Igniting Risk Communication? –

Organizational factors for effective risk communication: Forest fire risk communication in Canton Bern, Switzerland

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Abstract

Risk communication forms an integral part of disaster preparedness. In light of the increasing likelihood and intensity of forest fires, areas like Canton Bern in Switzerland, not usually known as a forest fire hot spot, have planned to strengthen their risk communication efforts to help increase overall preparedness and mitigation. Using the example of forest fires, this paper will shed light on the factors that organizations dealing with risk communication could fulfill in order to make such communication possible in the first place. The theoretical and conceptual basis for the general research work was established through communication models by Shannon and Weaver (1949) and the Convergence Model by Kincaid (1979). A scoping study will summarize existing findings in the literature on organizational factors for risk communication. Following, qualitative semi structured interviews with risk communication practitioners from Canton Bern were used to discuss the requirements for risk communication proposed by the scientific literature and the requirements and factors necessary in practice. Findings of this data collection and discussion include a strong overlap in the importance of inter- and intra-organizational cooperation. Differences encompass the creation and implementation of a comprehensive risk communication strategy and ideas and concepts of how to include the public in risk communication endeavors.

Acknowledgements

Summary

Traditionally in risk communication, the receiver's perspective and the content of the message have been subject to scientific analysis, rarely however is the communicator's side examined more closely. Several scholars like Chess et al. (1992:431), Eriksson (2017:164), and Boholm (2019a:1705) have highlighted the need to study the communicator's side of risk communication and its organizational factors that lead to successful risk communication. Following this prompt, the purpose of this thesis is to investigate what organizational factors are needed in order to facilitate effective risk communication in the context of forest fires. The aim is to span a link between research and practice. Scientific input of the factors that academic literature deems necessary for risk communication will come from a scoping study. The practitioners' side will be illustrated by the forest fire risk communication efforts of Canton Bern, Switzerland. Forest fires in Canton Bern are rare; hence, the local population has low exposure to such a hazard and correspondingly minimal knowledge and experience. Due to climate change, however, forest fire risk in the alpine region is expected to increase (Conedera, 2013). Consequently, forest fire mitigation is of growing importance. It is the communication structure and condition of the Canton Bern that will be the focus of the following analysis. The inquiries of literature and practice will be rounded off by a discussion on how the findings of both fields relate to each other.

The theoretical and conceptual basis for the general research is established through communication models by Shannon and Weaver (1949) and the Convergence Model by Kincaid (1979). The research focusing specifically on organizational factors that help risk communication is based on a framework presented by Eriksson (2017).

The most dominant organizational factors needed in order to facilitate effective risk communication are a comprehensive strategy and a good inter- and intra-organizational cooperation. Key differences between the two data sets were how to engage with the public and whether to perceive the public as a legitimate partner. The input from the conceptual framework and the results of the scoping study present an ideal state of the organizational factors for risk communication. In comparison, the practical insights revealed the challenges on the way to implementing ideal risk communication. Although Canton Bern does not fulfill all the factors introduced by the literature study, those that they do meet, are a good foundation on which a more comprehensive strategy for (long-term) risk communication can be built.

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Abbreviations

AWN   …………   Amt für Wald und Naturgefahren, Kanton Bern

Engl.: Regional Forestry and Natural Hazard Service

KomBe   ………..   Amt für Kommunikation des Kanton Bern

Engl.: Communication Department of Canton Bern

MEL   …………..   Monitoring, Evaluation and Learning

RFö   …………...   Revierförster*innen

Engl.: District Foresters

RSTH   …………   Regierungsstatthalter*innen

Engl.: District Governors

1. Introduction

Approximately 90% of the forest fires in the alpine region are human induced (BABS, 2020:1; Müller et al., 2020:3). In light of the expected increase in overall forest fire risk (IPCC, 2022; Mehta et al., 2021:34), the calls of the Sendai Framework and the Aarhus convention to actively involve people in preparing for disasters seem legitimate (Attems et al., 2020:2; Jönsson et al., 2016:207; UNECE, 1998). One of the opportunities to implement this is to engage in risk communication with the affected population. Risk communication prior to a hazard event helps contribute to a greater societal resilience during and after an event (Mehta et al., 2021:27). Traditionally, the receiver's perspective and the content of the message have been subject to scientific analyses, rarely however is the communicator's side examined more closely. Several scholars have highlighted the need to study the communicator's side of risk communication and organizational factors that lead to successful risk communication (e.g. Chess et al. (1992:431), Chess and Salomone (1992:29), Eriksson (2017:164), Rother (2019:568), and Boholm (2019a:1705)). Boholm (2019a:1705) goes as far as stating that "[f]or academic risk communication to have an impact on practice, we need qualitative knowledge of how risk communication work is actually carried out and understood by the practitioners themselves in contexts of national government agencies".

Following this prompt, the purpose of this thesis is to investigate what organizational factors are needed in order to facilitate effective risk communication in the context of forest fires[1]. The aim is to span a link between research and practice. To do so, this thesis will identify the factors that scientific literature deems necessary for risk communication and will identify what factors are applied and relied upon in practice. The former will be done through a scoping study, whilst the latter will require qualitative interviews with practitioners involved in risk communication. Afterwards the inquiries will be rounded off by a discussion on how the findings of both fields relate to each other.

The practitioners' side will be illustrated by the forest fire risk communication efforts of Canton[2] Bern, Switzerland. Forest fires in Canton Bern are rare; hence, the local population has low exposure to such a hazard and correspondingly minimal knowledge and experience. Due to climate change, however, forest fire risk in the alpine region is expected to increase (Conedera, 2013). Consequently, forest fire mitigation is of growing importance. Canton Bern

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[1] Forest fires are a subcategory of wildfires and refer particularly to fires taking place in the forest setting (National Park Service, 2022).
[2] Canton: a state within the Swiss confederation.

aims to decrease forest fire risk via sensitization of the local communities. Their goal is to optimize existing communication strategies and develop new ones for authorities to better engage with the local population and relevant stakeholders on forest fire risk and mitigation. These circumstances make Canton Bern a suitable example to investigate the practitioner side of risk communication: It is their communication structure and condition that will be the focus of the following analysis.

Risk communication often lacks theoretical frameworks and instead makes use of frameworks from other fields such as psychology or communication science (Chess, 2001:179). It is therefore that the conceptual background to this work will be one borrowing from several sources and disciplines. The communication model by Shannon and Weaver (1949) and the Convergence Model by Kincaid (1979) have shaped the initial conceptual understandings of this research. Whilst the previously proposed models will provide the basis for the overall topic, it is the risk communication framework by Eriksson (2017) that was used as an inspiration and source of guidance for the organizational factors necessary for risk communication. This framework sheds light on the components of risk communication that should be present in risk communicators at best.

This thesis is structured as follows: Chapter 2 will give an overview of forest fires in general and in Switzerland in particular, as well as introduce the current forest fire risk communication of Canton Bern. Chapter 3 outlines the conceptual framework of the analyses. Afterwards, Chapter 4 will elaborate on the methods used for the data collection of the literature and interview study. Following the presentation of the key findings of both data collections in Chapter 5, Chapter 6 will engage in a discussion of the findings. Lastly, the concluding chapter (Chapter 7) is going to summarize the main points of this thesis, elaborate on its quality and give inputs for future research activities.

2. Background Information – Forest Fires and the Swiss Context

2.1. *Forest Fire*

Every uncontrolled fire in a forest is considered a forest fire and can be scientifically differentiated by vegetation type, size, and magnitude (BABS, 2020:1). This study, however, will only consider forest fires in general, regardless of the vegetation type, size, and magnitude. Forest fires are caused either by human or natural factors, are unintentional fires or embers that

spread uncontrollably, and usually emerge in dry woods filled with flammable material (Zellmeyer & Tschanz, 2020:42). As human life patterns have changed towards greater mobility and increasing touristic activity, the majority of European forest fires is now induced by human activity, most often caused unintentionally or by negligence during outdoor recreational activities (Künzi & Pfammatter, 2019:1; Tedim et al., 2015:80,81; Vacchiano et al., 2018:945). Paired with intensifying climatic conditions forest fire risk is expected to exacerbate in the coming years (Tedim et al., 2015:78), for example in Switzerland. Although a lot of the literature does not distinguish between the terms forest fires and wildfires, it does not limit the applicability of the literature to the forest fire context. It is expected that similar risk communication procedures apply, as forest fires are a sub-category of wildfires (National Park Service, 2022).

2.2.   *Forest Fire Risk in Switzerland and Canton Bern*

Switzerland will be strongly affected by climate change (BAFU, 2021:10; Maduz et al., 2019:7). As of the current climate change scenarios, it is likely that Swiss summers will become drier and that the average and maximum temperatures will increase. Additionally, snow coverage is expected to decrease, adding to the overall dryness (BAFU, 2021:6). The changing precipitation patterns and longer periods of dryness will increase the frequency and severity of forest fire events even in regions north of the Alps, not traditionally known as fire prone areas (Künzi & Pfammatter, 2019:1; Müller et al., 2020:3; Peter & Pfammatter, 2019:266; Pezzatti et al., 2016:224,233; Zellmeyer & Tschanz, 2020:42). Especially in mountainous regions, this poses special challenges as the local public there is often dependent on the protective role forests play with regard to natural hazards such as landslides or avalanches (Zellmeyer & Tschanz, 2020:42).

Canton Bern, the case study region for this paper, is situated north of the Alps and falls into the category of non-traditional fire prone alpine areas (see Figure 1, Tschubby, 2011). With regard to the causes of fires, Canton Bern follows the general trend in which approximately 90% of the forest fires in the alpine region are induced by humans (BABS, 2020:1; Müller et al., 2020:3). This already high human induced fire activity is expected to increase even more in the future as more people have discovered forests as an area for recreation and increased heat and lack of precipitation make ignition more likely (Müller et al., 2020:3). Overall, there is low risk awareness for forest fires amongst the population living in the Alpine region (Müller et al., 2020:30). Hence, risk communication and awareness raising for forest fires in the Alpine region gives room for improvement. Nonetheless, in recent years Switzerland has increased its efforts

both nationally and regionally to improve risk communication aiming to prevent forest fires (Müller et al., 2020:30). According to Müller et al. (2020:4), given the expected increase in forest fire activity, long-term risk communication can contribute to lowering the overall risk of forest ignition.

Figure 1 - The location of Canton Bern (marked red) within Switzerland (left). Map of Canton Bern (right) with alpine landscapes (higher elevations with lighter color) in the South of the Canton (Maps by Tschubby, 2011).
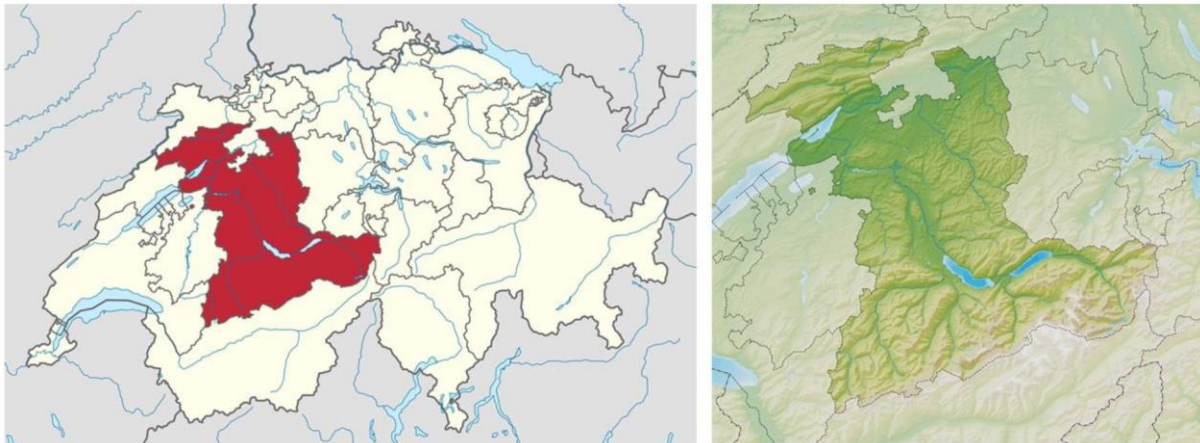
2.3.   Risk Communication in Canton Bern

In Canton Bern forest fire management is a collective task, including not only the forest management authorities but also foresters, fire fighters and district governors (Peter & Pfammatter, 2019:266). This is especially so due to the political set-up of Switzerland which has a strong federalist approach that often causes a multitude of actors having to coordinate (Maduz et al., 2019:7). In Canton Bern, the most critical instrument for forest fire prevention to date is the correct communication of the risk levels, and where necessary the implementation of fire bans within or in close proximity to the forest. Risk communication beyond these two measures is seldomly performed (Peter & Pfammatter, 2019:268).

The routine for forest fire risk communication is the following (see Figure 2, Valerius et al., 2022): The Regional Forestry and Natural Hazard Service (Amt für Wald und Naturgefahren - AWN) monitors the forest fire risk, mainly based on meteorological data and the assessment of specially trained forest fire foresters, and issues a local risk prognosis by making use of five risk levels (Peter & Pfammatter, 2019:267). If there is danger of forest fire (based on the five risk levels), the district governors (Regierungsstatthalter*innen - RSTH) can prohibit fires in the endangered areas (Künzi & Pfammatter, 2019:2). The coordination and streamlining on where to implement the respective measures is done through the district governor assembly
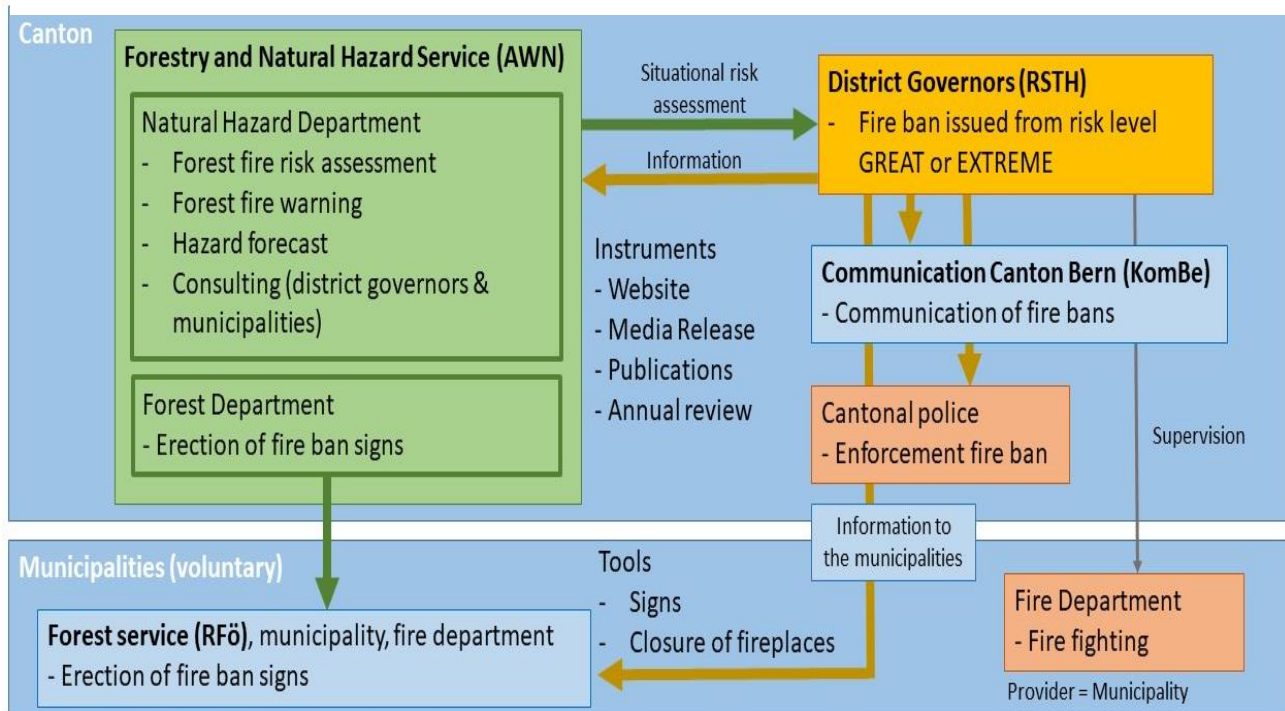
(Künzi & Pfammatter, 2019:6). Upon the identification of fire ban areas, the RSTH communicate with the respective communities and the public (Künzi & Pfammatter, 2019:6). Whilst AWN decides on and communicates the risk levels, fire bans are issued only by the RSTH. When considering to issue a fire ban, RSTH also consider additional risks such as low levels of extinguishing waters or national holidays, where fire risky behavior by the public is more likely to occur (Peter & Pfammatter, 2019:268).

The risk information is disseminated through risk level publications on the department's website, via media messages, and signs directly in the forest (Peter & Pfammatter, 2019:268). All published material is available in the Canton's official languages, German and French, as well as English (Peter & Pfammatter, 2019:268). The district foresters (Revierförster*innen - RFö) coordinate the installing of signs. Their job is to communicate the position of the fire ban signs with the respective communities and coordinate the postings with them to increase efficiency and improve timing with setting up the warnings (AWN, 2019:4). All other communication of the fire bans follow a prescribed routine involving Canton Bern's communication department (Amt für Kommunikation des Kanton Bern - KomBe) as well as the district governors and their communication departments (Künzi & Pfammatter, 2019:6). The communication departments keep several generic text modules and templates, which can then be adapted to specific circumstances, in order to allow for a more efficient and fast dissemination of the warning (AWN, 2018:2). The interaction with the local population takes place through a hotline that citizens can call to receive information (Künzi & Pfammatter,

2019:6). Apart from the dissemination of fire bans, risk communication is limited to rather passive prevention by encouraging foresters to increase their attention on forest fires in their daily work (AWN, 2018:3). In summary, AWN, RSTH, KomBe and RFö are the main communicators of risk communication. Pfammatter and Peter (2018:6) point out that at cantonal level not all responsibilities regarding forest fire prevention and management are thoroughly settled. The AWN emphasizes that good coordination and allocation of competences between all risk communication stakeholders are nonetheless crucial for the success of the same (Peter & Pfammatter, 2019:269).

3. Conceptual Framework

Although this thesis' focus is on the communicator's side of risk communication, it is also important to mark out the broader conceptual underpinning of risk communication. This chapter will introduce risk communication in general and then move on more specifically to the Shannon and Weaver model (1948) and the Kincaid's Convergence model to understand the communicator's position within the risk communication overall. Lastly, the framework by Eriksson (2017) will serve as a sounding board for specific communicator factors for risk communication. Although introducing several communication models to strengthen the general line of argument, this thesis will take its conceptual departure from the Convergence model and the research guidance from Eriksson's framework.

3.1. Risk Communication

The concept of risk communication started to receive increasing attention in the late 1970s and 1980s (Boholm, 2008:1; Plana & Font, 2015:3). Ever since then, risk communication has undergone various stages of development (Fischhoff, 1995:138). Possibly most dominant is the evolvement from one-way to persuasive to two-way communication (Plana & Font, 2015:3). With various stages of development, multiple definitions of risk communication emerged (Palttala et al., 2012:5). This thesis will make use of the popular definition by the US National Research Council: *"Risk communication is an interactive process of exchange of information and opinion among individuals, groups, and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk"* (National Research Council, 1989:21). In addition to this definition it is important to point out that risk communication includes internal as well as external communication, happens prior to an event, and is a lengthy process (Mehta et al., 2021:6,8,9,36). Risk communication can take on various forms depending

on the purpose it should fulfill, like increasing awareness and knowledge or motivating behavioral change and action (Bier, 1999:1,3). Not all of these objectives, however, require risk communication. Sometimes, also risk messages, as part of the greater risk communication can suffice (McCarthy & Brennan, 2009:22). Risk messages are unidirectional, have a distinct source, and can be directed towards one or several audience groups. Risk messages can come in a variety of verbal and visual forms and their purpose is to communicate risk, so informed choices are possible (McCarthy & Brennan, 2009:23). Risk messages do not require a response from the targeted audience.

Risk communication is often used interchangeably with crisis communication (Mehta et al., 2021:50; Plana & Font, 2015:5). For the argumentation of this text, however, a conceptual differentiation is necessary. Whilst risk communication as discussed earlier is a long term communication process, crisis communication focuses on the "communication *during* an event" (Steelman & McCaffrey, 2013:686, emphasis added). This thesis will explicitly base its conceptual understanding of risk communication on the elaborations made earlier in this chapter.

Defining the effectiveness or success of risk communication is challenging (Attems et al., 2020:2). Multiple reasons for this apply. It is difficult to do pre-post comparisons on how risk communication prevented a disaster or whether other factors outside the sphere of influence of the communicator did (Bier, 1999:2; Fischhoff, 1995:144). Furthermore there often is a delay in how risk communication translates into public action (Eriksson, 2017:169), and risk communication endeavors often lack clear goals and objectives with which to measure their effectiveness (Kasperson & Palmlund, 1989:143). Attempts have been made to define effective risk communication. The focus has mainly been on how the level of awareness, understanding, and knowledge about the hazard has increased within the affected population. Another focus has been on how well risk communication enabled the affected population to take informed prevention, mitigation and preparedness measures for the hazard (National Research Council, 1989:2; OECD, 2016:13). Overall, however, measuring or assessing the effectiveness of risk communication is still subject to scientific debate. For the purpose of this thesis effective risk communication is broadly understood as communication that has achieved its desired result of reducing the occurrence of forest fires (Balog-Way et al., 2020:2242). As all factors relate to some aspect of effectiveness, the assumption is made that all organizational factors to be discussed in this thesis will have a positive effect on the success of risk communication. An exact measurement of effectiveness for the factors to be analyzed is not going to be part of this thesis.

3.2. Communication Models for Risk Communication

According to Höppner et al (2010), despite the concept of risk communication being used since the 1970s, "there are hardly any communication frameworks and tools specifically developed for the field of natural hazards" (Höppner et al., 2010:29). It is therefore that risk communication is often analyzed on the basis of traditional communication models, such as the sender-receiver model by Shannon and Weaver (1949) (Boholm, 2008:1; Lundgren & McMakin, 2013:12). This model breaks down the main actors and communication flow into the following components: sender/messenger/communicator, the message, the channel, and the receiver (Figure 3, Wang & Li, 2017:3). The Shannon and Weaver model presents a very technical one-way approach to risk communication that does not include a feedback loop (Boholm, 2008:2; Kincaid, 1979:1). As a consequence, it has been debated, whether to apply a different model of communication that would be more appropriate to the development of seeing risk communication as an interactive and two-way process (Höppner et al., 2010:7).

Figure 3 - Shannon & Weaver model, illustration by Wang & Li, 2017:3.
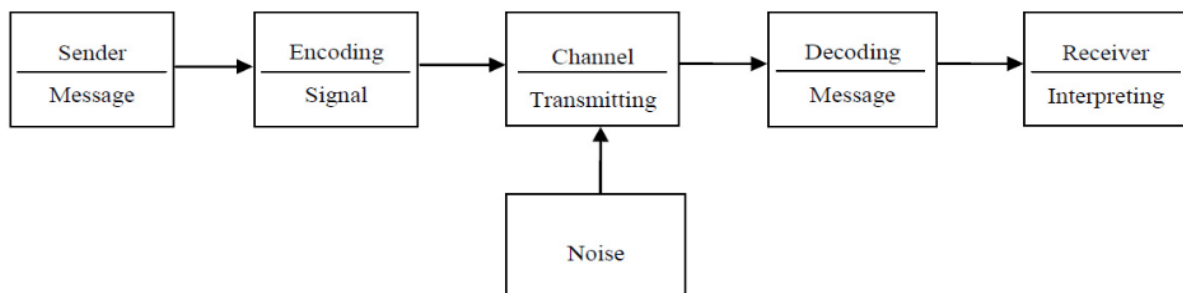
Growing from this discussion, Lawrence Kincaid developed the Convergence Model of Communication (1979, see Appendix 1). According to Bradbury (1994), "the convergence model shows communication as an iterative, long-term process in which participants are mutual communicators rather than senders and receivers" (Bradbury, 1994:361). The ultimate goal of this approach is to reach mutual understanding amongst those involved in communication. Mutual understanding, as this model portrays it, is shaped through feedback and a two-way exchange process that follows a cyclical nature, in an attempt to move the parties' positions closer to each other (Hampel, 2006:5; Kincaid, 1979:9,14). This model strongly highlights the interactive components of communication, that were also emphasized by the US National Research Council in their previously mentioned definition of risk communication. In Kincaid's model, the sender also takes on the role of a receiver and vice versa. Simply put, Kincaid developed the Shannon and Weaver model to have continuous feedback loops and to be less technical. Kincaid's model attempts to apply a dynamic and meta-understanding of

communication. For the clarity of argument, this thesis focuses on the factors that organizations of Canton Bern, involved in risk communication, would need to fulfill in their roles as communicators in the Kincaid model. The implications of these organizations in their roles as receivers will only briefly be discussed.

3.3. *Eriksson (2017) Framework*

Having established the communicator's role within the communication process overall in the previous chapter, this coming chapter will now focus on the communicator in more detail and discuss the factors needed by the communicator to communicate risk successfully. The study by Eriksson is one of the few studies focusing on the communicator's side of risk communication (Eriksson, 2017:162). Especially "risk communication practices by government[s]" (Boholm, 2019a:1696) are rarely observed. There are multiple potential reasons for this literature gap. Boholm (2019a: 1698,1696) mentions, "organizational dimensions of risk communication are not easily accessible" and fear of bad reputation or the fear of tension between organizations and within departments might hinder the willingness to be engaged in research. Chess et al. (1992:431) see another obstacle: the focus in risk communication literature is often on how organizations should behave externally and in cooperation with partners; rarely does it address the internal factors that lead to successful risk communication.

Eriksson (2017) has addressed this literature gap by drafting a conceptual framework for analyzing the factors necessary on the communicator's side to communicate risk successfully (see Appendix 2). This framework sheds light on the factors of risk communication that are necessary for the communicators of this risk. Those include amongst others (i) a clear understanding of the role and rationale of risk communication within the communicating organization, (ii) a thorough understanding of target groups, (iii) a good two-way relation and (iv) communication with the target groups as well as (v) a clear agreement on the risk topics to be communicated. Although this framework is set in a Swedish context it is nonetheless considered valuable for the analysis of similar organizational set-ups in other countries, even recommended by the author them self (Eriksson, 2017:176). It is this encouragement and the aforementioned gap in the literature that inspired this thesis to explore organizational factors for effective risk communication. The research question guiding this thesis is:

i)   *What are organizational factors to be considered for effective risk communication?*

        a) According to the literature, what are key organizational factors for effective risk communications?

        b) According to practitioners in Canton Bern, what are key organizational factors for effective risk communications?

ii)   *How do the findings of both the literature and the practitioners relate to each other?*

This thesis attempts to add to the sparse research on organizational factors for risk communication. The uniqueness of this research, however, is the equal focus of organizational factors proposed by both literature *and* practice. It is important to highlight that as part of the initial screening, the research by Eriksson (2017) gave overall guidance to this paper rather than serving as a theoretical basis.

4. Method

In order to discuss the organizational factors necessary for risk communication, this thesis used a two-track data collection approach: a scoping study and an interview study. The most frequently referred to organizational factors from the literature serve as a guideline for the interviews and thereby form an interface between academic research and practice. The aim is to achieve a holistic investigation of how science and practice can compliment each other. The following chapters will introduce both methods in more detail and elaborate on some of the limitations to the data collection procedure.

For transparency it should be noted at this point that this thesis was written in collaboration with the project "Risk of forest fires north of the Alps: Awareness and communication" at the Centre for Development and Environment (CDE), University Bern. This project is initiated and funded by AWN, Canton Bern, and the Wyss Academy for Nature at the University of Bern. The author of this thesis has no conflicts of interests to disclose and was given full freedom to conduct their research.

4.1. Method – Scoping Study

To extract factors for the communicator's effective risk communication from the literature, a scoping study approach was applied. Scoping studies "aim to map rapidly the key concepts underpinning a research area and the main sources and types of evidence available" (Mays et al., 2001:194). In a scoping study, literature is included on the basis of relevance rather than

quality and its goal is to identify broader concepts and themes rather than reflecting on specific research methods and their quality (Arksey & O'Malley, 2005:20; Poth & Ross, 2009:7). The scoping study approach was chosen to broaden the literature available for the analysis because only a limited amount of literature dealing with the organizational factors of risk communication in particular was available. It appears that organizations and agencies are often reluctant to give insights into their structures fearing bad reputation or inter-organizational tension (Boholm, 2019a:1698). This current scoping study aligns with the framework by Arksey & O'Malley (2005), considering the suggestions for improvements made by Levac et al. (2010).

The scoping study started out with an initial screening of the literature available. In combination with the framework presented by Eriksson (2017), see Chapter 3.3, this first review served as a knowledge base for the research to follow. Thereafter, two main databases (Google Scholar and LubSearch (University Lund)) were searched with a structured approach by applying the following combinations of key words: *"risk communication" AND (communicator OR sender OR messenger)*; *"risk communication" AND (institution* OR government* OR agency OR organization*)*; *"risk communication" AND ("forest fire" OR wildfire).* The use of synonyms of key words was motivated by the conceptual framework and the consideration of not to miss important texts. The above-mentioned key words represent the exact search strings applied with the databases. For each search string the first 50 articles were considered, as afterwards the accuracy of the search results decreased significantly. This primary search strategy produced around 150 texts, of which 97 texts were identified as relevant. Furthermore, the extracted literature was screened for other relevant sources by applying the snowball technique. This snowball technique produced 16 relevant texts. This overall search strategy was developed in consultation with an information expert/librarian from Lund University.

The primary selection of literature was done by skimming the title, abstract and key words. Texts that appeared to address the topic of risk communication in combination with forest fires and/or organizational factors were considered. Following the primary selection, the final selection was done through the revision of the full texts. Although time consuming, this method proved to be effective as abstracts varied in content and quality and did not always present the content of the paper adequately (Arksey & O'Malley, 2005:26). A flow chart diagram with the number of texts reviewed at each stage can be seen in Figure 4 below. Using this PRISMA[3]

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[3] PRISMA: transparent reporting of systematic reviews and meta-analyses, https://prisma-statement.org/Default.aspx .

chart approach gave general guidance and helped to increase the reliability of the results as each step of the iterative scoping study process was thoroughly documented (Arksey & O'Malley, 2005:22). The literature that emerged from this process will be described more in-depth in Chapter 5.1. The selected literature was thereafter specifically analyzed to identify key organizational factors for communicators to have for effective risk communication. The factors were clustered to form overall themes. To get a better overview of the key factors, their frequency was recorded. Frequency was assessed through binary coding, e.g. was the given factor present in the text -yes/no? Several factors could occur in one text.

Figure 4 - Flow chart of the literature selection for the scoping study. Concept: PRISMA chart (Tricco et al., 2018).
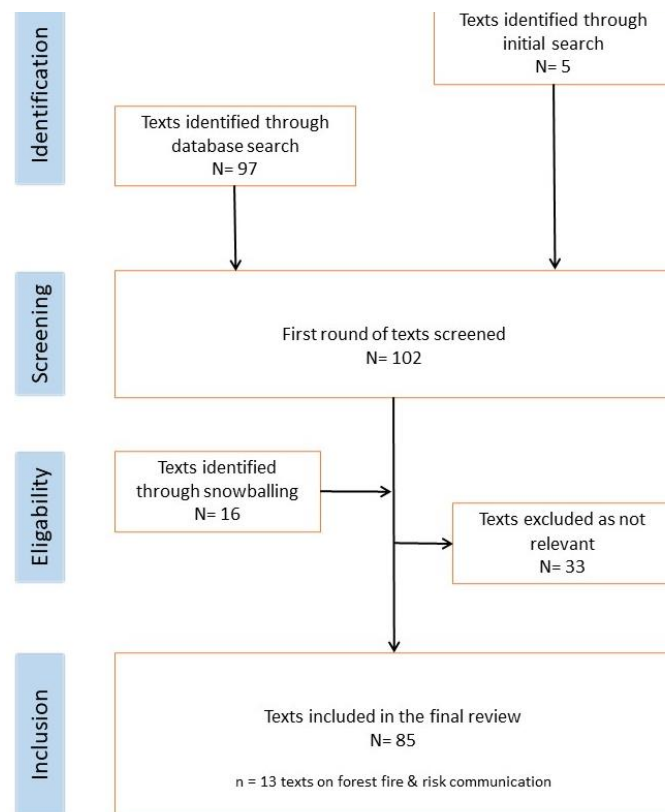
Apart from considering the title, key words and abstract, both the primary and final selection of texts were led by the following inclusion/exclusion criteria when reading the articles:

- Key words: The keywords for this scoping study were strongly motivated by the conceptual framework of this paper (see Chapter 3). It is therefore that possible synonyms like "crisis communication", "disaster communication" and "emergency risk communication" were not taken into account since their conceptual implications would

have diluted argumentative strength of the overall analysis. However, texts mentioning crisis communication but with their conceptual understanding clearly referring to risk communication were considered too. Literature searches for risk communication included texts on health much more often than any other topic. Literature with a focus on health was therefore only considered when showing a direct link to risk concepts and organizational dimensions.

- Language: Only texts in English were considered.
- Time span: The time span, 1980s until 28.02.2022, was motivated by repeated statements in the literature (Covello & Sandman, 2001:164; Plana & Font, 2015:3; Rowan, 1991:301) that risk communication began to grow in importance in the 1980s. The sources for the scoping study were therefore selected starting from these years until today. Merely the popularly cited "Mathematical Theory of Communication" by Shannon & Weaver (1948) and the Kincaid model (1979) pose an exception.
- Content: The focus throughout the screening process was strongly on information regarding the communicator's side. Information regarding the other components of risk communication, such as the channel, message or audience were not considered.
- Search results: Only the first five pages (approx. 50 sources) for each key word combination and database was considered, as an exploratory literature search prior to the start of this thesis had shown a significant decrease in the accuracy of search results afterwards.
- Type of literature: By the nature of databases consulted, the texts included in the scoping study were scientific literature and reports aimed at both academics and practitioners. No grey literature was included.

4.1.1. Limitations – Scoping Study

This and Chapter 4.2.1 aim to shed light on the possible limitations that the choice of method inherits. The limitation of the method is already made transparent at this point, in order to avoid irritations with the reader in the further course of the text and to anticipate criticism. Overall, the aim of this chapter is to enable the reader to have a comprehensive understanding of this thesis' approach before engaging with the results. A discussion of limitations aimed more broadly at the research endeavor overall will follow in Chapter 6.4.

This scoping study shares the limitations of many likewise explorations: there is no differentiation of the quality of the included studies and quantitative and qualitative studies are analyzed together (Stenberg et al., 2016:10). Other limitations of scoping studies include the

challenge to decide on the scope of the study as well as the absence of any discussion around the quality of the studies presented (Arksey & O'Malley, 2005:30). Regarding the inclusion/exclusion criteria, including only English sources in the scoping study might risk missing out the input of other relevant papers (Arksey & O'Malley, 2005:24). Additionally, the focus on scientific literature and reports might have excluded relevant grey literature (Stenberg et al., 2016:10). Despite these limitations and given that the field of risk communication is rather small; there was a noticeable point of saturation as the number of selected papers was increasing. Despite the methodological limitations, the scoping study approach is sufficient for the scope of this thesis, as the aim was to comprehend the field overall, instead of engaging in depth with the quality of the research that has been performed.

Regarding the analysis of the scoping study results, binary coding does come with limitations. Frequency based on binary coding is able to present how often factors were mentioned, however is not able to present the weight of the occurrence (Mayring, 2012:33). Papers focusing on one factor only, will create the same frequency for this factor as another one that mentions this specific factor only in one sentence. Measures to counteract this tendency included a back check with the framework by Eriksson (2017) as a guideline and the overall familiarity with the literature included in the scoping study. Furthermore, in the attempt to create clear-cut thematic categories for communicator's factors, analytical sacrifice had to be made: some factors were assigned to specific themes, although they could have also harmonized with others. Despite the methodological limitations, the binary coding approach is sufficient for the scope of this thesis. A more detailed analysis of the literature and a method other than the binary coding would have moved the methodological approach too far away from the scoping study, which was chosen particularly because of its suitability for getting a broad overview of the literature.

4.2. Method – Interview Study

A qualitative semi-structured interview approach helped identify factors for effective risk communication from practice, in this case Canton Bern. In accordance with Helfferich (2009:182-189) the questions for the interviews were gathered in a brainstorming process, by considering the scoping study results and balancing questions ensuring a good interview flow and comfort for the interviewee. Additionally, the interview guide by Eriksson (2017) served as an inspiration for possible interview questions. Afterwards, the questions were filtered, according to considerations, such as overall relevance to the topic or the length of the interview. Finally, the questions were sorted and structured into thematic bundles, so as to create a natural interview flow (Kruse, 2015:227, see Appendix 3). Having a semi-structured interview

approach helped focus on the research question whilst also allowing for new topics to emerge or be probed for (Kruse, 2015:209). This was especially important as the aim of this research was an open discussion on how factors found in the scoped literature would match with those in practice. Overall, the interview guide contained seven thematic blocks and 19 questions total. Not all questions were asked during all interviews, as some were not relevant for certain interviewees or had already been answered naturally. To guarantee some consistency between the interviews however, the first and last question were kept the same. The first question encouraged the interviewees to tell something about their professional background and their current work tasks. The last question asked for any wishes they might have regarding forest fire risk communication in Canton Bern overall. Especially the last question proved to be helpful in uncovering new aspects not yet discussed in the interview or confirmation of what had already been said. The interview was pretested with a forest fire communication specialist from Canton Luzern, as not to limit the already small available number of interviewees within Canton Bern even further.

A total of six interviews were conducted. The sampling of interview partners was based on the forest fire communication concept published by Canton Bern (Künzi & Pfammatter, 2019). As described in Chapter 2.3, this concept shows that the following units are involved in the forest fire communication: Regional Forestry and Natural Hazard Service (AWN), Canton Bern's communication department (KomBe), the district governors (RSTH) and the foresters (RFö). In a non-randomized purposeful selection one to two persons from each of these organizational entities was interviewed. All of the interviewees were employed in a higher managing position for their field of forest fire preparedness and response. An additional interviewee not mentioned in the communication concept but nonetheless relevant for the topic overall, and hence interviewed, was the head of one of the firefighting departments in Canton Bern. This additional interview gave substantial background insight into the practical forest fire situation in Switzerland and Canton Bern. This interview is therefore considered to be a special asset for the open discussion of literature versus practice in Chapter 6.

As forest fires are not yet a primary issue for these organizations within Canton Bern, there was only a limited number of people to sample interviewees from. Nonetheless, it was the position the interviewees worked in and the responsibilities they held within the communication process that vouches for the quality of the results overall. Although this limited sampling has the drawback of generating results that are not generalizable, there was a clear trend of saturation towards the final interviews, with similar issues being raised by multiple interviewees and the number of new insights decreasing.

The interviews were conducted between 21.04.2022 and 25.05.2022, and lasted between 37 to 59 minutes, with an average of 49 minutes. Variation in interview length was either due to time constraints of the interviewees or due to limited involvement with the topic overall. Two out of six interviews were held in-person, the other four were held through zoom. This different interview set-up was not seen as a drawback to the interview quality, as in previous studies with a similar topic and approach, telephone and face-to-face interviews seemed to have had the same validity and reliability (Boholm, 2019:161). All interviews were held in German and recorded to be transcribed for further analysis. Information about the motivation for and background of the interview as well as the procedures for data protection and anonymity was sent out to the interview partners in advance. The interviewees gave their written consent for the interview to be used anonymously in this thesis. It is therefore, and due to the small population sample, that in the following chapters interviewees will only be labeled I1, I2, I3 or interviewee 1, interviewee 2, etc., respectively. Including more information on the interviewee labels would allow for an identification of the interviewees. For the same reason, no other information concerning their exact position or educational background will be provided in this text.

The interviews were transcribed and coded with the NVivo 12 software. The majority of coding was done with a semi-deductive approach based on the themes brought up by the previous scoping study. Nonetheless, the coding process was flexible enough for emerging themes and factors to appear. Additionally, the postscripts conducted after each interview, as suggested by Kruse (2015:278–279), helped generate data-driven codes and where necessary triangulate them with the a priori codes generated through the results of the scoping study. Furthermore, the postscript procedure helped to minimize information loss between the different steps of the data handling. In total, six thematic blocks were created that will be discussed in more detail in Chapter 5. The codes generated both by the a priori and the data driven approach were recorded in a codebook, in order to have a "formalized operationalization of the codes (…) [and to ensure] consistency in the data analysis" (DeCuir-Gunby et al., 2011:138). Following the first coding cycle based on the previously described procedure, a second coding cycle was performed to ensure consistent coding throughout all interviews.

4.2.1. Limitations – Interview Study

The limited number of interviewees as well as the selection process of interviewees being motivated only by the risk communication concept, has contributed to the results of this qualitative research not being generalizable on statistical grounds. Nonetheless, the quality of

the research and data collected is ensured by the systematic collection and analysis of the data. It is therefore that the results may lend themselves, under critical and cautious reflection, not to statistical comparison but to comparisons with other settings similar to the one explored in this thesis.

Analytical quality and depth was ensured through accurate and detailed transcription (Kruse, 2015:341). Nevertheless, transcripts are also a reconstruction of reality and will never be able to be an exact mirror of the verbal word (Kruse, 2015:346). This touches upon a key weakness of analyzing interviews: one tries to interpret what another person has said. Perception of realities differ on both the interviewees and the interviewer's side. Furthermore, personal experiences of the interviewees could influence their responses and give a skewed impression of the reality within their organizations. On the other hand, the interviewer has its own underlying biases and has to try to make sense of what has been said. Consequently, understanding by the interviewer is only a continuous attempt to understand (Kruse, 2015:68). This cannot be avoided but was critically reflected upon throughout the analytical process. Unfortunately, the resources for this project did not allow for a second coder and analyst, which would have improved the reliability of results. This circumstance also justifies a word of caution regarding the underlying biases of the coding procedure. Since the same person performed the scoping and interview study and analysis, biases with respect to finding similarities between the results of the two data collections are likely. Furthermore, there are linguistic limitations: the interviews were held in High German, which was not the interviewees mother tongue. Additionally, the interview transcripts were translated from German to English for the purpose of this thesis. This challenge also applies to the results and concepts of the literature study which have been translated into German, so that they could be addressed in the interview. These linguistic jumps could have caused information to be lost in translation. Measures to counteract this limitation were amongst others an awareness for this challenge, good language skills of the author and a critical questioning of key terms used by interviewees and interviewer likewise.

5. Results

This following chapter will give insights into the data collected through the scoping study (Chapter 5.1) and the interview study with practitioners (Chapter 5.2). Chapter 5 is structured in a way that illustrated how the two methods complement each other with respect to illustration of organizational factor for effective risk communication.

5.1. Results – Scoping Study

In total, 118 pieces of literature were found in total and 85 of them were considered suitable for the scoping study (Figure 4 above, see Appendix 4). The texts' publication date covered a time span from 1986 to 2022, with a median publication year of 2007. The geographical focus of most texts (41%) was North America. Empirical and theoretical knowledge were almost equally dominant with 31% of the literature having a theoretical and 32% of the literature having an empirical focus. The last third of the texts either contained a mixed approach or was more of a practical nature. The most popular methodology was qualitative analysis (35%). No grey literature was reviewed, only books, reports, and peer reviewed journal articles, aiming towards an academic (75%), practitioner (6%) or mixed audience (19%). Most of the risk literature screened focused on multi-hazard events or on hazards not further specified. Forest fire risk communication in particular was only mentioned in 13 texts. Although most risk communication literature does not explicitly focus on forest fires, from the little amount of literature that does focus on forest fire risk communication it can be assumed that the general risk communication literature is transferable. Six reoccurring themes of factors for effective risk communication could be identified: (1) *inter-organizational factors*, (2) *intra-organizational factors*, (3) the *strategy of risk communication*, (4) the *communicator's attitude towards the public*, (5) *the mode of risk communication*, and (6) *intersecting themes*. The wording of the themes either came in vivo, by different texts mentioning the same words repeatedly or they were terms taken from the Eriksson (2017) Framework. Furthermore, aspects regarding the content of the risk communication were not considered, as this is not the focus of this thesis.

All factors constituting the six themes are presented in Table 1 below. All of the factors identified by the literature have an influence on the effectiveness of the risk communication effort in one way or the other. The following five factors appeared to be addressed most frequently by the literature, in absolute terms: *trust* (n=47), *interactive risk communication* (n=44), *good interoperability* (n=33), *seeing the public as a heterogeneous audience* (n=33) and *planned and intentional risk communication* (n=32). Each of the factors for effective risk communication originating from one of the themes will be described in more detail in the following chapters. Although six themes could be identified, only five factors will be elaborated on. This analytical choice was made on the basis of the frequency table. Intra-organizational aspects were generally given the least attention to by the texts. Reasons such as those mentioned earlier by Chess (1992), Boholm (2019), and Eriksson (2017) (Chapter 3.3) could apply. Due

to this circumstance the decision was made to focus on the five most frequently mentioned factors instead of considering one factor of each theme.

Overall, the frequency of the main themes is not considered. The reason for this being: the frequencies of the factors represent the literature in a more accurate manner and are less affected by the limitations of the binary coding approach. Nonetheless, the main themes are considered to be an important asset in giving overall structure to the analysis. The themes help to compartmentalize complex ideas that often have an intersecting character. In order to allow for a more detailed elaboration, otherwise not possible to the same extent, the focus of this results chapter will be on individual factors rather than the overarching themes.

Table 1 - Frequency table for organizational factors for risk communication grouped by themes & factors. Frequency refers to how often a certain factor was mentioned in the texts of the scoping study overall. Pink highlights the five organizational factors to be discussed in more detail.

Themes Factors	Frequency (n=397)	Percentage of Frequency (%)
Inter-organizational		
Good inter-operability	33	8,3%
Clear roles & responsibilities	14	3,5%
Resources	5	1,3%
Intra-organizational		
Good intra-operability	19	4,8%
Clear roles & responsibilities	13	3,3%
Resources	10	2,5%
Management & leadership	12	3,0%
Positive work atmosphere	13	3,3%
Communication training	16	4,0%
Risk Communication Strategy		
Communicators speak with 'one voice'	15	3,8%
Risk communication is institutionalized	18	4,5%
Planned & intentional	32	8,1%
Attitudes towards the Public		
Public is seen as a legitimate partner	26	6,5%
Understanding for a heterogeneous audience	33	8,3%
Mode of Risk Communication		
Interactive risk communication	44	11,1%
Visible communicator	6	1,5%
Intersecting Themes		
Monitoring, evaluation & learning (MEL)	20	5,0%
Credibility	11	2,8%
Trust	47	11,8%
Transparency	6	1,5%
Flexibility	4	1,0%
Total	*397*	*100,0%*

5.1.1. Inter-Organizational Factors: Good Interoperability

Cooperation between agencies is seen as an efficient measure to prevent forest fires in the Alpine region, amongst other factors (Müller et al., 2020:31; Peter & Pfammatter, 2019:266). Cooperation along with coordination, cooperation, communication, the sharing of information, efficient administrative structures and constructive conflict management help to reduce silo working and are a sign of good interoperability (Boholm, 2019b:165; Eriksson, 2017:164). Especially constructive conflict management and a good working climate between organizations have repeatedly been pointed out in being important for a trustful relationship (Chess et al., 2005, pp. 273–274; Clarke et al., 2006:163; Covello & Sandman, 2001:165; Mehta et al., 2021:42; Steelman & McCaffrey, 2013:698). Although highlighting the importance of inter-organizational cooperation, it can be a challenging endeavor (Tymstra et al., 2020:8). Risk communication should keep some degree of flexibility and not be limited too much by official procedures (Bharosa et al., 2010:52,56; Höppner et al., 2010:39; Kim & Kreps, 2020:6; Neville et al., 2015:3). Another challenge lies in defining the boundaries between within and between organizations as well as the organization's environment (Chess, 2001:180). It is therefore that this factor finds overlap with the factor of clear roles and responsibilities and the factors mentioned under intra-operability.

5.1.2. Risk Communication Strategy: Planned and Intentional

Planned and intentional risk communication most importantly refers to clear objectives, goals and strategies that are understood by all communicators (Höppner et al., 2012:1766; Tinker et al., 2000:123) and receive the appropriate priority in the overall risk management (Covello et al., 1986:172). Goals for effective risk communication include raising awareness or motivating a change in behavior (Bier, 1999:2). The planning of risk communication through goals and objectives should be undertaken in an informed manner and include other stakeholders in the decision making process as to obtain a variety of perspectives (Bier, 1999:2; Klein et al., 2021:411). This approach will help strengthen the overall risk management efforts.

Besides setting clear objectives and goals, planned and intentional risk communication also includes long-term planning and implementation (Eriksson, 2017:163; Mehta et al., 2021:8). Long-term risk communication has shown to improve "community resilience during and after an incident" (Mehta et al., 2021:27). Nonetheless, risk communication efforts should remain flexible and take place consistently with different time horizons (Viola et al., 2021:10). Long term continuous risk communication also means a long term relationship with the audience

which in turn generates trust, and will also help to find ways to reach audiences formerly not willing to engage (Olsen & Shindler, 2010:137,145; Stevens, 2008:6).

5.1.3. Attitudes towards the Public: Understanding for a Heterogeneous Audience

A solid understanding of the public and of the heterogeneous nature of the public as an audience increases the effectiveness of risk communication: risk communication itself and the risk messages to be disseminated can be adapted to the specific target group's needs and interests (McCarthy & Brennan, 2009:555; Mehta et al., 2021:30). This is an ongoing dynamic process and should be readjusted accordingly (Eriksson, 2017:169). Additionally social, contextual and local knowledge as well as local contacts are beneficial for communicators to have for effective risk communication, as they provide valuable insights into the dynamics, interests and concerns of the target audience (Bier, 1999:687; Eriksson, 2017:170,174).

5.1.4. Mode of Risk Communication: Interactive Risk Communication

Risk communication has undergone changes over the previous decades and has shifted from a one-way to a two-way communication approach (Plana & Font, 2015:3). Other terms such as bottom-up two-way communication, participation, dialogue and deliberation have been used almost interchangeably (McComas et al., 2010:365). Due to the fine theoretical differences of the terms, they will not be used interchangeably here and have instead been summarized as interactive risk communication. Interactive risk communication seems to foster adaptive behavior more effectively (Attems et al., 2020:1) and, specifically in the forest fire context , seems to increase the acceptance and support of programs to prevent forest fires (Steelman & McCaffrey, 2013:687). Furthermore, interactive risk communication leads to greater trust and credibility towards government agencies, and improves the overall decision making as the public can communicate information and concerns not available to the risk managers otherwise (Kim & Kreps, 2020:9; Ng & Hamby, 1997:4; Scolobig et al., 2015:3). Lastly, interactive risk communication is effective because it gives a feeling of "autonomy and control", which is especially important for the adult audience (Mehta et al., 2021:33).

In line with findings by Boholm (2019b) and Renn (2010), several counter arguments against interactive communication have been raised. First, not all risks might require a two-way flow of communication but a direct one-way dissemination of risk message suffices instead (McCarthy & Brennan, 2009:111; McComas et al., 2010:367). If a risk appears obvious, citizens might show very limited interest in being involved in the communication process (Höppner et al., 2010:28). Second, there might be a hesitancy to apply two-way risk

communication because there is a lack of ideas on how to cooperate citizen input (Boholm, 2019a:1701). Thirdly, the question also remains of how to motivate citizens to participate once an interactive risk communication is in place (Fisher et al., 1994:207; McComas et al., 2010:375; Stevens, 2008:16). Fourthly, involving citizens means sharing power (McCarthy & Brennan, 2009:111), which can be risky when not being able to handle such dynamics (Rowan, 1995:305). Lastly, involving the public in interactive risk communication is not a guarantee for absence of conflict and immediate success (Renn, 2010:90). In conclusion, stakeholder communication and engagement enhances effective risk communication (Steelman & McCaffrey, 2013:687). However, not all communication might require interaction, some might also only require risk messages, the difference of which was discussed in Chapter 3.1. (Bier, 1999:3; Jönsson et al., 2016:211; National Research Council, 1989:2).

5.1.5. Intersecting Themes: Trust

Trust is a complex phenomenon to analyze as it is a multi-dependent and dynamic concept (McCaffrey & Olsen, 2012:5) and hence a challenging concept to work with (Rusu & Baboş, 2015:59). It might be therefore, that trust is rarely defined in studies and if defined, multiple definitions are applied (Liu & Mehta, 2021:1). Nevertheless, over 55% of the texts reviewed have shown that trust, as "a prerequisite for any social interaction" (Renn & Levine, 1991:184), is considered to be an important factor in deciding on the effectiveness of risk communication (Attems et al., 2020:2). According to McCaffrey & Olsen (2012), Steelman & McCaffrey (2013) and Mehta et al. (2021:41), high levels of trust coincide with high level of compliance and "increases the likelihood that the messaging will be understood and believed by the public". However, it should also be noted that building trust is a lengthy process that can only be created through continuous local contacts (Eriksson, 2017:171). What the texts do not specify is in which relationship trust is explicitly taking place: between communicators, between communicators and the target audience, between the affected population? As trustful relationships are likewise important externally and internally (Eriksson, 2017:175; Kim & Kreps, 2020:11), this thesis will only consider the trust occurring between communicators.

5.2. Results – Interview Study

The six major themes identified in the scoping study (Chapter 5.1.) were also dominant throughout the conducted interviews. Although one might argue that through the semi-deductive approach with which the interview guide was shaped, little other results could be expected, the strength with which the themes were discussed in the interview can also be

understood as a sign of common emphasis of both literature and practice. Furthermore, there were little extra factors mentioned with respect to the factors for effective risk communication addressed by the literature. Instead, it was the degree to which the factors were emphasized that varied depending on the literature versus practice, more of which will be elaborated on in Chapter 6. Figure 5 below illustrates the frequency at which the codes were applied. The inner circle represents the themes important for risk communication. The mid-circle represents the coded factors and the outer circle represents the coded sub-factors. The inner circle is therefore an aggregation from the frequencies of the risk communication factors presented in the two outer circles. The figure shows how often factors were referenced and how many of the interviews addressed the respective factors. The number of interviews addressing

Figure 5 - Hierarchy chart of total code coverage across all interviews. Size of the areas indicates the number of coding references; large area refers to more code references. The color of the area indicates the number of interviews referenced by this code; greater indicates more interviews being referenced by the code.
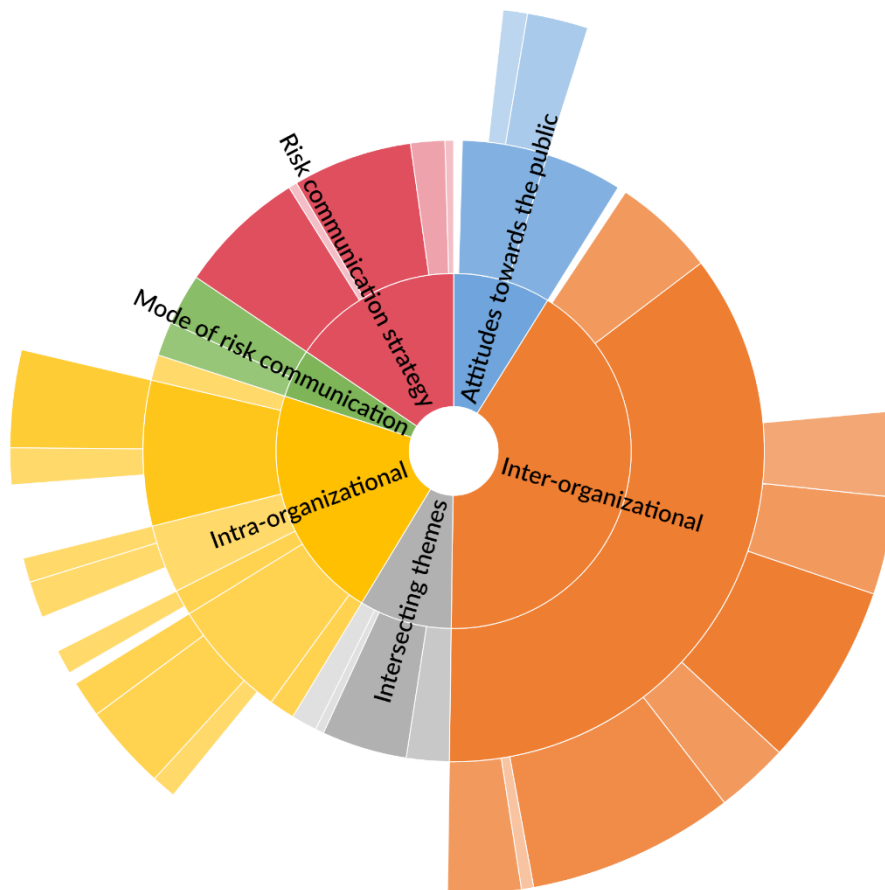
the factors is displayed by the shade of color, a darker shade indicating that more items referenced a specific factor. The frequency of factors referenced overall is indicated through the size of the circle's area. Any gaps in the outer circles signpost that factors on that level have not been observable within the interviews. With the inter-organizational factors as an example,

this graph is to be read as follows: In comparison to intra-organizational factors, the inter-organizational factors are mentioned more often by the interviewees overall and mentioned with the highest frequency within each individual interview.

It is to note that the majority of the themes presented below were present in all interviews, however, to varying degrees. Inter-organizational aspects were coded most frequently in the interviews (41.3%), followed by intra-organizational aspects (21.3%) and features involving the risk communication strategy (15.6%). Different from the results chapter of the scoping study (Chapter 5.1), this results chapter will address the organizational themes overall instead of explicitly referring only to one organizational factor. This analytical choice is motivated by the varying depth of information provided by the interviewees. Overall, all interviewees considered forest fire risk communication to be an important topic which will experience increasing urgency over the next years.

5.2.1. Inter-Organizational Factors

Inter-organizational aspects were referenced by far the most often in the interviews. The interviewees pointed out the good cooperation between the different organizations and greatly agreed on the good development that the inter-organizational cooperation has undergone in the past years:

"I consider this cooperation to be very collegial, because everyone involved really has the ambition to do a good job and prevent the forest fires."[4] (I4)

"It is a very, very good and pleasant cooperation. Where we simply say it really requires a certain loyalty." (I2)

"Actually, when you consider how many partners are involved, (…), I think it actually doesn't work out too badly." (I3)

"I think overall it's going well and certainly much better than 5-6 years ago when we started to really tackle the whole thing together and in a more consolidated way." (I1)

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[4] All interview quotes in this thesis have been translated with the help of the Deepl.com software.

An organization mentioned particularly often as having contributed to the strengthening of the workflow was the Regional Forestry and Natural Hazard Service (AWN). Therefore, the impression arises that AWN acts as a connector between the different relevant organizations:

"*In the last five years, thanks to AWN, it [the working routine] is well organized.*" (I5)

"*There is really a good cooperation also with AWN (...). It has greatly improved (...) and I think that we are well positioned.*" (I2)

"*I get the weekly reports from AWN; they are very helpful to us because they are anticipatory.*" (I2)

The interviewees also acknowledge potential for conflicts, as seems to be inherent to interdisciplinary work in which different professional backgrounds and thematic priorities collide:

"*Sometimes AWN thinks that it's absolutely necessary to communicate something now, and we don't think it's newsworthy at all. Then we oppose it, that is, we oppose broad communication.*" (I1)

"*But what is there, that is actually also normal, that experts, the communication people and the assigned authorities, like the RSTH, sometimes don't assess things the same way. There is a professional assessment of the risk of forest fires, but there is also a political assessment.*" (I4)

"*There is of course a different perception due to the different positions. However, I think that is surmountable. I think you just have to appeal a little to each other's mutual understanding.*" (I3)

The impression arose that all of the interviewees were thankful for how well the conflicts were handled amongst all actors in general and how they all helped bring the process of establishing a concept for risk communication forward:

"*The second thing that's certainly been helpful: any discussion or disagreement is sometimes uncomfortable, but I think it's moved us forward anyway.*" (I3)

Another challenge pointed out was how to include municipalities. Although they do not formally have a role in the risk communication concept, they are an important player when it comes to the implementation of the risk communication, in terms of on-site communication:

"*We have learned that we have to react as quickly as possible before the municipalities take their own initiative. That we really communicate before they do to get the media sovereignty. So that the communities sense and read, "Aha, it's being coordinated."*" (I2)

In summary, the inter-organizational cooperation is considered a strong and reliable prerequisite. Perhaps this result is not entirely counterintuitive, given that these organizations also work together in various other contexts as the interviewees do not only work with forest fire risk communication.

5.2.2. Intra-Organizational Factors

Internal workflows, atmosphere and knowledge on risk communication is referenced by the *intra-organizational* code. Overall, there was a continuously positive mentioning regarding the intra-organizational cooperation and work atmosphere:

"*Internally, we have good cooperation (…). In general, it is going very well and collegial.*" (I2)

"*We need everyone, I need the experts who can explain the facts to us well and we then translate it, their language, into what others also understand. I think it needs everyone.*" (I1)

Regarding knowledge of risk communication, the interviewees continuously mentioned to have undergone basic (media) communication training. Whilst two of the interviewees had some kind of communication background, none of the interviewees had undergone a special training tailored to risk communication. Most of the interviewees mentioned to have acquired their communication through 'learning by doing' (I1, I4, I2, I3, I6). Additionally, several interviewees reported to have a clear understanding of the roles and responsibilities regarding forest fire risk communication within their organization (I1, I2, I5). Nonetheless, the interviewees are often the only staff in their organizations to deal with forest fires, which could account for inter-organizational cooperation being referenced more frequently. As with inter-organizational cooperation, it is to note that drastic negative statements concerning the intra-organizational workflow might not have been made, as such could possibly affect future collaboration efforts. Nonetheless, in comparison to the results of the scoping study, intra-organizational factors were more dominantly addressed in the interviews.

5.2.3. Risk Communication Strategy

The theme risk communication strategy is concerned with whether there is an institutionalized risk communication, whether it is planned and intentional, it is harmonized and whether there

is a common understanding of risk communication across organizations. Although being referenced frequently, attention must be drawn to the different understanding of risk communication between the interviewer and the interviewees. When asked for their risk communication strategy, all interviewees referred to the risk communication concept published by Canton Bern. This concept, however, does not depict a strategy, as interviewee I1 aptly highlighted: "*Strategy and risk communication, (...), no, there is no such thing. But there is a concept of how we communicate in forest fire situations, i.e., more related to danger situations.*" This concept is perceived as a strategy by most interviewees and gives structure to the overall procedure of establishing fire bans. It does not, however, indicate any long-term goals, objectives, and pathways of change, all of which are factors that make up a strategy according to the literature (see Chapter 5.1.5.). Furthermore, there seems to be little unified understanding of the different kinds of communication leading up to a fire event and their respective time horizons. Whilst the other interviewees mostly referred to risk communication as something short term, only interviewee 1 and interviewee 4 expressed that there are different types of communication. Although there seems to be a unified understanding of what is to be communicated when, there is little sign of a common use of language when referring to the different types of communication:

"*For me, risk communication is the communication of a risk, i.e., an event that can potentially happen. (...) We do quite little on risk communication. (...) We focus on danger communication, i.e., when the risk of forest fire is high or special. Then we communicate.*" (I1)

"*I understand risk communication as trying to raise awareness in the run-up to events, to make people aware, to prevent disasters from happening, and that's not always easy because people don't feel any specific danger in such situations (...). The other thing is incident communication, when the incident takes place.*" (I4)

Despite the different understanding of what risk communication is specifically, the majority of the interviewees highlighted the need to speak with one voice and to have a harmonized risk communication, both in terms of content and timing:

"*It is very important in forest fire communication that you have a plan from the beginning. (...) when you communicate for the first time, you should already announce when the next communication steps will follow. This way we prevent other people from becoming nervous and communicating a day in advance.*" (I2)

"*That is why we then implemented this text module system.*" (I1)

"The aim is actually to always have ONE communication (…)." (I4)

In summary, there is no institutionalized risk communication and strategy per se. There is, however, a solid understanding that risk communication requires the one voice principle. Nonetheless, the understanding for different types of disaster communications seems to be missing.

5.2.4. Attitudes towards the Public

This code focuses on the communicator's perception of the public, specifically if the public is seen as a legitimate partner; there is openness to local concerns, needs and input; there is a willingness to engage with the public; and lastly there is an understanding that the public is a heterogeneous unit. Although many interview responses were assigned to this code, little explanatory power could be found in the individual statements even if probed for more thoroughly. The two main findings revolve around the awareness for the public being a heterogeneous unit and the willingness to engage with the public.

Concerning target groups, there seems to be no unified understanding, of who the groups are, that should be targeted by risk communication. The generic answer by most of the interviewees was "people who tend to go to the forest" (I1, I3, I4, I5). Additionally, there also was mentioning of "farmers" (I1, I4). Nonetheless, interviewee 1 also noted the need for more detailed information on who is visiting the forests and who could potentially set off forest fires or be in danger of them. Overall, this code was not strongly referenced which leads to the assumption that points like this have so far not been part of the forest fire risk communication agenda in Canton Bern and are hence rather vague concepts to the interviewees. Furthermore, there seems to be a diverging perception of which organization is to get involved with the public:

"I think it also makes no sense for us to inform the population: we are implementing a fire ban. This must be done through the media, not by us." (I2)

"For our part, (…) we do not think about which target groups we can reach best. I think KomBe would have to think about that (…)." (I3)

5.2.5. Mode of Risk Communication

Mode of risk communication is strongly focused on how visible the communicators are to the public and whether an interaction between the public and the communicator occurs. No unified pictured was identified in the interviewees' responses. Some interviewees did not see

themselves responsible for an interaction with the public beyond announcing fire bans and saw the reasons for this in their legal mandate:

"*Regarding forest fire, our role, even under the forest legislation, to communicate about the issuance and lifting of a fire ban is limited. I think our main role is not necessarily towards the final recipient (…).*" (I3)

"*No, because that [fire ban] is communicated in the media: Newspapers, RSTH and that must be sufficient enough.*" (I5)

Other interviewees felt more strongly about their responsibility to be seen by and to interact with the public. They did, however, have different understandings of what would be an adequate mode to interact:

"*In 2015, fresh on Facebook, we made a post about fire bans and suddenly had 130 000 people who saw it. It was a subject of discussion. We never expected that.*" (I4)

"*So far, independently of forest fires, we are conducting a bit of one-way communication. There is a bit of social media. But there's hardly any reaction, maybe a like, which I wouldn't really call interaction.*" (I1)

Specifically, Interviewee 1 however, elaborated on potential other forms of how to interact with the public and sees a necessity in adapting the current mode of communication to include more interactive formats.

"*In principle, we see there is a need for more interaction, but whether this is the right forum when it comes to forest fires, I don't know.*" (I1)

"*I think what would help a lot is more presence on-site. It has long been an issue that we think that as soon as there is a higher risk level, there should be more presence on the ground (…).*" (I1)

5.2.6. Intersecting Themes

Intersecting themes, including trust, flexibility, credibility as well as monitoring, evaluation, and learning (MEL) were seldomly addressed even if explicitly asked for. One potential reason for this being the delicacy of the topics, especially in inter-organizational cooperation. It can only be hypothesized that a good inter- and intra-organizational cooperation, themes that were frequently referenced, are a sign that these intersecting themes are present.

The most prominent code referenced was MEL, especially aspects relating to evaluation. A common pattern across all interviews was the mention of evaluation processes only being implemented when asked for internally or through the risk communication partner organizations. As seen with the different responses, not all interviewees` organizations seem to have the same evaluation routine, a fact potentially reinforced by the Covid-19 situation:

"Once a year, although we didn't do it the last two years due to corona, we sat down together and reviewed the year (...). We do this kind of classic debriefing." (I1)

"Not institutionalized, no. We sometimes do short verbal debriefings, but we haven't really done this systematically so far. There is simply often a lack of time (...)." (I4)

"No, if there are no problems, there is no discussion about it." (I5)

"If needed. Last year we didn't have a debriefing because we had little to do and the year before we had a debriefing." (I2)

The need for flexibility was often mentioned in combination with forest fires being a natural phenomenon and hence the communication setting also having to be adjusted. This does not only seem to apply during forest fire season but also throughout the different seasons:

"You have to be very tolerant: there can be no work for two years and then suddenly a lot comes all together." (I5)

Additionally, the change of setting or circumstance for a forest fire also calls for flexibility Interviewee 1 stated:

"I would say that at the "low" or "moderate" risk level, the procedure is very standardized, and I have little flexibility. However, that also helps me; it is not time-consuming (...). From risk level "considerable" on, (...) it needs more flexibility, because every situation is a bit different. Suddenly a completely different region is in focus, (...) suddenly it is not slopes but forest edges. If we have the feeling now we have to explain more than what we already have, then we have to act flexibly and produce something additional." (I1)

Interestingly one of the interviewees commented that the flexibility had not always been given:

"We have also created certain flexibility now in retrospect [to the communication strategy being published]." (I4).

5.2.7. Contextual Background

Forest fire setting in Canton Bern cannot be as easily compared to the forest fire context of other countries. Three aspects are unique: exposure and awareness of the local population, the forest set up and the infrastructure surrounding the forests. In accordance with the beginning of this thesis and the assessment of the interviewees, people especially in Canton Bern have little to no exposure to forest fires and hence lack awareness for the topic overall:

"*I think that people only become aware of it when the first forests really burn down, and even then, I think the understanding is simply not there in many cases: (...) People only see that in the movies. We are still far, far, far away from a new way of thinking, that this [forest fire prevention] is important.*" (I6)

When asked how different the forest set up between Switzerland and other more forest fire-prone countries are, Interviewee I6 replied:

"*Yes, everything is different. Switzerland is much smaller and has a completely different vegetation. (…) We have much fewer monocultures here, where fires could spread quickly. We have a lot of mixed forests, and deciduous trees automatically slow down fires.*" (I6)

According to I6, the types of fires in Switzerland are also different to other more forest fire-prone countries: fires mostly remain ground fires and rarely turn into treetop fires, as is the case in other countries. Although the forest itself might not be as easily inflammable, Switzerland's topography (e.g. steep slopes) in combination with specific weather events such as the dry Föhn winds can cause potential fires to spread more quickly.

Despite this risk, Canton Bern's asset in forest fire prevention is the good availability of water due to the many natural water sources and the accessibility of the forest itself:

"*The forest is alive. There are always people there or at least looking toward the forest and then the message comes relatively quickly to the fire department if something is ablaze. That's why we are there relatively quickly due to the good accessibility, due to the roads and due to the quick notification, and we can intervene quickly. This is not the case in America, France, or Sweden, because vast areas of land are not inhabited, and it takes a long time before anyone even notices that there is a fire.*" (I6)

6. Discussion

Catering to Boholm's urge (2019a:1705) for qualitative knowledge on how risk communication is carried out and understood by practitioners, this thesis has addressed organizational factors for effective risk communication, both from an academic and a practical perspective. The review of these organizational factors revealed that they are embedded in dimensions greater than just the organizational factors themselves. In order to address and discuss the results holistically, the author has chosen to structure the discussion of results along three dimensions. This approach will help identify implications of the results beyond the strict boundary of the research purpose. The three dimensions are: (1) the content dimension, in which the results will be discussed without a consideration of external factors; (2) the theoretical dimension, in which the results will be discussed in their greater theoretical setting and finally (3) the contextual dimension, in which the implications of different contexts on the results will be discussed.

6.1. Content Dimension

This chapter includes a discussion of the explicit organizational factors reviewed in the scoping and interview study. Overall, the greatest emphasis of both datasets was the positive inter- and intra-organizational cooperation. The biggest difference in emphasis appeared with reference to the mode of communication and the public being perceived as a legitimate partner. Most relevant for the successful implementation of risk communication to begin with, seems to be a discussion on the matters of risk communication strategy.

6.1.1. Risk Communication Strategy

In contrast to the literature, the understanding of the risk communication strategy was not as much a focus for the communicators of Canton Bern. Canton Bern's forest fire risk communication concept was understood as a strategy; however, when looking more closely it seemed to lack a clear statement of goals and objectives. Some of these goals for effective risk communication, as presented by Bier (1999:2) could include raising awareness or motivating a change in behavior. This was an aspect addressed by the interviewees as well, however, not as part of the risk communication concept. As one of the interviewees rightly pointed out, Canton Bern does not have a risk communication strategy. Introducing such strategy, however, could help to establish what Eriksson (2017) refers to as a common clear understanding of the role and rationale of the risk communication and clear agreements on what is to be communicated, to whom and how in order to establish a risk communication that speaks with one voice. Having a clear understanding of the rationale behind the disseminated risk communication could also

help with monitoring and evaluating such efforts, as to give room for learning and improvement. It is assumed that this difference in perception of what constitutes a risk communication strategy also stems from the different understanding of risk communication itself. Whilst the literature highlights the long-term and proactive character of risk communication, the interviewees appeared to have a short-term and rather reactive understanding of the term. One possible reason for this different understanding of risk communication could be the little exposure that the population of Canton Bern and hence presumably the communicators of Canton Bern have. Such low exposure might limit the necessity to think of forest fire prevention and the necessary behavioral changes by the target groups as something long-term. Nonetheless, as Viola et al. (2021:10) stated, it is the mixture of long-term, short-term, and continuous efforts that is necessary for risk communication efforts to be successful.

6.1.2. Mode of Risk Communication: Interactive Risk Communication

The lack of a risk communication strategy also shows in the lack of the interviewees' understanding of who the target groups for their communication are and by what means to interact with them. Some interviewees had even voiced that they did not see it as their responsibility to interact. A strategy and information on target groups could bring more clarity to this question. One interviewee mentioned the effort to identifying the target groups in the future. Involving target groups in the risk communication increases the likelihood of acceptance towards the introduced measures, as explained by Mehta et al. (2021:33) in Chapter 5.1.4. Furthermore, engaging in a two-way risk communication with the public increases the information available to the risk managers and helps to build trust between the communicators and recipients of risk communication (Kim & Kreps, 2020:9). Nonetheless, it is a difficult endeavor to involve target groups as risk communication settings are complex and hence a one-size-fits all solution will not be applicable (Lemon & VanDyke, 2021:391). Apart from the strategy and the knowledge of the target groups, there is of course also the question of whether interaction with the public is politically desired at all. Currently, Canton Bern is disseminating risk messages but not engaging in two-way communication. As pointed out by Interviewee 1 there is a hesitancy to apply two-way risk communication out of skepticism towards the success of this technique. Moreover, a reason presented by Höppner et al. (2010:28) could apply: citizens not aware of the risk might struggle to see the benefit of engaging in such communication. The question is therefore how to motivate these citizens to be part of a two-way risk communication. Lastly the question also arises of what adequate strategies could be to incorporate citizen input after the interaction, so it benefits the overall risk communication process (Boholm 2019a:1701; Stevens 2008:16). Some of these questions and challenges might

require further research and on the other hand courage and resources to explore. The communicators of Canton Bern, through their knowledge of local contexts, most likely naturally have familiarity with their target groups and hence are able to assess what could be the right strategy for interaction.

Another point of contact for this interaction could be the local municipalities. The involvement of municipalities in the risk communication could strengthen the local integration of awareness campaigns and interaction with specific target groups. Although including municipalities as a communicator in risk communication was not specifically mentioned in the literature, the practical input by the interviewees alongside the interviews does suggest a great potential there. This gap between literature and practice could arise from the cultural difference: The interviewees indicated that many Swiss people are very locally connected and are more inclined to listen to members of the local community than to outsiders, such as members from cantonal or even federal authorities. Therefore, it might be more relevant than in other settings of the literature to include the municipalities as communicators. Currently the municipalities are not obliged to take part in the risk communication but voluntarily they have offered assistance in the past. These relationships could be revisited and potentially included and emphasized in a risk communication strategy.

6.1.3. Inter-Organizational Factors: Good Interoperability

Although the elaboration of the importance of good interoperability will be comparatively short, it is a key factor for effective risk communication, nonetheless. Good interoperability strengthens the overall entity of the communicators. It is a vital base for efficient work and also makes harmonized risk communication more likely as discussed by Attems et al. (2020:2) in Chapter 5.1.5. Whilst strategies and concepts can be independently, it is the cooperation and collaboration that requires trust and social interaction, which is much more challenging to form (Renn & Levine, 1991:184). As Mehta et al. (2021:42) point out: especially constructive conflict management and a good working climate between organizations have repeatedly been identified as being important for a trustful relationship. It is therefore an encouraging trend that all of the interviewees spoke very well of the inter- and intra-organizational relationship and even drew attention to the positive development this relationship has undergone in the past years. The state of this factor marks a promising asset for the rest of Canton Bern's risk communication journey.

In summary, before progressing to the theoretical background of forest fires in Canton Bern, there is a strong presence of good inter- and intra-organizational cooperation as well as a solid

understanding to speak with 'one voice'. Interestingly, factors not or minorly referenced overall in both studies also give valuable insights into the collected data. Factors concerning risk communication itself were not as strongly referenced as organizational factors. The impression arises that an in-depth understanding of risk communication is missing amongst most of the interviewees. This impression is further supported by the low reference rates of factors compiling the *attitudes towards the public*. Based on the literature review, both themes are interdependent: risk communication strategies would also include ideas of how to include the public in the overall communication. Possible reasons for this pattern could be inter- and intra-organizational workflows being practiced and shaped on a daily basis during the daily routines of these organizations. To establish a strategy for risk communication however, more time and resources would be required next to the everyday tasks. The impression arises that risk communication is regarded as something more short-term than long-term. The reason for this might be that forest fires are not yet a (very) pressing issue in Canton Bern. With the forest fire potential growing in Canton Bern, a readjustment for the implementation of a long-term risk communication strategy could be beneficial.

6.2. *Theoretical Dimension*

When discussing the necessary organizational factors for risk communication, it is also important to engage in a theoretical discussion as there is no communication model that maps the structure and dynamic of risk communication (Höppner et al., 2010:29, Chapter 3.2.). Hence, the models that were presented might not be the perfect fit but rather are an attempt at rapprochement. The factors for risk communication discussed in the literature align well with Kincaid's convergence model in their core value of interaction and exchange. In practice however, it appears that most communication structures and procedures of Canton Bern are still very much based on the traditional communication model of Shannon and Weaver (1948). As it appears to the author, the traditional communication model seems easier to apply to practice since the communicators only need to engage with their role as communicators and not as receivers of communication. However, as seen in the interviews there is a growing awareness that change is needed. This change could also help to transition from a traditional theoretical understanding of risk communication to a more progressive interactive and strategic one. In the meantime, as suggested by Renn (1992:468), the practical application of communication models to the risk communication endeavors of Canton Bern could make use of both models. It would be reasonable to send risk messages with the understanding of the sender-receiver model by Shannon and Weaver (1948) and engage in interactive risk communication with the understanding of the transactional Convergence Model by Kincaid (1979). The author believes

that whilst theoretical models provide good guidance, they also present an ideal state, as they are free from practical circumstances. The literature findings on the other hand present a link between theory and practice, as the suggestions offered there are motivated by the theory but grounded in empirical research. The practical application of both the theory and the empirical findings, however, requires an adapted approach. Nonetheless, the theoretical and empirical implications of communication in general and risk communication in particular, should not be neglected, as the visualization of an ideal based on theoretical and empirical evidence can help bring forward development and change.

6.3. *Contextual Dimension*

To gain an in depth understanding of what communicator factors are necessary for risk communication, the author believes it is important to consider the contextual setting, in which this communication is happening as well. The contextual difference in terms of geographic circumstances is especially striking when comparing the literature and the interview study. Most of the literature has a North American background where forest fires, for many years, have been more prevalent than in Canton Bern. As pointed out by Interviewee 6, with this longer history of fire hazard exposure, the North American countries have managed to establish a mature risk communication. Canton Bern on the other hand can be seen as a novice region regarding forest fires and the risk communication thereof. The differences in experience, topography, accessibility, and culture would have to be considered in more detail when further developing the risk communication of Canton Bern. It is the contextual knowledge of the forest fire setting in Canton Bern that can help risk communicators to communicate fire risk more effectively. Additionally, not all risk communication strategies proposed by the literature might be applicable to the context of Canton Bern as the baseline knowledge and exposure of the population appears to be lower as indicated by Müller et al. (2020). To shed light on these differences, this thesis encourages future research to investigate more closely how forest fire settings differ between countries, both in terms of natural and societal structures.

In summary, although Canton Bern does not yet apply all communicator factors suggested by the literature, there is great potential for strong risk communication in the Canton Bern. The key communicators show a solid basis by fulfilling the requirements for good intra- and inter-organizational coordination. In combination with a proactive theoretical understanding, a strong contextual awareness and a comprehensive strategy for a variety of time horizons are expected to bring about success.

6.4. Discussion of Limitations

Whilst some of the more methodological limitations have been discussed previously in Chapter 4.1.1 and 4.2.1 this chapter will address broader limitations of this thesis. One of these is the researcher bias. Although the author of this thesis has no conflicts of interests to disclose and was given full freedom to conduct their research, the research setting nonetheless might have influenced how this research was conducted. As a foreign researcher in a new country, extra care was taken as not to violate any unspoken rules or cultural customs. This caution might have prevented this research from gaining an extra depth of information as questions and probing might have been too restrained. Furthermore, being a guest researcher in an ongoing research project also comes with its own limitations regarding networks, time, and individual and project resources.

Moving away from the researcher bias, this thesis and the contents discussed show a great limitation with respect to a critical reflection on gender, race, power, and background. In short, critical issues of intersectionality were not addressed in this thesis. The author recognizes that this is a normative limitation and does not impact the results in itself. Nonetheless, disregarding intersectional components especially, when it comes to risk communication can have detrimental effects on those effected. Intersectional issues are crucial for strengthening resilience and can contribute to the sustainability of disaster risk reduction (Walkling & Haworth, 2020:9). Yet they are often overlooked. Neglecting the discussion of intersectional issues when working with risk communication could hinder holistic change. When done in a wholesome and genuine way, a critical reflection on the different needs and positions of marginalized groups and living situations could help improve the inclusiveness and sustainability of risk communication efforts (Hansson et al., 2020:6-7). Parts of this discussion on risk communication inclusiveness could also be subject to future research.

7. Conclusion

In conclusion, the organizational factors needed to effectively communicate forest fire risk can be grouped as follows: (i) inter- and intra-organizational factors, (ii) risk communication strategy, (iii) attitudes towards the public, (iv) mode of risk communication, and (v) intersecting themes. The most dominantly addressed organizational factors to facilitate effective risk communication amongst these themes by both the literature and practice are a comprehensive strategy and a good inter- and intra-organizational cooperation. Key differences between the

results of the two data collections were how to engage with the public and whether to perceive the public as a legitimate partner. The organizational factors for risk communication were investigated through both a scoping study and an interview study with practitioners of risk communication in Canton Bern. The input from the conceptual framework as well as the results of the scoping study present an ideal state for the organizational factors for risk communication. In comparison, the practical insights through the interview study revealed the challenges on the way to implementing ideal risk communication.

Although Canton Bern does not fulfill all the factors introduced by the scoping study, those that they do meet, are a good foundation on which a more comprehensive (long-term) risk communication can be built in the future. This includes amongst other things a good intra- and inter-organizational workflow, that is shaped by trust, good communication and fruitful conflict management. For the future the establishment of a strong risk communication strategy, as well as a deepened understanding of the heterogenous target groups and an interactive format for risk communication could present a tangible goal for Canton Bern to improve its risk communication efforts. With approximately 90% of the forest fires in the alpine region being human induced (BABS, 2020:1; Müller et al., 2020:3) and the overall number of forest fires expected to increase, investing into risk communication with the affected population, by strengthening the organizational factors, appears to be a sustainable approach for mitigating forest fire hazard in the future.

This conclusion is consistent with the observations by Boholm (2019a:1696), who still sees room for "improvement in risk communication practices by government[s]". The author of this thesis suggests therefore, that this process of improving Canton Bern's risk communication should not be postponed for too long: Forest fire risk is expected to increase in Canton Bern in the coming years and since it is not yet a visible threat, it competes with many other pressing issues for the public's attention. Although they come with their own challenges, developing and implementing pilot projects, for example exploring different modes of interactive communication, could be of help to build momentum for change. Especially considering that risk communication is a complex field which tries to keep up with social change (Höppner et al., 2012:1755). Hence establishing a risk communication strategy could already in itself be a demanding and lengthy process. In order to strengthen the overall forest fire preparedness, risk communication should be at the top of practitioners' agenda. Likewise, more research on forest fire risk communication in general, and specifically on the European/Swiss context and the communicator's side of risk is encouraged. Equally, the realization of a theoretical model tailored specifically to risk communication is encouraged. A specific risk communication

model might help bring theoretical and conceptual clarity when engaging in risk communication both in research and practice. This thesis has shown that although there is some solid knowledge of organizational factors for risk communication in the literature and some first application of it in practice, more insights, knowledge and exchange between empirical research and practice is needed to prepare for the increasing number of forest fires yet to come. Nonetheless, 'igniting' organizational factors for risk communication now, will help prevent forests being ablaze in the future.

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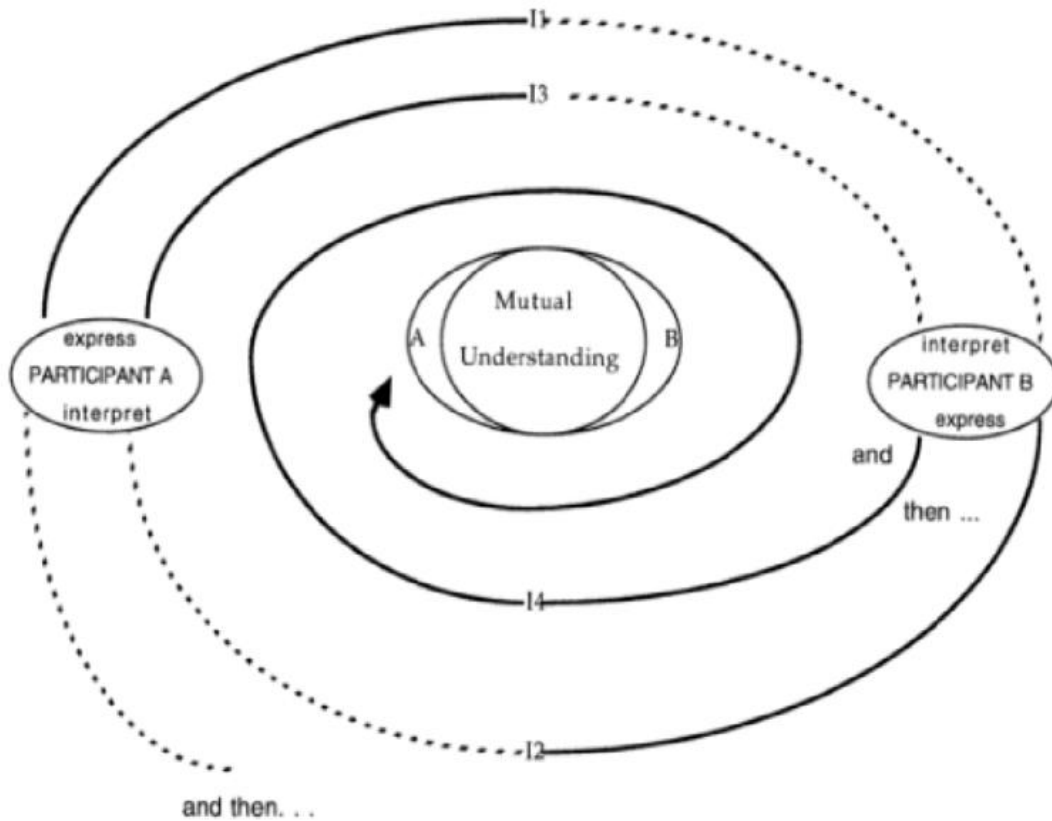
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Appendix

Appendix 1 – Kincaid "The Convergence Model of Communication"

Appendix 2 – Eriksson (2017) Framework

Appendix 3 – Interview Guideline

Interview guide - short version (English translation from German)

<u>Introduction</u>

1. Can you briefly tell something about yourself, your professional background, and your work?
2. What are your specific work tasks regarding risk communication?
3. Do you have any training in the field of communication or similar?

<u>Risk communication in general</u>

1. What do you understand by / what does risk communication mean to you?
2. How do you understand your role and that of your office within risk communication on forest fires here in the canton?
3. Do you understand risk communication more as the dissemination of information or do you want to motivate action?
4. Is there a common strategy, known to all, for risk communication on forest fires here in the canton?
5. How, what and when do you communicate specifically? (Means, content, frequency)

<u>Internal organizational cooperation</u>

1. How do you assess the cooperation within your organization?
   a. Working atmosphere (good team, few changes).
   b. Cooperation
   c. Dealing with conflicts
   d. Sharing of information
   e. Training for employees, -> are these desired?

<u>Cross-organizational cooperation</u>

1. And how do you rate all of what we just discussed in terms of cross-organizational cooperation?
   a. Clear division of tasks
   b. Cooperation
   c. Sharing of information

<u>Target groups and interaction</u>

1. Who do you think are target groups for your work?
2. How is the relationship with these target groups maintained?
3. What communication needs do you assume the target groups have?
4. On what occasions does interaction with target groups occur and on whose initiative?
5. To what extent does interaction with the target groups seem to you to have potential for forest fire communication?

Overarching themes

1. How do you perceive the trust relationship within your organization or in collaboration with others?
2. Risk communication literature often emphasizes evaluation and monitoring activities. [elaborate as appropriate]
3. Is this something that is also done in your organization?
4. Do you have flexibility in how you implement general tasks, or does it require more coordination with other stakeholders?

Challenges & Outlook

1. What do you think are the internal hurdles and challenges to their work on wildland fire communications?

Checkout

1. To conclude, suppose you could wish for something from the canton and the other entities involved in risk communication regarding forest fire prevention - what would it be?

End of the interview

1. Yes, now we have discussed quite a lot. Is there anything else from you that has not yet come up in the interview, or not clearly enough, but that is important to you and that you would like to tell me about?
2. May I contact you again if something is unclear to me in retrospect?
3. If so, thank you very much for your time and your willingness to provide information.

Appendix 4 – Literature of Scoping Study

Literature selected and reviewed for the scoping study

Author(s)	Publication Date	Title
Albris et al	2020	Disaster Knowledge Gaps: Exploring the Interface Science and Policy for Disaster Risk Reduction in Europe Between
Attems et al	2020	The influence of tailored risk communication on individual adaptive behaviour
Balog-Way et al	2020	The Evolving Field of Risk Communication
Bharosa et al	2010	Challenges and obstacles in sharing and coordinating information during multi-agency disaster response: Propositions from field exercises
Bier	1999	Summary of the State of the Art: Risk Communication to the Public
Boholm	2019b	Lessons of success and failure: Practicing risk communication at government agencies
Boholm	2019a	Risk Communication as Government Agency Organizational Practice
Boholm	2008	New perspectives on risk communication: uncertainty in a complex society
Bourrier	2018	Risk Communication 101: A Few Benchmarks
Bradbury	1994	Risk Communication in Environmental Restoration Programs
Chess	2001	Organizational Theory and the Stages of Risk Communication
Chess et al	1992	The Organizational Links Between Risk Communication and Risk Management: The Case of Sybron Chemicals Inc.
Chess et al	1995	Improving Risk Communication in Government: Research Priorities
Chess et al	1988	Improving Dialogue with Communities: A Short Guide for Government Risk Communication
Chess et al	2005	Speaking Like a State: Environmental Justice and Fish Consumption Advisories
Chess et al	1995	Results of a National Symposium on Risk Communication: Next Steps for Government Agencies
Chess&Salomone	1992	Rhetoric and Reality: Risk Communication in Government Agencies
Christianson et al	2011	Canadian wildfire communication strategies
Clarke et al	2006	Speaking with One Voice: Risk Communication Lessons from the US Anthrax Attacks

Covello	2010	Strategies for Overcoming Challenges to Effective Risk Communication
Covello	1992	Risk Communication: An Emerging Area of Health Communication Research
Covello et al	1986	Risk communication: A review of the literature
Covello&Allen	1988	Seven Cardinal Rules of Risk Communication
Covello&Sandman	2001	Risk communication: Evolution and Revolution
Demeritt&Norbert	2014	Models of best practice in flood risk communication and management
Eriksson	2017	Components and Drivers of Long-term Risk Communication: Exploring the Within Communicator, Relational, and Content Dimensions in the Swedish Forest Context
Eriksen&Prior	2011	The art of learning: wildfire, amenity migration and local environmental knowledge
Fisher et al	1994	One Agency's Use of Risk Assessment and Risk Communication
Grabill&Simmons	1998	Toward a critical rhetoric of risk communication: Producing citizens and the role of technical communicators
Grunig et al	2002	Excellent public relations and effective organizations: a study of communication management in three countries
Hadden	1989	Institutional Barriers to Risk Communication
Hampel	2006	Different concepts of risk – A challenge for risk communication
Holmes et al	2009	Communicating with the public during health crises: experts' experiences and opinions
Hyman et al	2022	How Do Perceptions of Risk Communicator Attributes Affect Emergency Response? An Examination of a Water Contamination Emergency in Boston, USA
Höppner et al	2010	Risk Communication and Natural Hazards
Höppner et al	2012	Linking social capacities and risk communication in Europe: a gap between theory and practice?
Jönsson et al	2016	Risk Communication and the Role of the Public: Towards Inclusive Environmental Governance of the Baltic Sea?
Kasperson&Palmlund	1989	Evaluating Risk Communication
KAWA	2019	Umsetzungskonzept Waldbrandmanagement: Detailkonzept Beschilderung Feuerverbot
Keeney&Winterfeldt	1986	Improving Risk Communication

Kim&Kreps	2020	An Analysis of Government Communication in the United States During the COVID-19 Pandemic: Recommendations for Effective Government Health Risk Communication
Klein et al	2021	Leveraging risk communication science across US federal agencies
Lejano et al	2018	Weather, Climate, and Narrative: A Relational Model for Democratizing Risk Communication
Lemon&VanDyke	2021	Expanding the discussion on internal management of risk communication: A critique of the current risk communication literature
Liu&Mehta	2020	From the periphery and toward a centralized model for trust in government risk and disaster communication
Lundgren&McMakin	2013	Risk communication: a handbook for communicating environmental, safety, and health risks
Maduz et al	2019	Individual disaster preparedness: Explaining disaster-related information-seeking and preparedness behaviour in Switzerland
McCaffrey et al	2012	Social science research related to wildfire management: an overview of recent findings and future research needs
McCaffrey&Olsen	2012	Research Perspectives on the Public and Fire Management: A Synthesis of Current Social Science on Eight Essential Questions
McCarthy&Brennan	2009	Food risk communication: Some of the problems and issues faced by communicators on the Island of Ireland (IOI)
Mehta et al	2021	A LIFE CYCLE-BASED MODEL TO RISK AND CRISIS COMMUNICATION DURING WILDFIRE EVENTS IN BRITISH COLUMBIA
Müller et al	2020	"Forest fires in the Alps – State of knowledge, future challenges and options for an integrated fire management"
National Research Council	1989	Improving Risk Communication
Neville et al	2015	Developing a decision support tool and training system for multi-agency decision making during an emergency
Ng&Hamby	1997	Fundamentals for establishing a risk communication program
OECD	2016	Trends in risk communication policies and practices
Oh et al	2021	Risk Communication Networks in South Korea: The Case of the 2017 Gangneung Wildfire
Olsen&Shindler	2010	Trust, acceptance, and citizen–agency interactions after large fires: influences on planning processes
O'Neill et al	2007	Miscommunication during the Anthrax Attacks: How Events Reveal Organizational Failures

Palttala et al	2012	Communication Gaps in Disaster Management: Perceptions by Experts from Governmental and Non-Governmental Organizations: Communication Gaps in Disaster Management
Plana&Font	2015	State of the art on the risk communication to journalists and media
Renn	2010	Risk Communication: Insights and Requirements for Designing Successful Communication Programs on Health and Environmental Hazards
Renn	1992	Risk communication: Towards a rational discourse with the public
Renn et al	2018	Risk Governance: Application to Urban Challenges
Renn&Levine	1991	Credibility and trust in risk communication
Rickard	2019	Pragmatic and (or) Constitutive? On the Foundations of Contemporary Risk Communication Research
Rohrmann	1992	The evaluation of risk communication effectiveness
Rother	2019	Challenges in Pesticide Risk Communication
Rowan	1995	What Risk Communicators Need to Know: An Agenda for Research
Rowan	1991	Goals, Obstacles, and Strategies in Risk Communication: A Problem-Solving Approach to Improving Communication About Risks
Rowan et al	2010	Risk Communication Education for Local Emergency Managers: Using the CAUSE Model for Research, Education, and Outreach
Rusu&Baboș	2015	Organizational Trust Between Institutional and Interpersonal Trust
Santos	1990	Developing a Risk Communication Strategy
Scolobig et al	2015	Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality
Sheppard et al	2012	Understanding Risk Communication Theory: A Guide for Emergency Managers and Communicators
Smillie&Blissett	2010	A model for developing risk communication strategy
Steelman & McCaffrey	2013	"Best practices in risk and crisis communication: Implications for natural hazards management"
Stern&Pedmore	2012	The importance of team functioning to natural resource planning outcomes
Stevens	2008	The government as a risk communicator: good communication practice in the context of terrorism as a "new" risk

Sutton et al	2021	Longitudinal Risk Communication: A Research Agenda for Communicating in a Pandemic
Tedim et al	2015	Forest fires in Europe
Tinker et al	2000	Assessing risk communication effectiveness: perspectives of agency practitioners
Tymstra et al	2020	Wildfire management in Canada: Review, challenges, and opportunities
Viola et al	2021	The more you know, the better you act? Institutional communication in Covid-19 crisis management
Wardman	2008	The Constitution of Risk Communication in Advanced Liberal Societies