods of Boeije, which divide the process into three parts: open, axial and selective coding. This method is according to her very useful to give a structure to the data and organize them logically (Boeije, 2010). For the coding deductive and inductive codes

have been used. Inductive codes emerge from inside the text whereas deductive codes have been arranged beforehand. Deductive codes for example consist of the concepts that are part of the theories applied like time, place, meaning, material and competence from practice theory and risks, safety, uncertainty and trust from the Risk Society. Inductive codes where chosen depending on reoccurrence and relevance for answering the research questions.

In the first part called open coding, *"(…) the process of 'breaking down, examining, comparing conceptualizing and categorizing data'* (Strauss& Corbin, 2007, p. 61 in Boeije, 2010, p. 96). The researcher goes cautiously through the transcripts, looks for clues in the text and forms first categories. This way also inductive codes were gathered. In a next step the data was viewed with regards to finding data that corresponds to the deductive codes, formed beforehand. Slowly categories emerged that consisted of sentences belonging to a specific type of context and were assigned with an analytical label. Categories and labels were merged and exchanged.

The second part of the analysis, axial coding "*(…) is a more abstract process and consists of coding around several single categories or axes*."(Boeije, 2010, p.108). In this process categories are viewed in context to each other and it is tried to identify connections between them. The difference between open coding and axial coding is that in the latter the researcher focuses on the code and moves from there to the data (Boeije, 2010). Applying this, the categories were organized in a way they would help answer the research questions. The result of this process was that for example categories with practices regarding ice information or weather information and specific materials used, were formed.

The last step consisted of selective coding. It "*(…) refers to looking for connections between the categories in order to make sense of what is happening in the field*."(Boeije, 2010, p.114). Consequently, the categories were again viewed in context to each other, single pieces were connected and aligned in a way they create a story. For example groups were made according to operational or planning practices and operations was divided into practices of the main actors: expedition leader, captain and guides. These categories were then used to write a coherent story. They were organized in a way a

logical structure would emerge. The headings of the categories built the baseline for this. Last, the content of a category together with the application of the theories guided the creation of the storyline, thereby keeping the research questions in mind.

4. Role of weather and sea ice information in expedition cruise practices

In this chapter, we will apply what Nicolini (2012) calls 'zooming in'. Thereby, we will take a close look at the details of enacted practices in the expedition cruise sector regarding weather and ice information and information systems. The aim is to understand the role of information in the context of risk, uncertainty and unpredictability. It is assumed that weather and ice information contain an important part in decision-making in this sector due to the insecure environment it is embedded in. Therefore, it is anticipated to see how this unstable environment influences the materials, meanings and competences of people's actions as well as the usage of information and information systems. Thereby the overall goal is to understand why certain information systems are used and by whom. Further, the driver of practices is interesting to look at. Is the information steering the decision-making, so the material entity determining the practice, is the meaning behind it the decision-making factor or a combination and what role does the changing environment play?

Therefore, in order to unravel this complexity the expedition cruise sector needed to be investigated at a detailed level to provide an insight into the current developments of generating more and better information and information systems and the motives behind it. This will enable us to illustrate in the next chapter that the strive for evermore information is connected to or rather a result of the way our society works and the broader environment it is embedded in.

We will first take a look at what the findings reveal and analyse them using practice theory and then conclude the role of weather and ice information in expedition cruise practices. The results of the data collection and analysis thereby, give insight into practices of different areas of expedition cruising. We will explain practices that are part of the operational phase and connected to different actors. We will start with an investigation of the most relevant materials and connected competences and meanings and follow with an investigation of different carrier and their use of weather and ice information. Last temporal and spatial relevance will be explained.

4.1. Reproduction of weather and ice information in materials, meanings and competences

We will use the material entities as a starting point to explain expedition cruise practices, as this study is mainly about information systems and environmental conditions, both material components. The weather and ice information and conditions are thereby part of the element that is most obvious in the operational practice, the material, whereas the competences and meanings are more hidden and repetitive. Nevertheless, this analysis will also show how the weather and ice information always play a role for each of the three elements. By then putting the elements together we will get an idea of what is currently being used and why. This understanding will enable us to look at practices related to different actors within expedition cruising and compare what elements play a role for each group. Thereby, clarifying what role the user plays for the choice of specific systems. It will provide us with a more holistic understanding of the role of weather and ice information in general, in this sector, but also enable us to say something about the importance of this information for different actors and the meaning behind it. This allows us to make suggestions about what domains play a larger role in tackling current problems and what is needed by them to enhance their decision-making.

4.1.1. The impact of weather and sea ice conditions

In this section, we would like to demonstrate how the different elements come together in different practices thereby showing how crucial the specific constellation of a material, a competence and a meaning in a specific context is for the practices engaged in. This is to prove that there is not just one information system to be used for each weather condition but that the usage of each system is dependent on the specific context. Meaning, the environmental conditions together with the competence of the carrier and the meaning connected to the situation are indispensable for determining what is being used and done.

Concerning the material entity, the changing environment and the different weather and ice conditions play a crucial role as the material part of a practice. Thereby, different types of ice, the coastal effect and drifting ice are aspects that determine navigation

practices (OP, TJ). Also wind conditions, waves and snow. *"I look into wind direction, wind speed, waves, sea ice cover, sea ice drift. Temperature is not important. Rain is annoying but not a reason to stop an excursion."*(FK). Each of these conditions in itself is connected to the information needed. Further, each of them requires different competences such as reading charts and instruments, calculating distances, judging the impact of wave heights. Again, also each of these competences is connected to the information used. This connection of the element to the information, we also see when it comes to the meaning as waves at a certain height mean danger or drift ice coming from a particular direction at a certain speed might mean having to turn around to be safe. Nevertheless, what a particular information means also depends on the goal in the particular moment leading to different competences being used. So to say, with the same weather information different competences are required whether the goal is to get quickly to the next location, providing adventure to the tourist or teaching something. Further, this constellation of the elements might again change depending on the context, like changes in weather and ice, different conditions coming together in a specific place at a specific time. This is to say that a specific information is not connected to a specific practice but the constellation of the elements of the practice with regards to the information make up the practice. Thereby the information always being part of each of the elements. We will now show what this means using a few examples.

4.1.2. Sailing boat or icebreaker?

One material entity that always plays an important role in the context of a practice are the ship specifics. This means that it matters if and what ice class the ship has, maximum speed, technical equipment, type of vessel and size. *"If you have a fast ship you can decide to make a detour on the way to the place you want to go."*(MD). This shows that for a fast boat the information of drift ice coming means something else than for a slower boat, leaving them with different options. Further, ice class is another one of these materials. Currently most expedition ships have no ice class but this will change in the future with the new regulations in the polar code that will require all ships to have a certain ice class. *"The new polar code will regulate this in the future so that you will need a certain ice class. Most have the lowest ice class if any at all."*(TJ). Consequently, ships that now have no ice class but in the future navigate the same route with ice class the information they

receive will mean completely different things and following lead to different activities. We see that these material entities are important in expedition cruising because they determine what a ship can do in different situations. The ice class determines through how much ice a ship can go, the speed determines how much detour a ship could make, the equipment determines how much information a ship has available for decision-making and the size is relevant with regards to how many passengers it has and with that where it can go onshore. These details play a major role when it comes to the satisfaction of the tourist. Especially with regards to sticking to the scheduled departure and arrival times but also with regards to where you can go and what you can show tourists. *"With paying passengers you cannot afford delay, ice strengthened ships help but still you have problems with sea ice."*(KK). However, these ship specifics do not alone provide clarity about what can be done in different situations, as different competences are required for different types of ships whereby a sailing boat requires other skills than a cruise vessel, faster speed requires better navigational skills, different ice classes require different levels of experience and other skills. Again, depending on the purpose of the cruise, whether it is for example sold as an adventure tour, educational cruise, or as a cruise for specific age groups. plays a role for the practice executed. Last, this all again then depends on the conditions of the environment and changes in it may lead to different constellations of competences, meanings and materials. This shows how always multiple factors come together and ship specifics thereby play a crucial role.

4.1.3. Wind force? Wave height? Check!

Another important material are the weather information systems that provide data about different conditions that are part of different practices.

A relevant tool for receiving wind and weather information are GRIB files. *"They consist of raw data from two big weather computers (there are two big institutions in the world, whose meteorologists interpret them) but they are also publicly available. You can look at wind, waves, rain, and temperature. It´s just numbers and figures, a graphical display."* (AR). Next to these, the barometer or barograph is used to get information about air pressure. *"With the barometer I measure the air pressure for the ship, it is written down every hour. Every ship has it, they are synchronized. Another thing is the barograph. You use it in that moment, it tells you if the pressure is up or down for the place you are in at*

the moment."(MD). These weather systems are important to provide data about the environmental conditions in a specific moment at a specific location. Depending on the conditions, different information systems are being consulted, influenced by the purpose of the consultation. Are wind conditions bad because drift ice might come closer quickly or is the wind too strong to lower the zodiac? Further, different weather conditions can come together and change the context (wind direction and speed, fog and waves etc.).

We can see that, on the one hand, the context in which these instruments are being checked is crucial but also the context that emerges from the data received. Further, to use them in the right moment requires skills and experience *"You need to be able to read a barometer, the egg code is quite easy, but it is not enough to read it, it is based a lot on experience, every time I learn new things."*(OP). Consequently, to draw the right conclusions from them, specific skills are needed "*GRIB files are not that easy, e.g. if you use a local GRIB they don't provide details and don´t show the coastal effect so I have to do it myself."*(OP). This shows that depending on the information received from the systems different actions follow. Either the plan is changed, ships in the area are approached to get further information and so on. These following steps thereby depend on the skills and experience of the decision maker, the outside conditions but also the meaning of the information, such as how relevant it is to get to a specific location and how safe it is.

4.1.4. Iceberg ahead

Compared to weather information systems, practices around sea ice information tools seem to be even more complex. The reason for this is that ice information are much less frequently available, more uncertain and less accurate which creates more complex decision-making contexts.

The data source used by all expedition cruise ships is the ice chart "*ice charts are data that are already looked at before and created by humans."*(MD). Ice charts play an important role as they reveal a lot about the amount of ice in a place and with that allow a ship or prevent it from taking a certain route. They are also easier to read than the raw satellite pictures because they have been processed and interpreted by experts. The ice information is revealed by the usage of the traffic light system, meaning different

colours signalise the level of ice cover and with that the accessibility of an area. *"Yellow is a maybe don´t go there if you have somewhere better to go to but maybe for polar bear views. Green means reduce speed especially in the dark, 1-4 of ice cover 1 means you can go full speed, for polar bear viewing you maybe go into the yellow but very slowly, orange zones you can maybe visit on the edge but you never go in. Further, red is a no go, its ice breaker style."*(TJ). Here, compared to weather conditions, it plays a highly crucial role what type of a ship is being used as access to specific areas relies on the amount of ice in combination with the ice-class of a ship. However, also the competence is crucial, as an unexperienced captain with no ice-navigation skills can also not take specific routes even with a high ice-class. In addition, here again the meaning of the ice information is relevant. For example encountering yellow ice would mean to go somewhere else if you can but yellow for a ship with a strict itinerary would more likely mean to go through the ice than for one that has full flexibility and can easily swop locations.

The situation gets more complex when ice charts are not available (as during the weekend). In those cases, satellite pictures are used. *"Satellite pictures are raw pictures not completely reliable because Norwegians don't work on weekends."*(MD). However, they are only used if necessary because, as mentioned above, they are more difficult to read as they are raw data and they are often incomplete because the satellite misses spots due to clouds and uneven circulation. This means that more skills are required to correctly understand them. Therefore, often satellite pictures are not considered and the ship simply calculates more safety buffer until more precise information are available. Which has the consequence that navigation is not as efficient as it could be. But again, the decision to use them depends on the purpose, the necessity, the skills available and overall on access to it.

The choice of the information source is thereby also highly contextual as usually information are used from the meteorological institutes of the area the cruise takes place in. *"In Greenland I use the Danish Meteorological Institute for weather and ice charts."*(KK). The Norwegian, Danish and Canadian ones are used most frequently. Next to these also the German Alfred Wegener Institute is used or Polar View. The latter are usually only consulted if the weather and/or ice situation is bad and additional

information is needed in order to still be safe, however this depends on the necessity of going to a specific place and on the value the user places on those additional sources.

4.1.5. Systems' dual role

The section above demonstrated the complex relationship between the practice elements when it comes to weather and ice information and its systems. We argue that there are systems being used that either reduce or intensify the complexity of decision-making in specific contexts.

4.1.6. Being connected

A lot of the information used on board is received via the internet *"ALL over the internet, no hardware, if no internet no information."*(MH). However, if and how good of a connection there is depends on the location of the ship and the size of the ship. *" Not all ships receive the data well because they don't have good internet connection, most ships use it through the satellite connection but bigger ships have permanent internet connection and can download more and constantly."*(AR). In case of a good internet connection, for example information can be updated, different sources can be used. In this case, decision-making is enhanced. However, in case of no internet connection, more difficulties are being met and depending on the environmental conditions and the goal the decision-maker needs to engage in more activities to get the necessary information. Therefore, the meaning of the internet on board is to be connected and have access to information.

Further, the internet connection is not only relevant to the crew but also for the tourist. For them it also is a medium to get information, to control whether the conditions are really as bad as the expedition leader said when he/she cancelled the landing but also a medium to be in touch with the outside world. However, for the tourist it is not a safety issue to have or not have access to information, as it is for the crew and therefore receives a different meaning.

4.1.7. Breaking through isolation

Another set of tools that is relevant for the practices are the communication devices. Communication is used a lot to share weather/ice information, to receive and provide updates from/ to the office and/or other ships. *"Through news updates information is shared but you also send info out immediately to other ships and to the AECO secretary. An official update is published one or 2 weeks later."*(TJ). For this purpose, mainly the internet is used as a medium in form of emails, but also radios are being used and the satellite phone. However, a major problem is that communication possibilities are very limited in the high Arctic and it is a current need to enhance these services. *"I want to improve communication, because currently the cell phone coverage in the fjord is bad. For ship to ship communication, VHF communication is used. For ship to shore, they report computerized data. But above 65° north, the system does not function well."*(KB). The relevance of communication tools lays in the fact that sharing information is crucial in expedition cruising. This is explained by the fact that the information available is often incomplete, unprecise or simply not available at all. Therefore, sharing with others increases the overall knowledge of all. Thereby, these tools mean, for the crew, that they can ask for help, provide help and have another source for obtaining information in risk situations.

Communication is used in many different contexts but plays a major role in emergency situations. Here it is used to get information that the crew does not have on board but considers relevant in a specific situation. In this case, the communication can be used to enhance decision-making. However, it can also lead to a situation being more complex when information received is not interpreted correctly or different people provide contrasting information. For example, a ship can receive the information that the ice situation further north is not bad and the crew can proceed on its way up north. However, this is only true if ships have the same ice class, speed and so on. Therefore, it is relevant that the person asks the right questions and interprets them correctly, which requires experience and knowledge about the area. What is further interesting is that communication seems to be a part of a serious of practices in most cases. This is due to the complexity of decision-making and the necessity to check different information sources, put them in context of time, place, goals and ship specifics. In this set of activities, communication is indispensable with regards to exchanging thoughts about

information, discussing their meaning and possible solutions. Further, communication is so elementary as it is one of the major sources to get information but also to provide them.

4.1.8. Additional information needs

In addition, there are tools being used to receive more general information like AECO, arctic web and others. A relevant tool provided by AECO is the schedule system where all members have to book landings. It plays a major role in the overall organization of the expedition practice and it is closely linked to safety issues in terms of sharing each other's locations. *"The schedule system is also relevant for safety, it is good to know what ships are nearby, and for knowing who is where. It is one of the most important tools in the Arctic"* (TJ). The schedule can become a problem in specific situations, as it limits the amount of ships in a specific location. Therefore, in case of having to change plans due to the environmental conditions, the schedule needs to be checked before a new location can be chosen. Is a location already taken, different conclusions need to be drawn. Here competences such as good knowledge of the area play a crucial role but also the meaning, whether the purpose is to see specific nature or animals.

Another platform for overall information is Arctic web. It is part of the current strive of information providers to personalize and combine information. Ones their website is fully applicable they will provide a well-integrated and individualized information service, which might ease the search for information, reduce the data volume and facilitate route planning. *"Arctic web is a website for ship operators to have an overview over the area, instant resource access and to not have to look for the information in other sources. It is all available right there very handy for emergencies. The aim is to have as much accessible data in one platform as possible."*(TJ). This development shows that ice and weather information are not the only important data they need for conducting an expedition cruise but that other data services are also needed that help organizing and executing the trip successfully as well as for guaranteeing safety.

4.2. Practice carriers and the role of weather and ice information

Above, we outlined what the most relevant and most frequently used information practices are within the expedition cruise sector and how much they are determined by the specific combination of material, meaning, competence and context. In the following, we will show how these practices are connected to different occupational groups within expedition cruising. In practice theory, it is claimed that all actors involved are carriers of a practice. In that case, the question what then distinguishes tourists from the crew, emerges. To find out it is relevant to look at what part of the elements differ with regards to the expedition leader, captain or guide. As occupation always has something to do with skills, it is likely that overall the competence determines which actor leads the rest. However, it is relevant to also look at the other elements. Do different carrier connect different meanings to the same information? Are different materials used by different carrier to get a specific information?

Investigating these questions will also show how authority is distributed and which practices are dominated by which type of occupational group. It is anticipated that this will tell us more about which information are relevant for which users and why. This will enable us to show how strongly connected users and information systems are and we will demonstrate that the user plays a crucial role in explaining information systems and its usage. Consequently, in the following the expedition cruise leader, the captain and the guide will be investigated in more detail. Note, as mentioned also the tourists are carrier of the practices, as however the focus is on the operators of expedition cruising, the tourists as carrier are not investigated in more detail.

4.2.1. Combining safety and adventure

The expedition leader uses most of the devices introduced in part one of the findings. However, in their case usually not only one practice is enacted but many practices are connected in a decision-making process.

For example when it comes to the radio, their competences are extended compared to the ones of the guide who mainly uses it to communicate with the expedition leader. The latter, however, also uses it for communication with other ships in order to exchange

information. They have the authority to change channels and with that have a broader range of action possibilities than for example the guide. *“On land you use radios for contact with your own ship, the satellite phone for emergencies and expedition leaders also have a radio for contact with other ships.”*(MD). In general, the weather situation determines how much it is used and how often updated information and communication with others is needed. *"There is also a lot of drifting ice, so that you have a lot of radio contact with other ships."*(CK).

For weather, mainly GRIB files are used and some use the barometer or barograph (AR, OP, TJ, MD). These tools provide data on a regular bases and are usually checked by the crew and in case of conspicuous data the expedition leader is informed. However, the expedition leader also communicates regularly with the crew. If the ship is smaller the expedition leader does all the data checking himself. They provide data that are used to make the daily and the next day’s plan. These services mean that the decision maker has the possibility to predict the weather and can decide if changes need to be applied to the itinerary or not. Users need to be skilled to correctly read and interpret the data especially as they do not provide information about everything, like the coastal effect. In order to be prepared for this it is necessary to know how to calculate it. For these tools expedition leader use mainly experience, meaning they need to know what the data mean, what implications they have, how they are connected to other weather and ice characteristics and correctly base the data into the specific context. These procedures are already complex if, however, the conditions change it requires even more to solve the situation. *"In case of sudden changes, expedition leaders have made alternative tours, they know most about all relevant factors like the ship´s speed, open spots in the schedule etc. and from that they make alternative routes. They often also just swop days for spots scheduled. It is an autonomous process of the expedition leader and captain working together. The schedule gets updated and send to other ships."*(TJ). We can see that regarding weather information what makes up the special competence of the expedition leader is the connection of different practices. It is not only the checking and understanding of the data but also connecting it to the context, where are they? Where do they want to go? Does the weather allow it? What are other options? What does the schedule look like? Thereby an essential part is communication with the crew and the captain and always informing the tourists about the next steps.

These tasks then become more complex when different environmental conditions come together or quick changes happen. For example, with regards to weather, wind can be considered one of the main factors influencing decision-making. If the current wind situation is problematic, data will be checked more frequently. It means that wind creates uncertainty and an increased need for information and communication. It also forces decision makers to be very flexible as a landing could be called off last minute. *"Keep an eye on wind for going on land, the ship's crew writes down everything about the wind, if it is already on the edge of being safe and its increasing you don't go to not get stuck, but if wind is decreasing and you are on the edge you check more regularly. Sometimes you have to cancel last minute, people are already dressed up and 15 min later it needs to be cancelled and you do a lecture. Depending on your location and the wind direction it is sometimes an option to go into a fjord and land there."*(MD).

Concerning weather information, the expedition leader also plays a determining role with regards to the satisfaction of the tourist. He/she is the one responsible for delivering adventures, educative, exciting cruise experiences to the tourist. This becomes complex when the weather changes and a planned activity is no longer possible. A Svalbard port agent who works together closely with expedition cruise operators stated *"The worst thing that can happen is if your sailing schedule changes after the product is sold to the passengers. Passengers will complain that reality does not match with the described itinerary when they booked it."*(TA). In those cases a lot of communication skills are needed to explain it well to them. Also communication is needed to plan new activities in cooperation with the captain and the crew. However, often the tourists expect to go to the place that was scheduled and they do not immediately understand the urgency of changing plans. In this case the expedition leader and the guide need to extend their practices and add to the communication further activities to convince the tourist of the necessity to change plans. For example, they need to demonstrate to them that an activity is purely not possible *"We lower a zodiac and try to show them it's not possible."*(AR). This often has the effect that the tourist understands that the crew cannot stick to the schedule. Seeing the danger and that the change is a purely safety oriented decision, for the sake of all passengers, is often a convincing argument. Receiving this understanding is important for the

expedition leader as he/she has the responsibility to make sure that the tourist is satisfied and for that an understanding of the conditions is important. For them a non-understanding by the tourist means possibly unhappy clients and with that unhappy companies. As expedition leader often work as freelancers this can mean they will not be booked again, so it is crucial to have satisfied guests.

To receive ice information mainly the ice chart and satellite pictures are considered. It is the responsibility of the expedition leader and/or the captain to check these. This depends mainly on the size of the ship. As these charts are only updated once a day satellite pictures need to be checked in case of bad ice conditions. This also accounts for the weekend. In case of a small boat that uses paper ice charts, these are used during the entire trip. Usually, the captain and the expedition leader together decide, depending on the information portrayed by the ice chart, where they can go. Thereby the expedition leader is in charge of the satisfaction of the tourist and the captain is responsible for the safety and has the last word about where the ship can go and where not. Here, we can see again, what a crucial element the communication is as one weather or ice information has different meanings for the different occupational groups. For example, getting close to the ice edge means for the expedition cruise leader that there is a change to show polar bears to the tourists or simply the sea ice. For the captain on the other hand it means he cannot go further but needs to think about a different route. These to meanings now need to be exchanged and discussed. Further, by applying the competence of the leader to know where the next nice place is to show to the tourists and the competence of the captain of knowing how to get to it safely, the next step are decided together.

As we see, ice represents a determining factor in expedition cruising (OP, MD, CK). It is a crucial decision-making component. As well as an element, that leads to a high degree of cooperation between cruise operators. Thereby, the unpredictable and dangerous environmental conditions force actors to exchange information, discuss and ask for advice. This extensive exchange of information mostly only takes place in case of bad ice conditions. *"Now usually only in special ice situations I have contacts with other ships, like last year, the ice situation was special, one ship went first and went around Svalbard and communicated they hardly made it and it had a good ice class then you know it's a no*

go area."(AR).

The expedition leader is also in charge of communicating with AECO. This is especially the case when the itinerary needs to be changed. In case of the data showing the expedition leader and the captain to move to plan b the expedition leader needs to check the schedule to see where in his area landings are still possible. He/she needs to communicate this change to AECO and to other vessels. This process is part of the guidelines of AECO and therefore a step that needs to be followed as a member. It means following a duty but is also seen as a necessary asset for the success of the trip as too many ships in one place are bad for everyone. *"Here are certain time periods in which many ships visit the same area. So it is kind of narrow, this could create a tension with the wilderness feeling we are trying to provide. To avoid this we communicate and cooperate with different ships. It works not perfectly, but fine. It becomes normal to communicate about this and not to encounter many ships on your itineraries."*(CB). These schedule changes consist of a connection of many different practices like communication on board, checking information, drawing conclusions, using the knowledge of the area, using communication devices to connect with other ships and AECO, as well as communicating changes to the tourist.

Next to the schedule system there are also other rules put in place by AECO. These rules mean a limitation and a guideline for the decision maker. The compliance is mainly built on a trust system and seems to work well as most understand the necessity to have these rules. However, rules are not always respected entirely and partly bent by expedition leaders to make the best decision in a specific situation." *I do not always follow them literally, sometimes I adapt to the situation. It is the best possible method I have to not affect wildlife."*(AC). Another example is that complying with the schedule seems to be less relevant if the ship or rather the number of tourists on board is small. In this case, an additional landing is less problematic in the eyes of the expedition leaders. *"For me it helps a lot that I have a small ship so our landing in addition does not make a big difference."*(AR). These guidelines tell the user which practices should be enacted however, this needs to be seen in the context and it is the expedition leaders task to connect the right practices in the right moment.

However, to make these decisions many factors come together that need to be taken into consideration. There is for one and most important, safety (OP, AR, TJ, MH). Nevertheless, the cruise still needs to be a positive experience for the tourist and the company needs to be satisfied. In some cases, now another actor plays a role, namely the travel agencies. Depending on whether they work with a travel agency, they can be confronted by additional pressures. Travel agencies often put pressure on the crew to stay with the sold itinerary, as that is what tourists bought and often expect to receive. *"Travel agencies give more pressure to expedition leaders to go around Svalbard but this means that people are just going to be stuck in fog or ice and turning around means going to other places and spending the time better."*(MD). We can see how even more complex decision-making processes get for expedition leader when the environmental conditions change.

Further, as mentioned before information services are mainly used from the national meteorological institutes (MET) depending on the area the ship is in, in our case this is mainly the Norwegian MET(MD, OP, AR, TJ). Different members of the crew apply this information however, in difficult situations it is often the expedition leader that takes the lead. This means he/she connects the general data checking to using contacts within other information providers to get additional information and advice *"The AWI helps out and I can ask the Polarstern (ship) for data, I use our contacts."* (MD). This is part of the special skills of the expedition leader, which often work as freelancer and therefore are able to freely connect with many different people, as they are not bound to one organization.

This section shows how weather and ice information for the expedition cruise leader are mostly connected to the implications they have for the safety and experience of the tourist. The expedition leader thereby has the competences to connect the information to the needs of the tourist, thinking about consequences, alternatives and ways to communicate it. Thereby applying all the skills he/she has with regards to getting the right information, analysing them accordingly, discussing their implications and taking decisions.

4.2.2. Guaranteeing the ship's safety

On board the responsibilities are divided. The main two parties involved in decision-making are the captain and the expedition leader. The two cooperate closely in order to secure safety (MD, FK). They have distinct tasks and their responsibilities are for the most part clearly separated. *"The captain is responsible for the ship´s safety, he can tell the expedition leader if it is possible to go there but the expedition leader changes the route, changes the schedule and sends it to the AECO secretary and informs the guests."* (TJ). He is the one familiar with the ship and the area in terms of geophysical specifics. He has to make sure that the places on the itinerary are free of ice and safe to go to. *"Concerning navigation in ice, the captain has the last word."*(KK). This shows how the responsibility of the captain increases with increased difficult weather and ice conditions. However, as the normal nautical education does not include navigating in sea ice this shows again how important experience is and learning by doing. *"There is no education for the navigation in sea ice. You learn it from experience. To navigate in ice is different and experience is the only thing that helps."*(CK). However, this is changing as more and more the presence of an ice pilot becomes an asset for navigating in Polar Regions, meaning for navigation in ice water actors with special ice navigation skills need to be on board of the ship (TJ).

Consequently, the captain makes decisions on whether a route is doable or not based on his knowledge and his experience. This experience is also crucial in terms of knowledge sharing as he, navigating in see ice, learns quickly how the data relate to the real conditions and therefore knows how to interpret them. This knowledge is then often shared with the expedition leader who thereby learns how to read and interpret this information source. *"The experience of the captain is relevant, with that he can tell you what you can do with what you see on the ice chart. Expedition leader don't have anything to say about what you can do regarding the information provided by the ice charts it's the captains' decision. They learn with experience what you can read from it and do with it."* (TJ). This only regards navigational decisions based on sea ice information, expedition leader do know what ice information mean regarding wildlife viewings and other activities. Further, the captain is responsible for the correct application of all navigational tools, like for example Olex but also for data sources like GRIB files which is part of the nautical education and with that makes the captain the expert in reading and

interpreting this data. *"A nautical education is crucial, not only for using them but also for how to understand them!"* (MH).

Next to these clearly separated responsibilities in terms of the captain being responsible for the ship and its navigation and the expedition cruise leader for the guests and their satisfaction there are also common parts of authority. This is for example the case when it comes to checking weather and ice information and making final decisions about the route. *"It is up to the captain and the expedition leader to check the conditions with all the instruments on board of the vessel and make a daily plan accordingly."*(FK). The responsibilities of the captain also depend on the size of the ship. On smaller ships, which often have less fixed itineraries, the captain is also often involved in the first planning of the route, which sometimes happens the day of departure (AR). The captain thereby gives input in terms of information he has about animal sights or relevant weather or ice information as well as his experience in and knowledge about the area.

We see how the weather and ice information concerning the captain are always connected to competences with regards to connecting the information to the ship, understanding the implications and making decisions about the route. The same accounts for the meaning of these information, they are centred on what a weather or ice information means for the safety of the ship and the further route.

4.2.3. Guiding, educating and entertaining the guest

The findings show that the guide plays a crucial role when it comes to communicating with the tourists, showing and teaching them elements of the environment they are in. Communication is therefore one of the main practices he engages in, with all actors on board. For this he often uses the radio. *"The most important tool from a guiding perspective is the radio"* (FK). It is used to communicate with the other crew members and overall the expedition leader. It means that the guides are in touch with the people responsible. This plays a very crucial role as they often guide groups on shore separated from the expedition leader, the person in charge. Therefore, they need a way to be in touch with the authorities as they are not in the position to make big decisions on their own but they also act as a medium between the expedition leader and the tourist. For

the usage of the radio they do not need any particular skill, but they need to know who to communicate with in what moment, considering all outside factors and always keeping the safety and satisfaction of the tourist in mind. Further, in special conditions these actions need to be extended by applying additional tools. For example, the GPS plays a role for the guides, as they are active on shore and it gives them security to find back to the ship in bad weather conditions (FK).

The guides mainly receive their orders from the expedition leader. Every morning they are informed about the daily activities. In case of weather/ice changes, the guides are integrated in the communication and informed about the new plan. *"I usually receive this information from the expedition leader, usually with the daily plan. He may warn me accordingly."* (FK). For the guides this process means that they will be told if things happen and changes need to be executed*." We have to 'copy' any new instructions."*(FK). To fulfil their tasks they need to be familiar with the processes on board. This, they mainly learn in the field by working closely together with the expedition leader and experiencing how to behave and make decisions in specific contexts. *"Knowledge exchange also takes place with guides who learn from more experienced expedition leaders."*(AB). The close work environment and the fact that the guide is normally present when decisions are being made (FK) support this learning process. This way they learn decision-making and information usage and with that how to react in certain situations. The guide is therefore also always in a "student" position enacting practices connected to learning whereas the expedition leader takes the role of the teacher, passing on his/her skills to the guide.

From a guiding perspective, changes in weather are mainly negative and in their eyes mean a reduction of the quality of the experience for the tourist, as it is often connected to a landing being called off. *"Often it changes plans for the worse, e.g. not being able to leave the ship and not being able to see anything, for example in mist."* (FK) This, for them means communicating with the expedition leader, considering possibilities, making new plans and communicating with the tourists.

Further, it means a reduction of their own experience, as they are mainly active and responsible on land. Following, with a worsening of the conditions and a landing being

called off also their moment to become active and lead the tourists in the foreign terrain, sharing their knowledge, is gone. However, a worsening of the weather conditions can also be a chance to show that they know the environment and are skilled to deal with those difficult situations. It signifies a way to earn respect. *"However, I also gain their respect when I am able to handle the zodiacs in 'a bit of weather' or spot wildlife where no one else had seen it. They often think I am tough since I am 'out there' longer than they need to be"* (FK). This is also where we find the difference between the practice of the tourist and the guide. Tourists, especially experienced expedition cruise tourists, also know how to behave and what to see in the Arctic, so what distinguishes them from the guide? The guide is part of the crew and with that has authority. Further, in most cases he will still be much more experienced then most tourists, therefore has better skills which give him the position of a practice leader. Further, being part of the crew provides him access to information that the tourists do not get which further strengthens his skills and his authority.

Consequently, for the guide weather and ice information seem to be centred on the implications they have for the next activities. They generally mean that a planned activity is either cancelled, changed or postponed. Therefore, weather and ice information require the guide to be flexible, open to changes, know alternatives and communicate well with crew and tourists.

4.3. Contextual challenges

The findings show that time and place are connected to practices around weather and ice information in the expedition cruise sector.

Time matters in the operational phase as, depending on the condition of the weather and ice situation data is checked more or less often. "*Depending on how necessary it is to check, if there is no ice on the chart you don't check all the time. If the ice chart says there is going to be a lot, I check ones a day. Weather data are checked as often as needed*." (MD) Then time plays a role for the activities that take place during the cruise. When conditions are bad, an activity may last shorter than planned or may be cancelled last minute. "*If new situations arise, for example the wind picks up, the expedition leader*

communicates this and either decides to return to the ship straight away or gives a time limit as to when tourists have to be back in the zodiacs or back on board." (FK) This also applies with regards to the schedule whatever time was booked in the schedule system this is the time for being able to do a specific landing.

Further, temporal factors matter with regards to information provisioning. Specific information is available in specific temporal sequences. For example, GRIB files are available in updated versions more often than ice charts. "*GIRB files, they provide data by hour"* (OP). "*The Norwegians update their data every day except weekend*s." (TJ). In this sense, time has an influence on not only what information is available but also what source. For example, information is provided via the radio at a certain time during the day. At other times, it can be used to specifically ask someone about something but as a general medium, it is only available at a specific time. "*At 7:30pm the radio is open for communication."* (TJ). Another example is the availability of updated ice information as ice charts are not available during the weekend, wherefore decisions need to be based either on old information or satellite images need to be used. This then has further implications as it requires more skills and experiences and with that is only usable by certain staff and thereby shows that access to good information is not equal but depending on knowledge and skills.

Location is very much connected to time. This combination of time and place plays an important role in the planning phase, as certain locations are only available at certain times of the year. This is also crucial during operating as depending on the schedule they are only allowed to visit a specific location at the time they booked it. Location then matters a lot as in expedition cruising visiting specific locations to see specific things is an essential part. Certain places are known to provide certain experiences connected to seeing wildlife or nature. *"I book places where you can experience these things. The scheduling depends on the aim of the trip: if it is only about wildlife, if they have certain requests*." (TJ). Further, the location determines which rules apply. As the Arctic territory consists of different countries, different rules need to be followed. "*Every country has its own regulations, for example gun regulations are different in the Arctic territories, in Spitsbergen you need to have a gun if you land, in Greenland it is mandatory in the northeast and in Canada it is not mandatory*." (OP). Also, rules determine which

location can be visited. Some locations are closed by authorities and cannot be part of an itinerary or in other cases, the amount of visitors per day is limited. "*It is regulated how many people and ships can be at a specific site per day*."(TJ). This is also part of the broader topic of expedition cruise governance in the Arctic which has been further researched by Pashkevich et al. 2015.

Apart from rules, the weather and ice conditions determine which location can be visited or which alternatives can be chosen in case of a change in weather. "*Depending on your location and the wind direction it is sometimes an option to go into a fjord and land there."* (MD). Last, the location plays a role when it comes to choosing which information source to use, as territorial information services are regarded as more precise than the data provided by an institution outside the territory visited. "*Depending on where you are, you use the national meteorological services."* (MH).

4.4. Weather and ice information and the interrelation of materials, meanings, competences and context

This chapter made clear how highly integrated the weather and ice information are in the practices, as being part of each of the elements. Thereby, the meaning, competence and material connected to the information play different roles for different expedition cruise actors. Further, it showed how relevant the combination of the material, the meaning, the competence and the context are for each practice and how the carriers need to connect different practices to engage with the complex environment. Thereby, one element that makes it so complex is the variety of materials that play a role. This can be explained by the fact that there is for one already a multiplicity of different weather and ice conditions that need different systems to be measured and interpreted in connection to each other. Further, there are different providers that partially deliver the same service but in different sources. Next to the material diversity, a challenge is to unite the different meanings, namely guaranteeing safety, adventure, education, following guidelines, timelines and expectations. Last, whether a practice is enacted depends on the available competences, which is often connected to having sufficient experience.

The reason for this is the lack of official trainings for expedition leader, captains and guides, the freelance positions and the unpredictability of the environment. This unpredictability thereby makes trained skills and behavior useless but requires knowledge of the environment and the implications specific conditions have for the cruise. This leads to this industry being quite particular as in expedition cruising decision-making processes are not very rationalized as often found in the remaining tourism sector, with standard education and rules to follow. In our case, processes are solely learned by watching others and seeing what happens in specific moments, learning by doing. It is framed by a set of guidelines that often need to be adopted to the situation, as they do not apply to each possible context. A consequence of this absence of strict rules and official trainings seems to be the use of common sense for decision-making. This is connected to what we saw earlier, namely that the crucial element in many practices is experience as the most important competence. Whereby this experience tells the carrier which practices to enact and connect. This is also important when it comes to using common sense. What seems right to do in what situation is determined by the competences of knowing the environment, interpreting different factors correctly within the context.

A consequence of this seems to be a high need for flexibility. It is the key thing that reappears in all areas of expedition cruising. In thinking, connecting activities and decision-making it is crucial to be flexible. This means that expedition leaders always need to have alternative plans ready. And it also means that those operators with most flexibility in their itinerary are freer in applying changes. They have fewer pressures from outside and can, depending on the situation, decide what a good alternative would be. The ships that follow a strict plan seem to feel the pressure of the company and the travel agencies to stick to it and with that have little space in their decision-making. This way of dealing with flexibility leads to a separation of the expedition cruise sector in two parties, where one thinks that there is enough information and it is not so needed in general because if it is not possible to go on you go somewhere else. This thinking was mostly encountered among employees of cruise companies with more flexible itineraries.

Contrasting to this, is the group that is more rationalized and wants more information and better systems. This opinion was shared by members of bigger cruise companies that often have very detailed planned tours and work in cooperation with travel agencies that put pressure on following itineraries and strict structures. Further, it seems that the more precisely the tour was planned and announced to the tourists the more they also expect to get what they bought and in this case the crew further gets pressured by the tourist to deliver what they expect. In this sense, least planning and most flexibility seems to be the best method to work in this uncertain environment. This need for flexibility is reinforced as many different information sources are provided through the same channel, the internet. The challenge here is that a good internet connection is still a major problem especially for small boats and in the far north. This means that actors are forced to flexibly engage in further activities, connecting with whoever is in the area, coming up with for the time and place possible ideas and much communication in order to deal with the challenge of reduced information availability.

Last, what became very clear is the central role safety plays and how much it drives different practices. In order to get this safety, information seems to be the key asset and many practices are aimed at receiving more information. This is especially the case in situations where uncertainty increases, for example if a landing is planned but the wind has been picking up and depending on whether it gets worse or stabilizes a landing could be carried out or could be cancelled. In this situation, data is checked much more frequently in order to know what to do or rather what is safe to do. It illustrates well how the degree of uncertainty in the situation is connected to a feeling of insecurity, which is tried to be balanced by increasing the input of information.

4.4.1. Current problems and developments

A problem regarding the current information available for the expedition cruise sector was mentioned to be that most of it is general ice and weather data usable for and applicable by different actors, different industries and with that different purposes. This means the data they use is not customized to their purposes and with that is lacking information or providing information that is less useful for reaching their goal. An example is that ice charts are made in order to avoid sea ice, however, usually it is one of

the goals of an expedition cruise to encounter ice, as this is what many tourists are probably curious about. Therefore, it would be more effective for this industry to have ice charts that show, depending on specific ship characteristics, where a good spot is to enter the ice and demonstrate it well to the tourist. However, we saw that there are ongoing developments in this direction by young companies like Arctic Web and big players like the Danish Meteorological Institute that just released a customized ice service project.

Another need is the availability of better communication technology especially for the areas in the high Arctic. As we saw, communication plays an important role in the generation and distribution of information and with a reduction of sea ice and more open water operation will move more and more towards the poles and require communication possibilities in those areas.

5. Risk Society and the expedition cruise sector

This chapter aims at showing the context the expedition cruise sector is embedded in. According to Nicolini (2012), practices are always connected to other phenomena and therefore need to be studied in relation to the broader context. By what he calls 'zooming out', we step back from the details of the practices and extent the scope. We will do so by using Ulrich Beck's concept of the Risk Society as we proposed that this will create a framework for better understanding the environment in which this study takes place. As mentioned in the theoretical framework chapter, this theory describes a view on how our society today functions, what it is driven by and what it is aiming at. According to Beck, we are placed in an environment determined by unstableness and unpredictability, and overall by a new era of risks which creates a striving for safety and to create more safety we try to gain knowledge and reduce uncertainties. In the previous chapter, we looked in detail at practices enacted in this environment and now we want to investigate how these practices are connected to the broader context, the environment they are embedded in. The aim is to understand the drivers and motives behind the way of acting in expedition cruising in order to get a clearer picture of their actual needs. Therefore, in the following we will look at some of the relevant concepts in the Risk Society theory and how they play a role in expedition cruising. Further, we will investigate the role other actors play in this context as well as taking a look at the role of risks and safety. Last, we will draw conclusions and show the connection between the elements investigated and how information, risks and safety belong together.

5.1. No competition?

In the chapter before, we mentioned that the expedition cruise sector is special and distinguishable from the rest of the tourism industry in many ways. Using the Risk Society concept we will know try to explain some of them.

One of the particularities we already mentioned is the high degree of cooperation among different actors from the expedition cruise sector. "*There is a general cooperation. In a way we are competitors and colleagues at the same time*."(AB). Meaning that different companies that are all trying to make a living of expedition cruises and thereby compete,

still support each other. According to Beck's theory, the reason for this deleting of boundaries lies in the emerging of systemic risks. These risks are so complex and outreaching that, in order to deal with them, actors need to closely cooperate, share information and help each other. This is what we find in the expedition cruise sector, which in order to be able to deal with the difficult and dangerous environment and the through climate change increased unpredictability, forgets about competition and unites to deal with the difficulties and dangers. This especially accounts for sharing information. "*Regarding knowledge exchange, it is quite nice between different boats. As far as we know there is no holding back or secrecy*."(CB). The exchange of knowledge between cruise operators plays an important role and it is part of the morals of this sector to share information about bad ice and weather situations with others. *"If there is bad weather we help each other, we communicate, for example if there is a lot of ice that is not on the chart"*(AR). "*Through news updates information is shared but you also send info out immediately to other ships and to the AECO secretary"*(TJ).

This cooperation is especially visible in the field of the expedition leaders as they are the ones out in the field in immediate contact with the unpredictability of weather and ice. It was commented "(…) *together we are strong and help each other"*(MD). The expedition cruise sector is thereby not only cooperating among one another but also with institutions outside, like the Governor of Svalbard or research ships like the Polarstern that helps out with information if situations are difficult to judge with the own information available. "*The AWI helps out and I can ask Polarstern for data.*"(MD). An increasing cooperation in the Arctic can also be witnessed among new information provider that base their information provisioning on high levels of cooperation with users, other providers and stakeholders (ER, MB).

5.2. Challenges in the Arctic

Chapter four demonstrated that a main problem in operations is the lack of stable conditions, reliable information about these and the amount of certainty in decision-making. In the Risk Society, this uncertainty is one of the elements that comes with the new systemic risks. The results of these risks in form of high levels of unpredictability and lack of certainty can be clearly seen in the expedition cruise sector.

For example, the planning of a journey usually happens more than a year in advance, *"I plan about 1, 5 years in advance."* (KK). Normally such a planning would require very stable conditions *"But there are uncertainties, like strong northern wind can bring sea ice, or the fjord can get closed. You cannot completely predict.* "(KK). This shows that in expedition cruising the conditions are anything else but stable. Another problem is that sea ice is not yet really predictable such a long time in advance "*In terms of sea ice predictions, technology is still in its early stage.* (KK). *"There are no sea ice predictions you can use in advance.*"(AR) Further, predictions regarding more current situations are also not completely reliable and the technology available does not yet allow exact predictions. "*It is not that easy, e.g. if you use a local GRIB they don't provide details and don´t show the coastal effect so I have to do it myself. Also the drifting is a problem, sometimes the data of the prediction is a bit wrong.*"(OP) Therefore, I can see that expedition cruising takes place on basis of unstable and unpredictable conditions that cannot fully be captured in information services and need experience to be interpreted correctly. Thereby, the fast developing climate change enhances uncertainty and unpredictability. In order to successfully work in this environment and guarantee safety actors need flexibility, experience and alternatives. *"Sea ice is attractive but it makes it also very unpredictable and requires flexibility. You need to think about plan b and you need captains with ice experience who can balance the risk."* (KK).

The problems that expedition cruise actors state regarding a lack of technology and information and too much uncertainty in information can also be found in the Arctic society. For example, information providers face the same problems and cannot provide more precise information and better technology as they themselves lack the technology and knowledge to produce this. Nevertheless, they see it as their obligation and a necessity to maintain trust. "*The users trust me to map the sea ice areas to the best of our capability. To maintain this I am constantly looking for ways our information provision can be improved, through better detail and more timely provision of information*" (MET). However, the uncertainty the information supply sector deals with gets, to a certain degree, passed on to the expedition cruise sector. This is represented in the operators' awareness of the information provided not being fully reliable or complete. For example, in difficult situations they do not solely trust in one set of information but consult

different sources or apply their own experience to calculate what might happen, f. ex. at what moment drift ice reaches which location (MD, OP). The providers thereby, fear the known uncertainty in their data as their overall goal is to enhance safety in the Arctic oceans (HT). This goal however, is constantly in danger, as they lack data, accuracy and certainty themselves.

5.3. Involvement, rules and regulations

We explained before, how relevant communication and involvement is in expedition cruising. This can be seen among crew members but also between the crew and tourists. "*It is important to always tell guests what happens.*" (OP). According to Beck's theory in the Risk Society, a high level of distrust exists. In expedition cruising we can especially see this among the tourist in case plans need to be changed due to the environmental conditions. The tourist seems often not to trust the crew when they say that a scheduled route cannot be followed anymore. We can see this in the high level of communication directed at the tourist. "*A lot of communication is necessary and if we explain things to people they usually understand."* (AR). "*In polar expedition cruising flexibility is crucial, that is what I explain to our guests as well."*(MH) However, sometimes this is not enough because the attitude amongst tourists going on expedition cruises changed putting more relevance on the money and itinerary bought than on the experience. In these more difficult situations, even measures are undertaken to deliver prove to the tourist "*Sometimes I go to the ice edge because of the tourists to show them the ice and let them see that you cannot go further."* (MD).

We also saw before that there is a high level of communication among the crew but also between them and other ships in order to exchange information and discuss situations. This can also be explained by a lack of trust, namely in the information provided by the information supply sector. Even though there seems to be a general level of trust in the National METs, *"Norwegians brought out a good detailed one. Their information is used for the Arctic because it is the closest one and it is fairly good. The layout is good and it is easy to read."* (TJ). This information service is not sufficient for four reasons and thereby leads to distrust. One, it is made to avoid ice and as expedition cruising is about seeing the ice and wildlife connected to it, this service is not ideal for operators' purposes. Two,

it does not deliver up to date data on weekends meaning that operators need to use satellite images that are not as reliable. *"On weekends satellite images are used. They are raw pictures not completely reliable."* (MD). Three, not all ships have sufficient internet connections to be able to always get the information on the ship *"But not all ships receive the data well because they don't have good internet connection"* (AR). Last, there are not equally well distributed measurement stations which has the consequence that there are areas in which only insufficient information sources are available to the providers, due to few data collection points, leading to gaps in information provisioning. *"Not so many measurement stations so not so much input."*(AR). This problem regarding information access and reliability leads to a situation in which many operators need to take extra precautionary measure. *"When I plan and make decisions I always calculate a percentage for safety."*(OP).

Another example of distrust in expedition cruising regards the usage of the system Olex, which "(…) *is an aid for navigation with crowd sourcing you upload your data and can see other data."* (MH) It is used for soundings, which play a role for the general navigation procedures in terms of knowing the depth of the water. This is crucial for knowing where you can go. Having this information enables safer navigation and it is very relevant for the entire expedition cruise practice as it provides data necessary for the overall safety. *"Sea charts are the main thing for insuring safety. I work on improving them. After each season ships upload all sounding data and share it for safer navigation."*(TJ). However, after changed regulations by international authorities like IMO and UN it is not allowed to use in-official soundings. Therefore, operators may not navigate in officially unsounded waters, even though ships have the information and often even better information than the ones publicly available. *"Legally can't navigate from it, paper chart is legally valid and the technological ones are not (even though they are more precise every second is measured). IMO and UN decided which charts are valid. You can't go to officially uncharted waters."* (TJ) This represents what is described in the Risk Society as the problematic relationship between authorities and other actors. Where society is aware of the incapability of authorities to properly regulate a situation and as a consequence neglects official orders in order to be safer in their practices. In this case, they know that their soundings are more accurate as many actors participate in collecting them and sharing them. This clearly demonstrates how the incapability of

authorities to handle certain situations leads to society acting on its own in a cooperation with others in order to create a better and more trusted situation for themselves.

Further, looking at trust, it becomes quite clear that this is a very relevant point in expedition cruising. It seems to be the determining factor within AECO. *"Compliance with AECO's guidelines works through a trust system."*(AC). *"There is a lot of trust building. If I need information, I am sure I will get an honest answer."* (KS). However, not only within AECO, but also with other authorities. *"Also between the company and the Governor of Svalbard, there is trust."*(AB). It seems that the vulnerability of the location makes people work closely together that under "normal" conditions would maybe not trust each other, like in everyday policy-industry relationships. Everyone visiting this area seems to understand that it is a very special place that is extremely sensitive to outside factors and therefore needs to be treated with special attention. "*We are so careful*"(KS). In this way people, working for the governor of Svalbard stated, "*Our impression is that they follow the rules most of the time.*" In addition, "*the cruise industry works hard to minimize their environmental impact. Examples are the site, wildlife and visitor guidelines created by AECO."* (FJ)

However, even though there seems to be a high level of trust within the expedition cruise environment there is also a high level of control guaranteeing the correct behaviour of everyone.
In this way the govenor of Svalbard is engaged in this process "*We control tourism. We follow up on nature all the time. We also check scientists' permission to go in the field."*(BEN). *"Compliance is ensured by the Governor of Svalbard for the legal rules and by AECO for the self-organizing rules."*(RB).

When it comes to engaging the public, also the information providers play an important role as they try to involve the public by sharing knowledge with them. Both the MET and the AWI see it as their duty and one of their main purposes to provide information to society and show them what the current developments and issues are. "*We produce information to make our research accessible and in particular visible to the public"* (CK). Both provide free information, guaranteeing the access of everyone that is interested.

This sharing of information can be seen as a reason for the increasing awareness among society and with that an increase of their participation in knowledge production. Nevertheless, none of the three supplier mentioned a direct involvement of the public in the knowledge production. Therefore, we can assume that scientists mainly execute the knowledge production process. However, one thing that did become clear is that in this process, scientists from different fields are involved and the process is a cooperation of different experts and professionals which could increase the degree of trust and credibility they obtain.

In addition, Beck states that there is generally distrust in science and that through an involvement of the public the trust is tried to be reinforced. *"I also carry out projects together with researchers."*(IL). According to Beck, by involving lay people in scientific research more awareness is created as well as more trust in science. *"We also get missions from scientists to count birds, reindeer, polar bears, walrus, foxes and endangered plants. We report this to the Sysselmannen."*(BEN). People will automatically trust science more if they know they themselves were involved in the knowledge production. The knowledge the expedition cruise sector thereby obtained is then passed on to the tourist thereby creating even more awareness of existing risks. *"They provide information that we pass on to our passengers."*(AB). Next to this sharing of information the cruise sector also shares its knowledge in terms of lectures. However, maybe even more relevant is that the tourists are always informed about what is happening on their tour.

Regarding the relationship between the tourist and scientists there seems to be not much interference between the two as contact is always via the cruise sector that seems to connect them. However, scientists and tourists encounter each other as they both have an interest in the Arctic, which can lead to tensions. *“There are no conflicts between tourists and researchers, but researchers are not always happy when tourists visit."*(KK) Apart from the degree of cooperation between science and sector, there seems to be also some misunderstanding. Beck seems to be correct with his assumption that there is a discrepancy between society and science. *"With scientists in Ny-Ålesund, there is also some kind of conflict."*(JB). *"Regarding researchers and tourism, there is no conflict, but a disconnection."*(AR). *"I have met researchers studying cruise tourism. Their*

point of view is so far from ours. There is a real dichotomy between cruise tourism and science."(AR)

5.4. Overload or lack of information?

The different MET services and other actors provide information to industries like the expedition cruise sector. According to Beck, we face an overproduction of information as everyone tries to take part in it. This is reinforced regarding the uncertainties connected to the new systemic risks and a wish of people to find solutions and explanations. When it comes to weather and ice information, most actors present more or less the same. *"An ice chart is a combination of different things so the end data don't change so much between different suppliers."* (TJ). However, the fact that ice charts are prepared by humans and based on satellite images that often vary a bit it seems like there are slight differences between the information provided. *"There are slightly different satellite images from different suppliers, also because the satellite is not that accurate and misses spots."* (TJ). Operators therefore sometimes take the effort to check different ones in order to get the best possible information. *"I use ice charts, the Greenland, Danish and Canadian ice info."* (OP). *"I compare different ones especially if one looks bad."* (KK).

Nevertheless, regarding these ice and weather information that are available from different sources there seems to be rather a lack than an overload. Especially when it comes to updated information. However, this lack is quickly turned into an overload when it comes to data access on board. Here the lack of adequate internet technology leads to the fact that only small volumes are downloadable. However, the information provided is often for a broad area and therefore a huge amount of data that is not relevant. The ship would need only a small part of the chart for the area it is operating in. Though, as this is often not provided they have to deal with not being able to download the necessary information or having to pay a lot. *"You cannot receive too big data volumes on the iridium satellite telephone."*(OP). However, this is something that providers currently work on like the DMI that has just published a possibility to get personalized ice information and Arctic Web that next to unifying information also tries to customize it.

Next to this lack of specific weather and ice information it seems to be the opposite regarding other types of information. *"These days I become bombarded with a lot of information."* (AC). *"(…) the reporting system and the amount of information we get is becoming too much."*(KS). Cruise operators are quite in consent regarding the fact that they receive too much information from AECO, which makes them feel overloaded. This is also connected to an increasing institutionalization of expedition cruising with more control, more bureaucracy and more structures. For example, expedition cruise leader stated that an increasing issue is that they have to report about everything after each tour, which leads to an increasing part of the work being paper work (AC, KS). We can see, that here increasing information flows are part of an ongoing institutionalization.

5.5. Risky business

In chapter four we saw how many choices the operators have to deal with. Especially expedition leaders are confronted with making important choices that influence the satisfaction of the tourist but also their safety. These choices are created through changing weather/ice conditions forcing the crew to make a decision. These choices are crucial in guaranteeing safety and a wrong decision can easily lead to a dangerous situation. According to Beck, this relationship between choices and risk creation is typical for the Risk Society. We can clearly see this everywhere in expedition cruising where always all different factors need to be taken into consideration, whereby the most relevant one is safety, *"safety first"* (MD) But to make a good choice, also the tourists expectations need to be kept in mind next to the ship specifics, the itinerary and other factors (TJ). As mentioned before, in this sector flexibility is a key aspect that is very relevant in order to make the necessary choices. "*Very much, in polar expedition cruising flexibility is crucial, that is what I explain to our guests as well. I always have plan A, B, C, D and sometimes end up with plan E."*(MH). In this sense, we can see that choices in expedition cruising are everywhere and that there is a high risk potential. For example, there has been an incident where a captain misinterpreted satellite pictures because he did not have the expertise to read them correctly. "*Once a captain decided to turn around because he had checked the satellite pictures and thought that if they continued they would be trapped between two icebergs. It was a false interpretation, which can happen easily because these pictures contain a lot of information that need to be understood and*

interpreted correctly. "(CK). In this case, the captain made a safe choice, which still had major consequences with regards to the planned route, leading to itinerary changes, communication processes and so on.

Perceptions of people within the cruise sector about whether their business is harmful or not are quite diverse, reaching from seeing it as extremely bad for the environment to determining it as low impact. Thereby people also mention different points as being problematic. Among them are the ships emissions, possible oil pollution, wildlife disruption and disturbance of local inhabitants (JB, RB, FJ). However, most of the interviewed people think that there is quite a high potential danger, in terms of if a disaster would happen it would have immense consequences due to the vulnerability of the area and the bad infrastructure available for such incidents. *"The environmental impact can take different forms. If there is a ship wreck, oil pollution will be a major problem. Disturbance of wildlife is an issue as well. We know there are populations here that are not at their original size anymore like walrus and whales. If tourism is getting too large, certainly if it does not always respect the rules, there is a conflict."* (JB)
These examples show that cruise tourism is not only facing dangers but is also involved in creating risks. Consequently, there are immediate risks like accidents but also long-term risks created by reinforcing climate and environmental change through emissions, waste water and so on. Beck states that modernity is through their actions majorly involved in the risk production, which we can see well in the expedition cruise sector. Expedition cruising as an outcome of modernity is putting itself in these risky situations and itself holds a stake in the creation and enforcement of climate change.

Nevertheless, this industry is also quite aware of the influences that it could have and has on people, animals and nature in that area. Knowing that their business is dependent on a good status of the environment as what they sell is pristine nature. *"Therefore it is important to work with precautionary measures like the heavy fuel oil ban and the limit on 200 passengers per ship."* (FT). In order to make sure that their impact is not too high they undertake different measures. Some are manifested in AECO's guidelines trying to make sure that ships behave in an appropriate way (BEN, IL). Other ones come from the governor of Svalbard that also sends out people that make sure these rules are complied to. *"The Governor of Svalbard defines legal rules which have to be obeyed to.*

If you do not obey to them, you will lose your license to operate for next year, get a fine or even be prosecuted."(AC). These rules and controls thereby function as a medium to guarantee the safety and protection of the area. "*We control expedition cruise ships and whether tourists do not go on shore on places they are not allowed to"* (BEN).
Last, there are rules from higher authorities like the IMO that change international regulations forcing industries to make major changes, for example with regards to ice class and ice pilots (TJ).

What becomes quite clear from the interviews is that everyone thinks that the rules are overall good and necessary to protect the environment. *"We are in favour of environmental regulations to ensure the least possible environmental impact of cruise tourism. Meaning no garbage dumping, no disturbance of animals."*(KK). This engagement shown by the expedition cruise sector to keep the environment at the standard it is at now also gives us an impression of the sense they have for safety, because these guidelines are not only to protect the environment but also to secure safe standards for humans, animals and nature. Beck states that in the Risk Society there is a growing desire for safety. This desire for safety is in expedition cruising extremely high, what is not surprising regarding the conditions they operate under. Safety seems to be the determining factor, having more value than tourist satisfaction and with that, also more value than money. *"Safety is the decision-making factor if conditions are unsafe I will abort or adopt our program and go elsewhere to continue."* (MH).

Moreover, there are national tourism organizations like tourism Svalbard that play a role in regulating, trying to increase safety and to reduce impacts. They are part of a big network of actors that together make tourism possible in this unpredictable environment. Each of these actors like the governor, AECO, the port authority and tourism authorities contribute to creating safe and sustainable tourism practices. Nevertheless, people feel unprepared to properly act in this environment and have a need for more information "*We need more knowledge; tourism is not very well developed in terms of facts and figures."* (RB). They have the imagination that only by generating more knowledge safe practices can be achieved. This strive for safety seems to be a major theme within the Arctic society. All over the Arctic society, actors are trying to create a safer environment by conducting research, building new and better information technologies, distributing stricter rules and engaging in cooperation "*The mission is to*

improve the safety of navigation in the Arctic" (MB). It portrays that there is a need for more safety in this area, which is also taken to the operators. Moreover the awareness that there is an increased need for safety and that authorities themselves are still trying to achieve it, meaning it currently is not safe enough, can be seen as a reason for the 'safety-first' approach taken on in expedition cruising.

5.6. The Arctic: a zone of risk?

In this chapter we tried to analyze the broader context Arctic expedition cruising is embedded in. The aim was to understand why safety plays such a powerful role and why information is seen as the key to avoid risks. Thereby, the different concepts of the Risk Society theory allowed us to take a closer look at the connection between specific characteristics of the broader environment and the workings of the expedition cruise sector. It demonstrated that different domains, whether governmental, private or public, all are focused on reducing uncertainty and creating safety through generating knowledge and providing information. Whereby the information can take on the form of rules and regulations from authorities, data from scientific domains or knowledge exchange between actors. Irrespective of the position or role of the societal actor, they all are aware of the fact that the environment they work in is risky, unpredictable and uncertain. Moreover, they know that it is an area with a high intrinsic value endangered by climate change and other human induced impacts. This awareness is turned into a need to create safety either in terms of protecting plants and animals or people thereby using knowledge and information in different forms.

By taking a closer look at the supply sector we saw that knowledge generation and information provisioning is a collective action and all providers are concerned about creating better information systems and more precise information. The information providers are therefore a good representation of the relationship between the high uncertainty of the environment and the high desire for more and better information. Further, it showed that not only the expedition cruise sector is a risky business but that the work of other actors in this context is similarly characterized by a high percentage of unknowns and a high risk factor. This high risk can be explained in terms of putting people and the environment at risk in case of providing false information or unreliable

information tools as well as by a high chance of losing trust when providing inaccurate information. This may explain that the central theme of discussion in this sector is developing better information systems and better ways to provide more reliable and complete information. This demonstrates well the proportional relationship between need for information and amount of unknowns and its connection to the desire to create a safe environment. This combined with the behavior of authorities which is based on regulating, controlling and making sure practices are safe for humans and the environment seems to explain why most practices in expedition cruising are centralized around safety. Therefore, it can be stated that the entire weather and ice information environment with its domains of information provisioning, regulation and application is focused on making the naturally unpredictable and risky conditions of their work environment safer.

6. Discussion

In the following chapter, we will reflect on this research. Starting by looking at the usefulness of the theories for investigating the role of weather and sea ice information in Arctic expedition cruising. We will also compare findings to what other research states about this topic. Following, terminology will be elaborated on, as well as my role as a researcher, ethical considerations and limitations.

6.1. Practices and Risk Society: a tool to explain the role of weather and sea ice information in Arctic expedition cruising?

In this section, we will reflect on the usefulness of applying practice theory as a tool to research information usage in the Arctic. In addition, we will elaborate on the gain the concept of the Risk Society was or was not for better understanding the role of information in the expedition cruise industry, thereby comparing it to other relevant research results.

6.1.1. Risks in the Arctic

Overall, the concept of Ulrich Beck's Risk Society supported the aim of the study as it describes the situation and circumstances that this study takes place in. It enabled us to set a frame around the study and explain the background and basis, which was helpful to better understand the settings of this research. Its common concepts: risk, safety, uncertainty, information and knowledge are very much present in expedition cruise tourism in the Arctic and with that facilitated taking a closer look at these concepts and their meaning in this sector. It helped to critically overthink the situation we are facing today with climate change and the thereby provoked change of the environment around us where characteristics of unique places are being eroded and replaced by new ones. This is especially true for the Arctic where climate change moves much faster than in other areas of the world (Winton, 2006), thereby destroying the unique features that attract tourism (Lemeling et al., 2010).

The Arctic is described as an area that will be increasingly determined by risks due to two developments. First, the impacts of climate change in form of extreme weather

events will make operations in the Arctic more risky (Harsem et al., 2011). This is further supported by Hall and Saarinen (2014), Stewart et al. (2011) and Lamers and Amelung (2010) who expect climate change to increase the unpredictability of the Arctic and with that enforce navigational difficulties. Secondly, the melting of sea ice is expected to lead to an increase in economic activity in the Arctic, which will pose new risks on the environment (Berkman, 2012). Moreover, Ho (2010) states that the future shipping activity in the Arctic will need an advancement of marine infrastructure and weather and ice information. We also saw this in expedition cruising, where the limited accessibility of information portrays a drawback to decision-making and navigation processes. In addition, this was shown in the discourses of information provider that are very much focused on finding ways to deal with climate change and enhancing information provisioning and with that safety.

However, the Risk Society concept only describes our society in one way whereas there are always multiple other developments and characteristics that also play a role. For example, Hilty and Ruddy (2000) explain increases in risks in the fact that we are moving towards an 'information society', which is characterized by advancements in technology, mainly information technology, which produces opportunities but also new risks. In my opinion, we can clearly see this playing a role in expedition cruising as without advancements in communication technology and satellite information services current levels of economic activity in the Arctic would hardly be possible. Consequently, with less activity there would also be less emissions and less enforcing of climate change, as well as less accidents. On the other hand, without good information technology onboard, accidents are also more likely. Therefore, the technological advancements also create opportunities and risks in expedition cruising that need to be taken into consideration.

Further, we saw how climate change and the character of the Arctic environment determine the character of the expedition cruise industry with for example its high level of cooperation among members. Also among other actors we found this cooperation in the Arctic, for example the new information providers that are emerging, such as Arctic Web that base their work on cooperation with others. Moreover, this depletion of borders (Beck, 1992) will likely be even enforced with future climatic changes. This is

further supported by literature predicting that with increasing impacts of climate change an increase in cooperation will be needed in the entire Arctic to deal with the complex conditions (Bertzky & Stoll-Kleemann 2009, Overpeck et al. 2011, Berkmann 2012, Pulsifer et al. 2014).

Overall, we see that the Arctic is generally defined as an area of risks with its severeness likely to increase in the future. Therefore, the concept of Risk Society seems to be adequate to investigate the Arctic and expedition cruising. It supported the purpose of this study well and created a good framework and baseline for investigating the role of weather and ice information, risks and safety. Nevertheless, this should not be seen as the only way to look at developments in this area and other drivers should also be considered (such as technological developments).

6.1.2. Can practices explain the needs and relevance of weather and sea-information in Arctic expedition cruising?

The advantages of using a practice theory approach for this study can clearly be found in the enabled close-up look at what is being done and used in the expedition cruise sector regarding weather and ice information. The division of practices in the three elements: materials, competences and meanings allowed us to look at each one of these in detail as well as at their interrelationship. Thereby, investigating the role the weather or ice information plays for each of the elements and how this constitutes decision-making processes. This detailed look thereby facilitates gaining a better understanding of the processes (Shove et al. 2012). By using this concept, we gained knowledge about what tools and devices are being used, why they are being used and last, what skills are needed to use them. Apart from this, the other factors that play a role in practice theory like time and place, enabled us to also research the role of information in the context of expedition cruising. In my opinion, looking at these two helped a lot to understand the on-goings in this sector, as time and place play a crucial role with regards to weather and ice conditions and information. In this business, the place you are in at a specific moment decides whether certain conditions will affect you and your plans or not. Therefore, all the information from all factors of practice theory together provide a very clear picture of the current situation regarding the role of weather and ice information

in expedition cruising. It allows us to draw a conclusion regarding information needs, which further facilitates others to work on improving the situation.

Moreover, we found what Nicolini (2012) described (as an interpretation of Heidegger) that practices always follow a goal. In the context of weather and ice information, this is very true in expedition cruise practices because actors seem to always follow the aim of guaranteeing safety and meeting expectations thereby using information, their experience and intuition to decide what to do.

The downside of practice theory is that it does not enable us to understand better why certain people make certain choices. The reason for this is that practice theory claims that practices are independent of the users and that meanings are usually connected to the practice but not to the person executing the practice (Shove et al., 2012). However, Nicolini (2012) acknowledges that there is always some 'individual performance' as the carrier constantly needs to adopt to new conditions and circumstances. However, he agrees with Rouse (2007) that this individualism is always part of an enacted practice and therefore connected to the practice and not to the individual. This is a part of the practice theory that we disagree with, at least with regards to expedition cruising. We saw that the individual does play a role as experiences are very much connected to an individual. Therefore, the amount and the type of experience an actor has influences what he does and in which sequence he/she enacts which practices in a decision-making process. Similarly, Lindberg and Rantatalo (2014) stress that experience is often underemphasized in practices and that the competence of a professional is a result of the interrelation between individual and job. Further, the circumstances the individual has to adopt to in expedition cruising are much more variable than in everyday life. Therefore, we think that in this sector the individual with its background, knowledge, thoughts and attitude matters in how he/she deals with weather and ice information. However, as the main purpose of this study was to find out what the general role of weather and ice information and its needs are in expedition cruising. Consequently, it was more relevant to study the enactment of practices on a broader scale, such as groups of actors. This means it was relevant to look at practices connected to specific professions in expedition cruising. Distinguishing information usage and meaning

between different groups was thereby needed to understand the overall significance of weather and ice information in operations.

In general, practice theory was in this study well applicable, as it was known before that AECO members would use more or less the same devices. In a study with more different devices and information practice theory with all the different parts and elements that belong together, would have meant even more complexity, with a lot more data collection to feel saturation and with that probably too much data for a master thesis project.

6.1.3. Compatibility of the two theories

Both of the theories taken separately, seem to be adequate for looking at the role of information in expedition cruising however do they also fit together? In my opinion, there is no clear reason why they should not be used together. In the contrary, it can be a gain for the research, as they work on different scales thereby replenishing the picture. Both of these theories look in some way at behavior, thereby Risk Society deals with the actions of the whole society in a risk environment. It looks more at the outside factors determining behavior. Practice theory on the other hand, looks in more detail at behavior, at the different elements that come together in determining a specific activity, in all contexts. This means that the two theories cannot contradict each other as they look at different parts of behavior, at different scales. Rather, it shows how well they complete each other in together presenting a holistic picture of activities and their context. In this study it means that with the Risk Society theory we could look at the broader environment of expedition cruising and which elements of this society have an influence on the practices in expedition cruising. Whereas, practice theory allowed us to understand how these outside factors are represented in the different practices, meaning how this sector responds to its environment.

6.2. Implications for the current debate

The current debates regarding expedition cruise tourism and climate change state that on the one hand expedition cruise tourism is and will be positively affected by climate change in the coming years (Stewart et al., 2007, 2012; Pizzolato et al., 2013, Dawson et

al., 2014). This is explained by an opening up of waters facilitating better navigation possibilities. On the other hand, literature shows that this industry will also be negatively affected in terms of more uncertainties and weather and ice unpredictability emerging (Hall and Saarinen, 2014; Stewart et al. 2011; Lamers and Amelung, 2010). My findings do not support the positive image of climate change but rather it is seen as a growing threat to the industry (KK). The melting of sea ice is not considered a positive asset but rather portrayed as a decrease of the quality of the expedition cruise product. This business depends on the availability of sea ice and a reduction of it signifies a threat to the business. Further, among expedition cruise operators as well as weather and ice information providers climate change is considered a danger in terms of safety reduction. It creates, especially among providers, a strong need for technological development and improvement in order to be able to adequately respond to this change in the environment.

What further became quite apparent in this study is the role flexibility seems to play in expedition cruising. It seems to be a key element to accomplishing a successful cruise, meaning guaranteeing safety and having satisfied tourists. Also Lindberg and Rantatalo (2014) found in their study that flexibility plays a crucial role in practices and for professional competence. In our case, the more planned the cruise is, the less room there is to respond to changing weather and ice, with regards to decision-making processes and alternatives. Further, the more detailed the description about the tour, its landings, sights and experiences up front the more pressure there is to follow this plan. The research clearly showed how some cruise operators have to handle the pressure of companies, travel agencies and overall, unsatisfied tourists. This is supported by Schwabe (2008), who talks about a case in which an Arctic tourist sued a tour operator because the latter had promised in his brochure that guests would see 'meter-thick pack ice' that, however did not happen. In addition, the opposite can happen and adhering to original plans, even though the ice situation would suggest changing plans, can lead to having unsatisfied tourists. This is exemplified by a story in which expedition cruise tourists got money back due to having been caught in pack ice (Kölner Stadt-Anzeiger, 2012). Further, the problem of having unsatisfied guests and needing more flexibility seems likely to become more of an issue with ongoing climate change and increasing changes in the Arctic. The changes might make it more difficult to encounter multiyear

ice and polar animals, which already is an issue cruise operators have to deal with. Findings by Maher and Maede (2008) about unsatisfied tourists in the Arctic due to a lack of wildlife viewings support this.

Against current debates stating a general lack of climate information available to the users (Vaughan & Dessai 2014, Giorgi et al. 2009, Scott et al. 2011), including the tourism sector, my findings expressed no strong need for more information. In the expedition cruise sector the main problem, regarding information was stated to be the accessibility in terms of poor internet availability (CK, MH, AR,), data volumes (TJ, CK) and more frequent updates (TJ, HT). With regards to a lack of information, the only shortcoming was considered to be the non-availability of processed ice information on weekends (CK, MD, AR). However, even though expedition cruise operators might feel little need for extended information availability the information supply sector supports the statement that more information and better systems are needed (AWI, MET). This can also be seen in current developments towards better and more personalized information provisioning.

Regarding information needs for decision-making, Miller (1965) states that these processes are not very complicated and the general line of thinking is that procedures that worked in the past will also work again now. Similarly Keen (1985) states, "*All in all, human information-processing tends to be simple, experiential, nonanalytic, fairly effective."* (p. 25). These two statements seem to account for information usage and processing in expedition cruising. We can see this in the way experience plays a major role and often not rational behavior guides decision-making but instinct and practices enacted in the past. It is further mentioned, that generally enhanced information would not profoundly change the decision-making process (Keen 1985). We argue that in expedition cruising, however, more accurate and reliable weather and ice information would reduce some of the complexity of decision-making processes as less practices would need to be enacted before coming to a conclusion. In bad weather conditions now, often many different communication processes are being enacted to clarify the true impact the conditions have on the plans. Further, alternatives need to be discussed, calculations have to be done and additional sources are being used to compare data. These steps would not be necessary anymore, if the available information would be

more reliable and precise. Moreover, what we clearly saw in expedition cruising is the relationship between information access and authority. Our main actors, namely captains and expedition leader are the ones that have the main access to all relevant information on board and have the decision-making power. Further, this access to information is also a key factor that determines the relationships between the expedition leader and the captain or the expedition leader and the guide but also between the guide and the tourist. The one with more official information is the one that decides about activities and leads them or passes those tasks on to others. In most cases it is for all actors involved clear that the one obtaining the information shall be listened and followed. This is supported by Wildavsky (1974, p. 74) who states that *"Information is a resource that symbolizes status, enhances authority and shapes relationships."*

Last, my findings portrayed that weather and ice information are seen as a way to deal with risk situations and as a solution to safety. This corresponds with other researchers in this field (Vaughan & Dessai, 2014; Hewitt et al., 2012, Scott et al., 2011) that agree on the fact that a response solution to climate variability and related risks is enhanced information and information services.

5.1. Terminological considerations

In this study, we chose to use the term "weather and ice information" to talk about weather, wind, waves, mist and sea ice information. There are terms, such as biophysical or geophysical information that would be all inclusive, however, they further include much more elements, regarding natural processes related to physics or biology. Another terminological option would have been the term "climate services", however, after a literature review regarding terminological usages in this context we decided that it is not suitable for the purposes of my study. The reason is that the focus of this study is on the momentary application of information, on sudden changes in the environment and with that on the instantly emerging information. The term climate services, however relates strongly to climate change induced weather variability and long term predictions of and for dealing with these changes. According to Vaughan & Dessai (2014, p. 588) *"climate services convey information about average weather, using the analysis of time series data to estimate trends, departures from average conditions, and low-probability*

events on timescales from seasons to centuries.". This means that this term put emphasis on the availability and application of climate information for planning and less for its instant usage. Applying this term, would mean that the focus of the study should be on practices in the planning phase and would reduce the research on climate service relevant tools and information that differs from pure weather services (Vaughan & Dessai, 2014). Therefore, we decided to use the simple term "weather and sea ice information".

5.1. Role of the researcher an ethical considerations

The researcher as an individual human being plays an important role in the research. His personal values, background and education play a vital role in the way he/she interprets information. This requires that the research is aware of his/her personal influence throughout the entire study. Therefore, after different steps within the study like the data collection I took time to reflect on my role within the interview. Further, acknowledging the Wageningen University code of conduct I behaved in a for a master student appropriate way in the interviews.

Informed consent and overt research

Overt research requires that all participants are informed about the nature of the research beforehand, as well as briefly informed about the content. They had the chance to participate or to refuse. They were further, made aware of the fact that they could withdraw from the study. They were made aware of the outcome of the study, a master thesis.

Privacy and confidentiality

Participants' privacy was respected and they were considered anonymous by assigning them codes instead of using their names. The codes are only known my selected people from University that are involved in the study.

5.2. Limitations

There are several limitations to the study. Firstly, only a small part of the Arctic could be taken into consideration as due to time limitations only the European Arctic was taken

as a research location. Therefore, the findings only reflect the situation in this part of the Arctic leaving the other territories untouched. Then the number of actors that was interviewed was limited and reduced to certain groups thereby not including the perspectives of for example captains or other personnel also involved with weather and ice information. This is mainly due to a lack of contacts and positive responses to inquiries. These limitations imply that the study cannot be generalized to a broader population.

The method of conducting interviews offered a win in terms of saving time and money for the travelling, the negative effect is that interviews could not be held in person wherefore important body language and other values got lost. Further, due to technological limitations comments and other possibly relevant information can have been overheard. A last limitation is the fact that practices will be only identified via what people say they do, as participant observation is in this case not possible. This means we have to trust that they provide us with correct information, however, as this is not a critical topic the purposive provision of false information is unlikely. Further, by conducting multiple interviews we were able to identify patterns and common behaviour.

6. Conclusion

In this last part, we will briefly highlight the most relevant conclusions and finish up with providing an answer to the research questions.

7.1. Relevance of weather and sea ice information in expedition cruising

This study was initiated with the goal to better understand weather and sea ice information usage and needs of the expedition cruise sector. We argued that these information play a crucial role and determine many of the activities onboard. Further, we stated that the context in which these practices take place plays a particular role in expedition cruising. Last, we stressed that the practices are influenced by the societal context they are placed in and the role weather and ice information play there.

In a first step we looked at the practices in the expedition cruise sector in detail and saw that weather and ice information play a crucial role for decision-making in expedition cruising thereby steering the course of the cruise. This was shown by the fact that weather and sea ice information are always part of each of the three elements of a practice and thereby play a large role in characterizing the latter. We also saw that the particular combination of the elements highly depends on the context, of which the weather and ice conditions are a key factor. Further, two elementary factors determining the context are the strictness of the itinerary and the degree of risks faced. Those two have large influence on the degree of information needs and usage in operations. The more flexible the operators are, the less needed is accurate weather and ice information as more alternatives are open and more safety buffer can be planned. Further, we saw that the higher the perceived risk the higher the need for information and the bigger also the range of information sources used. From that, we can conclude that weather and ice information require a broad range of skills to understand them but also to draw the right conclusions in the context. They are a medium to guarantee safety, adventure and satisfaction for the tourists as well as for complying to company goals. Whereby, different actors in expedition cruising are responsible for achieving different goals. This leads to weather and ice information having different meanings for different actors, requiring different competences, engaging different tools and overall different combinations of practices.

In a second step, we looked at the Arctic as the environment around expedition cruising and the role of weather and ice information through the lens of the Risk Society concept. We assumed that the way society deals with risks and safety and the value different actors place on information would show connections to the expedition cruise practices. By looking closer at the information supply network, we saw that these actors are very concerned about creating a safer environment for navigation in the arctic. However, they are influenced by problems in technology and the presence of climate change, which leads to not being able to provide the information that is thought to be necessary for creating a fully safe environment. By looking at other actors like tourism and governmental authorities it became apparent that here as well a safe environment and safe practices are tried to be achieved by modes of regulating and informing. This shows that there is a deep awareness of risks around this topic and that information and knowledge production are thought to be a solution to the problems and to creating a safer environment. Actors in the expedition cruise sector thereby take up this thinking, of needing information to make safe decisions. Especially by those, that have a high degree of responsibility. The more authority an actor has, the more he seems to need information for safe decision-making. These realizations resemble that in order to create a more sustainable and safer expedition cruise industry practices in the society at large need to be changed as their behavior is strongly influencing happenings in the cruise sector.

7.2. What to remember

In this last section, we will shortly summarize the main points that give answers to the research questions. It shall give the reader the possibility to review the main findings and conclusions.

7.2.1. Role of weather and ice information in expedition cruise practices

We think what this study made clear is that weather and ice information are an essential part of expedition cruising and are a central element of the decision-making processes. Thereby, one information can mean different things to different members of the crew and can require different competences. Further, we saw that this information always has

to be seen in the context of time, place, mission and ship specifics. Whereby this complexity of decision-making often requires the connection of a series of practices. One of these practices is thereby usually some sort of communication. It is relevant for exchanging opinions about information, for receiving information and for providing information.

When it comes to needs one could say that they are actor specific, meaning that some companies and their employees need more information than others do. This can be explained by the size of the company and cruise as well as by the flexibility of the itinerary. The more open the cruise is kept the less information is urgently needed, as less pressure is there to go to a specific place at a specific moment. However, when it comes to material needs, the most present need seems to be the availability of updated ice charts on the weekend. Currently this is not provided by the MET wherefore satellite images have to be used which are less reliable and require more skills to draw good conclusions from. A second big need is the availability of better internet connections and lower data download costs, as well as fewer data volumes. As many of the developments within the information sector are based on the availability of good internet connections on-board this is a problem that needs to be solved, in order to enhance information availability. However, different supplier like Arctic Web or the DMI, are working on reducing the big amount of information that is available by providing more personalized and more condensed information. This would help to reduce the costs by reducing the data volume and would also help to increase safety by delivering a more clear and specified picture of the conditions for one's personal context which might enable less complex decision-making processes.

7.2.2. Role of weather and ice information in the characterization of the Arctic as a risk zone

The Risk Society concept allowed us to illustrate what role information plays in the Arctic environment in which expedition cruising is placed. It illustrated characteristics of this environment in terms of levels of cooperation and competition, the role trust plays, the significance of risks and the connections between different domains. Further, it enabled us to look at different actors in this context and different types of information

that are produced and distributed. We saw that no matter what actor and in what form, information was clearly seen as the key element for achieving more safety. Thereby information could be delivered in form of rules, data or education, directed at different recipients (e.g. tourists, citizens, industries) and structured by the role the particular actor plays in this context.

Overall, this concept made clear what crucial role information play in the context of this uncertain work environment as well as in the presence of the risk of climate change. It further made clear what strong role the weather and ice information supply side plays by on the one hand increasing the need for more safety by sharing information and creating awareness among society about the insecurity of their environment and on the other hand with that creating a need for more information as the tool to create more safety. These characteristics of the Arctic make clear why most practices in expedition cruising especially in the operational phase are aimed at creating a safe situation as often a change in the weather and ice environment leads to making the situation unsafe, requiring new steps. It also shows why information play such a crucial role within this decision-making process, as it is seen as the medium to creating a safe environment in the Arctic environment in general and the supply sector in particular. Practices in expedition cruising around weather and ice information are following determined by the desire to be safe in the presence of risks for which they depend on the information they receive from outside and second are driven by the intrinsic need to have enough information to make a safe decision. The latter means that they outreach and make contact with other actors in the environment in case of too little knowledge available on the ship.

Ulrich Beck's concept, thereby, signified well what role different actors play in the context of risks, safety and information. It demonstrated how on different societal levels a strive for safer practices in the Arctic is promoted and how they all in different ways work on achieving this. Thereby, the supply sector tries to produce more reliable and better-updated information and information technologies, governmental agencies try to regulate practices in a better way and local authorities try to form closer networks with other relevant actors for more aligned functioning. They are all driven by an increasing awareness of risks and a resulting strive for more safety. Within this knowledge and

information play a crucial role and are seen as a key to solving risk problems wherefore multiple actors are involved in the knowledge production and distribution. Within the weather and ice information supply sector we could divide three different actor domains relevant for expedition cruising. The currently maybe most relevant actor is the national weather and ice information provider. They provide free accessible information to everyone and play a crucial role for the expedition cruise sector. A second domain is the research-based provider whose main task it is to generate knowledge and close gaps in the current information availability. They also provide free information and see it as their duty to inform the public. The last group is than the private domain that consists of private companies that are either commercial or also provide free information. In the latter case, their main role is to unify information from different sources that are all necessary for safe navigation practices. National actors now also pick up this personalization of information, as the DMI. It shows how on different societal levels the same issues are being discussed and that different actors face the same problems of uncertainty, technological shortcomings, climate change and a need to provide reliable information to remain trust and safety.

7.2. Recommendations

In terms of the expedition cruise sector, several internal mechanisms seem to limit the functioning of the sector. It seems that partly guidelines are formulated in a too stiff manner that does not suite the necessary flexibility in this sector. It was mentioned several times that due to these guidelines are not fully respected, as they do not fit the specific circumstances. Therefore, in order to make compliance with guidelines easier a cooperation between AECO and expedition leaders and guides should be initiated in defining them in a more practical way.

Further, in order to guarantee better future information provisioning either a different medium than the internet needs to be found or current technologies need to be improved and costs reduced. This is necessary in order to make use of the developments and improvements in the supply sector. The new trend to unify information and customize it, seems to be a good way that could make operations in the Arctic more easy and safer for everyone, however if available information is not accessible all developments are of little value.

Last, the expedition cruise sector should think about different marketing strategies in order to promote expedition cruising more as the unpredictable and unstable type of tourism that it is. If itineraries would be less strict, operators would have more options to make the best out of the trip and to best respond to sudden changes in the weather and ice environment. Further, if tourists would be better prepared for the fact that the itinerary is flexible and dependent on weather and ice events there would be no false expectations and possibly more satisfied tourists in the end. Moreover, it would allow expedition leader and captains more space for good decision-making, with less pressures in a less tensed context. However, as practices of tourists have not been investigated in more detail in this study, it is also relevant to do this in a separate research. Understanding their connection to weather and ice information would be relevant for marketing expedition cruises more successfully with regards to further climatic changes in the Arctic. Further, this understanding could enhance the crew's skills regarding communication with the tourists, informing them about weather and ice induced changes to the itinerary.

Future research, should also look in more detail at the planning phase of expedition cruising, as we focused on the operational part. We also glimpsed into planning however, practices in the planning phase regarding weather and ice information are less striking as more other organizational aspects play a role, like staff coordination, schedules and other preparations. Further, the ice and weather information that play a role would be more related to climate services, as it is about long term prediction and not current information. Consequently, as climate services are not as developed yet, the planner is left with little information. Therefore, when it comes to decision-making in the planning phase it seems that mostly sea ice statistics from previous years and experiences are being applied. The planning of a route, is thereby always seen in the broader context of past sea ice conditions, experience and extrapolations. However, the planning issue would need to be investigated in more detail in another study, thereby looking at the current status of climate services, planners' needs and expectations, current challenges and so on. Further, future research should look at other industries that operate in the Arctic to get a more holistic picture of the information needs of vessels in this area. Further, also other territories should be included in this research, as the focus now, was on the European Arctic. Last, the supply sector needs to be investigated in more detail, including more knowledge domains, like the science side of data generation. In addition, the relationship between users and providers should be investigated in more detail as it is highly relevant for the further development of information technology to fully understand how they influence information provisioning and what role they could play in the future.

8. References

AECO, http://www.aeco.no/about-aeco/ Accessed 09.10.2015

Arctic Council (2009). Arctic Marine Shipping Assessment Report. https://oaarchive.arctic-council.org/handle/11374/54?show=full Accessed 10.07.2016

Arts, B., Behagel, J., van Bommel, S., Koning, J. de, Turnhout, E. (Eds.) (2013). Forest and Nature Governance - A Practice Based Approach. World Forests, Springer Dordrecht, 14:265 pp.

Boeije, H. (2010) Analysis in Qualitative Research. London, SAGE Publications Ltd.

Beck, U. (1992). Risk Society. Towards a New Modernity, Sage Publications, London.

Berkman, P. A. (2012). Our Common Future in the Arctic Ocean. The Round Table. 101:02, 123–135.

Bertzky, M., Stoll-Kleemann, S. (2009).Multi-level discrepancies with sharing data on protected areas: What we have and what we need for the global village. Journal of Environmental Management. 90:8-24.

Dawson, J., Stewart, E. J., Lemelin, H., Scott, D. (2015). The carbon cost of polar bear viewing tourism in Churchill, Canada, Journal of Sustainable Tourism, 18:3, 319-336.

Dawson, J., Johnston, M. E., & Stewart, E. J. (2014). Governance of Arctic expedition cruise ships in a time of rapid environmental and economic change. Ocean & Coastal Management, 89, 88–99.

Drever, E. (1995) Using Semi-Structured Interview in Small-Scale Research. A Teacher's Guide. Edinburgh.

Fischer, F. (2001). Environmental Crisis and the Technocratic Challenge

Giorgi, F., Jones, C., Asrar, G. (2009). Addressing climate information needs at the regional level: the CORDEX framework. WMO Bulletin, 58:3.

Guston, D.H. (2001). Boundary Organizations in Environmental Policy and Science. An Introduction. Science, Technology, & Human Values, Special Issue: Boundary Organizations in Environmental Policy and Science.26:4, 399-408.

Haavisto, R., pilli-Sihvola, K., Harjanne, A., Perrels, A. (2016). Socio-Economic Scenarios for the Eurasian Arctic by 2040. Finish Meteorological Institute. 1:1-65.

Hall, C. M., Saarinen, J. (eds.). (2010). Tourism and Change in Polar Regions. Climate, environments and experiences. London: Routledge.

Harsem, Ø., Eide, A., Heen, K. (2011). Factors influencing future oil and gas prospects in the Arctic. Energy Policy. 39:8037-8045.

Hilty, L. M., Ruddy, T.F. (2000). Towards a sustainable information society. http://www.academia.edu/451699/Towards_a_Sustainable_Information_Society Accessed: 28.07.2016

Ho, J. (2010). The implications of Arctic sea ice decline on shipping. Marine Policy. 34:713–715

Johnston, A., Johnston, M., Stewart, E., Dawson, J., & Lemelin, H. (2012). Perspectives of Decision Makers and Regulators on Climate Change and Adaptation in Expedition Cruise Ship Tourism in Nunavut, The Northern Review, *35*, 69–95.

Keen, P. G. W. (1981). Information Systems and Organizational Change. Communications of the ACM. 24:1, 24-33.

Kölner Stadt-Anzeiger (2012). Packeis fehlt, worueber Urlauber so klagen. http://www.ksta.de/ratgeber/-worueber-urlauber-klagen-4873780 Accessed: 30.07.2016

Kolstad, E.W., Bracegirdle, T.J., 2008. Marine cold-air outbreaks in the future: an assessment of IPCC AR4 model results for the Northern Hemisphere. Climate Dynamics. 30:7–8, 871–885.

Lamers, M. and Amelung, B. (2010). Climate change and its implications for cruise tourism in the Polar Regions. In: Lueck, M., et al. (Eds.) Cruise Tourism in the Polar Regions: Promoting Environmental and Social Sustainability. London: Earthscan. 147-163.

Lamers, M., Olsen, J., Hovelsrud, G., Lang, W. E., Jorgensen, F. (2014). 1st Science-Industry platform on expedition cruise tourism in Svalbard. Workshop report. Wageningen University, Nordland Research Institute, Association of Arctic Expedition Cruise Operators.

Lemelin, H., Dawson, J., Stewart, E., Maher P., Lueck, M. (2010). Last-chance tourism: the boom, doom, and gloom of visiting vanishing destinations. Current Issues in Tourism, 13:5, 477-493.

Lindberg, O. and Rantatalo, O. (2014). Competence in professional practice: A Practice theory analysis of police and doctors. Human Relations. 1-22

Maher, P. T. (2012). Expedition cruise visits to protected areas in the Canadian Arctic: Issues of sustainability and change for an emerging market. Tourism, 60:1, 55–70.

Maher, P.T: and Meade, D. (2008). Cruise tourism in Auyuittug, Sirmilik and Quttinirpaaq national parks (Technical Report- ORTM Publication Series 2008-02). Prince George: UNBC ORTM Program.

Miller, R.B. (1965). Psychology for a man-machine problem-solving process. IBM Data Systems Division Laboratory. Rept TR00-1246.

Nicolini, D. (2012). Practice Theory, Work, & Organization. An Introduction. Oxford Press.

Noy, C. (2007). Sampling knowledge. The hermeneutics of snowball sampling in qualitative research. International Journal of Social Research Methodology. 11:4, 327-344.

Overpeck et a. (2011). Climate data challenges in the 21st century. Science. 331:700-702.

Pashkevich, A., Dawson, J. & Stewart, E.J. (2015). Tourism in Marine Environments, 10:3–4,225–240.

Peter Mason (1997). Tourism Codes of Conduct in the Arctic and Sub-Arctic Region, Journal of Sustainable Tourism, 5:2, 151-165

Pulsifer, P.L. et al. (2014). Towards an International Polar Data Coordination Network. Data Science Journal. 13:94–102.

Rapley et al. (2014). Time for change? Climate Science Reconsidered. Report of the UCL Policy Commission on Communicating Climate Science.

Reckwitz, A. (2002). Toward a theory of social practices. European journal of social theory, 5 (KK), 243-63.

Rouse, J. (2007). Social practices and normativity. Philosophy of the social sciences, 37 (1), 46-56.

Scott, D. J., Lemieux, C. J., Malone, L. (2011). Climate services to support sustainable tourism and adaptation to climate change. Climate Research. 47: 111–122.

Schwabe. W. (2008). Klage gegen packeis. Kölner Stadt-Anzeiger. http://www.ksta.de/html/artikel/1226655119168.shtml Accessed: 04.09.2009

Shove, E., Pantzar, M., Watson, M. (2012). The Dynamics of Social Practice. Everyday life and how it changes. SAGE, London.

Stewart, E. J., & Dawson, J. (2011). A Matter of Good Fortune: The Grounding of the Clipper Adventurer in the Northwest Passage, Arctic Canada, Arctic 64(KK).

Stewart, E. J., Dawson, J., Howell, S. E. L., Johnston, M. E., Pearce, T., Lemelin, H. (2015). Local-level responses to sea ice change and cruise tourism in Arctic Canada ' s Northwest Passage, Polar Geography, 36(1-2): 142-1624

Strauss, A. & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, CA: Sage

Vaughan, C. & Dessai, S. (2014). Climate services for society: origins, institutional arrangements, and design elements for an evaluation framework. WIREs Climate Change, 5:587-603.

Wildavsky, A. (1974). Politics of the Budgetary Process. 2nd Ed. Little, Brown, Boston. Mass.

Winton, M. (2006). Amplified Arctic climate change: What does surface albedo feedback have to do with it? Geophysical Research Letters. 33:3

9. Appendix

9.1. Interview questions expedition cruise operators

Interview questions:

- What is your position in the expedition cruise sector?

- Which technical devices are used to get biophysical information? (name of device, producer/brand)

  Wind:
  Waves:
  Sea ice:
  Storms:
  Others:

- Which devices are used for the planning of a route and which ones are used for direct operations? How do they differ?

- Why do you use these devices (these brands) and not other ones?

- Do you know if other companies use the same devices and if not which ones they use?

- Why is every single one of those tools relevant?

- Where are they located? (portable, stationary)

- What skills do you need to use these devices?

- After you receive a weather/ice information what is the next step, what do you do?

- What role does weather/ice information play in trying to satisfy tourists and guarantee safety?

- How does a sudden change in weather/ice affect your actions, what are your next steps?

- How do you know how to react? (training, common sense)

- What role does flexibility play?

- What role does time play in decision-making? (time to adapt the plan to changes in biophysical conditions)

- Are temporal procedures determining which tool to use first and which follows? (explain)

- Is this procedure flexible, depending on the situation/information or always the same?

- What are weather/ice related rules you need to comply to?

- What new/different information/devices would you need to enhance your performance and increase safety?

9.2. Interview questions information supplier

- Where do you get your data from, what are your sources?
- Who is all involved in the knowledge/information production (professions)?
- What are the main competitors or comparable institutions in your domain?
- What are the main discussions in your branch about?
- What does the communication within your institution look like?
- What does the communication between you and the cruise sector/consumer of your product look like?
- Who is your main consumer/audience?
- Why do you produce information for this audience and not a different one?
- Which communication channels do you use?
- What are the main laws you have to comply to?
- What are the biggest uncertainties you have to deal with and why?
- What are the main problems you face in providing good weather/ice information services?
- What role does trust play?

9.3. List of self-conducted interviews

Company	Interviewee	Profession	Interview Details
Oceanwide Expeditions	Ko de Korte	Arctic Program Coordinator	2.12.2015, phone conversation, 40min
	Mark van der Hulst	Ship Manager	15.12.2015 Questionnaire and 20 min phone conversation
	Troels Jacobsen	Product and Sales Manager	10.12.2015, Skype, 1:25h
RUG	Frigga Kruse	Guide	27.11.2015, Questionnaire
	Ronald Visser and Annette Scheepstra	Expedition Leader	21.12.2015, Skype, 50min
Longyearbyen Camping Guides	Michelle vn Dyke	Expedition Leader	8.12.2015, Skype, 45min
69Nord	Olivier Pitras	Expedition Leader, Office Manager	22.12.2015, Skype, 30min
Alfred Wegener Institut	Christian Katlein	Guide and Sea-Ice Expert	4.01.2016, Phone, 1hour and questionnaire
ArcticWeb	Mads Bentzen	Project Manager	28.01.2016, Online Meeting Platform, 1hour

Norwegian Meteorological Institute	Hanneke Luijting	Researcher	Questionnaire, 17.02.2016
	Helge Tangen	Weather Expert	Questionnaire, face-to-face 27.06.2016, 50min
	Nicholas Huges	Sea ice Expert	Questionnaire, face-to-face 27.06.2016, 35min

9.4. List of Linde van Bets' interviewees

Company	Interviewee	Profession	Interview Details
Polar Quest	Axel Broman	Expedition Leader	24.07.2014, face-to-face, 50min
	Christian Bruttel	Nature Guide, Assistant Expedition Leader	21.07.2014, face-to-face, 50min
G Adventure	Alex Cowan	Expedition Leader	20.07.2014, face-to-face, 30min
Abercrombie & Kent	Aaron Russ	Expedition Leader	2.08.2014, face-to-face, 30min
Hurtigruten	Karin Strand	Expedition Leader	24.07.2014, face-to-face, 50min
Oceanwide Expeditions	Ko de Korte	Arctic Program Coordinator	17.06.2014, face-to-face, 1,5h
	Jan Belgers	Expedition Leader	18.07.2014, face-to-face, 50min
	Jim Mayer	Expedition Leader	28.07.2014, face-to-face, 50min

	Philipp Schaudy	Expedition Leader	29.07.2014, face-to-face, 30min
AECO	Ilja Lang	Denmark Office Manager	25.07.2014, face-to-face, 90min
	Frigg Jørgensen	Longyearbyen Office, Executive Director	19.06.2014, Skype, 50min
Tourism Svalbard	Ronny Brunvoll	Director	15.07.2014, face-to-face, 60min
Harbor-master Ny-Ålesund	Dag Lennart Andersson	Harbor-master	30.07.2014, face-to-face, 50min
Port Longyearbyen	Kijetil Bråten	Harbor-master	15.07.2014, face-to-face, 60min
Governor of Svalbard	Margrete Keyser	Tourism Advisor	14.10.2014, face-to-face, 40min
	Bjørn Eirik Normann	Field Inspector	6.08.2014, face-to-face, 50min
Ministry of Climate and Environment	Fredrik Theisen	Director	15.10.2014, face-to-face, 50min
Pole Position Logistics	Terje Aunevik	Managing Director	25.07.2014, face-to-face, 50min