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Risk and uncertainty in team decision-making
Case study in an Arctic context

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Icing is like other forces of nature, if you cannot work against it, you have to work with it (M6).

Abstract

Teams operating in the Arctic are surrounded by hazardous environments, and therefore make decisions influenced by uncertainty. This case study aimed to gain an understanding of how risk and uncertainty influence team decision-making processes in hazard environments in the Arctic. To collect data, nine interviews from fishing vessels operating in the Barents Sea, as well as search and rescue crew members have been conducted in order to find commonalities and differences between environments operating in the Arctic. Three people with experience from search and rescue were consulted initially to address challenges within the field.

A model focusing on team decision-making address five codes through a literature review. This review consists of 30 articles from the research fields of human behavior, psychology, business and health. These codes are elements in a team decision-making process, and consist of the terms shared mental models, trust, awareness, task management and time management. Also, communication has been identified in the data as importance for team decision-making. These codes all help obtaining optimal decision-making in teams, even when affected by uncertainty.

The necessity of the role of the leader was also identified in the data. Interviewees stressed the importance of the leader being in charge, but also listening to crew members to secure safety and a good working environment. Further, to secure optimal team decision-making processes under uncertainty, each individual's risk perception much be taken into account. This perception regards to previous experience, but also how the team works together. As a result, the leader has great importance to establish a good work environment where each crew member can trust each other and communicate properly, by having shared mental models and a situational awareness in the given situation. The main findings in this research shows a differentiation between different teams operating in the Arctic. Nevertheless, the data shows similarities in teams when it comes to the leaders' role in the team. The leader is in charge of making decisions, but the team members are, to some extent, welcomed to speak their mind and contribute in the decision-making process. Doing so will increase the communication about risk perception, which may contribute to safer operations and rescues. This thesis will hopefully be a small contribution to what team members should be aware of in decision-making processes in hazardous environments surrounded by uncertainty.

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28.05.21, Levanger

Marte Raknerud Hoel

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Chapter 1: INTRODUCTION

1.1 INTRODUCTION

The average annual temperature in the Arctic has increased twice as fast as the rest of the world during the past few decades (Rottem, 2013, p.1). Irrespective of mitigation efforts, the global mean temperature is claimed to rise in the 21st century (Rottem, 2013). However, the full impact of the rising global mean temperature on the climate is still uncertain. The Arctic sea ice is known to be one of the most sensitive environments to climate change, particularly with regards to rising temperatures (Rottem, 2013). The impact of climate change on sea ice has resulted in some changes in the Arctic region. The retreating sea ice extent has resulted in an increase in commercial activity in the Arctic Ocean (Rottem, 2013). However, polar shipping routes can substitute other ways of transportation considerably. Predictions show that transport routes between Europe and Asia can be reduced by 40% via polar shipping routes (Rottem, 2013). Other predictions suggest that climate change can dramatically change sea ice extent such that appropriate ice-class vessels may operate year-around in the Arctic Ocean (Stephenson, Brigham, & Smith, 2013).

Maritime shipping opportunities in summer periods increase due to the ice melting in the Arctic Ocean (Eguíluz, Fernández-Gracia, Irigoien, & Duarte, 2016). Shipping in the Barents Sea has also increased due to the presence of oil and gas operations in the region (Rashid, Abbas Khawaja, & Edvardsen, 2016). This increase in vessels operating further north brings up the issue of safety regarding navigation (Valdez Banda, Goerlandt, Montewka, & Kujala, 2015), route planning (Aylward, Weber, Man, Lundh, & Mackinnon, 2020), environmental protection (Jensen, 2008) and weather and climate hazards such as spray icing (Rashid et al., 2016). The challenging environment in the Arctic can contribute to both the likelihood of environmental and human accidents occurring, as well as magnifying their consequences (Roud, Borch, Jakobsen, & Marchenko, 2016).

Several shipping accidents in the Arctic have been caused by different weather conditions (Rashid et al., 2016) resulting in ice aggregation due to sea spray and strong winds. Human behaviors involving lack of effective communication (Leonard, Graham, & Bonacum, 2004) or a lack of a common situational awareness (Endsley, 2000; Stanton, Chambers, & Piggott, 2001) has also been a contributing factor to accidents occurring in the Arctic. Creating a common situational awareness between the crew members in such hazardous environments might increase the team decision-making. Hazardous situations such as the aforementioned can affect the safety of the ship's crew, cargo and environment (Darbra, Crawford, Haley, & Morrison, 2007). Furthermore, extreme precipitation and strong winds can cause accidents, making search and rescue operations in the Arctic complex and hazardous (Rottem, 2013). Sea spray icing is an important phenomenon when addressing hazardous scenarios in the Arctic Ocean. However, there are limited information on short-term and long-term trends of spray icing frequencies needed for decision-makers to make optimal decisions. Therefore, decision-makers involved in operations like oil and gas, search and rescue, and shipping and logistics do not always have the optimal information to assess, manage and mitigate the risks associated with spray icing (Naseri & Samuelsen, 2019). The safety of those operating in the Arctic, are dependent on other individuals working in the team. However, there are numerous uncertainties in decision-making processes regarding potential spray icing incidents or rescue operations. This thesis will therefore look into how hazardous weather conditions in the Arctic impacts commercial maritime activity in the region, as well as the safety of those working abroad vessels.

1.2 PREVIOUS RESEARCH

In this section, previous research within the maritime field is presented. To narrow it down, several decision-making systems and models are presented, some focusing on human behavior. Finally, research focusing on time pressure, risk and uncertainty in decision-making is addressed, explaining the implications for this thesis.

Not much research has been conducted on team decision-making in an Arctic context. Therefore, it is necessary to investigate which factors affect the team decision-making process and how the individuals of the team influence this process. A brief literature review will be presented to address previous research within the fields of team dynamics and team decision-making, as well as previous studies within the maritime field on decision-making in risk assessments.

Research conducted in the maritime sector within decision-making is slightly narrow. Most research related to decision-making has focused on risk and risk assessments, or risk culture. Klein, Schmitt, McCloskey, and Phillips (2000) examined the Marine Expeditionary Force (MEF) Combat Operations Center (COC) looking at the organization's current decision-making processes. They discovered several difficulties within the decision-making concept. However, their developed model focused on building situational awareness, planning, decision-making, information management and guidance. Results show that these components make decision-making under uncertainty and time pressure more efficient. Balmat, Lafont, Maifret and Pessel (2010) presented a decision-making system to maritime risk assessments. Using the decision-making system 'Maritime Risk Assessment' (MARISA) presented by Balmat et al. (2009), the authors validate their results using real data from ship's characteristics and weather conditions to define a risk factor for each ship. Other studies have focused on safety for those working on board vessels. Darbra, Crafors, Haley and Morrison (2007) researched safety culture and risk perception by interviewing 77 maritime pilots in Australia and New Zealand. The results show that commercial pressure affects safety culture, fatigue management, training, risk, and hazard reporting. Nævestad, Phillips, Størkersen, Laiou and Yannis (2019) addressed unsafe behaviors and work accidents in maritime transport in Norway and Greece in their study. The paper indicates that safety culture influence types of unsafe behaviors, resulting in the risk of injuries. This previous research focus on the influence of risk in decision-making. Further, some research has also focused on time pressure in decision-making.

Various research has focused on time pressure and time constraint in decision-making processes. The US Government financed TADMUS, *Tactical Decision Making Under Stress*, as a result of the American warship USS Vincennes shot an Iranian passenger plane resulting in a big civil loss (Johnsen & Eid, 2006). Young, Goodie, Hall and Wu (2012) modeled decision-making under time pressure in a prospect theory framework to address how people react in practice. The results found an increase of risk-seeing behavior under time pressure. Tohidi and Jabbari (2012) on the other hand, examine what goes into a decision and how we come to them. Furthermore, researchers investigated time-pressure perception in decision-making (Ordóñez, Iii, & Pittarello, 2015) by providing a new model. The authors claim that having sufficient time while thinking about a decision may increase the awareness of ethical issues and implications related to the decision. The results show that having the optimum time constraint can help efficiency while maintaining an acceptable level of decision quality. Time pressure can be challenging when facing complex decision-making. However, uncertainty also influence the decision-making process due to the impossibility to address all possible outcomes before making a decision. These factors might therefore affect team dynamics in team decision-making.

Research within team dynamics in decision-making is conducted mostly in the field of human behavior, management and health care. These decisions vary from simple go-no go decisions to complex decisions with major consequences (Johnsen & Eid, 2006). Other studies on decision-making and human behavior have been conducted by Goodie and Young (2007) by looking at power and overconfidence (Fast, Sivanathan, Mayer, & Galinsky, 2012), learning (Dillon & Tinsley, 2008), time pressure and risk-seeking behavior (Young, Goodie, Wu). Moreover, other researchers have studied trust in decision-making, looking at swift trust in temporary teams (Thommes & Uitdewilligen, 2019), planning (Aylward et al., 2020) and facial emotions indicating that displays of anger influence decisions to trust (Campellone & Kring, 2013). In addition, Sapp, Torre, Larsen, Holmboe and Durning (2019) addressed group trust in group decisions and explored factors which influence trust. The authors concluded attitudinal and performance outcomes have been associated with trust on both individual and group levels. Further, several models of decision-making have been developed the past decades.

Decision-making models have been developed, focusing on resilience, uncertainty or unknown unknowns. Klein (1993) has developed a Recognition-Primed Decision (RPD) Model of Rapid

Decision-making. The model shows how people can use experience to avoid some of the limitations of analytical strategies. Lipshitz and Strauss (1997) address a Naturalistic Decision-Making Analysis when coping with uncertainty. The paper looks at how decision-makers conceptualize and cope with uncertainty, and different coping strategies for decision-making under uncertainty. Other researchers have studied decision-making under uncertainty by developing a decision field theory (Busemeyer & Townsend, 1993), focusing on psychology to develop risk-management strategies (Pasquini, Steynor, & Waagsaether, 2019), or addressing control and competence (Goodie & Young, 2007). Also, researchers have addressed uncertainty in decision-making by uncovering unknown unknowns (Feduzi & Runde, 2014) or looked at police strategies for resilient decision-making under uncertainty in a high-risk critical incident by apply the RAWFS heuristic when coping with uncertainty (van den Heuvel, Alison, & Power, 2014). These models form a broader picture of how a decision-making process take place under uncertainty and time pressured situations.

However, little research has been conducted within the field of risk and uncertainty in team decision-making in the maritime community. With this presented backdrop, this research will investigate whether individuals influence team decision-making processes or not. Due to the lack of research maritime safety regarding risk and uncertainty in team decision-making, there is the necessity to investigate which factors affect the decision-making process and how the individuals of the team influence this process.

1.3 ANALYTICAL IMPLICATIONS

1.3.1 Relevance of studying team decision-making in the Arctic

There has been little research within the field of team dynamics in the maritime sector or during hazard situations, particularly in the Svalbard context. The Governor of Svalbard is responsible for planning, leading and coordinating rescue operations around Svalbard (Rescue Service | Governor of Svalbard, n.d.). If an accident should occur on a vessel near Svalbard, the search and rescue (SAR) team in Svalbard would be one of the first, if not only, responders for a search and rescue operation in the area around Svalbard. However, the search and rescue team in Svalbard covers a large area, with limited resources. Such limitations in response capacity creates more severe consequences, particularly in large-scale accidents (Roud et al., 2016). Maritime safety is therefore an important issue for societal safety. As a result, factors in decision-making and team dynamics will be presented in this research project, focusing on the much-needed application of these concepts in hazardous maritime situations. The main goal of this research is to see if either environmental factors influence team decision-making in hazardous environments in the Arctic, or whether uncertainty and individual risk perception influence this process. The research is narrowed down to focusing on a team within search and rescue, and fishing vessels operating in the Barents Sea with potential sea spray ice hazards. These teams will not be compared, but rather used to cover larger areas of teams operating in the Arctic. This research will gather insight in the decision-making process a team face in hazardous environments. To do so, a qualitative study will be used to investigate the research gap found in the literature review.

1.3.2 Research questions

In this section, an outline of the objectives in this research are provided. The research questions and sub-questions of this thesis will be presented in this section. In addition, frequently used terms throughout this thesis are presented with their definitions. This section concludes with an outline of the remaining chapters of the thesis.

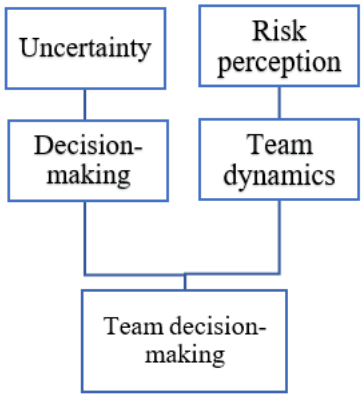


Figure 1: This thesis address the intersection between decision-making, team dynamics, risk perception and uncertainty

This research will focus on team dynamics in decision-making, gathering data from operational search and rescue teams and fishing vessels operating in the Arctic Ocean and the Barents Sea. The main research question (RQ) is supported by sub-questions, aiming to answer different aspects of each question. Research questions aim to confirm assumptions in a hypothesis or address new discoveries (Flick, 2004). In addition, each research question aims to be a stepping-stone for the next. To limit the scope, the main research question investigates whether climate change influence the decision-making process within a team working abroad vessels operating in the Arctic Ocean. Further, this research seeks to compare whether rescue teams views climate change differently, as well as if they have different decision-making processes. The research question for this thesis is the following:

> *What are the most important factors in team decision-making for at-risk or support vessels in a hazard context like sea spray icing and SAR operations when it comes to climate change-induced, environmental hazards in the Arctic Ocean caused by strong winds and low temperatures?*

The main research question has additional sub-questions:

- RQ1: Are there any noticeable trends in team dynamics?
  - RQ1.1: Are these trends related to changes in the climate?
- RQ2: Do hazardous environments make team decision-making more or less of a challenge?
  - RQ2.1: Does the intensity of the hazard make this more or less of a challenge?

- RQ3: Does an individual's risk perception affect the team decision-making?
  - RQ3.1: How do teams define an optimal decision? Is this definition similar across different teams and different environments?

To frame the main thesis question, I first need to explore if strong winds and low temperatures influence the decision-making for operating teams in the Arctic. After examining how teams work together during hazardous operations, I can address whether this issue is present in different type of environments or in different types of teams. The final research question investigates several factors which come into play when addressing decision-making processes in a team and how teams approach decision-making and individual risk perception as a team.

1.3.3 Definitions of frequently used terms

Frequently used terms in this thesis will be presented below. Other terms and theoretical implications will be presented in the third chapter.

Table 1: Frequently used terms in this thesis

Term	**Definition**	**Source**
Risk	Risk is an uncertain consequence of an event or an activity with respect to something that humans value.	(IRGC, 2005)
Risk perception	Risk perception is the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences.	Sjöberg et al. (2004, p.8)
Hazard	A hazard is a potential source of harm or adverse health effect on a person or persons.	Health and Safety Authority https://www.hsa.ie/eng/Topics/Hazards/#sthash.lQDk85Qj.dpuf
Uncertainty	A situation in which one has no knowledge about which of several states of nature has occurred or will occur.	Anderson et al. (1981) in Lipshitz R, Strauss O (1997, p.150)
Decision-making	The main duty of decision maker is receiving possible ways and the results due of them, and to choosing the best way.	Tohidi and Jabbari (2012, p.827)

Work team	A group of individuals working together in which individual success is based on group success.	Lanza (1985, p. 47)
High-Performance	Performance which is consistently higher than that of the majority of peer organizations in the same sector, and over a prolonged time period.	Graham Jones, Mark Gittins and Lew Hardy (2009, p.140)
Team decision-making	Team decision-making include the following requirements: (a) team members who have different and specialized expertise, (b) the interaction of individual and groups in problem-solving activities, and (c) substantial interpersonal communication in non-sequential task time frames.	Galegher (1990) in Castellan (1993, p.249)

1.4 READING GUIDE

Introduction

To benefit the reader, the structure of the thesis from start to finish is presented below. An overview of the importance of this thesis is presented initially. The research questions are presented, looking at decision-making, team dynamics, risk perception and uncertainty. The theory grounded in the research questions are literature about individuals risk perception regarding team decision-making, in addition to decision-making affected by uncertainty.

Theory

This thesis will begin with a backdrop of the terms used in this thesis. The theory chapter will address relevant theory for the reader to understand how decision-making processes are affected. Different authors within the field of decision-making are established. The chapter also explains a developed model looking at team decision-making are presented, establishing five codes of shared mental models, trust, task management, time management and awareness. Further, a risk perception model is presented, in addition to implications for risk management.

Research Approach

This chapter explains the research approach for this thesis. Moreover, the methodological aspect will be addressed. The chapter will look at the research conducted in the spray icing- and search and rescue community in the Arctic region, including Svalbard. Corporations and people involved in this project are also presented in this chapter. Also, the ethical aspect of research and my role as a researcher are presented.

Results

This research will further be coded and analyzed, before a summarizing conclusion to this contribution are being made. The results are presented from the interviews conducted within search and rescue and fishing vessels teams operating in the Arctic region. The findings from the interviews have also been categorized into three subgroups, trends in team dynamics, challenging in hazardous environments, and risk perception in team decision-making.

Analysis and discussion

The chapter of analysis will compare the results from the research to the relevant literature presented in the theory chapter. The focus is the decision-making process under spray icing situations, and search and rescue operations in the Arctic.

Conclusion

The conclusion of this thesis is based on the results, analysis and discussion conducted in the previous chapters. The conclusion focuses on the implementation of trends in team dynamic to make a better foundation for making optimal decisions.

Implications

The chapter of implications focus on future research within hazardous environments and decision-making processes.

Limitations

The limitations of the conducted research are presented in this chapter.

Chapter 2: METHODOLOGICAL APPROACH

This chapter will focus on the research methods and the methodological approach. The qualitative case design is presented initially. Further, data collection strategies and analysis of the conducted interviews will be addressed. Finally, the ethical concerns of this thesis are discussed.

2.1 QUALITATIVE REASEARCH DESIGN

There are numerous variations of research design in qualitative research. Deciding on a type of research design helps the researcher to control, minimize and exclude the influence of the research or researcher when gathering data (Flick, 2004). The interviews have been conducted in Norwegian, before translated to English with my own translation and interpretation. Within the translation theory, one can divide between the instrumental translation using the word-for-word approach, and the hermeneutic translation using the sense-for-sense approach (Venuti, 1977). The latter has been used in this study offering a more sophisticated translation.

2.1.1 Study design

Research design address how to set up the data collection and analysis, selection of empirical material and which research question to answer with the time available (Flick, 2004). The theoretical framework helped develop concrete research questions, which further influenced the research design and research method. Moreover, the research design helped frame the research to focus on the theme, using a mix between tight or loose research designs. After developing the research question, I addressed the degree of standardization and generalization goals (Flick, 2004). In this study, the point is not to generalize the population, but to investigate minor teams working in a specific environment. Finally, the temporal, personal and material resources available to conduct the study were addressed (Flick, 2004). How many people the researcher intend to interview and how many variables they investigate, affect the decision for research method.

Quantitative methods are preferred in research using large data sets with multiple variables. However, since this thesis consists of a low number of interviewees and therefore have few

variables, using a qualitative method is preferred. By using qualitative method, in-depth information from few participants makes the basis of the data. Due to the short time period to conduct research, I have lowered the number of participants, and ways to conduct research. Time management made it difficult to investigate near miss documents to address commonalities to learn from previous incidents. In the beginning of this research, there was an intention to interview focus groups and observe rescue operations, in addition to staying in Svalbard for a longer period to conduct in-depth interviews. However, due to Covid-19 regulations, this was impossible to carry out. Even though these methods would be preferable, the number of participants was lowered and ways to research were change due to the available resources.

2.1.2 Case study

Case studies are used to address the research questions in the best possible way. Two teams were investigated to gather data for this thesis. Using SAR-teams (search and rescue) operating in the Arctic created a good overview of the Norwegian rescue operations in the high north. Further, teams operating in the Barents Sea on fishing vessels were interviewed to address commonalities in different Arctic environments. The SAR-teams mostly conduct rescue operations on their own. Therefore, their team dynamic is important to address to see how they function in critical situations. Due to the low number of interviews, the two cases are not compared but rather used to cover a larger area of the Arctic region. However, factors addressed in the analysis of the gathered data were compared to see whether environment, intensity or team correlated with the factors found.

2.2 SAMPLING

The data collection in the study consists of interviews conducted with crew working on search and rescue operations in Svalbard, and fishermen operating in the Barents Sea. In this thesis, teams have been interviewed, looking at their decision-making process and how they work together as a team. Triangulation has been used as a strategy to test the validity and develop a comprehending understanding of the method to strengthen the empirical framework (Carter, Bryant-Lukosius, Dicenso, Blythe, & Neville, 2014). Furthermore, a model was developed through a literature review resulting in five common elements in team decision-making. Also, administrative workers have been interviewed using unstructured interviews.

2.3 RECRUITING

Initially, I was in contact with five people to address issues within the field of search and rescue in different contexts. The people were found using my network and through LinkedIn. These meetings helped form a basis of issues within the field of SAR, and helped me get a greater insight of the cooperation between different departments and organizations. By using the snowball method, additional interviews were settled. The snowball method makes you start with one informant and allow the chain to follow its own course (Biernacki & Waldorf, 1981). The informant finds another informant to interview, which means the researcher does not need to find all the informants themselves. Without prior experience within the fields of research, the snowball method was used to gain insiders' knowledge to locate people for this research (Biernacki & Waldorf, 1981). The method was initially relying on preliminary introductions from the existing Fram Centre-funded VesselIce project, as well as through our UiT and SINTEF teams, to help find relevant interviewees for this project (Naderifar, Goli, & Ghaljaie, 2017). In addition, several participants were conducted by using network, through LinkedIn or by reacting out to people working in the maritime industry, in addition to search and rescue teams. Several interviewees were also found through the service BarentsWatch, which shows vessels operating in the Barents Sea in the actual moment. Interviewees were contacted through email or by phone to participate in this project. Thank you notes, or calls were undertaken after the interviews. In addition, the thesis was also offered to be shared with the participants.

2.4 SAMPLE SIZE

The sample size of this research aim to look at different hazards in the Arctic. Furthermore, the research aim to address several regions in the Arctic, including Svalbard, and different vessels operating in the Barents Sea. Different data has been provided from two different communities operating in the Arctic. The target group was chosen based on the topic in the study. Consequently, 15 people have been consulted or interviewed regarding this thesis, and 9 of these have contributed directly to the empirical findings of this research. The division of interviewees are shown in the figure below.

Table 1: Sample size of interviewees in this research

Spray icing							Search and rescue	
I	I	C	C	C	C	C	A	A
M1	M2	M3	M4	M5	M6	M7	O1	O2

Explanation letters: I= information maritime, C= captain, A= administration

2.5 DATA COLLECTION STRATEGIES

2.5.1 Literature review

In the initial part of the project's period, a literature search, using the search engine Google Scholar, was conducted to find relevant literature. Chosen literature were based on several criteria. First, the article had to be presented in English, in addition to having Open Access through University of Tromsø's licenses. The name of the published article's journal, and the number of citations also affected the selection by focusing on articles with more citations. Literature was also found by looking at references from other articles. This gave a better knowledge of the literature within the field, but also made the work more complex by adding a large amount of literature. In each article, abstract, introduction, and conclusion were read through a manual review to find the relevance for the thesis. The short amount of time for this thesis also affected the number of articles included in the literature review. The literature review focused on 30 articles in decision-making and team dynamics, mostly from sectors within organizational behavior, health, and psychology. These articles were used to find common concerns and thoughts. The literature review conducted various aspects of the team in a decision-making process and found five commonalities in shared values, trust, time management, task management and awareness. The factors found in the literature were used in comparison to actual teams working together.

2.5.2 Focus groups

Additionally, to gather a greater understanding of team dynamics, I addressed the possibility to interview focus groups. The main purpose of focus groups is to address the participants' attitudes, feelings, beliefs, experiences and reactions in a way which cannot be found using

methods like observations, interviews or questionnaires (Gibbs, 1997). In focus groups, several people are gathered to speak their point of view or talk about their own experiences. Topics presented by the moderator opens for the group to discuss. Focus groups gives an insight to people's shared understanding and are suited to obtain different perspectives from the same topic (Gibbs, 1997). In focus groups can the participants interact with each other and follow up with a statement or disagreement. However, due to Covid-19 regulations, focus groups were difficult to plan for and implement in this thesis.

2.5.3 Semi-structured interviews

The goal of the study is to address the interviewees' experiences and perception. The best way to understand this through qualitative interviews. By using qualitative interviews, the interviewee can explain their own opinions. The operational interviewees were asked semi-structured questions, while the initial interviewees were asked open questions to address issues in hazardous environments. Open questions invite the interviewee to present their own thoughts and experiences (Thagaard, 2018). However, semi-structured interviews gave room to change the order of the questions, by making the interview a bit more formal.

The initial interviewees were informed of the topic but were able to address the issue with their own words. By letting them express issues themselves, the interview might have been perceived as more natural. The interview started with open questions about experiences with hazards in spray icing or SAR for the interviewee to remember back to a certain situation. It might have been easier for the interviewee to remember certain events rather than feelings or thoughts from the past (Thagaard, 2018). Because team dynamics are complex and hard to understand, other terms were used during the interview to describe the context in a more common language. Moreover, the term 'spray icing' do not have an equivalent term in common Norwegian language. As a result, other common terms were used to make sure the terms were not lost in translation.

2.5.4 Ways to conduct interviews

A key question when conducting interviews is whether to record the interviews or not (Yin, 2014). Some of the interviews were recorded on an online platform. This made it easier to actively listen and ask follow-up questions. Having a listening approach means having all the attention towards the interviewee, and showing interest by giving responses to their stories (Thagaard, 2018). However, some interviews were conducted over the phone due to lack of internet or to ease the burden of participating. Since notes were taken instead of recording the interview, I could not be as present as a researcher should. This might have led to the interviewee not fully elaborate about the topics.

Also, having interviews over the phone and not in person results in not being able to read body language. Body language can be used to ask follow-up questions to get a broader understanding of the topic (Thagaard, 2018). In addition, some interviews were conducted in person, with a recorder. These interviews were transcribed in full and coded as described below. Doing so made it easier to have an open conversation while being present and focused on the flow instead of taking notes.

2.5.5 Interview guide design

The interview guide focuses on topics and open questions to discuss in the interview. The questions are relevant to the chosen research questions and the main topics in this research. The interviews started with simple background questions about themselves, regarding education and work experience. Furthermore, the questions went on to team-related questions. The interview guide was structured with help from the theoretical framework. Using this structure in the interview guide makes the data analysis easier. Follow-up questions were also prepared in case the interviewee misinterpret the question or did not understand it. The interview guide is presented in full in the attachments section.

2.6 ANALYZING STRATEGIES

Notes were taken during the interviews, but those notes were not transcribed in full. This might have led to essential information being lost underway. The transcriptions from the interviews were processed and translated immediately after, even those not recorded. This was done to

make sure sentences and interpretations lost in the text were noted from memory to give the sentences its full meaning. The process of analysis has moved from looking at research questions, to the data collection, and interpreting the data back and forth several times.

2.6.1 Coding

Analysis and interpretation of data was a continuous process throughout the whole research period (Thagaard, 2018). The interviews were transcribed and coded to understand the main ideas of the interview (Roulston, 2015). During the first reading, the aim was to note occurring topics and individual aspects related to the research questions in a broad sense (Schmith, 2004). Moreover, the interviews were coded and categorized according to the categories previously established. The text was read and processed several times to discover new sides of the data. Several findings were addressed while transcribing the interviews, by finding commonalities or contrasts. Nevertheless, the aim is not to find the same topic in every interview (Schmith, 2004).

Data from all participants were used to explore different topics (Thagaard, 2018). The interview guide was already structured into categories, but due to the structure of semi-structured interviews, the data were still categorized when analyzing them. Further, to get a better understanding of the concepts, the codes were classified into larger groups, in reference to Schmith (2004). Coding made the foundation to compare the interviews and divide the text using different code words (Thagaard, 2018). This made it easier to discover topics for the analysis. Finally, an in-depth analysis of several concepts was conducted.

2.6.2 Presentation of data

As a researcher I had the authority when presenting the results, but also a responsibility towards the participants in the project in my way of authoring the thesis (Thagaard, 2018). So, it has been necessary to keep in mind how the interviewees react when reading their opinion on written paper. Also, it has been important to remember not putting too much weight on strong single opinions, but instead focus on showing different sides of the story. This is addressed further in the following section on ethical issues. In addition, the chapter about theory and methodology is structured the same to ease the empirical findings and conclusion for the reader.

2.7 RESEARCH ETHICAL ISSUES AND METHOD

2.7.1 Informed consent

Before conduction research, I prepared myself and gained insight regarding the applicable ethical guidelines. There are no international regulations for ethical standards conducting research (Ryen, 2004). However, there are some common guidelines for ethical issues. The interviewees were provided with a short background on the project in the informational letter sent beforehand. Further, they were informed of their anonymity and right to withdraw their participation at any point developed from NSD's standards. Informed consent gives the research objectives the right to know the nature of the research and that they are being researched (Ryen, 2004). This was repeated before conducting the interviews. Because the topic of the study regards a field the interviewees most likely do not think about during their workday, the brief letter of information was sent out beforehand to make the interviewees reflect upon the topic. However, the information given was kept to a minimum to avoid biased participants or increase the risk of participants withdrawing.

2.7.2 Confidentiality and the issue of harm to participants

Further, the ethical issues of confidentiality and trust were addressed. The researcher is obliged to protect both the participant's identity and the location of the research, which is not always as easy to keep anonymous in small communities (Ryen, 2004). Moreover, it is the researcher's responsibility not to harm the field for other researchers by making the participant reluctant to researchers (Ryen, 2004). Trust can also be seen as an important key to gain access to the field. However, the Arctic region is a much-researched area. Consequently, my impression as a researcher leaves a footprint to other researchers conducting interviews after me. One of the informants stated unprovoked that because of previous researchers providing incorrect statements from interviews, the maritime sector struggles from research fatigue. It has therefore been considered how the participants are presented in this thesis to maintain their integrity (Thagaard, 2018).

2.7.3 Privacy

A universally applicable issue with the ongoing pandemic is ethics online. It was not an option to receive written answers from informants. Having the participants send their responses in written text forms a weak member validation, in addition to control and evaluate projects (Ryen, 2004). In addition, it causes issues regarding privacy. The interviews were therefore recorded on video using the University's cloud server. The interview was recorded to present and ask follow-up questions. However, some interviews were not recorded and were conducted over the phone while by taking notes. This might have led to more openness and willingness to be interviewed.

The interviews were anonymized when transcribing. Contact information and statements from the interviewees were coded and confidential, before storing them at the University's cloud storage. Both contact information and videos from the interviews were deleted after the finalizing of the thesis. The project has also been sent to the Norwegian Centre for Research Data. NSD's social mission is to archive, facilitate and disseminate data for research and analysis (Norwegian Centre for Research Data, 2020). Storing the data in NSD's database means that the data are stored in a correct ethical way, making sure that valuable data not being lost. In addition, other researchers are able to use the data to future research. In this way, the research group can also read the data. Keeping the data open is good research ethics.

2.8 QUALITY OF THE RESEARCH

This section will discuss the quality of the research. Qualitative research can be measured by addressing validity and reliability. Validity in a research project gives an indication about the validity of the results and how the researcher measure these (Thagaard, 2018). On the other hand, reliability address whether the study can be repeated with the given measures. A research project might have a high degree of reliability, without having a high degree of validity.

2.8.1 Validity

Looking at validity in research, one divides between concept validity, internal validity, external validity, and method validity. These will all be presented below.

2.8.1.1 Concept validity

By using several articles from different researchers, there has been presented a nuanced picture of the team dynamics in decision-making. This can contribute to strengthening the results from the research. The process in the project has been described in section of research methods. There has also been described how the interviews were conducted, and which research questions were selected. All these elements help other researchers to continue within the same topic and to create free access to the material through NDS' database.

2.8.1.2 Internally and externally

Internal validity looks at how and why one event leads to another event (Yin, 2014). The researcher must address the variables which can influence the results of the research and reduce the chance of false results. External validity looks at how results from one research project can be generalized to other studies, regardless of which method that is used (Yin, 2014). The data has been triangulated by using a literature review and unstructured interviews from different people working within several fields of search and rescue. Further, it is necessary to address if the research aim to generalize the entire population or if the study is a comparison between two individuals or companies. It is not possible to get a representative selection with a sample-size of the people interviewed. By having a small sample size, dimensions from lager groups might have been avoided (Flick, 2004). However, even if the teams are too small to generalize, the results can be representative for other teams operating in hazardous environments.

In this research, the interview guide help to secure the internally validity by focusing on the specific topics. Also, I have been careful drawing conclusions based on extreme statements presented from one interviewee with disagreements from the rest of the group. In addition, I as the researcher might have influenced the situation of the interview, which may have impacted the internal validity of this research. Nevertheless, during the interviews I have been hesitant to show agreement or disagreement to make the interviewees speak their minds without feeling judged.

2.8.1.3 Method

The interviewees were informed about their anonymity. By keeping their answers anonymous, their participation in the research will not affect their work life in the aftermath of the research. By using semi-structured interviews, topics which were not addressed to the participants, can

still be presented as point of views. This can result in addressing other challenges in decision-making that were not already conducted beforehand. During my research, I tried to stay objective instead of looking for a confirmation of the initial anticipations and conclude the research based on this. By using semi-structured interviews, topics which were not addressed to the participants, could still be presented as point of views. That helped address other challenges in decision-making that were not already conducted beforehand. The interviews were constructed over a shorter period and not conducted within the same period. As a result, my behavior as a researcher might have been different from one interview to another.

2.8.2 Reliability

The results from this research project can also be relevant in other situations (Thagaard, 2018). Reliability looks at how research conducted by using the same method can result in the same findings as the previous research did. How the data was collected and approached is an important part of sharing the findings of the research. To measure the degree of reliability, followed procedures and the given approach of the research has been addressed.

Reliability in qualitative research is challenging whereas I as the researcher increasingly draw the conclusion myself, compared to quantitative methods. There is also a greater challenge regarding the method in collecting the data and analyzing them. Direct quotes can strengthen the reliability since they are not interpreted before they are presented in the findings. However, the quotes are translated by me from Norwegian to English, which might have led to jargon and sayings being lost in translation. One often finds fitting quotations in the first reading, thereby overlooking parts that fits less with the initial expectations (Schmith, 2004). However, I have been cautious to find direct quotes in the first round of analysis to avoid basing the results on strong quotes.

2.8.3 The quality of this research in practice

Although this chapter aimed to guarantee quality in this research, the study might involve some limitations affecting the quality of the research. These limitations are outlined in the final part of this thesis.

Chapter 3: THEORY

In this chapter, theoretical implications used in this thesis will be presented. Initially, teams and team dynamics will be introduced. Moreover, five codes in decision-making found in a literature review will be presented. Decision-making under uncertainty and how people work under uncertainty are addressed, before tying risk and risk perception into decision-making under uncertainty. This framework makes the basis of the theoretical implications in this research and will be discussed further.

3.1 TEAM DYNAMICS IN DECISION-MAKING

Data from fishing vessels exposed to spray icing hazards are used together with data from search and rescue to secure a broad sense of team decision-making in an Arctic context. The teams operating in the Arctic are working in teams surrounded by potential hazards (Liu & Frangopol, 2018), and make decisions with high uncertainty and high risks. To investigate how teams make decisions under uncertainty, one must first understand what a team is. A team can be defined as 'a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have been assigned specific roles or functions to perform, and who have a limited life-span of membership (Salas, Dickinson, & Converse, S. A. Tannenbaum, 1992, p.4). Individuals make up a team, which works together to achieve a common goal. Also, teams consist of a minimum of two people with predestined roles and divided tasks (Johnsen & Eid, 2006), have individual success based on group success (Lanza, 1985), and have a clear purpose, with a common understanding of the team members interdependence of one another (Kazemak & Albert, 1988). Further, they bring a set of opinions and experiences into the group, making the dynamic work differently depending on each member. However, not all individuals function in a team setting.

Every individual of a team has their own risk perception. This has to be communicated to the rest of the team, to make sure everyone is onboard and have the same goal. Further, uncertainty could influence decision-making in hazardous environments. Team dynamics are therefore important to keep the team unity. Different codes of team in decision-making will be presented in the

following, as well as what risk perception and risk management mean to individuals in a team. A well-functioning team keep positive dynamics. However, negative aspects that can destroy the positive dynamics are relationship conflict, dysfunctional behavior, divergent interests or dissolvent in the team (Cater, Kidwell, & Camp, 2016). These conflicts might evolve from different perceptions of a situation and risks. Different perceptions of the situation can lead to controversy within the team about how to view the given risk (Pratt, 1964). This might further affect their opinion when making decisions.

3.2 RISK AND RISK PERCEPTION IN DECISION-MAKING

There have been developed numerous definitions of the term risk. In general, the term can be divided into two categories with risk being expressed by a) means of probabilities and expected values, or b) through consequences and uncertainties (Aven & Renn, 2009). A definition looking at probabilities and expected values claims that 'risk equals the expected loss' (Willis, 2007). However, risk has also been defined as 'an uncertain consequence of an event or an activity with respect to something that humans value' (IRGC, 2005). The latter definition refers to risk as a state of the world, and address risk as an event or the consequences of an event subject to uncertainties (Aven & Renn, 2009).

In addition, since every individual in a team has their own experiences with risk, they also view risk in different ways and have different risk perceptions depending on the situation. Risk perception is defined as 'the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences' (Sjöberg et al., 2004, p.8). Individual risk perception contributes to someone being able to go forward when others have reached the limit. Based on the decision-maker, decisions are made by either risk aversion, being risk taking, or staying risk neutral (Pratt, 1964). This perception differs some each situation and can therefore be a contributing factor to the decision-making process under uncertainty.

3.2.1 Four context levels of risk perception

Risk perceptions differ depending on the type of risk, the risk context, the personality of the individual, and the social context (Wachinger, Renn, Begg, & Kuhlicke, 2013). Renn and Rohrmann (2000) have developed a model examining four context levels of risk perception. The findings show an importance of creating a formula to reducing the risk concept down to probability and consequences violating people's initiative feeling (Renn & Rohrmann, 2000).

Figure 2: Four context levels of risk perception (Renn & Rohrmann, 2000)

The first level addresses information processing on both an individual and a collective level. Heuristics like dread, perceived controllability and familiarity influence the forming of the perceived risk (Renn & Rohrmann, 2000). The primary mechanisms of risk perception are therefore based on qualitative characteristics. However, the specific manifestation and relative importance depends in the social and cultural context in which the individual is raised (Renn & Rohrmann, 2000). Knowledge, experience, values, attitudes, and emotions influence the judgment of individuals about the acceptability of risks (Wachinger et al., 2013).

The second level refers to mechanisms which affect the perception through heuristics either directly or indirectly. Several researchers have agreed that what people believe is true about the given risk govern the process of evaluation, in addition to the selection of the universal characteristics (Renn & Rohrmann, 2000).

The third level refers to the social and political framework individuals and groups operate in. Previous research has investigated trust, status and values of individuals on this level (Renn & Rohrmann, 2000). Moreover, social groups, media and organizational bonds shape each individuals experience with risk. There is no research claiming that media create opinions about risks or determine risk perception, but the media can contribute substantially to a person's perception of risk even when controlling the extent of direct hard to people or property (Renn &

Rohrmann, 2000). However, information provided by mass media only have an effect on risk perception if the respondents lack direct experience (Wachinger et al., 2013).
The fourth and final level refers to cultural factors that govern the lower levels. Even with conflicting opinions about the validity of cultural risk theory and the relevance of four types of cultural factors, researcher agreed that specific culture-based preferences and biases are important factors in risk perception (Renn & Rohrmann, 2000). Further, risk perception needs to be communication to the team members to be able to do something about it. Risk management and risk communication are therefore tightly couple to individual risk perception for team members.

3.2.2 Implications for risk management

Risk communication is a part of risk perception in the way that team members should express their perceptions through communication in the decision-making process. Risk communication processes require trust and credibility between the communicators (Renn & Rohrmann, 2000). Communication is a process where two people or more exchange information and the recipient get an understanding of the message irrespective of the medium (Salas & Cannon-Bowers, 2000; Salas, Sims, & Shawn Burke, 2005). Risk communication tighten the gap between conclusions based on quantitative risk analysis and inferences based on risk perception (Renn & Rohrmann, 2000). How risks are communicated might affect how individuals interpret and examine the risk. Risk communication and risk perception can therefore be tightly coupled. Most risks are never experienced by people themselves, but informed about the risk through communication (Renn, 2008). However, the goal of risk communication is to process the available information and form a well-based judgment based on factual evidence, arguments from both sides and their own interest and needs (Renn & Rohrmann, 2000). A team member might have conflicting goals with the organizational goals, resulting in withholding information that might give incorrect information to the group (Hjertø, 2013). Having clear communication is therefore a vital part of team decision-making under uncertainty. How people talk to other people, receive, and interpret other people's opinions can affect the way we look at the argument for the decision. However, more communication is not necessarily better. An increase in communication frequency takes away time in high speed situation where finding solutions are key (Hjertø, 2013). The teams must therefore find an optimal frequency to exchange enough information to create a common understanding, without communicating more than necessary.

3.3 TEAM DECISION-MAKING PROCESSES

A decision process usually begins with acknowledging a problem (Hjertø, 2013). This problem creates a barrier to reach a goal (Tohidi & Jabbari, 2012). The decision-maker must estimate the main problem to be able to make a decision. Between the problem and the decision lies the decision-making process (Hjertø, 2013). There have been developed several models for this process (Klein, Orasanu, Calderwood, & Zsambok, 1993; Tohidi & Jabbari, 2012; Yates & de Oliveira, 2016). One can distinguish between decisions as a process and decisions as a result (Hjertø, 2013). A decision represents a choice of options with a commitment to an action (Langley, Mintzberg, Pitcher, Posada, & Saint-macary, 1995). However, these options are not always as easy to uncover in the process. Furthermore, several components are present in team decision-making processes. A developed model focusing on team decision-making are presented below.

3.3.1 Developed model of a team decision-making process

30 articles were reviewed for this literature review to develop the following 5 codes. The literature overview is listed below.

Table 2: Articles included in the literature review

no	Authors	Field and discipline	Journal
1	Yates & de Oliveira 2016	Business	Organizational Behavior and Human Decision Processes
2	Sapp et al. 2019	*Scoping review*	BMC Medical Education
3	Klein et al. 2000	Marine	
4	Tohidi & Jabbari 2012	*Review*	Procedia - Social and Behavioral Sciences
5	Lipshitz & Strauss 1997	Human Behavior	Organizational Behavior and Human Decision Processes
6	Klimoski & Mohammed 1994	Management	Journal of Management
7	Dillon and Tinsley 2020	Management	Management Science
8	van den Heuvel, Alison and Power 2014	Police, Human Behavior	Cogn Tech Work

9	Feduzi and Runde 2014	Organizational Behavior	Organizational Behavior and Human Decision Processes
10	Fast, Sivanathan, Mayer and Galinsky 2012	Human Behavior	Organizational Behavior and Human Decision Processes
11	Young, Goodie, Hall and Wu 2012	Human Behavior	Organizational Behavior and Human Decision Processes
12	Pasquini, Steynor and Waagsaether 2019	Human Behavior, psychology	Literature review from United States Agency International Development
13	Darbra, Crawford, Haley and Morrison 2007	Maritime	Marine Policy
14	Yammarino , Mumford , Connelly & Dionne 2010	Military, leadership	Military Psychology
15	Filho 2019	Sports	Sport Sciences for Health
16	Cater, Kidwell & Camp 2016	Family Business	Family Business Review
17	Jones, Gittins and Hardy 2009	Coaching	Annual Review of High Performance Coaching & Consulting 2009
18	Scotti 2007	Healthcare	Journal of Healthcare Management
19	Campellone and Kring 2013	Human Behavior	Cognition & Emotion
20	Goodie and Young 2007	Human Behavior	Judgment and Decision Making
21	Klein 1993	Human Behavior	Decision Making in Action: Models and Methods
22	Gillespie and Mann 2004	Psychology	Journal of Managerial Psychology
23	Ordóñez, Benson and Pittarello	Psychology/ Management	
24	Balmat, Lafont, Maifret, Pessel 2010	Maritime	Ocean Engineering
25	Busemeyer and Townsend 1993	Psychology	Psychological Review
26	Nævestad, Phillips, Størkersen, Laiou, Yannis	Maritime	Marine Policy journal
29	Lunde og Braut (2019)	Rescue	Air Medical Journal
30	Thommes and Uitdewilligen (2019)	Human Behavior	American Psychological Association

Further, the relevant articles used for each code are listed, per code, in Figure 3. These are elaborated in the following section, and further discussed in the analysis in chapter 4.

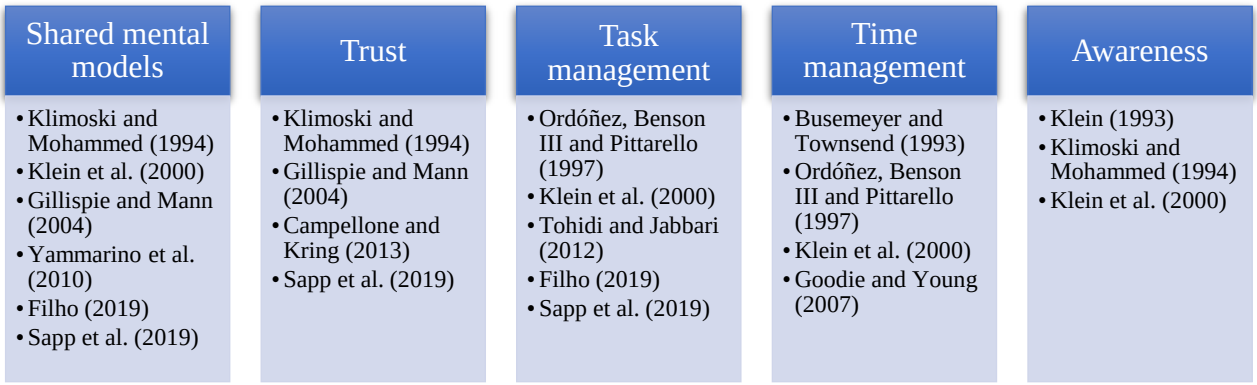


Figure 3: Developed model of components of uncertainty in team decision-making processes

3.3.1.1 Shared mental models

Shared values in a team have been described differently in the literature and phrased as either collective interpretations, shared frames or shared meanings (Klimoski & Mohammed, 1994), common values (Gillespie & Mann, 2004) or shared mental models (Sapp, Torre, Larsen, Holmboe, & Durning, 2019). Further, mental models are seen as a framework for understanding how strategists interpret their competitive environments (Porac & Thomas, 1990). Even described differently, they all stress the importance of a collective understanding for the team to function together (Salas et al., 2005). Individuals use mental models to encode information of the environment. Mental models are also used to manage interdependencies among each team member (Zaccaro, Rittman, & Marks, 2001). By sharing an understanding, the team will perform backup behavior and mutual performance monitoring (Salas et al., 2005). Shared mutual models and socially shared cognition help increase the performance in team dynamics (Klimoski & Mohammed, 1994). This common understanding is also preferable to interpret the situation and understand the individual risk to make optimal decisions. Team members anticipate and predict each other's needs through a common understanding of the environment and performance expectations. This leads to an update in their shared understanding through closed-loop communication, mutual trust and teamwork (Salas et al., 2005).

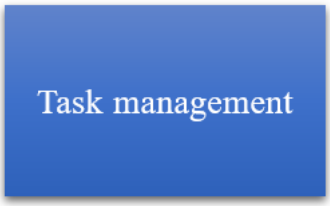
Research has explored team training and performance the last decades (Bowers, Kreutzer, Cannon-Bowers, & Lamb, 2017; Methner et al., 2019; Salas et al., 1992, 2005). Both team effectiveness and the role of shared mental models have been addressed in team decision-making in multiple studies (Jentsch, Curtis, Cannon-Bowers, & Salas, 2019; McEwen & Boyd, 2018; Sundstrom, De Meuse, & Futrell, 1990). Other researchers have looked at a team's shared mental models to acknowledge how teams understand, interpret and act in different situations. Shared mental models and team training are both critical features in team decision-making (Johnsen & Eid, 2006). Klimoski and Mohammed (1994) looked at the concept of Team Mental Models and illustrated how team mental models can bring power to team performance. The authors address both collective strategic decision-making and team dynamics/performance in a literature review. Filho (2019) used an integrated, explanatory and systemic view of team dynamics into the Team Dynamics Theory (TDT), linking processes of cohesion, team mental models, coordination, collective efficacy and team outcome to an output. The model implicates team development, enhancement of team functioning and profiling of team resilience.

3.3.1.2 Trust

Davis (1973) made a social decision scheme model and found that optimal decisions are made better in a group than by individuals. Working as a part of a team makes individuals achieve highly complex goals that cannot be achieve by individuals working alone (Filho, 2019). Perceived commitment to the group, ability and perceived trustworthiness are factors in trust which lead to better performance and attitudes (Sapp et al., 2019). Team members are more likely to interpret behaviors like disagreements or missed deadlines as damaging acts to the team if group trust has not been developed (Salas et al., 2005). Sapp et al. (2019) study several group processes looking at trust when making decision in a group. Processes in cooperation, conflict and climate, in addition to leadership were analyzed (Sapp et al., 2019). In addition, processes within task interdependence, procedural fairness and swift trust were addressed looking at trust when making decisions in a group. The trustor has to show vulnerability, have positive expectations and a suspension of uncertainty. The trustee characteristics are ability, benevolence meaning in which degree the trustee want a trusting

relationship, and integrity. Through fostering mutual trust, it is understood by the team members that they are looking out for each other for the good of the team (Salas et al., 2005). Further, over repeated interactions, emotional displays consisted of established patterns, strengthening decisions to trust (Campellone & Kring, 2013). Further, displays of anger influence decisions to trust in the initial state.

3.3.1.3 Task management



The manning level and work pressure can both influence the safety culture and management of the tasks under demanding conditions (Nævestad, 2017). This will further impact the perception of safety and the management of the tasks under demanding conditions. Complex tasks might lead individuals to adopt different task performing strategies (Parasuraman, 1997). However, giving attention to different tasks help the perception of time pressure in decision-making (Ordóñez et al., 2015). Moreover, having core teamwork schemas and collective cause maps (Klimoski & Mohammed, 1994) can help managing the different tasks. This could mean that the team members know what the tasks to another team member is, in order to being able to be less effected if changes happen. Further, several researchers have found that cohesion is important in team dynamics (Filho, 2019; Sundstrom et al., 1990; Yammarino, Mumford, Connelly, & Dionne, 2010). Cohesion in a group can be either by task or socially (Filho, 2019). Therefore, as an extent to having a trusting work climate, cohesion between team members could help managing the tasks within the team.

3.3.1.4 Time management

People are often expected to manage multiple tasks or projects simultaneously (Ordóñez et al., 2015). However, it can be hard to switch from one task to another. Time pressure has been shown to lead people to complete the most pressing task to the exclusion of others (Leroy, 2009). On the other hand, having the time pressure perception in a decision-making process can lead to riskier decisions (Ordonez et al., 1997). Discussing options in decision-making takes time. Getting the team members involved in decisions are important, but it can mean putting something else at stake due to the time consumption and resources. Furthermore, changes in the preferred option can also change due to time pressure (Busemeyer & Townsend, 1993). Time constraint can affect the behavior of the

decision-maker. Lower-status team members might be resistant to communicate their observations under pressed circumstances, which can have a negative outcome (Alliger, Cerasoli, Tannenbaum, & Vessey, 2015). Lacking proper communication can lead to losing a common understanding of the situation.

3.3.1.5 Awareness

Situational awareness indicates a high level of awareness of task and environmental conditions, as well as the ability to predict how conditions may change in the near future and understand how situations will develop (Naderpour et al., 2016, p.147). Situational awareness can be divided between psychological, engineering and system, where the psychological is the most cited (Aylward et al., 2020). However, there are several disagreements to how to properly measure it. Klein et al. (2000) argue that building and maintaining situational awareness and planning in important considerations in decision-making. The authors address factors of uncertainty, the need to set preconditions and feedback from previous operations as elements in maintaining this awareness. Also, Naderpour et al. (2016) also investigates the ability to predict a change in conditions, in addition to high levels of awareness in tasks and the environment when indicating situational awareness. To enchant situational awareness, one must reduce the requirement for people to make calculations (Endsley, 1995). Further, a situational assessment can be conducted to maintain situational awareness. Doing so will decrease the uncertainty regarding the decision and maintaining situational awareness (Klein et al., 1993). Consequently, research shows that time management, task management and situational awareness are linked in team decision-making. Five codes have been addressed in this section, addressed the importance of each code in team decision-making. In the following, uncertainty in team decision-making processes will be presented.

3.3.2 Uncertainty in team decision-making processes

The goal of any decision-maker is to make the most optimal decisions possible with a minimal amount of cognitive strain or effort (Young, Goodie, Hall, & Wu, 2012). However, there will always be some sort of uncertainty to some extent when making decisions. Uncertainty in general is defined as ‘a situation in which one has no knowledge about which of several states of nature has occurred or will occur’ (Anderson, Deane, & Hammond, K. R. McClelland, 1981). The authors describe uncertainty and risk the same way. Decision-making strategies to approach uncertainty can either be used as a strategy of suppression to ignore the uncertainty, a strategy of reduction to increase information or ask for advice, or use a strategy of acknowledgement to select a course of action (Pasquini et al., 2019). Further, uncertainty regarding a specific task or decision is called task uncertainty which is defined as ‘the difference in the amount of information required to perform a task and the amount of information already possessed by the organization’ (Galbraith, 1973). Nevertheless, there is a chance that something will interrupt the plan or the process, making the team face new challenges in a complex situation.

Decision-making processes might be influenced by uncertainty. However, how the crew members approach this uncertainty varies. In the next chapter, empirical findings from teams operating in the Arctic will be presented.

Chapter 4: EMPIRICAL FINDINGS AND ANALYSIS

In this chapter I will present the results from the analysis of the collected data. Trends in team dynamics will be presented first, before moving on to presenting issues in maritime environments like search and rescue and spray icing in particular.

4.1 NOTICEABLE TRENDS IN TEAM DYNAMICS

When addressing trends in team dynamics, several viewpoints from the interviewees have been uncovered. The interviewees exposed trends related to teamwork and team structure, experience and communication. First, the results show the importance of all team members working together to secure efficiency by having shared mental models and trusting each other. These trends further impact how to manage task in decision-making.

4.1.1 Shared mental models

Being a part of the team and having proper team work has been shown some importance. Some elements within team composition have been examined since the structure might affect the team decision-making process. One interviewee claims that the team members themselves are not the most important, but transferring the knowledge they all hold for the greater good of the team. *'It is not so important that one is super well known but each other, but that one can transfer knowledge about what can we do together and how can we solve it'* (O1). Without crew members working together as a team, one cannot operate. Informant 3 stated that operating offshore is all about teamwork. If one person does not do his job, the rest of the crew will lose their job.

Further, working together as a team by being efficient and having team work has also been found as a trend in team dynamics. An effective team can maintain high levels of collective performance, even during adverse circumstances (Zaccaro et al., 2001). The interviewees explain several effective and ineffective ways of teams to work together. Ineffective ways to work in a

team were describes as poor communication and people doing the same task (M1), and doing the same thing tasks resulting in low value (M2). People that do not want to go 'the extra mile' can also make the team ineffective *'It just take one person to make a bad atmosphere'* (M5). However, effective ways to work in a team are therefore by dividing tasks to suitable people or brainstorm, in addition to proper communication (M2). Furthermore, being a part of the also mean to be able to trust the others in team work.

4.1.2 Trust

Trusting the other team members to be able to speak freely has been come up during the interviews as an important component of team dynamics. Further, the results show that it is important for the crew members to know their own limitation. *'I think it's great that people actually speak up. The best part is when people say it's not my day today and you let me know* (O1). However, admitting that they are having a bad day and cannot join might be easier said than done for certain people. *'No matter how much we focus on it, it will be a tough decision for people to say that today I am not there'* (O2). One has to be true to yourself to be able to communicate to the team how you feel. This also goes in hazardous environments where the time pressure is on and the list of tasks is long.

4.2 CHALLENGES IN HAZARDOUS ENVIRONMENTS

Several challenging components were addressed when talking about factors preventing situations within spray icing. The Barents Sea is exposed to severe marine icing and needs therefore reliable icing forecasts (Samuelsen & Edvardsen, 2015). One interviewee claims that small errors in the weather forecast can have huge impacts for the people working aboard. As a result of these challenging in the Arctic, it is necessary to have sufficient focus on how to conduct tasks, and how to do so with the time given to conduct proper decision-making.

4.2.1 Task management

Before knowing what tasks to conduct, one usually gathers information to know what to focus on first. Various maritime crew members state that more information is needed to gather sufficient information (M1, M7) and frequent updates are important (M3). Furthermore, someone has to be physically present in the ocean to give information (M3). Observations from an accident cannot

be used because the vessel sinks (M1), nor general observations from a boat or a satellite (M7). One interviewee states that reliable forecasts make more vessels operate during the winter (M2). In addition, some interviewees stated that experience (M3, M4) was highly important to make decisions regarding spray icing. Some also talk to other boats around to make go-or-no-go decisions. *'I look at the weather forecast and talk to other boats around if they are out'* (M3). Interviewee 4 agrees and states that decisions often are based on other operating vessels *'Several boats are often together in it, so if one boat decides to go, so does the others. And if someone stays ashore, others stay as well'*. Gathering information from other boats are a good way to discuss decisions to go or not go out fishing. However, the leader is the person in charge making the decisions, and making sure that the team conduct the tasks they are supposed to do.

Sapp et al. (2019) has researched group processes when fostering trust in decision-making, and found great importance in task interdependence. One interviewee claims that managing tasks are important in team dynamics (M1). However, the results show that different ways to conduct a task can be challenging (M2). The role of the leader is also highlighted when talking about task management. One interviewee states that *'a good day at work is not to give any orders'* (M4), meaning that a self-directed team is preferable. Moreover, one interviewee states that the person in charge has to make sure that the tasks has been completed. *'Someone in charge who know their role has to check that it is done'* (M2). On the other hand, it is not always easy to know what tasks has to be done. Further, one interviewee finds great importance of situational awareness and having sufficient information to conduct tasks when operating in teams (M1). However, in search and rescue operations, even if the emergency call state that one thing happens, another thing might have greater importance when they enter the situation. '*You get a mission, but it is different from situation to situation because it is not certain that those in involved know what has really happened'* (O1). Therefore, the rescuers has to be open to create a situational picture when entering the situation, before dividing tasks and getting them done. Consequently, task management can be correlated to time management and to situational awareness.

4.2.2 Time management

The results show the difficulties between remaining safe and taking time to conduct proper decision-making. Several of the interviewees within the maritime field, have operated in the waters for a long time. Safety is the number one priority when operating on fishing vessels. *'You base a lot on experience and how the boat moves. We work a lot towards safety. That's the main priority'* (M6). The important in hazardous environments is claimed to get the crew members back without any incidents. *'If it is bad weather, then the main priority is lives and health. One has to get the boat and crew back to shore in a good condition'* (M3). However, a differentiation has been found within the interviewees when it comes to managing spray icing situations.

One interviewee states that one must calculate the stability of the vessel to prevent spray icing hazards. *'I've never ended up in a hazard situation because I always make calculations'* (M7), the interviewee argue. Also, an interviewee claims to not end up in specific spray icing incidents because the ice is removed rapidly. *'We remove ice before it's a problem, so we never end up in hazard situations'* (M3). However, several interviewees have various experience with spray icing incidents. Informant 5 explain a specific incident involving spray icing resulting in a spray ice on the vessel: *'When the sea temperature was low and slight gale, we had icing. The boat was filled after four hours'* (M5). Moreover, another interviewee has also experienced spray iced decks *'I've experienced several tons of water on deck after waves. It's not necessarily dangerous, but it's uncomfortable'* interviewee 5 claims. Another interviewee has some bad experience with spray icing incidents, without going into too much detail about it. *'If we see bad weather coming, we leave even if it's good fishing. I've done it once before and I won't do it again'*, interviewee 7 claims.

Furthermore, the crew members have different opinions of what is seen as dangerous or unsafe. This is also the case when it comes to removing ice on deck after spray icing. One interviewee claims: *'Everyone understands that ice is dangerous. If we have to remove it, everyone understands'* (M7). Other interviewees are well aware of the risk spray icing involves for the people working aboard the vessel.

> *'Everyone is afraid of icing. That is nothing to conceal. It is something everyone fear. But it is up to me to say stop to remove ice. If it's too late, then many people are dissatisfied because I waited too long, so I do it sooner to make the others feel safe. It is not alright to sleep with one eye open knowing its ice and gale outside'* (M7).

As explained, the captain is the one in charge to make decisions affecting the whole crew. Making sure that you eliminate risk and respect everyone's risk acceptance onboard is therefore important to keep a good atmosphere. *'Removing ice is again a common goal and give a good team dynamic. If I wait too long (edit. to remove ice), the atmosphere soon turns bad'* (M5). To keep a good dynamic in the team, risk perception is something which should be discussed and taken into account in team decision-making.

4.3 RISK ACCEPTANCE IN OPTIMAL TEAM DECISION-MAKING

In hazardous situations like the ones describes above, communication is key to secure unity and work flow in the team. Also, communication is important to express the individual's risk perception regarding how conferrable they feel in that specific moment. However, even with focus on speaking freely to secure unity and mutual trust, feedback and communication are important components to validate information in the decision-making process. However, many factors contribute a situation where someone feels safe and others do not. Risk-acceptance varies from different team members might have an effect on which missions they are suited to join. That means that the crew members can get another type of role before leaving to the place of injury if they express their thoughts on the risk related to the rescue. '*There's a big difference between our members in terms of how risk-averse they are (…) but we also need different people. We're not always going out to save people on a mission'* (O1). By sharing information within the team, the common situational awareness increases.

Informational sharing will increase situational awareness but might slow down decision-making processes (Andreassen et al., 2020). The rescue mission has to make decisions based on few or little information when receiving an emergency call. When they get on-site, they have little time before implement action. As a result, situational awareness is important to adjust the response to the given information.

> *'You have a decision window where you can't wait until you have all the information because then you have no options left. You have to be comfortable making a decision on a failing basis in a crisis (...) and then you have to be sure that your situational awareness turns out to be completely wrong, but that's the chance you have* (O1).

The rescue crew has to make decisions based a little information. Communicating your situational understanding is therefore important to make a common decision.

> *'I expect if I'm out with people and they see something obviously wrong and dangerous that they give feedback about it. We have to expect that from the crew to let us know (...) People need to be able to let us know if it's not safe'* (O1).

One crew member might therefor detect something unsafe that the others did not. Further, it is vital to communicate this observation. Further, having different risk perception might lead to creating a situational picture. This might further lead to one crew member spotting something another did not.

4.3.1 Awareness

Working in a team means having different ways of interpreting a situation. Having previous experience from multiple decision-making processes can be an advantage to see patterns. *'I think you can't get away from the fact that you have to have some experience to be a good decision-maker. I think that's just the way it is* (O1). Further, both experience and trainings are important to create situational awareness. *The more exercises you have participated in, the more experience you have. We see that those who have been involved in exercises are good at pulling out patterns and forming a situational picture* (O1). Participating in exercises and having some years of experience can therefore help create patterns when arriving at the place of injury. Further, one of the interviewees stated that situational awareness and knowledge are needed in terms of teams in decision-making processes (M1). Research shows that group situational awareness can increase the team mental model (Klimoski & Mohammed, 1994). The mental models might further lead to an increase of working together towards a common goal. Having a common goal to work towards in hazardous environments are important. Further, the leader is responsible to make the team work towards the same goal.

4.3.2 Leadership in team decision-making

Vessels operating in the Barents Sea differ between consisting of small teams, which have been working together for a longer period of time, and bigger teams with a younger crew (M4, M6, M7). The captain is usually the designated leader aboard, taking most of the decisions. However, in volunteer rescue operations there are not always that explicit. *'Many have experience from the guide industry. It is not said explicitly, but it is the one who drives first who becomes the leader'* (O2). There is not always a designated leader in such way as a captain on a boat, even if the task force leader or the subject leader may be head of the operation. With a small rescue operation, a designated leader is not required, resulting in easier communication and openness towards disagreements across the team members. *'Ideally you have a team leader in the group who makes decisions. In the glacier group they are only three people if they don't agree, someone has to cut through with 'that's how we do it'* (O1). In addition, a leader can lead the team forward by thinking ahead. *'And I think that's where it's important to have a clear leader who is able to think about the next steps forward and think more strategically. (..) If you have a group to discuss the situation, you lose this (strategically thinking)'* (O2). In rescues, the team has a bigger participation in the decision-making but still taking orders from the leader if a member disagrees highly (O1). Further, the rescue operations are based on volunteer work, resulting in temporary teams on every single mission. Temporary teams have a member diversity, task importance and limited of time (Lv & Feng, 2020). In addition, they must quickly adapt to changes in the external environment. This difference between temporary teams and regular teams, in addition to volunteering compared to working might be influenced in the decision-making processes. In addition, the vessels operate under a maritime company with their demands, while the volunteers only focus on the rescues itself and not that much about being cost-efficient.

The results show a differentiation when it comes to involvement in the decision-making process. When it comes to decision-making in spray icing situations, some interviewees claims that the team members contribute in the decision-making process while others states that they do not let the decisions in the hands of the other team members. Several of the participants state that they make the final call but include the team in the process (M3, M4, M5). *'Everyone can share their opinions, but I have the last word'* (M4). Further, it is important that the crew is onboard with the

decisions. *'I make decisions, so it's important to include the team to secure unity'* (M3). This unity is also related to safety issues onboard. Another interviewee argues that the captain is responsible to make decisions, and will therefore not leave that to the crew members to decide. *'It's my responsibility. I appraise it so it's my responsibility. I'm not going to leave that to anyone else'* (M7). Furthermore, not all decisions are as popular with the crew members. In that case, it is important to stand for those decisions, even if some of the crew members disagree. One interviewee claims that anyone on the team can express their opinions and tips. However, the informant is responsible for the actions taken.

> *'Sometimes decisions made can be unpopular in the team with certain things. I mean the decision is right, but it is unpopular. One must take that decision even if the crew is not happy. It doesn't lead to anything big, just a bit of wining'* (M5).

Having a clear leader with previous experience, which let the crew members be involved in the decision-making process, but also holds their ground in disagreements are shown to be the key points found in this data.

Chapter 5: DISCUSSION

5.1 NOTICEABLE TRENDS IN TEAM DYNAMICS

Initially, open questions about team dynamic were discussed. Several trends in team dynamics were addressed from the interviews. Working together, having team commitment and having group interaction increase team dynamics when solving problems and making decisions (Cater, Kidwell, & Camp, 2016). Being self-directed (M4), having common goals (M5), using proper task management (M1, M2), and communicating well (M1, M2, M5) are important trends in a team. However, one interviewee claim that they base most of their work of experience, so team dynamics are not something they think too much about (M4). Moreover, none of the interviewees expressed any concerns regarding the changing climate during team decision-making processes.

The results show of the trends in team dynamics shows great similarity to the components of a high-performance environment. High-performance has previous been defined as performance which is consistently higher than that of the majority of peer organizations in the same sector, and over a prolonged time period (Jones, Gittins, & Hardy, 2009, p.140). The High-Performance Environment Model (HPE) from Jones, Gittins and Hardy (2009) address components of people, performance enablers and leadership surrounded by organizational culture to create a performance environment. The people within the team makes the core of high-performance teams. They all bring their own attitudes, behaviors and capacity into the team work. In this research, people's behavior has been addressed both on an individual and team level. Several volunteers on rescue operations have experience from the army (O2). However, they have been trained in a slightly different way. The army has a focus on getting the injured people out of the hazardous area and bringing them to a medical team, instead of helping the injured person on-site like the rescue team does (O2). This way of thinking might cause some disagreement within the team in the transition between the army and volunteer rescue operations. Further, people have different capacities regarding personal issue related to the accident itself or something going on at home. In such cases, letting other people know that it is not the best day to conduct a rescue operation is important (O1), even if admitting it and staying home might be really difficult (O2).

Furthermore, in the theory section, several components of team dynamics have been addressed. The results show some correlation with the model developed on team decision-making. Although the interviewees express terms in team decision-making similar to the model, the findings show that the interviewees use other terms to express the importance of team work. Furthermore, the findings show great importance of communication within the team. These results are similar to the model developed by Salas et al. (2005) addressing elements in team efficiency when looking at shared mental models, mutual trust, and closed loop communication. First, shared mental models can be seen as a common term for a team understanding a situation the same way. This can be done by having sufficient experience (M4) and expertise (M1) to make up their mind of how to react to the given situation, in addition to confidence (M1) as individual elements in team dynamics. By having common goals and having proper task management, the team work towards something together and make sure they are all on the same path.

Task management was described in terms of being able to remove ice before it was hazardous, or depending on team members to do their part to secure efficiency in a hazardous situation. Individuals must coordinate decisions and activities by sharing information and resources to a reach common goals (Dickinson & McIntyre, 1997). Moreover, closed loop communication are addressed in the interviews as communication by multiple (O1,O2) of the interviewees as an important component in teams. However, none of the interviewees mentioned mutual trust as an important element. On the other hand, by discussing the given trends in the interviews, both having common goals, having experience and divided tasks all need some sort of trust to be conducted. Without trust in the fellow team members, none of the tasks can be delegated. This also leads to having proper time management when time is short in hazardous situations.

5.2 CHALLENGES IN DIFFERENT HAZARDOUS ENVIRONMENTS

The theory section focuses on uncertainty and risk in team decision-making. However, when researching elements decision-making in hazardous and uncertain situations, other elements than initially thought were explored. In the unstructured interviews and semi-structured interviewees, the importance of leadership, experience and training, in addition to information and communication were examined.

A big part of a decision-making process is to gather sufficient information to make a decision basis. Information in both short-term and long-term trends of spray icing is critical for risk-based decision-making in operations and industrial activities (Naseri & Samuelsen, 2019). The interviewees states that they use different tools to help the decision-making process. Results show that both BarentsWatch and Olex (M4) are used in addition to the forecast from Yr and the Norwegian Meteorological Institute (M4, M7). Moreover, length of waves, direction of wind and distance to shore are components used in spray icing decision-making (M3, M4). Captains making decisions aboard vessels rely mainly on weather forecast to predict the coming weather.

Information regarding spray icing contributes to address the risks for operations in the Artic. Information regarding spray icing can contribute to selecting optimizing routes in terms of risks, avoiding financial loss by delays and reducing fuel consumption and costs related to de-icing measurements (Naseri & Samuelsen, 2019). Gathering and using informational systems are a part of the decision-making process as elaborated by several of the interviewees. However, one interviewee claim that is it difficult to make decisions before the icing occur (M2). Forecasting sea spray icing can be challenging due to the uncertainty regarding the accuracy of the different factors measured. However, more information is needed to small crafts and regulators to maintain existing regulations and ensure a safe operational environment for all users of commercial waterways (Darbra et al., 2007). Some interviewees claims that they have the adequate quantity of information to conduct optimal decision-making regarding spray icing (M4), while others seek more frequent information (M7, M3) in the Barents Sea. Having this knowledge, makes it possible to seek advice and guidance to provide better information regarding direction or procedures.

5.3 RISK ACCEPTANCE IN OPTIMAL TEAM DECISION-MAKING

When analyzing the collected data, several differentiations are found in the perception of the intensity in the hazard. One interviewee states that one has to stay ashore not to be exposed to spray icing situations (M3). On the other hand, another interviewee states that the crew members are all afraid of icing and that removing the ice cannot wait too long (M7). Waiting too long will create tension in the group, which is not preferable. The main priority seems to be life and health (M3), even when the captain struggles to decide between good fishing and maybe ending up in a hazardous spray icing incident. However, due to the number of interviews, it is hard to conclude or discuss if these concerns are present aboard others vessels operating in the Barents Sea.

The results show that some teams have participating team members in the decision-making process, while others make the decision on their own. To be able to seek information to make optimal decisions, the decision-maker must have knowledge of the complexity of the system, and which information they are missing (G. Klein et al., 2000). Some state to use informational systems to make calculations (M5, M7), while others rely more on experience (M3) or a mix of the two (M4). The team can express their opinions (M5) and involving the team members are important to secure unity (M3). However, some decisions are harder to make than others. One interviewee stresses the importance of taken decisions even if they are unpopular within the team (M5). Also, the captain is responsible for the decisions taken. One interviewee states that the decision is not left to anyone else to make (M4).

The importance of a leader has been discussed in several interviews. Leaders have the ability to be more strategic (O2) by having an overlook of the situation, in addition to experience (O1, M3, M4) and being in charge (M5) to prevent hazardous spray icing incidents. However, leadership and managing a crew can be challenging for a captain with different opinions. Therefore, it is important to make the crew feel safe onboard while also standing your ground (M7) if the leader feel that the decision taken is the right one.

Chapter 6: CONCLUSION

This study assessed team dynamics in decision-making under avalanche research and rescue. The purpose was to determine whether situational awareness was influenced by functions of communication and decision-making as team processes.

The main research question in this thesis was the following:

> *What are the most important factors in team decision-making for at-risk or support vessels in a hazard context like sea spray icing and SAR operations when it comes to climate change-induced, environmental hazards in the Arctic Ocean?*

Furthermore, three sub-questions focusing on trends in team dynamics, hazards and risk perception in team decision-making have been investigated. The main research question focused on trends in team dynamics. The findings show trends like shared mental models and trust in team dynamics. Task management and time management, in addition to awareness was shown importance in team decision-making. Also, communication was claimed to have great importance to secure trust, mental models and a situational awareness. This will further increase the task- and time management. Further, the importance of a leader with experience, knowledge a clear voice was highlighted in the data. However, these results show no correlation to changes in the climate.

In the theory section, a model investigating factors of uncertainty in team decision-making were identified. The model addressed factors of shared mental models, trust, awareness, task management and time management in team decision-making. The empirical findings shows that the interviewees did not address these factors using the specific terms unsolicited. However, factors like decision window and time constraint were addressed, in addition to the leader's role and dividing tasks within the team. The results show that the team structure and team dynamics does not have much focus aboard vessels. However, depending on others regarding proper task management has importance on vessels. Moreover, situational awareness was mentioned as importance to create a common view on the situation and not to create group thinking biases. On the other hand, the factor of trust was not addressed by the interviewees. The importance of

having a proper team that function together had importance, which can be discussed if that term belongs with the term of trust. Also, communication was addressed in the results as important under uncertainty in team decision-making processes. Both communication and decision-making are team processes (Hjertø, 2013). The leader's role was again stressed with great importance to ensure proper communication to be on the same page and avoid misunderstanding on-site. A critical feature of this research in the difference between search and rescue and maritime vessels are the role of the leader. Fishing vessels usually have a more top-down approach, while search and rescue operates more lateral.

Following, the second research question investigated whether hazardous environments (RQ2) and the intensity of the hazard (RQ2.1) is a challenge in team decision-making. The most important findings in this research have been the difference in leadership and risk perception in various hazardous environments. The fear of risk is looked at in a different abroad vessel and within search and rescue. The latter team conduct trainings and has a group with various expertise and experience, while the ladder relies mostly on the captain's risk perception. The findings show that the crew members can express their concerns and perceptions to the captain. However, the crew members themselves have not been interviewed and it is thus difficult to conclude their participation in the decision-making process regarding hazardous spray icing situations. The results address factors of time pressure, time constraint and a small decision window as challenges in team decision-making. Volunteers in search and rescue operations are involved in more active decision-making, since the operating could consist of something else than first thought.

Finally, the third research questions focused on individual risk perception in team decision-making (RQ3) and how the team define optimal decisions (RQ3.1). Overall, the captains did not discuss their own risk perception much. However, the results showed the importance of the crew feeling safe and taken care of aboard. Several captains stated therefore that they remove ice on deck to make sure the crew feels safe, even before it is necessary to secure the stability of the vessel. On the other hand, the risk perception is handled slightly different in search and rescue operations. Since the team members operate on a volunteer basis, they are able to turn a rescue mission down if it affects them too much to participate. However, even with the possibility to turn a rescue operations down, it might not be as simple to do so like one of the interviewees

stated. The results show correlation with Renn and Rohrmann's (2008) risk perception model, focusing mostly on the heuristics of information processing contributing to the risk perception. However, without a more throughout research and individual risk perception, it is difficult to conclude whether this model is applicable to this research or not. More research is therefore needed to address factors involved in the individual risk perceptions in team decision-making.

Chapter 7: LIMITATIONS AND CRITICAL VIEWS ON THIS RESEARCH

7.1 LIMITATIONS

Some limitations of this thesis have been discussed in the methodological section. In addition, the quality of the research in practice will be presented in this section. First of all, there are several limitations regarding the interviewees of search and rescue. Due to time constraint, and the on-going pandemic, I was not able to gather as much data as wanted initially and ended with only two interviewees to provide some data to this thesis. The interviewees could neither elaborate much concerning specific people or cases due to the small community and where the people easily could be identified. The interviews were therefore kept on a general level and might have resulting in specific cases being left untold. Further, documents on near-misses were supposed to be conducted and used in the interviews for a deeper understanding of decision-making in rescue operations. However, due to lack of time to obtain permissions to access such documents, this were refrained. Moreover, focus groups and participation in preparedness exercises could not be proceeded due to Covid-19-regulations.

Also, I might have affected the conduction of this research. I have been aware not to make conclusions based on what I was looking for, which might have influenced or reduced the validity of the thesis. The interviews are constructed over a shorter period and not conducted in the same period. As a result, my behavior as a researcher might have been different from one interview to another. The interview guide has been revised several times to make sure that the questions are clear and not to make room for any misunderstandings. However, even with this pre-work, some questions might have been misunderstood, making the interviewees answering something else than this thesis was investigating.

Two different fields have been examined to investigate trend in team dynamics and group decision-making in hazardous environments. However, with such a narrow case study and low number of interviewed people, this thesis only grasps the surface in team decision-making. More research is needed to develop a greater understanding of how multiple teams function in hazardous environments and which factors influence their group decision-making.

7.2 IMPLICATIONS FOR FUTURE RESEARCH

Further research is recommended to investigate other factors influencing team decision-making. An optimal study could test workload and trust within the team compared to mental models. A longitudinal study could assess these issues over time in various situations, looking at rescues in avalanche or landslide. Also, it would be interesting to see the difference between trust, communication and situational awareness in temporary vs. permanent team. In this way, one can see if the situational awareness is affected by the knowledge of each team member or the knowledge of the other team member which comes into play. In addition, this research has not focused on tacit knowledge, nor the difference between protocols versus improvisation in hazardous environments. This could be interesting to address in future research when investigating learning after incidents or when making team decisions in uncertainty.

Initially, I spoke with several people with either experience or knowledge of systems that record a rescue operation. For future research, I could be interesting to see whether The Norwegian Air Ambulance Foundation's video transmitting system increase situational awareness, or use recording from Health service organization for emergency network HF to address how communication within the different rescue departments are handled.

One of the interviewees made be aware of the Ice Service presenting maps developed by the Norwegian Meteorological Institute. The maps show a huge increase in so-called 'very close drift ice' between January and February 2019, and little change from January 2019 to February 2020. The Norwegian Polar Institute explained in an email that this can happen due to several processes within air temperature, drift ice, melting and refreezing or ice flacks squeezing against each other. My advice from the interviewee, was to look into the Ice Maps with a shorter time period to investigate the air temperature at the given time. Due to the short time frame for this study, I was unable to do so. However, I highly recommend others to conduct a study to make weight to the fact that the ice is rapidly changing and can behave rather unpredictable to operating vessels without sufficient informational systems.

Chapter 8: BIBLIOGRAPHY

Alliger, G. M., Cerasoli, C. P., Tannenbaum, S. I., & Vessey, W. B. (2015). Team resilience: How teams flourish under pressure. *Organizational Dynamics*, 44(3), 176–184. Retrieved from https://doi.org/10.1016/j.orgdyn.2015.05.003

Anderson, B. F., Deane, D. H., & Hammond, K. R. McClelland, G. H. (1981). *Concepts in judgment and decision research: Definitions, sources, interrelations, comments.* New York: Praeger.

Aven, T., & Renn, O. (2009). On risk defined as an event where the outcome is uncertain. *Journal of Risk Research*, 12(1), 1–11. Retrieved from https://doi.org/10.1080/13669870802488883

Aylward, K., Weber, R., Man, Y., Lundh, M., & Mackinnon, S. N. (2020). 'Are You Planning to Follow Your Route?' The Effect of Route Exchange on Decision Making, Trust, and Safety. *Marine Science and Engineering Article*, 8(280), 1–19. Retrieved 30 August 2020 from https://doi.org/10.3390/jmse8040280

Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, 10(2), 141–163. Retrieved from https://doi.org/10.4135/9781483365817.n1278

Bowers, C., Kreutzer, C., Cannon-Bowers, J., & Lamb, J. (2017). Team resilience as a second-order emergent state: A theoretical model and research directions. *Frontiers in Psychology*, 8(AUG), 1–14. Retrieved from https://doi.org/10.3389/fpsyg.2017.01360

Busemeyer, J. R., & Townsend, J. T. (1993). *Decision Field Theory: A Dynamic-Cognitive Approach to Decision Making in an Uncertain Environment*. *Psychological Review* (Vol. 100).

Campellone, T. R., & Kring, A. M. (2013). Who do you trust? The impact of facial emotion and behaviour on decision making. *Cognition and Emotion*, 27(4), 603–620. Retrieved from https://doi.org/10.1080/02699931.2012.726608

Carter, N., Bryant-Lukosius, D., Dicenso, A., Blythe, J., & Neville, A. J. (2014). The use of triangulation in qualitative research. *Oncology Nursing Forum*, 41(5), 545–547. Retrieved from https://doi.org/10.1188/14.ONF.545-547

Castellan, N. J. (Ed.). (1993). *Individual and Group Decision Making: Current Issues* (1st ed.). Psychology Press. Retrieved from https://doi.org/https://doi.org/10.4324/9780203772744

Cater, J. J., Kidwell, R. E., & Camp, K. M. (2016). Successor Team Dynamics in Family Firms. *Family Business Review*, 29(3), 301–326. Retrieved from https://doi.org/10.1177/0894486516656255

Darbra, R. M., Crawford, J. F. E., Haley, C. W., & Morrison, R. J. (2007). Safety culture and hazard risk perception of Australian and New Zealand maritime pilots. *Marine Policy*, (31), 736–745. Retrieved 20 August 2020 from https://doi.org/10.1016/j.marpol.2007.02.004

Davis, J. H. (1973). 'Group decision and social interaction: A theory of social decision schemes': Errata. *Psychological Review*, 80(4), 302. Retrieved from https://doi.org/10.1037/h0020065

Dickinson, T. L., & McIntyre, R. M. (1997). A Conceptual Framework for Teamwork Measurement. In M. T. Brannick, E. Salas, & C. Prince (Eds.), *Series in applied psychology. Team Performance Assessment and Measurement: Theory, Methods, and Applications* (pp. 19–43). New Jersey: Lawrence Erlbaum Associates Publishers.

Dillon, R. L., & Tinsley, C. H. (2008). How near-misses influence decision making under risk: A missed opportunity for learning. *Management Science*, 54(8), 1425–1440. Retrieved from https://doi.org/10.1287/mnsc.1080.0869

Eguíluz, V. M., Fernández-Gracia, J., Irigoien, X., & Duarte, C. M. (2016). A quantitative assessment of Arctic shipping in 2010-2014. *Scientific Reports*, 6(July), 3–8. Retrieved from https://doi.org/10.1038/srep30682

Endsley, M. R. (1995). *Measurement of Situation Awareness in Dynamic Systems*. *HUMAN FACTORS* (Vol. 37).

Endsley, M. R. (2000). Situation Models: An Avenue to the Modeling of Mental Models. *Proceedings of the XIVth Triennial Congress of the International Ergonomics Association and 44th Annual Meeting of the Human Factors and Ergonomics Association, 'Ergonomics*

for the New Millennium', 61–64. Retrieved from https://doi.org/10.1177/154193120004400117

Fast, N. J., Sivanathan, N., Mayer, N. D., & Galinsky, A. D. (2012). Power and overconfident decision-making. *Organizational Behavior and Human Decision Processes*, 117(2), 249–260. Retrieved from https://doi.org/10.1016/j.obhdp.2011.11.009

Feduzi, A., & Runde, J. (2014). Uncovering unknown unknowns: Towards a Baconian approach to management decision-making. *Organizational Behavior and Human Decision Processes*, 124(2), 268–283. Retrieved from https://doi.org/10.1016/j.obhdp.2014.04.001

Filho, E. (2019). Team Dynamics Theory: Nomological network among cohesion, team mental models, coordination, and collective efficacy. *Sport Sciences for Health*, 15(1), 1–20. Retrieved from https://doi.org/10.1007/s11332-018-0519-1

Flick, U. (2004). Design and Process in Qualitative Research . In U. Flick, E. von Kardorff, & I. Steinke (Eds.), *A Companion to Qualitative research* (pp. 146–153). London: SAGE Publications. Retrieved 13 January 2021 from https://play.google.com/books/reader?id=lRSL1KJjEPoC&hl=no&pg=GBS.PA146

Galbraith, J. (1973). *Designing complex organizations*. Reading, MA: Addison-Wesley Pub. Co.

Gibbs, A. (1997). What are focus groups ? Why use focus groups and not other methods ? *Social Research Update*, (19), 1–8.

Gillespie, N. A., & Mann, L. (2004). Transformational leadership and shared values: the building blocks of trust. *Journal of Managerial Psychology*, 19(6), 588–607. Retrieved 3 December 2020 from https://doi.org/10.1108/02683940410551507

Goodie, A. S., & Young, D. L. (2007). The skill element in decision making under uncertainty. *Judgment and Decision Making*, 2(NA), 189–203.

Hjertø, K. B. (2013). *TEAM* (3rd Editio). Bergen: Fagbokforlaget.

IRGC. (2005). White paper on risk governance. Towards an integrative approach. Geneva.

Jensen, Ø. (2008). Arctic shipping guidelines: towards a legal regime for navigation safety and environmental protection? *Polar Record*, 44(229), 107–114. Retrieved from

https://doi.org/10.1017/S0032247407007127

Jentsch, F., Curtis, M., Cannon-Bowers, J. A., & Salas, E. (2019). Individual and Team Decision Making Under Stress: Theoretical Underpinnings. *Simulation in Aviation Training*, 255–276. Retrieved from https://doi.org/10.4324/9781315243092-16

Johnsen, B. H., & Eid, J. (2006). Samhandling i operative team. In B. H. Johnsen & J. Eid (Eds.), *Operativ psykologi* (2nd ed., pp. 298–313). Bergen: Fagbokforlaget.

Jones, G., Gittins, M., & Hardy, L. (2009). Creating an environment where high performance is inevitable and sustainable: the high performance environment model. *Annual Review of High Performance Coaching and Consulting*, 1(13), 139–150.

Kazemak, E., & Albert, B. (1988). Learning the secret to teamwork. *Healthcare Financial*, 42(9), 108–110.

Klein, G. A., Orasanu, J., Calderwood, R., & Zsambok, C. E. (1993). *DECISION MAKING IN ACTION: MODELS AND METHODS*.

Klimoski, R., & Mohammed, S. (1994). Team Mental Model: Construct or Metaphor? *Journal of Management*, 20(2), 403–437. Retrieved from https://doi.org/10.1177/014920639402000206

Langley, A., Mintzberg, H., Pitcher, P., Posada, E., & Saint-macary, J. (1995). Opening up Decision Making: The Vie w from the Black Stool. *Organization Science*, 6(2), 260–280.

Lanza, P. (1985). Team Appraisals. *Personnel Journal*, 64, 47.

Leonard, M., Graham, S., & Bonacum, D. (2004). The human factor: The critical importance of effective teamwork and communication in providing safe care. *Quality and Safety in Health Care*, 13(SUPPL. 1), 85–90. Retrieved from https://doi.org/10.1136/qshc.2004.010033

Leroy, S. (2009). Why is it so hard to do my work? The challenge of attention residue when switching between work tasks. *Organizational Behavior and Human Decision Processes*, 109(2), 168–181. Retrieved from https://doi.org/10.1016/j.obhdp.2009.04.002

Liu, Y., & Frangopol, D. M. (2018). Probabilistic risk, sustainability, and utility associated with ship grounding hazard. *Ocean Engineering*, 154, 311–321. Retrieved from

https://doi.org/10.1016/j.oceaneng.2018.01.101

Lv, M., & Feng, S. (2020). Temporary teams: current research focus and future directions. *Quality and Quantity*, 55(1), 1–18. Retrieved from https://doi.org/10.1007/s11135-020-00990-y

McEwen, K., & Boyd, C. M. (2018). A Measure of Team Resilience. *Journal of Occupational and Environmental Medicine*, 60(3), 258–272. Retrieved from https://doi.org/10.1097/JOM.0000000000001223

Methner, N., Hamann, R., Nilsson, W., Dreyer, B., Boyd, S., Makaula, L., … Gentile, M. C. (2019). BGS Session 5 : *Harvard Business Review*, 7(4), 1–6. Retrieved from http://link.springer.com/10.1007/978-3-319-11827-7%5Cnhttp://link.springer.com.proxy.timbo.org.uy:443/chapter/10.1007/978-3-319-11827-7_15%0Ahttps://doi.org/10.1080/02692171.2019.1524043%0Ahttp://dx.doi.org/10.1016/j.leaqua.2011.09.009%0Ahttp://dx.doi.org

Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball Sampling: A Purposeful Method of Sampling in Qualitative Research. *Strides in Development of Medical Education*, 14(3). Retrieved from https://doi.org/10.5812/sdme.67670

Naderpour, M., Lu, J., & Zhang, G. (2016). A safety-critical decision support system evaluation using situation awareness and workload measures. *Reliability Engineering and System Safety*, 150, 147–159. Retrieved from https://doi.org/10.1016/j.ress.2016.01.024

Nævestad, T. O. (2017). Safety culture, working conditions and personal injuries in Norwegian maritime transport. *Marine Policy*, 84, 251–262. Retrieved from https://doi.org/10.1016/j.marpol.2017.07.019

Naseri, M., & Samuelsen, E. M. (2019). Unprecedented vessel-icing climatology based on spray-icing modelling and reanalysis data: A risk-based decision-making input for Arctic offshore industries. *Atmosphere*, 10(4). Retrieved from https://doi.org/10.3390/ATMOS10040197

Norwegian Centre for Research Data. (2020). About NSD - Norwegian Centre for Research Data | NSD. Retrieved 21 December 2020, from https://www.nsd.no/en/about-nsd-norwegian-centre-for-research-data

Ordóñez, L. D., Iii, L. B., & Pittarello, A. (2015). Time - pressure Perception and Decision Making.

Parasuraman, R. (1997). *Humans and Automation: Use, Misuse, Disuse, Abuse*. *HUMAN FACTORS* (Vol. 39).

Pasquini, L., Steynor, A., & Waagsaether, K. (2019). *LITERATURE REVIEW THE PSYCHOLOGY OF DECISION MAKING UNDER UNCERTAINTY A LITERATURE REVIEW*. Retrieved from https://www.climatelinks.org/projects/atlas

Porac, J. F., & Thomas, H. (1990). Taxonomic Mental Models in Competitor Definition Linked references are available on JSTOR for this article : Taxonomic Mental Models in Competitor Definition. *Academy of Management Review*, 15(2), 224–240.

Pratt, J. W. (1964). Risk Aversion in the Small and in the Large. *Econometrica*, 32(1–2), 122–136.

Rashid, T., Abbas Khawaja, H., & Edvardsen, K. (2016). Review of marine icing and anti-/de-icing systems. *JOURNAL OF MARINE ENGINEERING & TECHNOLOGY*, 15(2), 79–87. Retrieved 29 August 2020 from https://doi.org/10.1080/20464177.2016.1216734

Renn, O. (2008). *Risk Governance: Coping with Uncertainty in a Complex World*. London: Earth Scan.

Renn, O., & Rohrmann, B. (2000). Cross-Cultural Risk Perception. In *Cross-Cultural Risk Perception: State and Challenges* (pp. 211–233). Boston, MA: Springer Science+Business Media. Retrieved from https://doi.org/10.1007/978-1-4757-4891-8

Rottem, S. V. (2013). The Arctic Council and the Search and Rescue Agreement: the case of Norway. *Polar Record. Page*, 1(9). Retrieved from https://doi.org/10.1017/S0032247413000363

Roud, E. K. P., Borch, O. J., Jakobsen, U. ;, & Marchenko, N. (2016). *Maritime emergency management capabilities in the Arctic*.

Roulston, K. (2015). Analysing Interviews. In *Qualitative Data Analysis* (pp. 297–312).

Ryen, A. (2004). Ethical issues. In *Qualitative Research Practice* (pp. 218–235). SAGE

Publications.

Salas, E., & Cannon-Bowers, J. A. (2000). The anatomy of team training. In S. Tobias & J. Fletcher (Eds.), *Training and Retraining: A Handbook for Business, Industry, Government, and the Military* (pp. 312–335).

Salas, E., Dickinson, T. L., & Converse, S. A. Tannenbaum, S. I. (1992). Toward an understanding of team performance and training. In *Teams: Their training and performance* (pp. 3–29). Ablex Publishing.

Salas, E., Sims, D. E., & Shawn Burke, C. (2005). Is there A 'big five' in teamwork? *Small Group Research*, 36(5), 555–599. Retrieved from https://doi.org/10.1177/1046496405277134

Samuelsen, E. M., & Edvardsen, K. (2015). *MARINE ICING OBSERVED ON KV NORDKAPP DURING A COLD AIR OUTBREAK WITH A DEVELOPING POLAR LOW IN THE BARENTS SEA*.

Sapp, J. E., Torre, D. M., Larsen, K. L., Holmboe, E. S., & Durning, S. J. (2019). Trust in Group Decisions: A scoping review. *BMC Medical Education*, 19(1), 1–13. Retrieved from https://doi.org/10.1186/s12909-019-1726-4

Schmith, C. (2004). The Analysis of Semi-structured Interviews. In U. Flick, E. von Kardorff, & I. Steinke (Eds.), *A Companion to QUALITATIVE RESEARCH* (pp. 253–259). London: SAGE Publications.

Sjöberg, L., Moen, E., & Rundmo, T. (2004). *Explaining risk perception. An evaluation of the psychometric paradigm in risk perception research*. *An evaluation of the psychometric paradigm in risk perception research*. Trondheim: Rotunde publikasjoner. Retrieved from http://66.102.9.104/search?q=cache:x8G44WOi3ssJ:www.svt.ntnu.no/psy/Torbjorn.Rundmo/Psychometric_paradigm.pdf+Explaining+risk+perception.&hl=en&ct=clnk&cd=3&gl=uk

Stanton, N. A., Chambers, P. R. G., & Piggott, J. (2001). Situational awareness and safety. *Safety Science*, 39, 189–204. Retrieved from www.elsevier.com/locate/ssci

Stephenson, S. R., Brigham, L. W., & Smith, L. C. (2013). Polar Geography Marine accessibility along Russia's Northern Sea Route Marine accessibility along Russia's Northern Sea Route.

Retrieved 5 March 2021 from https://doi.org/10.1080/1088937X.2013.845859

Sundstrom, E., De Meuse, K. E., & Futrell, D. (1990). *Work Teams Applications and Effectiveness*.

Thagaard, T. (2018). *Systematikk og innlevelse - en innføring i kvalitativ metode* (5th ed.). Bergen: Vigmostad & Bjørke AS.

Thommes, M. S., & Uitdewilligen, S. (2019). Healthy suspicion: The value of low swift trust for information processing and performance of temporary teams. *Group Dynamics*, 23(2), 124–139. Retrieved from https://doi.org/10.1037/gdn0000102

Tohidi, H., & Jabbari, M. M. (2012). Decision role in management to increase effectiveness of an organization. *Procedia - Social and Behavioral Sciences*, 31(2011), 825–828. Retrieved from https://doi.org/10.1016/j.sbspro.2011.12.149

Valdez Banda, O. A., Goerlandt, F., Montewka, J., & Kujala, P. (2015). A risk analysis of winter navigation in Finnish sea areas. *Accident Analysis and Prevention*, 79, 100–116. Retrieved from https://doi.org/10.1016/j.aap.2015.03.024

van den Heuvel, C., Alison, L., & Power, N. (2014). Coping with uncertainty: Police strategies for resilient decision-making and action implementation. *Cognition, Technology and Work*, 16(1), 25–45. Retrieved 16 September 2020 from https://doi.org/10.1007/s10111-012-0241-8

Venuti, L. (1977). *Genealogies of Translation Theory: Schleiermacher*. *Counter-Memory*. Retrieved from University of Chicago Press:

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox-implications for governance and communication of natural hazards. *Risk Analysis*, 33(6), 1049–1065. Retrieved 13 May 2021 from https://doi.org/10.1111/j.1539-6924.2012.01942.x

Willis, H. H. (2007). Guiding resource allocations based on terrorism risk. *Risk Analysis*, 27(3), 597–606. Retrieved from https://doi.org/10.1111/j.1539-6924.2007.00909.x

Yammarino, F. J., Mumford, M. D., Connelly, M. S., & Dionne, S. D. (2010). Military Psychology Leadership and Team Dynamics for Dangerous Military Contexts. Retrieved 21

October 2020 from https://doi.org/10.1080/08995601003644221

Yates, J. F., & de Oliveira, S. (2016). Culture and decision making. *Organizational Behavior and Human Decision Processes*, 136, 1–2. Retrieved from https://doi.org/10.1016/j.obhdp.2016.05.003

Yin, R. (2014). How to Know Whether and When to Use the Case Study As a Reserach Method. *Case Study Research Design and Methods*.

Young, D. L., Goodie, A. S., Hall, D. B., & Wu, E. (2012). Decision making under time pressure, modeled in a prospect theory framework. *Organizational Behavior and Human Decision Processes*, 118(2), 179–188. Retrieved from https://doi.org/10.1016/j.obhdp.2012.03.005

Zaccaro, S. J., Rittman, A. L., & Marks, M. A. (2001). Team leadership, 12, 451–483.

Chapter 9: ATTACHMENTS

9.1 OVERVIEW LITERATURE REVIEW

no	Author	Field and discipline	Journal	Keywords
1	Yates & de Oliveira 2016	Business	Organizational Behavior and Human Decision Processes	Culture, decision making, decision making phases, cultural differences
2	Sapp et al. 2019	*Scoping review*	BMC Medical Education	Trust, group decisions, factors to influence trust
3	Klein et al. 2000	Marine		Decision making, marine, operations, planning
4	Tohidi & Jabbari 2012	*Review*	Procedia - Social and Behavioral Sciences	Effectiveness, new management, decision making process
5	Lipshitz & Strauss 1997	Human Behavior	Organizational Behavior and Human Decision Processes	Uncertainty, methods of coping, coping mechanisms
6	Klimoski & Mohammed 1994	Management	Journal of Management	Group cognition, team mental models, team performance, collective strategic decision-making
7	Dillon and Tinsley 2020	Management	Management Science	Near misses, learning, decision making, perceived risk
8	van den Heuvel, Alison and Power 2014	Police, Human Behavior	Cogn Tech Work	Strategies, uncertainty, resilience, high-risk, RAWFS heuristic, management, decision-making, coping strategy, action implementation
9	Feduzi and Runde 2014	Organizational Behavior	Organizational Behavior and Human Decision Processes	Black swans, unknown unknowns, address problem, state space
10	Fast, Sivanathan, Mayer and Galinsky 2012	Human Behavior	Organizational Behavior and Human Decision Processes	Power, overconfident, high-and-low-power-roles

11	Young, Goodie, Hall and Wu 2012	Human Behavior	Organizational Behavior and Human Decision Processes	Time pressure, prospect theory framework, decision behavior, risk-seeking behavior
12	Pasquini, Steynor and Waagsaether 2019	Human Behavior, psychology	Literature review from United States Agency International Development	Psychology, uncertainty, decision-making, strategies, factors for decisions, strategies dealing with uncertainty, group thinking, biases, prospect theory
13	Darbra, Crawford, Haley and Morrison 2007	Maritime	Marine Policy	Safety culture, risk perception, maritime, incident report, Regulations, training, improvement
14	Yammarino , Mumford , Connelly & Dionne 2010	Military, leadership	Military Psychology	Leadership dynamics, team dynamics, team performance
15	Filho 2019	Sports	Sport Sciences for Health	Team mental models, collective efficacy, cohesion, coordination, team outcome
16	Cater, Kidwell & Camp 2016	Family Business	Family Business Review	Positive track, negative track, decision-making, problem-solving, group interaction
17	Jones, Gittins and Hardy 2009	Coaching	Annual Review of High Performance Coaching & Consulting 2009	Attitude, values, high performance environment, climate, leadership
18	Scotti 2007	Healthcare	Journal of Healthcare Management	Service quality, customer satisfaction, high performance work system
19	Campellone and Kring 2013	Human Behavior	Cognition & Emotion	Trust, behavior in decision-making, facial emotion, investment
20	Goodie and Young 2007	Human Behavior	Judgment and Decision Making	Control, choice, risk, betting, overconfidence, learning

21	Klein 1993	Human Behavior	Decision Making in Action: Models and Methods	Decision, situational assessment, prior experience, search and rescue, command and control
22	Gillespie and Mann 2004	Psychology	Journal of Managerial Psychology	Trust, leadership, motivation, values, effectiveness, team leaders
23	Ordóñez, Benson and Pittarello	Psychology/ Management		Time pressure, risky decision-making, risk aversion, time constraint
24	Balmat, Lafont, Maifret, Pessel 2010	Maritime	Ocean Engeneering	Decision-making, risk factors, risk assessment
25	Busemeyer and Townsend 1993	Psychology	Psychological Review	Violations, decision-making, uncertainty, probability, theories
26	Nævestad, Phillips, Størkersen, Laiou, Yannis	Maritime	Marine Policy journal	Safety culture, transport, risk violations, non-reporting, safety management systems, safety behaviors
29	Lunde og Braut (2019)	Rescue	Air Medical Journal	Overcommitment, air medical, medical services, mangament
30	Thommes and Uitdewilligen (2019)	Human Behvaior	American Psychological Association	Swift trust, group decision, temporary teams, performance, information prosessing

9.2 INTERVIEW GUIDE

Tema		
Introduksjon - 1 min	Navn Bedrift Tittel Arbeidsby Grad av utdanning Kjønn Aldersspenn Kan du fortelle om dine arbeidsoppgaver og ansvarsområder? Kan du forklare hvordan et redningsoppdrag gjennomføres fra det ringes inn til oppdraget er avsluttet? Har du noen erfart eller blitt utsatt for en situasjon med høyt stress og høy risiko? Dersom ja, utdyp.	 Bachelor Master PhD Studie 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65+ Månedlig 3-4gr i året 1-2 gr i året Sjeldnere
Generelt om gruppedynamikk	Hva vil du beskrive som godt teamarbeid? Synes du selv at strukturen i ditt eget team fungerer bra? Hvis ja, hvordan og hvorfor? Hvis nei, hvorfor ikke? Utfordringer? Hvordan vil du si at dynamikken i teamet påvirker redningsoppdraget?	
Felles forståelse og mentale modeller	Blir du påvirket av stress? Hvordan? Kjenner du til de andre på teamet sine arbeidsoppgaver? Hender det at dere utfører hverandres arbeidsoppgaver? Med vilje? Eller grunnet tilpasning? Har du opplevd å måtte improvisere under et oppdrag? Eksempel? Påstand: Du har en risikofylt jobb. Enig eller uenig? Hvordan da?	

	Trener dere på krisesituasjoner? Hvordan? Hva kan være utfordrende for å gjennomføre et redningsoppdrag på en god måte?	
Kommunikasjon	Hvordan snakker dere sammen under et oppdrag? Endres kommunikasjonen med stressnivået? Har du opplevd situasjoner hvor det har oppstår forvirring fordi teammedlemmer har tolket situasjonen forskjellig? Har du opplevd forskjellig forståelse av risiko blant team medlemmene? Hvordan påvirker konflikter arbeidsoppgavene og hvordan blir dette løst? Hvordan påvirker det deg og dine valg dersom du blir misforstått eller misforstår andre? Vil du si at det er rom for de andre på teamet å komme med innspill til alternative løsninger?	
Beslutningstaking	Hvordan blir beslutninger tatt hos dere? Hvem bestemmer? Har noen i teamet større påvirkning enn andre? (Leder, flertall, konsensus) Avhenger de som tar beslutningene av andre for å ta en beslutning under redningsoperasjoner? Hvordan håndteres uenigheter/enigheter i beslutningsprosesser?	
Informasjon	Hjelper det beslutningsprosessen å ha informasjon om søk og redning (modeller og forutsigelser)? Hvis ja, hva slags informasjon synes du er mest nyttig? Er det noen informasjon du skulle ønske du hadde? Har du en anbefaling for å gjøre informasjonsarbeidet rundt søk og redning bedre?	

Avslutning Feedback *Kun for informasjonsdeler e*	Er det noe du ønsker å få ut av dette prosjektet eller lære fra det? *Hva slags tilbakemelding fra interessenter er du interessert i?* *Har du mulighet til å inkorporere disse tilbakemeldingene inn i informasjonsproduktene deres?*	

9.3 INFORMATIONAL LETTERS TO INTERVIEWEES

Vil du delta i forskningsprosjektet

'Risikoaksept ved beslutningstaking i Arktiske redningsoppdrag?'

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å se på hvilke faktorer som spiller inn under beslutningstaking i team ved redningsoppdrag innen søk og redning på Svalbard. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Formålet med prosjektet er å på hvilke faktorer som spiller inn under beslutningstaking i team ved redningsoperasjoner ved skred. Det vil bli sett på hvem som tar beslutninger og på hvilket grunnlag disse beslutningene blir tatt. I tillegg ses det på hvor høy risikoaksept redningsmannskapene har ved redningsoperasjoner bygget på usikkerhet.

Prosjektet vil danne grunnlaget for en masteroppgave i beslutningstaking på Universitetet i Tromsø som gjennomføres denne våren.

Hvem er ansvarlig for forskningsprosjektet?

Universitetet i Tromsø er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?

Da du har stor erfaring på området, var det ønskelig å inkludere deg i prosjektet.

Hva innebærer det for deg å delta?

Hvis du velger å delta i prosjektet, innebærer det at du blir intervjuet digitalt over Teams. Det vil ta deg mellom 30 og 45 minutter. Spørreskjemaet inneholder spørsmål om ditt forhold til søk og redning, beslutningstaking og gruppedynamikk. Dine svar fra spørreskjemaet blir registrert elektronisk som lyd-/videoopptak. Det er også mulig å gjennomføre intervju per telefon.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg. Det vil heller ikke påvirke din arbeidsforholdet på arbeidsplassen din.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Opplysningene fra intervjuet vil kun være tilgjengelig for student Marte Raknerud Hoel og førsteamanuensis Dina Abdel-Fattah. Dataene vil lagres på skylagring. Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrige data.

Du vil ikke kunne bli gjenkjent i en publikasjon. Opplysninger som publiseres vil kun være på generelt grunnlag av hvilke faktorer som påvirker beslutningsgrunnlaget.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?

Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er 01.07.2021. Personopplysninger og opptak vil slettes ved prosjektslutt.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene,
- å få rettet personopplysninger om deg,
- å få slettet personopplysninger om deg, og
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Universitetet i Tromsø NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
Universitetet i Tromsø ved Dina Abdel-Fattah dina.abdel-fattah@uit.no eller Marte Raknerud Hoel mho178@uit.no

- Vårt personvernombud: Joakim Bakkevol på personvernombud@uit.no

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:

- NSD – Norsk senter for forskningsdata AS på epost (personverntjenester@nsd.no) eller på telefon: 55 58 21 17.

Med vennlig hilsen

Marte Raknerud Hoel

Prosjektansvarlig, masterstudent

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Risikoaksept ved beslutningstaking ved Arktiske redningsoppdrag* og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i intervju digitalt over Teams

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)