

STEN TORPAN

European disaster risk reduction  
institutions' practices in mitigating  
communication-related vulnerabilities  
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UNIVERSITY OF TARTU

Press

Institute of Social Studies, University of Tartu

Dissertation accepted in fulfilment of the requirements for the degree of Doctor of Philosophy (in Sociology) on July 10, 2025, by the Council of the Institute of Social Studies, University of Tartu.

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Commencement: August 29, 2025, at the University of Tartu

The publication of this dissertation is granted by the Institute of Social Studies, University of Tartu. This research was also supported by the H2020 project BuildERS (“Building European Communities’ Resilience and Social Capital” N° 833496, 1.05.2019–30.04.2022”).

ISSN 1736-0307 (print)  
ISBN 978-9916-27-966-3 (print)  
ISSN 2806-2590 (pdf)  
ISBN 978-9916-27-967-0 (pdf)

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University of Tartu Press  
[www.tyk.ee](http://www.tyk.ee)

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## LIST OF ORIGINAL PUBLICATIONS

- I. **Torpan, S.,** Hansson, S., Rhinard, M., Kazemekaityte, A., Jukarainen, P., Sunniva Frislid Meyer, Sunniva Frislid Meyer, Meyer, S., Schieffellers, A., Lovasz, G., & Orru, K. (2021). Handling false information in emergency management: A cross-national comparative study of European practices. *International Journal of Disaster Risk Reduction*, 57, 102151. <https://doi.org/10.1016/j.ijdr.2021.102151>
- II. **Torpan, S.,** Hansson, S., Orru, K., Rhinard, M., Savadori, L., Jukarainen, P., Nævestad, T.-O., Meyer, S. F., Schieffellers, A., & Lovasz, G. (2023). European emergency managers on social media: Institutional arrangements and guidelines. *International Journal of Emergency Services*. <https://doi.org/10.1108/IJES-08-2022-0041>
- III. **Torpan, S.,** Hansson, S., Orru, K., Jukarainen, P., Gabel, F., Savadori, L., Meyer, S. F., Schieffellers, A., Lovasz, G., & Rhinard, M. (2024). Mitigating vulnerabilities with social media: A cross-national study of European disaster managers' practices. *Risk, Hazards & Crisis in Public Policy*, rhc3.12286. <https://doi.org/10.1002/rhc3.12286>
- IV. **Torpan, S.,** Orru, K., Hansson, S., & Klaos, M. (2025). Using a table-top exercise to identify communication-related vulnerability to disasters. *International Journal of Disaster Risk Reduction*, 119, 105264. <https://doi.org/10.1016/j.ijdr.2025.105264>

## **AUTHOR'S CONTRIBUTIONS**

Study I – “Handling false information in emergency management: A cross-national comparative study of European practices”: the author was responsible for (1) collecting data for the Estonian case study, including document analysis and expert interviews, (2) analysing all country case studies, (3) compiling, drafting, finalising and revising the paper based on co-author, peer, supervisor and reviewer feedback.

Study II – “European emergency managers on social media: Institutional arrangements and guidelines”: The author was responsible for (1) collecting data for the Estonian case study, including document analysis and expert interviews, (2) analysing all country case studies, (3) compiling, drafting, finalising and revising the paper based on co-author, peer, supervisor and reviewer feedback.

Study III – “Mitigating vulnerabilities with social media: A cross-national study of European disaster managers’ practices”: the author was responsible for (1) collecting data for the Estonian case study, including document analysis and expert interviews, (2) analysing all country case studies, (3) compiling, drafting, finalising and revising the paper based on co-author, peer, supervisor and reviewer feedback.

Study IV – “Using a table-top exercise to identify communication-related vulnerability to disasters”: the author was responsible for (1) co-organising and designing the table-top exercise for data collection, (2) facilitating the table-top exercise, (3) analysing exercise data sheets, (4) compiling, drafting, finalising and revising the paper based on co-author, peer, supervisor and reviewer feedback.

## **ACKNOWLEDGEMENTS**

I would like to express my gratitude to my supervisors, Professor Kati Orru and Associate Professor Sten Hansson, for their valuable guidance and support throughout this project, and to my co-authors in Studies I–IV, for their collaboration and contributions to the research.

## GLOSSARY

<b>Disasters</b>	events arising not so much from the physical forces that trigger them at specific times as from longer-term global and societal processes, which in turn result in an increase of the potential for loss (Tierney, 2019)
<b>Crisis</b>	the perception of an unpredictable event that threatens important expectancies of stakeholders related to health, safety, environmental, and economic issues, and can seriously impact an organisation's performance and generate negative outcomes (Coombs, 2023)
<b>Emergencies</b>	include events such as multi-vehicle traffic accidents, large structure fires, and minor industrial accidents – incidents that may cause deaths and injuries but that are localized, do not create large-scale disruption, and are typically handled by public safety agencies such as fire and police departments. Emergencies are more or less everyday occurrences in large urban areas (Tierney, 2019)
<b>Social vulnerability</b>	the social origins and aspects of the differential potential of individuals and communities to experience short- and longer-term losses as a consequence of disasters (Tierney, 2019)
<b>Communication-related vulnerability</b>	the proneness of people to experience adverse effects due to problems with accessing, understanding, or acting upon information about hazards (Hansson et al., 2020)
<b>Emergency/crisis/disaster management</b>	coordinating resources and responsibilities during all phases of a disaster, from preparedness to recovery ( <i>Disaster Management</i> , s.d.)
<b>Disaster risk reduction</b>	the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness for adverse events ( <i>Links Glossary</i> , s.d.)

<b>Disaster risk reduction institutions</b>	refers to a range of organisations responsible for increasing the resilience of populations, managing ongoing emergencies, and/or mitigating the effects of disasters on the population (UNDRR, 2016)
<b>(De)centralised (disaster) management</b>	involves distributing disaster management responsibilities and resources across various levels of government and organizations (Mazereeuw & Yarina, 2017)
<b>Crisis communication</b>	involves the communication strategies and methods used to help organisations and institutions respond to and recover from disruptions and is typically focused on protecting lives, property, and reputation, depending on the context. Not all crisis communication is about disasters (Liu & Mehta, 2024)
<b>Risk communication</b>	refers to the exchange of information among individuals, groups, and institutions regarding risks to public health, safety, and the environment. It is considered a precursor to crisis communication, focusing on building awareness and preparedness before crises occur (Liu & Mehta, 2024)
<b>Disaster communication</b>	involves the strategies and methods used to communicate with the public during a disaster to provide information, manage perceptions, and mitigate the effects of the disaster. Disaster communication is a subcategory of crisis communication (Liu & Mehta, 2024)
<b>False information</b>	an umbrella term that encompasses two types of problematic information: 1) Misinformation: Information that is false, but not created with the intention of causing harm. Could be false connections, or misleading content; 2) Disinformation: Information that is false and deliberately created to harm a person, social group, organisation or country. Could be false context, imposter content, manipulated content, fabricated content (Wardle & Derakhshan, 2017)

<b>Media</b>	the combination of tools, devices, and platforms that enable the creation, distribution, and consumption of various forms of media content, such as text, images, audio, and video ( <i>Media Technology</i> , s.d.)
<b>Social media</b>	refers to online platforms that enable individuals to connect and network for personal or professional purposes, allowing them to share content and ideas in real time ( <i>Social Media</i> , s.d.)
<b>Simulations</b>	refers to the use of experiments and models to generate artificial data, scenarios, and test assumptions or strategies in situations where real-world experiments are not feasible or advisable, particularly in complex dynamic systems within the Social Sciences domain ( <i>Simulation Mode</i> , s.d.)
<b>Table-top exercise</b>	enables to discuss and experience actual problems and try out ideas or processes during hypothetical situations. Usually meant to enhance institutions' readiness, test planning assumptions, or help to clarify the duties and responsibilities of different roles in the organisation (McCreight, 2023)
<b>SWOT</b>	this organizational tool involves an informal look at an organization's Strengths, Weaknesses, Opportunities and Threats, the SWOT analysis tool is designed to identify these factors in an effort to help with decision-making and planning ( <i>SWOT Analysis</i> , s.d.)
<b>Society and community</b>	society can be regarded as a moral and structural whole created by the interdependence of differentiated roles (Giddens, 1972), while a community is a form of social life sustained by a network of shared values (Tönnies & Harris, 2001). These are intertwined – societies rely on formal ties but still draw cohesion from underlying communal bonds (Brint, 2001)

# 1. INTRODUCTION

Extreme events such as tsunamis, earthquakes or floods, but also conflicts and false information are predicted to affect more populations each year – reasons vary from climate change to population growth in vulnerable areas, and (geo)political polarisation to technocracy (Busayo et al., 2020; Dilek et al., 2021; World Economic Forum, 2025). Social vulnerability usually refers to either group or individual susceptibility to negative consequences due to hazard exposure (Tierney, 2019). However, vulnerability and resilience studies have moved away from considering vulnerability and resilience as fixed characteristics of certain groups. Instead, vulnerability and resilience are increasingly recognised as dynamic due to factors like human agency and capacities, technological functionality or accessibility of societal support structures intersecting depending on the situation (European Commission, 2023; Krüger, 2019; Marzi et al., 2019; Orru et al., 2022; Sellnow & Seeger, 2021; Sun & Liu, 2023).

Understanding vulnerability as a dynamic rather than a fixed combination of drivers (i.e., the set of factors that generate susceptibility to hazards), processes (i.e., the evolving interaction between those factors and a hazard), and states (i.e., the observable condition that results when the process is underway) allows us to identify how vulnerabilities emerge, change and can be mitigated. Communication-related vulnerability to disasters may have three kinds of drivers: individual (e.g., people having cognitive impairments), social-structural (e.g., disaster management institutions' lacking capacity to warn people), or situational (e.g., people being exposed to false information during a disaster). Special attention has been paid to disaster communication's possible role in mitigating people's vulnerabilities deriving from problems with accessing disaster information, understanding the received information, and adequately reacting to said information (Hansson et al., 2020). The aim of this thesis is to clarify how disaster risk reduction institutions address and mitigate these communication-related vulnerabilities in disasters.

The Sendai Framework of the United Nations (United Nations, 2015) has emphasised the need to rethink how governments and international institutions can support world communities in mitigating social vulnerability and coping with disasters. The framework has specifically emphasised the aim to substantially reduce the number of people affected by disasters, and increase availability of disaster information. Disaster risk reduction institutions are the key actors in this effort. The term refers to a range of organisations responsible for increasing the resilience of populations, managing ongoing emergencies, and/or mitigating the effects of disasters on the population. These include national-level institutions such as ministries, emergency management agencies, local governments, police, fire and rescue services, health boards, or state-owned vital service providers, but also relevant international institutions such as the United Nations Office for Disaster Risk Reduction or the EU Civil Protection Mechanism.

While their shared role is to coordinate and manage public safety, they differ in structure, responsibilities, and practices. In this thesis, I use the term practices to refer to the activities of individuals working in disaster risk reduction institutions that aim to mitigate people's vulnerabilities and increase their resilience in disasters. These can include, for example, tackling false information, issuing warnings and instructions via social media, coordinating institutional communication, or identifying vulnerable groups. Exploring these institutional differences and practices helps to understand how communication influences vulnerability in disasters.

Disaster communication is a natural part of disaster management (Coombs, 2023). Communication practices such as monitoring, warning or campaigning can contribute to the available information that people base their decisions on (Alexander, 2014; Houston et al., 2015). However, the constant overflow of information, accompanied by harmful false information, is making it more difficult, both for the disaster risk reduction institutions and individual people, to communicate during disasters and make sense of turbulent times. When available disaster risk reduction information happens to be unclear, inadequate or incomplete, people might base their decisions on false premises. Instead of mitigating hazards to their health, property or lives (Seeger, 2006), their decisions could amplify already existing social vulnerabilities such as unequal access to information (e.g., Clemente-Suárez et al., 2022; Johansson et al., 2024; Tran et al., 2020; Wardle & Derakhshan, 2017; Yang et al., 2023).

Problems with people falling for false information are rooted in issues of trust towards public institutions (Drakos et al., 2019; Hertzum et al., 2002; Paton, 2008a; Siegrist et al., 2021). Tackling false information is in essence fighting opinions and attitudes (Ecker et al., 2022; Jankowicz, 2020; Lewandowsky et al., 2012; Walter & Murphy, 2018) which means that ordinary counter-measures, such as fact-checking, content removal or labelling, would just alleviate the problem. To focus on the actual problem, definitions play a large part, especially for institutional efforts. Common definitions or understanding of false information would clearly help to delineate what the institutions are up against (El Mikati et al., 2023; Tandoc et al., 2018). Currently, the knowledge of how disaster risk reduction institutions understand and conceptualise false information and which practices they employ to tackle it is presented mostly in technical descriptions (Antoniadis et al., 2015; Choy & Chong, 2018; Peter & Koch, 2019; Yang et al., 2023; Zhang et al., 2016), rather than through the lens of communication-related vulnerabilities which also encompass problems related to false information (Kuran et al., 2020; Orru et al., 2023).

Modern disaster management and communication is a networked process complicated by a mixture of factors – audiences, channels, stakeholders and responsibilities. Alongside traditional crisis communication tools (including leveraging news media and communication on radio or TV), both the people and the (disaster management) institutions use social media (Reuter et al., 2018). In 2024, the 5,17 billion social media users represent 63,7% of the world population (Petrosyan, 2024b). This showcases the rising share and importance of social

media communication in people's lives, meaning that disaster communication could and should systematically use social media for disaster risk reduction (Houston et al., 2015). Both practitioner and academic knowledge of how disaster risk reduction institutions and stakeholders have arranged their risk and crisis communication in terms of tackling false information is yet fragmented (Clemente-Suárez et al., 2022; Daume, 2024; Lewandowsky et al., 2012; Peter & Koch, 2019; Smith et al., 2023; Tran et al., 2020; Walter & Murphy, 2018).

While social media has considerably widened the scope of information that people base their decisions on during disasters (Lindsay, 2011), it has also facilitated the spread of uncontrolled and unverified information (Tran et al., 2020; Yang et al., 2023) which means both new possibilities and pitfalls for disaster management. One of the possibilities is to knowingly use communication practices – such as warning, campaigning, or crowd-sourcing – to address and mitigate people's communication-related vulnerabilities in disasters. Besides the responsibility shift, changed media landscape has brought numerous other stakeholders into disaster risk communication – citizens social media users, journalists, or other unofficial sources which balance on the borderline of journalism, blogging and just posting, leaving journalistic ethics to the background (Ireton & Posetti, 2018; Lovari & Bowen, 2020). This exemplifies how in addition to navigating a more complex information ecosystem, the disaster risk reduction institutions have to tackle (and sometimes outperform) a variety of other possibly malicious or shady actors (Humprecht et al., 2020).

Although the possibilities of using social media in disaster risk reduction have been researched (Alexander, 2014; Houston et al., 2015; Imran et al., 2015), the empirical knowledge of how disaster risk reduction institutions have employed social media in disasters is scattered in numerous case studies (Lin et al., 2016; Plotnick & Hiltz, 2016; Reuter, 2022; Reuter & Kaufhold, 2018; Xu, 2020; Young et al., 2020). Neither has it been studied in the light of social vulnerability – the sociological understanding of disaster vulnerability (Kuran et al., 2020; Morsut et al., 2021; Orru et al., 2022; Tierney, 2019).

Mimicking communication-related vulnerabilities, especially the harmful effects of false information requires an experimental environment. Disaster risk reduction organisations use scenario-based simulations for training and evaluation (McCright, 2023). Scenario-based frameworks such as table-top exercises (Orru et al., 2023) help both to identify the population's communication-related vulnerabilities but also the disaster risk reduction institutions' practices and capacities in identifying and mitigating these vulnerabilities. Until now, table-top exercises have not been used to research the dynamic character of vulnerability.

With this thesis I aim to clarify how European disaster risk reduction institutions address and mitigate communication-related vulnerabilities in disasters (see Hansson et al., 2020). To do so, I combine sociological theories of social vulnerability and disaster risk reduction; communication research on communication-related vulnerabilities, risk and crisis communication, and disaster communication; and disaster risk reduction scholarship on institutional capacities. I clarify how institutions approach and respond to false information (Study I), how they

use social media for disaster communication (Studies II and III), and how scenario-based simulations can help identify and address vulnerabilities (Study IV). Exploring the factors of dynamic social vulnerability (see Kuran et al., 2020; Morsut et al., 2021; Orru et al., 2022, 2023; Tierney, 2019) helps to understand whether and how disaster risk reduction institutions could address and alleviate these problems. Furthermore, it highlights which shortcoming in social-structural support structures, including institutions' own capacities contribute to these vulnerabilities, how these can be addressed, and how specific situations trigger or combine particular factors in ways that either amplify or reduce vulnerability. These findings will advance our understanding of how institutional arrangements and practices interact to shape vulnerability in disasters.

My research questions are:

1. How do European disaster risk reduction institutions conceptualise and handle false information? (Study I)
2. How is social media communication arranged in European disaster risk reduction institutions? (Study II)
3. How do European disaster risk reduction institutions use social media to mitigate communication-related vulnerabilities? (Study III)
4. How can table-top exercises be used to identify communication-related vulnerabilities to disasters? (Study IV)

The empirical material for answering the research questions 1–3 was collected with an extensive multi-country document analysis and 95 expert interviews by an international team in eight European countries – Germany, Italy, Belgium, Sweden, Hungary, Norway, Finland, and Estonia (for Studies I–III). Additionally, for research question 4, a multi-stakeholder table-top exercise disaster simulation was carried out in Estonia to explore how institutions identify, analyse and tackle vulnerabilities related to communication (for Study IV). Comparative insights about institutional communication will help researchers understand its effect on mitigating the spread of false information. Understanding how disaster managers handle false information will also help future decision-makers at multiple governance levels to alleviate the impact of false information and eventually enhance people's capacity to cope with disasters.

The **Study I** that this thesis is based on (*Handling false information in emergency management: A cross-national comparative study of European practices*) contributes to our understanding of how European disaster management institutions conceptualise false information and what have they done so far to tackle (or combat) it. **Study II** (*European emergency managers on social media: Institutional arrangements and guidelines*) shows how those practices have been implemented in guideline documents. **Study III** (*Mitigating vulnerabilities with social media: A cross-national study of European disaster managers' practices*) explores the additional possibilities that social media offers for mitigating communication-related vulnerabilities in disasters, and the **Study IV** (*Table-top exercise for identifying communication-related vulnerabilities in disasters*)

explores how we can train stakeholders to identify, analyse and tackle vulnerabilities related to communication. The four articles all explore the theoretical possibilities of mitigating communication-related vulnerabilities (Hansson et al., 2020), and discuss and exemplify the state of current practice and future implications.

This thesis is structured as follows: First, I review important theoretical concepts. Then I describe the methodology. Then I present the results of my studies and discuss the main findings. My thesis ends with a conclusion and a summary in Estonian.

## 2. THEORETICAL FRAMEWORK

### 2.1. Disaster vulnerability

Society is a system of constant disruption and change (Vollmer, 2013). When it's easier to cope with gradual (also *creeping*) changes, sudden and rapid changes are usually regarded as disasters or crises, depending on the context (Al-Dahash et al., 2016; Gundel, 2005). During crises, it is the society's and its members' resilience that helps to adapt, overcome and cope with the new situation. Lack of or low resilience constitutes society's vulnerability (Morsut et al., 2021; Sun & Liu, 2023; Thomas et al., 2013). A central concept for understanding vulnerability in disasters is social vulnerability – the idea that social structures (e.g., communities), systems (e.g., capabilities of civil protection agencies), and inequalities (e.g., socio-economic or demographic differences) expose certain individuals or groups more to risks (Cutter et al., 2003; Tierney, 2019).

Disasters have different scopes and effects – for instance, cities could be more vulnerable to floods or earthquakes, while rural areas more to wildfires – meaning that disaster vulnerability emerges when the social conditions intersect with a specific hazard, converting potential exposure into actual risk. Furthermore, vulnerability of a society, groups or individuals is not a constant, but a dynamic descriptive measure that can change due to individual, social-structural, or situational factors such as person's skills, supporting structures or the nature of a disaster (Kuran et al., 2020; Orru et al., 2022). Exploring the underlying factors of dynamic social vulnerability helps to identify those who are at greater risk and which specific factors contribute to disaster vulnerability (Kuran et al., 2020).

To explore the factors of vulnerability specifically in the context of communication, Hansson et al. (2020) have provided a conceptual framework. Instead of crisis phases (i.e., preparedness-response-recovery-mitigation) it follows the information-processing flow that a person moves through while communicating. The framework identifies three phases in which people could become vulnerable (communication-wise) during disasters – these are troubles accessing information (can the message physically or digitally reach the person), problems with understanding information (does the person adequately interpret its meaning and relevance), and problems with reacting to that information (can the person translate that understanding into timely protective action). These phases help us understand how individuals respond to disaster communication and which troubles they could encounter with that. In turn, the described vulnerabilities could derive from (the intersection) of three distinctive factors: individual (such as skills, knowledge, impairments, etc), social structural (such as the effectiveness of social support structures, community support, etc), and situational factors (such as the nature of the hazard, false information, etc). These factors help to systematically analyse and understand the underlying reasons for why people have trouble coping during disasters, and consequently highlight where improvements in communication can increase the society's resilience in disasters.

One social-structural vulnerability factor central to this thesis is the (disaster risk reduction) institutions' capacity to shape vulnerability through communication (e.g., monitoring, warning, or campaigning). Disaster risk reduction institutions (including national, international, non-governmental or private disaster-related institutions) deal with increasing the resilience of populations, managing ongoing emergencies, and mitigating the effects of disasters on the population (European Parliament & European Council, 2023). In Europe, national disaster risk reduction institutions are tied to the nations' disaster management systems (European Commission, 2025b), though they operate within the framework of European Commission's disaster risk management policies (e.g., the EU Civil Protection Mechanism), and international guidelines such as the United Nations Sendai Framework (European Commission, 2025a; United Nations, 2015).

One vital element of disaster management is risk and disaster communication – it is an essential part of managing and directing the changes that the society is experiencing in preventing, preparing for, responding to, and recovering from disasters. Variations in institutional responsibilities (centralised vs. decentralised), supporting regulatory frameworks, and institutions' preparedness influence how an institution communicates. Consequently, the effectiveness of disaster management contributes to the society's vulnerability, but could also address and mitigate the factors of vulnerability (Oostlander et al., 2020; Plotnick & Hiltz, 2016). Institutional capacity is therefore not only an operational issue but also a core component of vulnerability itself.

## **2.2. Information disorder challenges in disaster risk reduction**

The EU has emphasised the importance of individual states and collaborative efforts in tackling false information (European Commission, 2018b, 2022). Disasters are also handled by managing information – constantly communicating hazards or instructions (Coombs, 2023; Daume, 2024; Paton, 2008b) – disorderly information can hamper those efforts, endangering lives and wellbeing. Although the phenomenon itself is not anything new, the term “information disorder” was systematically delineated in 2017 (Wardle & Derakhshan, 2017). This umbrella term distinguishes different types of false and harmful information, with an emphasis on how disorderly content could disrupt the normal functioning of communication within society, including in the context of disaster communication. Depending on the research domain – either more technical, social or corporate research, terms such as misinformation, disinformation, false information or fake news are (sometimes interchangeably) used.

Disinformation is supposedly effective when it has an element of truth, or some basis in true stories and societal beliefs – this taps into people's perception and the rest is filled with imagination (Ecker et al., 2022; Johansson, 2019; Lewandowsky et al., 2012; Li & Wagner, 2020a). Although the disaster panic has

been long contemplated to be a myth (Nogami, 2018), the effect on public sentiment and fear is real – fearmongering has a direct effect on the mental wellbeing (e.g., anxiety) of people (Heinisch et al., 2021; Klemm et al., 2019; Lovekamp & McMahon, 2011; Ravenelle et al., 2021).

Successful disinformation campaigns target already existing division in the society (European Parliament. Directorate General for External Policies of the Union., 2021; Jankowicz, 2020; Schia & Gjesvik, 2020). Information disorder has proven especially dangerous during disasters (Hansson et al., 2020) when people need quality information to make adequate decisions about their further actions. To find that information, people turn to sources they trust (Johansson et al., 2024), whereas susceptibility to information influence is higher among people who use fewer news sources (Dutton & Fernandez, 2019). Often disaster managers (and communicators) are not prepared to tackle false information (Daume, 2024; Fischer et al., 2016). This means that besides communicating their own agenda, disaster communication ought to also address various information disorders. This challenge is amplified by the mixture of low professional resources and the sheer volume of content being available on the internet and online social media platforms (Dekker et al., 2020; Fischer et al., 2016; Lovari & Bowen, 2020; Plotnick & Hiltz, 2016). A major challenge is tackling false information once it has spread widely (Nguyen et al., 2012; Ozturk et al., 2015; Stich et al., 2014; Vosoughi et al., 2018). One of the main reasons for proliferating false information during crises seems to be late official reaction time and since correction takes time, while public perception still lags behind, false information could have a potentially lasting impact.

Building public trust towards disaster management institutions is one ground basis for influencing the public's information retrieval habits during disasters (Castelfranchi et al., 2003; Drakos et al., 2019; Hertzum et al., 2002; Kitagawa et al., 2022; Paton, 2008b; Siegrist et al., 2021). Surveys have shown and research has highlighted the importance of fading public trust towards institutions (Chrysochoidis et al., 2009; European Commission, 2019; Madar et al., 2022). Further on, trust will determine whether an actor's messages are taken seriously, and whether they have an actual effect (Johansson et al., 2021). To foresee, prevent and address these challenges, disaster communicators would need heuristic mechanisms (such as proposed by Hansson et al., 2020 and Orru et al., 2023) for recognising and tackling information disorder and its effects.

Despite the growing focus on disaster communication quality (e.g., Lin et al., 2016; Medford-Davis & Kapur, 2014; Veil & Husted, 2012; White, 2012), research on managing a primary threat to quality communication – information disorder – is scarce, and is mostly dedicated to either mapping the domain (e.g., Nguyen et al., 2012; Shao et al., 2016; Yang et al., 2023; Zhang et al., 2016) or describing dissemination mechanisms (e.g., Nguyen et al., 2012; Stich et al., 2014; Zhang & Zhang, 2009). Few studies have systematically explored how European institutions define and tackle information disorders. Definitions are especially important in the context of freedom of expression, which by standards should not be limited without reason. Besides that, tackling strategies are explored

mostly in technical literature (e.g., Mossie & Wang, 2020; Yang et al., 2023; Zhang et al., 2016), which describes the technicalities of tracing, detecting and labelling mis- and disinformation, leaving the social aspect and the influence out of scope.

The actual influence of information disorder is however essential from the perspective of disaster risk reduction which does not deal so much with the technicalities, but the consequences (Cornia et al., 2016; Thomas et al., 2013; Tierney, 2019). In essence – research rarely looks at how false information impacts social vulnerabilities in disaster contexts.

### **2.3. Arranging social media communication in disaster risk reduction**

Disaster communication has evolved from relying solely on traditional media (e.g., news media and communication on TV, radio, or newspapers) to using digital communication platforms (European Commission, 2018a; Farnham, 2006; Xu, 2020). The adaptability and decentralised nature (making it also technologically resilient service-interruption-wise) of social media have turned it into a dominant arena in disaster risk reduction (Bennett, 2014; Möller & Von Rimscha, 2017; Reuter et al., 2016). Disaster communicators perceive social media and their online presence as giving them an advantage over traditional news media (Johansson & Odén, 2018). Within and alongside other internet-based communication, social media has had the most effect on global communication habits and patterns during the first decades of the 21<sup>st</sup> century (Alexander, 2014; Apuke & Tunca, 2018; Houston et al., 2015; Imran et al., 2015; Jurgens & Helsloot, 2018; Lindsay, 2011; Reuter, 2022; Reuter & Kaufhold, 2018).

Existing frameworks and guidelines for social media use in disasters take social media just as a part of traditional disaster communication, using primarily the amplifying effect of social media to spread messages to a wider audience. These solutions tend to be reactive (such as responding directly to what is happening in the environment), not proactive (such as knowingly designing communication strategies, tailoring them to multiple groups, building trust) (e.g., Austin et al., 2012; Kim et al., 2016; Kitagawa et al., 2022). Besides that most institutions even lack formal approaches to using social media, regarding it somewhat secondary for disaster communication (Nielsen et al., 2023). In some cases, governments might not have caught up to advances in social media with regulations (Beaumier et al., 2020). A need for disaster communication guidelines that would incorporate social-media-specific communication strategies for mitigating vulnerabilities during crises has been highlighted (Abid et al., 2024; Lovari & Bowen, 2020).

Disaster risk management institutions and stakeholders either arrange risk and crisis communication with regulations, documentation or rely on the employee experiences, sometimes both (Christensen, Danielsen, et al., 2016; Christensen,

Laegreid, et al., 2016). Emergency management systems' institutional arrangements are shaped by the broader administrative traditions in a country, mirroring their overall structures and levels of public administration (Bossong & Hege- mann, 2013). Institutional memory instruments (i.e., regulations, guidelines, documents) help organisations to uphold quality in spite of changing workforce, on the other hand individual memory (i.e., the individual experiences of risk and crisis communication specialists) is resourceful, but makes the institution vulner- able to loss of knowledge with staff changes, that could hamper the overall quality of disaster risk management (Fontanella Pisa, 2024; Hardt, 2017; Stark, 2020).

European nations and disaster risk reduction institutions have made a signifi- cant shift from centralised disaster management to decentralised disaster man- agement, including risk and crisis communication. This also marks the systems' adaptation to the changed realities of communication (European Commission, 2018a). Nonetheless, the shifting realities have left only a few European nations behind in the process of decentralisation (i.e., sharing disaster risk reduction responsibilities horizontally) – some such include Belgium (central disaster management), but also Hungary, where disaster communication is the responsi- bility of one institution (Government of Hungary, 2012; Petkov & Tagarev, 2015).

In a nutshell, disaster communication has been democratised, but additional (uncontrolled) stakeholders have made navigating the media landscape more difficult. With this thesis, I argue that decentralised approaches call for compre- hensive guidelines.

## **2.4. Practices of using social media in disaster risk reduction**

But how does social media perform for risk and crisis communication. When early risk and crisis communication approaches emphasised centralised top-down controlled information flow during disasters, research in the last decades has shown that one-way narrow communication does not address disaster vulnerabi- lities adequately. Instead, as disaster vulnerability is dynamic (Hansson et al., 2020; Orru et al., 2023), so should be the communication medium and techniques that address those vulnerabilities (Alexander, 2014; Jurgens & Helsloot, 2018; Reuter, 2022; Reuter et al., 2016; Stewart, 2024; Veil et al., 2011).

Digital platforms – such as internet-based social networks (e.g., Facebook), blogs (e.g., WordPress), microblogs (e.g., X), forums (e.g., Reddit) and wikis (e.g., Wikipedia); and platforms for crowdsourcing (e.g., Safecast.org), digital mapping (e.g., Ushahidi), podcasts (e.g., Soundcloud), video sharing (e.g., YouTube), and photo sharing (e.g., Flickr) – have added two-way multimodal communication and an array of useful background data (like location, device, and network metadata) to the disaster manager's toolbox (Haddow et al., 2020; Mavrodieva & Shaw, 2021; Palen & Anderson, 2016; Reuter & Kaufhold, 2018; Sarker et al., 2020; Veil et al., 2011; Xu, 2020). This means that various

additional possibilities for mitigating disaster vulnerabilities have opened up for risk and crisis communicators (Brynielsson et al., 2018; Kaufhold et al., 2019).

Admittedly, social media alone cannot address the majority of factors contributing to disaster vulnerability, including poverty, disabilities, inequality, limited language proficiency, or inadequate communication infrastructure. In spite of being statistically the most available communication medium for a large part of the society (Petrosyan, 2024a, 2024b), social media might leave out the most vulnerable segments of the society (Dargin et al., 2021; Vassilakopoulou & Hustad, 2023), and targeting the right audience with correct messages is intrinsically different on those platforms (Farnham, 2006; Park & Avery, 2018), which is why the underlying reasons for disaster vulnerability should be addressed separately (Choo & Yoon, 2024; Kuran et al., 2020).

Social media has been used in many past disaster situations to mitigate vulnerabilities, but its opportunities and actual practices for mitigating social vulnerabilities have been underused, though somewhat researched (Alexander, 2014; Houston et al., 2015; Kim et al., 2016; Lovari & Bowen, 2020; Meijer & Thaens, 2013; Picazo-Vela et al., 2012). Broadly, disaster communication practices divide into risk and crisis communication (Liu & Mehta, 2024). However, research points at the disaster managers' challenges of using social media, such as the multimodality, variety of opportunities and metadata that require more expertise (Li et al., 2022; Rodavia et al., 2018; Singla & Agrawal, 2022; Spielhofer et al., 2016; Trezza, 2023). Without direct regard to the effect it has on disaster vulnerability, authors have suggested various **ways of using social media** in disaster risk reduction: Alexander (2014) suggests using social media for listening, monitoring, risk reduction and management, crowd-sourcing and collaboration, creating social cohesion, furthering causes, and research. Houston et al. (2015) propose more specifically: expressing emotions or concerns or providing mental health support. Some authors have built on Houston et al. (2015) and classified real social media use during disasters, such as messaging about caution and advice, affected people, infrastructure/utilities, need and donations, and other useful information (Imran et al., 2015).

Past disasters (such as the COVID-19 pandemic) have highlighted the double edged nature of social media – it can both inform and mislead the public (e.g., Hansson et al., 2021). The increased reach and speed, the effectiveness and scale are both a blessing and a challenge for disaster risk reduction (Dekker et al., 2020; Lovari & Bowen, 2020; Ozturk et al., 2015). Digital platforms amplify the messages, but social media amplifies both accurate and false information (Kumar & Shah, 2018; Vosoughi et al., 2018; Zannettou et al., 2019). Direct engagement (e.g., fact-checking, inoculation, etc) can amplify risk and crisis communication, but is happening against the backdrop of constant information overload (Bawden & Robinson, 2020; Bontcheva et al., 2013) and information disorder (Allcott et al., 2019; Brandtzaeg et al., 2018; Himma-Kadakas & Ojamets, 2022; Li & Wagner, 2020b; Ozturk et al., 2015).

Research has shown that false information circulates social media much faster than truthful information (Allcott et al., 2019; Meel & Vishwakarma, 2020;

Vosoughi et al., 2018; Zhu et al., 2018). Algorithm-driven exposure to information and filtered content (Chayka, 2024), closed groups or information bubbles (Spohr, 2017), and malicious counter-actors disseminating false information (EEAS, 2024) require well-planned, well-researched and balanced approaches to using social media for disaster risk reduction. More information on peer experience, attempted solutions, and the effect that social media practices have on disaster vulnerability would help disaster risk reduction stakeholders (such as local government, national or international institutions, but also NGOs) better handle social media tools for disaster risk reduction purposes (Kavanaugh et al., 2012; Jin et al., 2014; Choy and Chong, 2018).

Within this thesis, I highlight the disaster risk reduction institutions' rules and practices (Studies II and III) in using social media for mitigating disaster vulnerabilities. Fulfilling this task of mitigating vulnerabilities requires reflexive analytical techniques to identify the sources of communication-related vulnerabilities, including the institutions' capacities as a contributing factor. Scenario-based methods, such as table-top exercises, provide a structured way to simulate disasters in a controlled environment and observe institutional capacities in recognising and mitigating vulnerabilities as they emerge.

## **2.5. Table-top exercise as a vulnerability assessment tool**

Scenario-based simulations can be used as a possible approach to uncovering vulnerabilities stemming from disruptions to communication. Paired with vulnerability frameworks (Orru et al., 2023) simulations like table-top exercises can easily be modified to accommodate elements from all sorts of (worst case) scenarios such as extreme weather events, infrastructure failures or disaster risk reduction capacity gaps (Aven, 2015; Etkin et al., 2018), and shed light on the intricate and multi-dimensional problems with communication (see Hansson et al., 2020) during emergencies.

Table-top exercises help to simulate and practice emergencies and try out ideas and processes cost-effectively compared to organising complex full-scale exercises or drills. They permit stakeholders, such as disaster managers, volunteers, local governments, and humanitarian NGOs, hands-on experiences with actual problems (Fleming et al., 2020; Holloway, 2007; Renner, 2001). The scenario is usually set up in phases, giving participants a chance to apply their skills and knowledge by doing specific tasks (Alexander, 2000). For research, table-top exercises help to unearth institutional capacity gaps that may cause harm to individuals or society at large (Hagelsteen & Becker, 2019).

Research using simulations has focused primarily on emergency management in general (Boin et al., 2004; Carlson, 2024; Friedman et al., 2011; Gundran et al., 2022; Miller et al., 2017; 't Hart, 1997), healthcare (Dausey et al., 2007), decision-making practices (Järvensivu et al., 2021), or cyber-security (Chowdhury & Gkioulos, 2023), but not explicitly on inadequate or false information and its harmful effects. With this thesis I aim to address this gap by mapping the

situation, researching communication-related vulnerabilities and advocating a tool for assessing the institutions' capabilities in identifying and addressing these vulnerabilities.

This thesis explores how European disaster risk reduction institutions address and mitigate communication-related vulnerabilities in disasters. This is achieved by combining the concept of dynamic social vulnerability (Kuran et al., 2020; Morsut et al., 2021; Orru et al., 2022, 2023) with the exploration of individual, social-structural and situation-specific factors of vulnerability that hinder access, understanding or possibilities to react on risk and crisis information (Hansson et al., 2020). The outcome will shed light on whether and how disaster risk reduction institutions can address and alleviate the shortcomings in social-structural support structures, including institutions' own capacities. These findings will inform policy recommendations of best practices and contribute to a deeper understanding of how institutional arrangements and practices shape vulnerability in disasters.

### 3. METHODOLOGY

To answer all the thesis' research questions, I followed a study plan outlined in Table 1. Each study builds on the results of the previous one and four studies altogether offer a comprehensive picture of European disaster management institutions' capabilities in handling and tackling communication-related vulnerabilities. **Studies I to III** follow BuildERS (European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 833496) research project's detailed protocol for data collection. **Study IV** simulation exercise for data collection was designed and carried out in cooperation with the Estonian Rescue Board.

**Table 1.** Research questions and methods

Study	Thesis research question	Study research question	Method
Study I	1. How do European disaster risk reduction institutions conceptualise and handle false information?	1.1. How do different national institutions concerned with disaster management conceptualise false information? 1.2. How have disaster management institutions mitigated the risks posed by false information? 1.3. How has false information been handled by disaster managers in actual crises?	Data collection: document analysis and 95 expert interviews with disaster risk reduction and related institutions in Germany, Italy, Belgium, Sweden, Hungary, Norway, Finland, and Estonia. Data analysis: qualitative thematic content analysis.
Study II	2. How is social media communication arranged in European disaster risk reduction institutions?	2.1. How is social media communication institutionally arranged? 2.2. How are formal guidelines used to coordinate risk and crisis communication in social media?	Data collection: document analysis and 95 expert interviews with disaster risk reduction and related institutions in Germany, Italy, Belgium, Sweden, Hungary, Norway, Finland, and Estonia. Data analysis: qualitative thematic content analysis.

Study III	3. How do European disaster risk reduction institutions use social media to mitigate communication-related vulnerabilities?	3.1. How do disaster managers use social media for mitigating communication-related vulnerabilities?	Data collection: document analysis and 95 expert interviews with disaster risk reduction and related institutions in Germany, Italy, Belgium, Sweden, Hungary, Norway, Finland, and Estonia. Data analysis: qualitative thematic content analysis.
Study IV	4. How can table-top exercises be used to identify communication-related vulnerabilities to disasters?	4. How can table-top exercises be used to identify communication-related vulnerabilities in the context of disaster?	Data collection: 1 simulation exercise with 25 participants from disaster risk reduction and related institutions in Estonia, exercise working sheets. Data analysis: qualitative thematic content analysis.

### 3.1. Data Collection

Combining document analysis, expert interviews and a scenario-based table-top exercise helped uncover the disaster risk reduction institutions’ formal approaches and structures in documentation; in interviews, the practitioner views and knowledge that might never reach to documents; and actual institutional capacities in a simulated environment (see Orru et al., 2023).

#### Document analysis

In **Study I** – “Handling false information in emergency management: A cross-national comparative study of European practices” – **Study II** “European emergency managers on social media: Institutional arrangements and guidelines” – and **Study III** “Mitigating vulnerabilities with social media: A cross-national study of European disaster managers’ practices” – the international teams carried out the **document analysis** between September 2019 and February 2020 in eight European countries – Germany, Italy, Belgium, Sweden, Hungary, Norway, Finland, and Estonia, following a detailed study protocol designed by my co-authors Kati Orru and Sten Hansson. I collected the data in Estonia.

The selection of eight countries aligns with the membership of the BuildERS (Building European Communities’ Resilience and Social Capital) research consortium (see “BuildERS”, s.d.) that supported data collection for **Studies I–III** in

this thesis. The project grouped partners with varying historical and socio-economic backgrounds from Northern (Finland, Sweden, Norway), Western (Germany, Belgium), Southern (Italy) and Central-Eastern Europe (Estonia, Hungary), including small and large populations, and both centralised (e.g., Belgium, Hungary) and decentralised (e.g., Finland, Estonia) disaster management systems.

The country teams collected **empirical material** including publicly accessible legal acts, policy documents, official guidelines, and press reports. **For Studies I, II and III** the pre-specified purposive sampling criterion required that the documents be publicly available and related to disaster management. I and the international research teams conducted inductive analysis of the empirical material to identify themes related to institutions' approaches and responses to false information (Study I), and arrangements and practices of using social media for disaster communication (Studies II and III).

## Interviews

To complement the empirical material for **Studies I–III**, I and my co-researchers carried out 95 semi-structured expert **interviews** (approximately 60 minutes each) between September 2019 and February 2020 with disaster managers in the same selection of European countries. The **interviews** were conducted in local languages both in person and online, were then transcribed, and together with the **document** analysis in respective countries, then summarised into country **case study reports** in English.

**Interviewees** were selected through a convenience sample with attention to their current or recent responsibility for communication within a disaster risk reduction (or related) institution. The number of interviews per country was not consistent (e.g., 22 interviews in Estonia, 14 in Germany, but only 4 in Belgium). Because the interviewers were of different backgrounds (i.e., academic researchers in Germany, Italy, Sweden, Norway, Finland, Estonia; and non-academic researchers from NGOs in Belgium and Hungary), the sample may reflect their own networks and overrepresent more approachable or accessible institutions (this is more thoroughly addressed in the thesis limitations in chapter 3.3).

We **interviewed** informants from local governments (e.g., Estonian city of Tartu crisis team), national ministries and government offices (e.g., Swedish Ministry of Justice, or Estonian Government Office), national and international NGOs (e.g., Belgian Red Cross, Hungarian Red Cross, or Save the Children Sweden), social security agencies (e.g., Estonian Social Insurance Board, or Finnish Regional State Administrative Agencies), cyber security agencies (e.g., Estonian Information System Authority), national and local rescue boards (e.g., Swedish Civil Contingencies Agency, or Finnish Oulu-Koillismaa Regional Rescue Services), vital service providers (e.g., Hungarian Budapest Waterworks, or German utility representatives), civil protection agencies (e.g., Italian Department of Civil Protection, or Hungarian Civil Protection Agency), and police or security forces (e.g., Norwegian Police Security Service). Including such a variety of governmental and non-governmental institutions, spanning local, regional

and national levels, allowed us to trace how responsibilities are distributed and intersect across Europe's disaster risk reduction systems.

The semi-structured questions for the informants followed these analytical themes: (for **Study I**) how different crisis management institutions conceptualise false information, what are the actions taken by these institutions to mitigate the risks posed by false information, and experiences of handling false information in past major crises; (for **Study II** and **III**) general organisation for the use of social media within institutions tasked with resilience/crisis management, formal guidelines or regulations on how to use social media in the context of resilience/crisis management, officials/units/agencies with tasks to manage social media with regard to resilience/crisis management.

To find more specific information on the practices and examples of how disaster managers use social media for mitigating communication-related vulnerabilities, we further specified the practices by asking the **interviewees** to describe their experiences of using social media in **past disasters** in their own countries. We **examined various disasters** that have affected European communities: earthquake in L'Aquila, Italy (April 2009); terrorist attacks on a government building in Oslo and at the island of Utøya, Norway (22 July 2011); Pukkelpop festival severe thunderstorm disaster in Belgium (August 2011); snowstorm in Hungary (March 2013); flood disaster in Germany (June 2013); red sludge flood disaster in Veszprem, Hungary (2013); increase in asylum seekers in Sweden (2015); the terrorist attack on Brussels airport and metro (22 March 2016); Munich shooting in Germany (2016); drinking water contamination in Nousiainen, Finland (January 2017); critical infrastructure failures due to a storm in Southern Estonia (October 2019). Although not all interviewees had direct experience with these disasters in their current roles, information was obtained from all countries. The cases were chosen to best illuminate the hypothetical crisis communication challenges experienced in Europe, and include crises triggered both by natural as well as man-made hazards.

### Table-top exercise

In **Study IV**, to explore how disaster management table-top exercises can be used to **identify** communication-related vulnerability **factors** related to false information, we (I and my co-authors Kati Orru, Margo Klaos, and Sten Hansson) organised a crisis scenario simulation with 25 practitioners in disaster management, and related institutions (e.g., local governments, NGOs) in Estonia. To gather the participants, we sent out e-mail invitations to a selection of practitioners and experts representing different levels of decision-making and key institutions involved in disaster management.

We designed the table-top exercise as a small group workshop where the participant groups were tasked with identifying communication-related vulnerabilities emerging during a realistic five-phase hazard scenario in which access to crisis information was disrupted and people were exposed to false information. Each group was assigned with a facilitator who, throughout the day, gradually

introduced the scenario to the participants. Throughout the simulation, information about drivers of vulnerabilities gradually unravelled – the five groups received five working sheets that included information injects and tasks for discussion. We systematically collected reflections in the groups, paying attention to how the participants went about identifying particular vulnerable groups. I was the facilitator of one of the groups.

For identifying vulnerabilities in **Study IV**, we developed an assessment table that included cells for identification of individuals in vulnerable situations, description of their specific individual vulnerabilities, sources for obtaining information about the target group, the urgency for external assistance, and description of potential community support. To gather data from participants with varying institutional backgrounds and to explore the capacity gaps in crisis communication, we decided to use the interdisciplinary SWOT tool for structured reflection and debriefing (Benzaghta et al., 2021; Jarzabkowski & Kaplan, 2015). The acronym stands for “Strengths, Weaknesses, Opportunities and Threats” and the analysis tool helps to explore the internal and external environments of an agent (e.g., a stakeholder’s capabilities in disaster management) and reflect on their inner strengths and weaknesses, and eventually map these along with external opportunities and threats (Benzaghta et al., 2021).

### 3.2. Data Analysis

In **Studies I, II and III**, preliminary analyses of interviews and documents, with those in languages other than English were read and summarised into case studies by native speakers. For each country analysis there were two outcomes: an answer sheet with brief answers to thematic questions about disaster management systems in Europe; and, a longer more detailed country study narrative. I then conducted an inductive **qualitative thematic content analysis** (see Kohlbacher, 2006; Nowell et al., 2017) on the country reports and created thematic categories which were derived from the research questions – major commonalities and differences in the ways in which false information is defined and treated in different political/administrative systems in **Study I**; major commonalities and differences in institutional social media use, and themes about institutional regulations, guidelines, and practices for using social media in **Study II**; and practices and examples of how disaster managers use social media for mitigating communication-related vulnerabilities in **Study III**. For all studies, I reviewed all country reports multiple times, and I checked coding reliability with the original researchers in the 8 countries.

In **Study IV**, we set our focus to exploring institutional shortcomings in identifying and mitigating communication-related vulnerabilities (i.e., Hansson et al., 2020) and thus collecting reflections about how participants in the groups identify vulnerabilities. We searched for and did a **qualitative thematic content analysis** on passages describing how disaster managers and their partnering institutions understand individuals’ and disaster management institutions’ vulnerability to

inadequate information, and what are their capabilities and strategies for identifying individuals' vulnerability due to barriers to communication during disasters. Here, my thematic coding was guided by the elements in communication-related vulnerability framework – the stages of accessing, understanding, and reacting to information; and the individual, social-structural and situational vulnerability factors. I coded the exercise working sheets manually, and synthesised themes across different thematic participant groups, allowing me to trace the communication capacities more specifically.

### **3.3. Limitations**

While the four studies that this thesis is based on were conducted using systematic study protocols aimed at consistency, there are methodological challenges that may influence the interpretation of the findings.

#### **Scope alignment (Study II)**

The **Study II** focus on formal arrangements and guidelines for social-media use in disaster risk reduction provides an important context for interpreting the more practice-oriented findings of Studies III and IV. Yet, the fit of Study II with the thesis aim is more indirect than for the other articles – Study II does not trace the full causal chain to mitigating communication-related vulnerabilities.

#### **Cross-national comparability (Studies I-III)**

As a cross-national qualitative study, this research faces several limitations. For such large- scale cross-national analyses, a detailed research protocol as used in **Studies I-III** should have improved the consistency of data collection from different countries. The diversity of particular national settings, including the culture-specific connotations of the terms regarding crisis communication and false information, poses a challenge for interpreting the data. The risk of misrepresenting the country-specific data was lowered because our research team members had deep and native knowledge of the national and local socio-cultural contexts.

#### **Access and sampling biases (Studies I-III)**

The research team's access to relevant interviewees differed between countries, because the interviewers were of different backgrounds (i.e., academic researchers in Germany, Italy, Sweden, Norway, Finland, Estonia; and non-academic researchers from NGOs in Belgium and Hungary). As such, the sample may reflect the interviewers' own available networks that are in turn affected by their professional status or seniority. The interviews were conducted with experts selected through purposive sampling. While this allowed us to reach knowledgeable practitioners, the sample may overrepresent more approachable or accessible

institutions. Additionally, not all of the conducted 95 interviews were fully referenced in the country case studies that offered the analytical base for Studies I–III. This was because the amount of confidentiality requests differed between countries and for instances of missing written consent, some of the sources could only be referred generically (e.g., “government agency” or “director of an NGO”) in the case-study reports.

### **Document selection and availability (Studies I–III)**

The research team’s access to relevant documents differed between countries, and as such the country studies represent the information best available from public documents. The inclusion of policy documents, strategies, and guidelines depended on public availability and willingness of institutions to share materials. In some countries, limited transparency or scarcity of formal documentation may have led to gaps in the data.

### **Interpretive bias (Studies I–III)**

After collection and before the thematic analysis, both the local language documents and interviews were first synthesised into eight country case study reports in English. Because of this, many findings presented in Studies I–III rest on a composite of the two datasets and should be understood as mixed-method insights unless explicitly stated otherwise. As the main analyst, I carried out the cross-national synthesis based on the filled study protocol and separate country case studies in English. This placed interpretive responsibility largely on a single researcher, which could have potentially biased the results. I attempted to mitigate this by repeatedly discussing and sharing findings with co-authors and country teams during the analysis phase.

### **Limitations of the simulation (Study IV)**

The table-top exercise was conducted with 25 participants in Estonia, thus representing a single country. This means that the findings from the exercise cannot be generalised to all European contexts. The insights produced by the exercise depend on the chosen scenario, meaning that slightly different scenarios could actually produce different results. Additionally, the simulation method is participatory (rather than statistical) and therefore the results of the exercise reflect the experiences and knowledge of its participants. Involving a variety of thematic stakeholder groups helped us overcome the participant selection bias that may affect qualitative participatory vulnerability assessment. Finally, the SWOT reporting methodology is limited in relying on subjective judgments and simplified interdependencies confined into a table format.

### **Time constraints (Studies I–IV)**

The research team collected the data in 2019–2020 for Studies I–III; and 2020 for Study IV. The observations in these studies may already be partly outdated, given the fast-evolving nature of social media, digital communication and disaster communication in general, especially after the COVID-19 pandemic between 2019–2023. This means that platform shifts (e.g., Twitter’s change to X or the mainstream adoption of TikTok), or the spread of AI-generated (false) information are not captured in the dataset.

## 4. RESULTS

### 4.1. How do European disaster risk reduction institutions conceptualise and handle false information

The answer for thesis' first research question came from **Study I**. The key findings were that official definitions for false information existed in none of the studied countries and the approaches to handling false information varies considerably among countries, ranging from institutionalised, centralised management of false information to decentralised guidelines and a hands-on approach emphasising individual officials' responsibility.

#### Conceptualisations of false information

While none of the studied institutions have formally defined false information, in most countries (Germany, Italy, Sweden, Finland, Norway and Estonia), related terms (e.g., misinformation, disinformation, misleading content, etc) appeared either mentioned in documents or were used informally by disaster managers. The absence of formal definitions could indicate that disaster communication experts' knowledge and available guidance has been sufficient for practical needs. This is supported by the fact that much of the discourse on false information in our data derives specifically from guideline documents and is backed with interviews.

Terminology revolves around two sub-terms of false information: misinformation, that is false, but not created with the intention of causing harm (such as false connections, or misleading content); and disinformation, which is false and deliberately created to harm a person, social group, organisation or country (such as false context, imposter content, manipulated content, or fabricated content). The term "misinformation" is prevalent in the discourse. However, it is often used in both meanings, lacking consistent differentiation in language or context. False information spread is often attributed the lack of information, but also on the lack of trust in public institutions. Overall, the understanding of false information is rather biased towards the malcontent part of it, i.e. disinformation.

#### Approaches to handling false information

We found that responding to false information is organised relatively loosely in Germany, Italy, Hungary, Norway, Finland, and Estonia and more strictly in Belgium and Sweden. It appears that countries with decentralised emergency management (Germany, Norway, Finland, Estonia) also have a decentralised system for responding to false information. Formal guidelines or regulations for dealing with challenges of false information in the context of disaster management exist in Sweden, Norway, Estonia and Finland.

The first aspect of handling is the level of organisation in tackling false information. Italy, Belgium, and Sweden have specific agencies either dedicated

to, or with clear responsibility for, countering false information. Somewhat more decentralised (i.e., using the help of benevolent groups, NGOs, citizen initiatives, on-call volunteers, etc) information response systems can be found in Germany, Italy (in addition to specific agencies), Hungary, and Norway.

The second main difference among the studied countries was the emphasis on spreading truthful information. When examining Finland and Estonia we find an emphasis on spreading truthful information rather than directly tackling false information via specific agencies. In these decentralised systems, each emergency management institution and vital service provider (e.g., water and electricity companies) is responsible for their own communication.

Third, semi-official groups participate in countering false information in Germany, Italy, Finland, and Estonia. With varying intensity and roles between countries, online communities counter false information campaigns, do fact-checking, and unmask hoaxes; non-profit organisations, independent editorial boards and impartial journalistic initiatives use social media for collecting and distributing factual information, which highlights the role of good journalism in tackling disinformation and improving citizens' media literacy.

Fourth, false information is also being handled with campaigns to enhance awareness. Italy, Belgium, Sweden, Norway, Finland, and Estonia have carried out campaigns for informing the public about the dangers of false information. Existing campaigns have either been addressed to the youth (e.g., Italy, Finland, Norway) or just to unspecified "public" (e.g., Italy, Belgium, Sweden, Finland, Norway, Estonia). However, only a few of them have focused on false information in emergency situations (e.g., Italy, Estonia). In Germany, there are no campaigns on false information threats in crisis situations. Likewise, Hungarian institutions tasked with crisis management have put an emphasis on crisis communication rather than on preparedness campaigns.

Fifth, to gather experiences with handling false information we examined various disasters that have affected European communities (see chapter 3.1). Official institutions reacted to false information, in some way, in almost all crisis cases. However, we found that the diffusion of false information was commonly caused by the inability of the authorities to gather and share verified information widely and in time. The studied cases indicate that the vastness of the operations that need to be coordinated to restore normal services may halt the normal information circulation and give room for the spread of rumours and false information. False information also spread due to the institutionalised, habitual information behaviour by officials, which was not reflexive to the situation at hand (for example, in the interruption of vital services in Estonia, and in the Finnish drinking water contamination case). Underestimating threats (e.g., the Italian earthquake case) may later cause harm due to growing distrust in official sources. The duration and foreknowledge of the hazardous event also played a significant effect in the spread of false information. In some cases (e.g., German floods) predictability about the event left less room for the emergence of false information and this might have led to less casualties.

## **4.2. How is social media communication arranged in European disaster risk reduction institutions**

The answer for the second research question came from **Study II**. The key findings were that emergency management institutions' social media usage is rarely centrally controlled and social media crisis communication was regulated with the same guidelines as crisis communication on traditional media. This might imply that for some countries (i.e., Estonia, Finland, Sweden, Norway, Belgium, and Italy) social media has either been seamlessly integrated to the countries' emergency management crisis communication systems, and thus separate regulations are not needed. However, this finding might suggest that for other countries (i.e., Germany and Hungary) both fast-changing social media trends and experimentation shapes *ad hoc* and widely varying approaches that do not lend themselves to strong guidelines.

### **Centralisation of social media communication**

Countries like Estonia, Finland and Norway have a decentralised emergency management system in which communication specialists/teams at each institution responsible for the management of a particular type of crisis are tasked with crisis communication (also in social media) in their field. This means that the choice of media is up to the institution as long as it serves the aim of reaching varied publics.

Whereas Sweden, Italy, and Hungary all have specialised institutions who manage institutional crisis communication in social media, but only in Sweden and Italy are social media communications with citizens organised at the local, regional, and national levels. In some countries, such as Italy, while each institution (national or regional) is responsible for its own social media management, it's also controlled at the central level (directly by the Civil Protection Department) and at the regional level (by the Regional Civil Protections). In Hungary however, a special institution called the Governmental Information Centre centrally coordinates the communication policy of the National Directorate General for Disaster Management (NDGDM).

Even though Belgium has a centralised emergency management system, social media usage varies based on the responsible institution. Germany has implemented a somewhat similar hybrid solution. Emergency management and crisis communication are decentralised and federal in Germany. However, Virtual Operations Support Teams centrally monitor and respond to emergencies in social media from a national level. Additionally, German crisis communication intensity via social media varies between different types of institutions (aid organisation, public agency, emergency management authority) as well as regions (due to the federal system).

## **Guidelines for social media communication**

There are no separate guidelines for using social media in crisis situations, neither national regulations or policies including specific requirements for social media communication. At most, we identified some rules for using social media within broader guidelines that address crisis and risk communication in a general sense.

In Estonia and Finland, any employee of a given institution can represent their establishment within their own competence, although they ought to be familiar with the communication practices of citizens, the media and stakeholders to consider their information needs. In Norway, social media guidelines are a part of DSB's (the Norwegian Directorate for Civil Protection) guidance on crisis communication and most government agencies in Sweden have guidelines that include communication in social media. Each Italian civil protection related institution had to build their own policy and publish it on their social account/profile in 2015, whereas the Italian Civil Protection Department must follow a dedicated social media policy document. Although the German Federal Office for Civil Protection and Disaster Assistance has formulated guidelines on how to deal with unaffiliated volunteers on social media, Germany and neither Hungary have no guidelines or regulations for emergency managers' use of social media.

### **4.3. How do European disaster risk reduction institutions use social media to mitigate communication-related vulnerabilities**

The answer for the third research question came from **Study III**. We identified six distinct institutional social media practices that may reduce disaster vulnerability: sharing educational guidelines, informing and warning the public, identifying citizens' concerns, identifying missing persons, sharing guidelines during disaster, and organising volunteers.

#### **Sharing educational guidelines**

A common practice of using social media for mitigating disaster vulnerability is the sharing of educational guidelines (e.g., safety instructions, preparedness advice, or explanations of how to act in specific hazards). Without sufficient knowledge regarding preparation, people might not understand the guidance they receive during disasters and fail to react adequately to protect themselves from hazards. Uses of social media for prevention feature in the case studies of Italy, Finland, and Norway. Only Germany, Belgium, and Finland have explicitly noted education in their official strategies. Similarly, we find strategies toward preparedness and prevention in Belgium, Italy, Sweden, Hungary, and Norway. All use social media for either disaster or civic preparedness.

## **Informing and warning the public**

By far the most common usage of social media for risk and crisis communication is informing and warning the public. Regularly informing people helps to build a habit of information retrieval, thus encouraging access to relevant information channels during disasters. Furthermore, using warning messages in social media contributes to situational awareness and can help people react adequately to protect themselves from hazards. Generally, all countries issue some type of alerts. Our research in Germany, Belgium, Sweden, Norway, and Estonia revealed policies of informing and communicating with the public. In Italy, Hungary, and Finland, approaches are more specific – real-time responses, alerts about accidents, hazards and weather warnings.

## **Identifying citizens' concerns**

Identifying citizens' concerns helps disaster managers to identify the context of vulnerability and then send people relevant information or resources to mitigate this vulnerability. This obligation is pointed out in Finnish and Estonian documents, which tell that the institutions' communication teams are (among other communication tasks) obligated to monitor social media and consider citizen practices and information needs. Norwegian and Swedish documents and interviews contained no mention of using social media for monitoring or identifying vulnerable. Germany and Belgium use professional volunteers, also known as Virtual Operations Support Teams, to search for new information, validate information, and support social media communication during disasters.

## **Identifying missing persons**

During disasters, people may go missing (e.g., trapped earthquake or flood victims) and lose contact with others. Social media posts and discussions can be monitored for position or discourse data to help locate missing persons or identify who is missing. For instance, disaster managers in Hungary have used position data from social media to locate people during a major snowstorm and Italians searched social media groups to find out if there were any earthquake survivors under the ruins.

## **Sharing guidelines during disaster**

Besides issuing warnings, social media can be used to share behavioural guidelines during an ongoing disaster response. Greater knowledge about the changing circumstances of a disaster helps people make informed decisions about their subsequent actions. We found dissemination of guidance materials in Sweden, Hungary, and Finland – correcting word-of-mouth rumours, sharing guidelines on surviving in traffic jams in a snowstorm, and advice on dealing with contaminated drinking water. Although the German civil protection authority (BBK) uses a dedicated warning app to share basic advice during extreme events, we

found no examples of effective use. Similarly, no clear guidelines were shared in the Italian, Belgian, or Norwegian cases.

### **Organising volunteers**

Another noteworthy crisis communication practice from our case studies was publishing tasks for spontaneous volunteers who could help people during crises. The Finnish National Rescue Association (SPEK) uses social media for advocating volunteer action, Germany firefighters organise volunteers on Twitter and Facebook, the Hungarian General for Disaster Management recruits volunteers for rescue efforts, National Volunteer Council and various non-profit organisations publish tasks for spontaneous volunteers on their website, social media sites, and a crisis app. It became evident, however, that, some volunteers could accidentally be guided to wrong places (as was the case in Germany during the Elbe floods).

#### **4.4. How can table-top exercises be used to identify communication-related vulnerabilities to disasters**

The answer for the fourth research question came from **Study IV**. Using a table-top exercise conducted in Estonia, we systematically mapped out the barriers to accessing, understanding, and reacting to crisis messages as sources of vulnerability. The following insights are based on the discussions, observations, and reflections of the 25 practitioners who participated in the table-top exercise.

##### **Barriers to accessing crisis information**

In a scenario involving difficult weather conditions, prolonged power outage, and proliferating false information, exercise participants brought out three broad kinds of barriers to accessing crisis information that could make people more vulnerable. First, emergency managers may have no access to data about potentially affected people. Some databases that would help to map and identify vulnerable individuals, can be accessible for local use only during state-declared emergencies. For instance, feasible solutions for cross-referencing power outage data with other databases for checking overlapping and accumulation of multiple vulnerability factors is currently not possible. Furthermore, without electricity, the electronic databases are rendered useless. Thus, responsible institutions cannot identify and contact the vulnerable.

Second, no pre-existing communication arrangements are in place to warn or guide the affected populations. When no informant networks with clear points of contacts have been arranged or coordinated, during infrastructure failures, lack of alternative communication strategies may hinder informing stakeholders of the local conditions – extend the time to reach individuals in vulnerable situations

(e.g., by involving third parties and/or other bureaucratic time-consuming procedures), or hamper correcting false information when conventional means of communication are cut off.

Third, people might have no access to official warnings and behavioural guidelines due to their communication habits and capacities. People overly dependent on social media, or people with chronic illnesses or disabilities might find it hard to use other channels beside electronic communication and may face barriers in accessing critical and vital information. People in home-care, individuals hospitalised, might be reliant on social workers to access relevant crisis information. People in care homes, closed institutions such as prisons, cannot access information freely, or children in kindergartens and schools are also dependent on staff efficiency, to receive timely updates. Additionally, low trust towards government sources could lead people to access unverified alternatives. However, the habit of trusting a source could also become a vulnerability itself, when the source is compromised.

### **Barriers to understanding crisis information**

Language barriers may amplify existing vulnerabilities when individuals who are unable to understand the local language find it difficult to interpret crisis-related information. Some highlighted groups language-wise are international students, tourists, and foreign workers, but also in terms of capacity children in kindergartens and schools who may find it hard to interpret written text, and individuals with mental impairments who might need simple visuals instead of text. At the same time, channelling information through intermediaries might be time-consuming and risks delay and distortion. On the other hand, an overwhelming influx of new directives during an emergency might make it harder to discern the latest directives.

Exposure to false information can negatively affect how people understand emergency information. People dependent on social workers or individuals with mental challenges such as anxiety could be especially vulnerable to false information due to limited information environment or capacities to interpret crisis communication. Additionally, vague public messages about proliferating false information could also lead to a wider distrust towards credible sources, which in a chaotic information environment could be amplified by low digital or media literacy.

### **Barriers to reacting to crisis information**

Limited local resources and limited capacity to take protective action are two key barriers to reacting adequately to official warnings and instructions. The lack of crisis management specialists and limited local administration resources limits availability of local expertise in identifying the vulnerable during emergencies. Lingering situation increases people's dissatisfaction and might lead to hasty or impulsive decision-making, impeding emergency management. Some groups

who might lack capacities to react or could potentially overreact to the information are individuals with mental health challenges and limited language skills (i.e., ability to interpret information), or farmers with livestock who could disregard risks (e.g., postpone evacuation or ignore instructions to safeguard their animals).

## 5. DISCUSSION

In this chapter I will argue for the necessity and feasibility of addressing communication-related vulnerabilities (see Hansson et al., 2020) in disaster management before, during and after disasters. I also outline theoretical perspectives for vulnerability, resilience and disaster communication alongside practical implications for policy-makers and practitioners. The discussion is structured around my four main theses (chapters 5.1 to 5.4) which correspond with Studies I–IV: 1) Disaster management institutions' approaches to tackling false information vary in duty and responsibility, 2) Social media communication is regulated within traditional disaster communication guidelines, 3) Disaster management institutions use social media in six distinctive ways to mitigate communication-related vulnerabilities, and 4) Table-top exercises help to identify potential barriers to disaster communication.

### 5.1. Disaster management institutions' approaches to tackling false information vary in duty and responsibility

**Study I** revealed that official definitions for false information existed in none of the studied countries, that may signify that crisis communication experts possess sufficient knowledge and existing official guidance related to the subject. In Sweden, Finland, Norway, and Estonia, false information is frequently linked to malicious foreign influence, though the degree to which each country acknowledges and addresses this threat varies considerably. Though all studied country cases showed some use of proactive measures (e.g., awareness campaigns or social media monitoring), not all disaster risk reduction institutions engage consistently. For effective and coordinated communication response this is problematic. While some institutions perceive false information as an acute hazard, those that view it as peripheral may respond late, relying on *ad hoc* corrections, thus amplifying vulnerability.

The country case studies showed that false information spreads primarily when official information is delayed or incomplete. This showcases how approaches shape vulnerabilities – a proactive approach, involving continual monitoring and swift correction, can limit the spread of false information; by contrast, *ad hoc* response leaves false information time to proliferate (see Allcott et al., 2019) before discovery and elimination. The country case studies demonstrated that social media is also the primary channel for disseminating false information. Consequently, these variations in approaches can be attributed to the varying levels of adopting social media tools altogether (Jurgens & Helsloot, 2018). This insight highlights the institutions' capacity as one of the important social-structural communication-related vulnerability factors (Hansson et al., 2020) aligning with the Sendai Framework's call to coordinate institutional responsibilities clearly (United Nations, 2015).

Media literacy training rooted in all levels of education (i.e., the Finnish example) offers a productive strategy for reducing disaster vulnerabilities related to false information. Vulnerability to false information is higher among people who use fewer news sources (see Dutton & Fernandez, 2019) and distrust toward official sources exacerbates this risk (Drakos et al., 2019; Siegrist et al., 2021). Efforts in building and maintaining trust between institutions and the public may discourage people's reliance on alternative unconfirmed sources.

Though our findings imply the need for consistent international (or European) guidelines for tackling false information in disaster management, the question whether pan-European campaigns would complement or contradict the diversity of national level responses remains unexplored. Future risk and disaster researchers could cross-analyse the relations of European risk cultures and approaches to tackling false information (e.g., Cornia et al., 2016).

## **5.2. Social media communication is regulated within traditional disaster communication guidelines**

Echoing **Study I** implications for coordinating institutional responsibilities more clearly, **Study II** revealed that social media use in European disaster risk reduction institutions is addressed within the guidelines for traditional media communication, although digitally networked age calls for more adaptive strategies (Daume, 2024; Reuter, 2022). Our analysis shows that mentions of social media use in these guidelines coincide with decentralised emergency management systems, as is the case in Italy, Sweden, Finland, Norway, and Estonia (Bossong and Hegemann, 2013). Meanwhile, centralised systems like Belgium and Hungary maintain specialised agencies for social media communication but lack detailed guidelines.

It appears that guidelines in decentralised systems tend to compensate for less central oversight. But the relative paucity of social media policy guidelines found in our study seems to indicate that social media's rapid evolution has been outpacing governments' regulatory capacity (Beaumier et al., 2020) leading governments to decentralise. Italy, Sweden, Finland, Norway, and Estonia have developed mixed systems to address disasters case-by-case. A combined approach may be optimal (Coombs, 2023; Mazereeuw & Yarina, 2017), particularly in multi-actor emergencies, as it balances rapid decision-making with the flexibility to adapt to local conditions (Christensen, Danielsen, et al., 2016; Christensen, Laegreid, et al., 2016; Orru et al., 2022).

With increasingly complex transboundary, multi-level and/or multi-actor emergencies and omnipresent internet, clear and understandable guidelines are becoming more important across countries increasingly required to work together, as in the European Union (European Commission, 2025b). However, overregulation could backfire – overly prescriptive and detailed guidelines risk ignoring emergency managers' actual experience, overlook local context and knowledge, and prevent the use of innovative solutions. Ideally, social media

guidelines are an official capacity that could support disaster risk reduction institutions (see Hansson et al., 2020; Orru et al., 2022) in systematically identifying vulnerable individuals, reaching out to particular vulnerable groups with adapted information and supporting their abilities to respond to disasters (see specific practices in **Study III**).

### **5.3. Disaster management institutions use social media in six distinctive ways to mitigate communication-related vulnerabilities**

In **Study III**, I looked at how the European disaster managers' official communication practices on social media can address people's barriers to communication and mitigate disaster vulnerability. Six practices emerged from our case studies: sharing educational guidelines, informing and warning the public, identifying citizens' concerns, identifying missing persons, sharing guidelines during disaster, and organising volunteers.

While these six practices appear promising, their implementation is inconsistent, pointing to a gap between recognised "best practices" (e.g., Alexander, 2014; Houston et al., 2015) and context-specific feasibility (see Orru et al., 2022). Evidently, to mitigate harm arising from factors such as poverty, disabilities, inequality, or limited language proficiency, risk and crisis communicators cannot rely on social media alone (Dargin et al., 2021; Vassilakopoulou & Hustad, 2023). Problems with accessing, understanding, or reacting to information (see Hansson et al. 2020) differ across disaster contexts, meaning that a single practice rarely addresses all three equally. This importance of flexible strategies resonates with findings from **Study II**.

For example, sharing guidelines via social media both prior to and during disasters improves access to and understanding of relevant disaster information (e.g., the disaster and civic preparedness campaigns in Belgium, Italy, Sweden, Hungary, and Norway) but only for those who actually (can) use social media at the time. In a similar vein, timely online alerts in Belgium, Italy, Sweden, Hungary, and Norway improve outreach, but exclude people who cannot go online or face disruption (e.g., the long-term power outage in Estonia). Real-time alerts improve access to timely relevant information and can trigger fast reaction, but the same amplification logic also applies to unverified or possibly harmful information (Kumar & Shah, 2018; Vosoughi et al., 2018). Thus, while reach has improved, the understanding phase could still suffer from information disorder and overload (Bontcheva et al., 2013).

A unique advantage of social media over traditional channels is the rich metadata (e.g., geotags, timestamps, user networks). For instance, Hungary geolocated tweets during the 2013 blizzard and Italy searched Facebook for identifying missing persons after L'Aquila earthquake. This showcases social media's hidden access data (location clues) to life saving reaction (dispatching rescuers), but

because its outputs stay within responder circles, it offers little to public understanding. Moreover, social media scraping is becoming increasingly difficult due to algorithmic filters (Spohr, 2017) and limited data access (Trezza, 2023), while new solutions require extensive expertise (Singla & Agrawal, 2022).

Although in limited capacity, Finnish and Estonian communication teams identify citizens' concerns monitoring information gaps, misconceptions and evolving needs in social media. Perhaps the most peculiar, but also effective way of acquiring social media expertise is organising and using volunteers, for instance the German or Belgian VOST (*Virtual Operations Support Team*) volunteers. Besides bringing technical expertise they can help cover more minority languages, improving access to the help that follows, but also deepen understanding through peer explanations and translations (e.g., for the Swedish asylum seekers in 2015).

Sharing educational guidelines like multimodal tutorials, quizzes, or infographics (e.g., in Italy, Finland, or Norway) boosts understanding before a hazard strikes. Sharing guidelines during disaster improve understanding and steer reaction, yet their effectiveness hinges on continuing connectivity. Disseminating formal and rigid guidelines that do not fit the disaster at hand could lead to adverse effects (like in the case of Utøya in Norway in 2011 when young people were encouraged by a generic Police message on Twitter and came out of hiding too soon). To improve individuals' capacity to process vital alerts and instructions during disasters, sharing educational guidelines could focus on improving people's skills (i.e., applied knowledge) to protect themselves from hazards before and during disasters.

Across all six practices, our findings echo that social media communication must be adaptive, multi-lingual, and reflexive to keep up with dynamic disaster vulnerability (Hansson et al., 2020; Orru et al., 2022). Institutional social media guidelines (as seen in **Study II**) would help to build the capacity of disaster risk reduction institutions to interact with and meet the needs of various groups.

#### **5.4. Table-top exercises help to identify potential barriers to disaster communication**

To highlight institutions' capacity gaps, I and my co-authors turned to disaster simulations. **Study IV** demonstrated how scenario-based simulation exercises can be used as part of vulnerability assessment to systematically identify communication barriers (Krüger, 2019; Orru et al., 2023; Tran et al., 2020). Importantly, the exercise format can also help stakeholders better understand their institutional capacity gaps and take steps to address these vulnerabilities.

Participant experiences in **Study IV** highlighted that communication failures are often rooted in institutional capacity gaps – for example, problems with accessing databases about vulnerable groups, and lack of pre-existing communication arrangements. Therefore, each seemingly inadequate response to disaster

communication might not be a problem of communication effectiveness but rather a sign of disconnect between the message and the needs of society.

When electricity and communication was disrupted, participants pointed out that, in some cases, databases that would help to identify the most vulnerable people, were legally inaccessible until a state of emergency was declared. Without an alternative plan (e.g., pre-arranged informants) institutions had no way to pinpoint or warn people who rely on caregivers, assistive devices, or a single social-media feed. This demonstrated that vulnerability is as much a data-governance issue as a technological one (Orru et al., 2022).

Moreover, the participants (and thus their respective institutions) lacked clear rules for dealing with information disorders. The participants hesitated to directly tackle the false information in the scenario, noting that vague messages about circulating false information could erode public trust faster than the rumours themselves. Additionally, understaffed local governments with few to no disaster risk reduction specialists were unable to manage last-mile efforts to reach, inform and help the vulnerable (i.e., no alternatives once the power is out). This aligned both with the results of **Study I** and **Study II**, showing that clear guidelines, but also a clear understanding of false information harms are a necessary institutional capacity.

These findings reveal that table-top exercises can be used to uncover communication-related vulnerabilities. Besides that, the exercise highlights that communication strategies (such as in **Study III**) cannot compensate the institutional systems that enable them. Bridging the last-mile to vulnerable groups therefore demands more than just refining communication practices and content.

## 5.5. Theoretical and practical significance

My research revolved around the idea that problems with communication could make people more vulnerable in disasters. In terms of disaster risk reduction this touches primarily upon risk and crisis communication practices, but is not limited to those, as communication happens also out of the bounds of intentional (official) risk and crisis communication. For analysing the vulnerabilities that are related to communication systematically, I relied on the heuristic framework created by Hansson et al. (2020) which states that people could become vulnerable in three distinct phases of communication – accessing information, understanding that information, and reacting based on that information. Instead of disaster phases (i.e., preparedness-response-recovery-mitigation) it follows the information-processing flow that a person moves through while communicating. Because this flow can break at any step, and at any time before, during, or after a disaster, the framework provided an analytical lens that is independent of disaster phases. The framework also proposes that the vulnerabilities that could arise in those phases are stemmed in three distinct categories – individual (such as knowledge and skills), social-structural (such as institutional support for the individual), and situational factors (such as broken infrastructure, nature of the disaster, etc) – an

idea originally stemmed in previous sociological research on intersecting vulnerabilities (see Tierney, 2019).

My work started with looking for disaster managers' definitions of false information and strategies to tackle it in **Study I** – it turned out they did not have any. To effectively tackle anything, one would have to know how to delimit the phenomenon, this is why definitions become important. European disaster managers do not rely on a systematic understanding of the false information phenomena, but instead rely on past communication experiences. But the employee experience is a fluid resource, it could leave with the employee, leaving institution vulnerable (e.g., Fontanella Pisa, 2024). Institutional experience (guidelines, arrangements, etc), on the other hand does not leave with the employee, which brought me to research institutional arrangements in **Study II**.

Arrangements and guidelines for countering different forms of false information are useful depending on the type of disaster management system – central, decentral and hybrid. My analysis revealed that there are no systematic arrangements and guidelines for tackling false information in disasters, let alone in social media which is considered as an important medium for false information (e.g., Allcott et al., 2019). This result shows that most practices are therefore derived from personal experience and not institutional memory, and this creates a vulnerability for both the institutions and eventually the population who are relying on the professional capacity of the institutions. In the European context clear guideline material could be created and implemented by the EU institutions (e.g., European Commission, s.d.b).

When analysing disaster communication guidelines in **Study II**, it became evident that disaster risk reduction institutions have not considered social media as something different from traditional communication (i.e., news media and communication on TV, radio, or newspapers), and thus have not systematically planned its use. Uses of social media could however be plenty, which brought me to researching the practices of mitigating communication-related vulnerabilities with social media in **Study III**.

It became apparent that there's a large gap between theory and reality. While theoretical studies (Alexander, 2014; Houston et al., 2015; Imran et al., 2015) have described numerous (10–20) slightly distinct practices of using social media in disaster risk reduction, my analysis revealed only six communication practices that have the capacity to mitigate disaster vulnerability in social media. This shows that social media is underused by disaster management practitioners. Implementing clear and concise guidelines for the numerous possibilities of social media would improve systematic preparedness (as outlined in **Study II**).

Guideline documents (**Study II**) and communication practices (**Study III**) alone do not constitute institutional capacity to tackle disaster vulnerability. The table-top exercise in **Study IV** helped to uncover further institutional shortcomings in identifying and mitigating vulnerabilities. Curiously, though unsurprisingly participant-stakeholders focus largely on vulnerability stemming from social support structures and institutional capabilities. This theory-based practical simulation showed that table-top exercises could be used in academic

research. In general, more research is needed to test and develop the table-top exercise design.

This thesis is addressed to three audiences, who each could find some take-aways from here – practitioners, researchers, and policy-makers. The **practitioners**, risk and crisis communication specialists, or just communication specialists, who are responsible for institutional communication during crises, could take upon themselves the creation of clear and concise guidelines documents (**Study III**) that would have clear distinctions of the different forms of false information with their tackling strategies (**Study I**) and a research-based strategy for social media communication for risk and crisis communication (**Study II**). Based on those guideline documents, the practitioners could regularly test their institutional experience and carry out table-top training sessions to test their preparedness gaps (**Study IV**).

The **researchers** have the capacity to carry on, confirm or contradict the findings of this thesis, to inform further policy-making. Building on **Study I**, future comparative research could examine how national risk cultures (e.g., Cornia et al., 2016) affect the proactivity or passivity of disaster communication. This would contribute to our understanding of institutional responsibility as a socio-structural component of vulnerability (see Hansson et al., 2020). **Study II** would inform further research how decentralised and centralised systems (e.g., in Bossong & Hegemann, 2013) adapt differently to the regulatory lag associated with quick technological change (see Beaumier et al., 2020). This would open space for extending theories of institutional adaptability and hybrid disaster governance (e.g., Christensen, Danielsen, et al., 2016; Christensen, Laegreid, et al., 2016; Coombs, 2023). This thesis, however, implies not only on disaster risk reduction research but also on parallel research on institutional or societal trust, governance, and resilience. For example, understanding how institutions navigate communication challenges in the digital age is also relevant for policy domains such as public health, environmental governance, or education.

Building on **Study III**, researchers could further assess how each of the six practices works under constraints such as information overload (e.g., Bawden & Robinson, 2020), algorithmic filtering (e.g., Spohr, 2017), digital exclusion (e.g., Dargin et al., 2021; Vassilakopoulou & Hustad, 2023), or contextual factors such as various information seeking repertoires (Johansson et al., 2024). In light of **Study IV**, simulation studies could be further integrated into social science disaster research (e.g., Orru et al., 2023). This would help scholars simulate difficult scenarios, and at the same time systematically gather data about institutional capacities, information disorder and disaster vulnerability.

Most implications, however, from this work concern regional, national, and EU level **policy-makers** who are uniquely positioned to initiate the bureaucratic procedures needed to standardise risk and crisis communication guidelines for mitigating communication-related vulnerabilities (**Study III**). This aligns with the goals of the Sendai Framework and EU Civil Protection Mechanism, which call for stronger institutional coordination and communication strategies (European Commission, 2025a; United Nations, 2015). Informed by this thesis, national

governments and EU-level policy-makers could also support the development of training programmes (such as in **Study IV**) that would strengthen institutional capacity to withstand information disorder; and the creation of centres of excellence that would inform risk and crisis communication policies over time. Additionally, the constantly changing media landscape requires constant revising of definitions and scientifically proven tackling strategies (implied in **Study I**) – an area where EU level cooperation could reduce fragmentation. All in all, policy makers hold the capacity to influence the most, from enabling policies, implementing findings in legislation or other official documents, and even organising exercises for research and training.

Finally, while institutions strive to prepare for disasters, complete control or foresight is rarely possible. This shows the importance of managing expectations and communicating openly about uncertainties. At the same time, to protect life, health and property in disasters, people should be encouraged to take precautionary measures individually.

## CONCLUSION

In this thesis I addressed four research questions concerning how European disaster risk reduction institutions conceptualise and handle false information, how they have arranged social media communication in disasters, how they use social media to mitigate communication-related vulnerabilities in disasters, and how can table-top exercises be used to identify communication-related vulnerabilities to disasters.

Regarding the first research question on how national institutions conceptualise and handle false information, we see that definitions for false information existed in none of the studied countries. The absence of formal definitions could indicate that disaster communication experts' knowledge and available guidance has been sufficient for practical needs. This is supported by the fact that much of the discourse on false information in our data derives specifically from guideline documents and is backed with interviews (**Study I**).

The second research question focused on social media communication arrangements within European disaster risk reduction institutions. I found that in spite of a strong degree of regulation in some countries, the general use and choice of social media tools in emergency management is not centralised, and social media crisis communication is predominantly regulated with the guidelines for crisis communication on traditional media (**Study II**).

Addressing the third question, I found six practices that contribute to mitigating communication-related vulnerability to disasters: sharing educational guidelines, informing and warning the public, identifying citizens' concerns, identifying missing persons, sharing guidelines during disasters, and organising volunteers (**Study III**).

Finally, regarding the use of table-top exercises, I found that the proposed simulation exercise format helps to foresee potential barriers to accessing crisis information and uncover capacity gaps within the authorities responsible for communication management during a disaster. (**Study IV**).

With this thesis I show that institutional communication can mitigate disaster vulnerability if it is adaptive, grounded both in practice and research. I point out that **communication-related vulnerability is not just a messaging problem, but rather a structural issue** that can be mitigated with flexible guidelines, but also with systematic research. In this regard I have demonstrated how scenario-based simulations can be used not just for training but for systematically identifying institutional communication gaps and aligning strategies with real information needs.

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## SUMMARY IN ESTONIAN

### **Euroopa kriisihaldajate praktikad kommunikatsiooniga seotud haavatavuse leevendamisel hädaolukordades**

Kommunikatsiooniprobleemid võivad muuta inimesed hädaolukordades haavatavamaks. Kriisihalduse kontekstis tähendab see, et puuduliku riski- ja kriisikommunikatsiooni tõttu on inimestel keerulisem langetada otsuseid ja toime tulla ohtudega enda elule, tervisele või varale. Samas ei pruugi haavatavus lähtuda ainult kriisihaldajate tegevus(etus)est, vaid kommunikatsioon toimub ka väljaspool ametlikku (teadlikult planeeritud) riski- ja kriisikommunikatsiooni. Selleks, et kommunikatsiooniga seotud haavatavusi süsteemselt analüüsida, toetusin Hanssoni jt (2020) loodud heuristilisele raamistikule, mille kohaselt võivad inimesed muutuda haavatavaks mitmesuguste tõrgete tõttu kommunikatsiooni kolmes etapis – info kättesaamisel, selle mõistmisel ja infole reageerimisel. Raamistik eristab ka kolme haavatavuse allikat: individuaalsed (nt teadmiste ja oskuste puudumine), sotsiaalstruktuurilised (nt institutsionaalse toe puudumine) ning situatiivsed tegurid (nt katkine infotaristu). See käsitlus põhineb sotsiaalse haavatavuse teorial (Tierney, 2019).

### **Uurimisküsimused ja meetodid**

Minu doktoritöö koosneb neljast empiirilisest uuringust. **Uuringutes 1** („Handling false information in emergency management“), **2** („European emergency managers on social media“) ja **3** („Mitigating vulnerabilities with social media“) analüüsiti dokumente ja viidi läbi 95 ekspertintervjuud ajavahemikus september 2019 – veebruar 2020 kaheksas Euroopa riigis: Saksamaal, Itaalias, Belgias, Rootsis, Ungaris, Norras, Soomes ja Eestis. Andmekogumisprotokollitöötasid välja Kati Orru ja Sten Hansson, Eesti andmed kogusin mina.

Dokumendianalüüsi käigus koguti ja analüüsiti kaheksas riigis asjakohaseid õigusakte, poliitikadokumente, juhendeid ja meediakajastusi, mis puudutasid kriisihaldust ning väärinfo käsitlemist ja sotsiaalmeedia kasutamist kriisihalduses.

Ekspertintervjuud olid poolstruktureeritud küsimustikuga, igaüks kestvusega umbes 60 minutit. Intervjueeritavad olid eri tasandite kriisihaldajad ja kommunikatsiooniekspertid (nt ministeeriumid, riiklikud päästeteenistused, politsei, sotsiaalkindlustusasutused, elutähtsate teenuste pakkujad ja kriisihaldusega seotud MTÜ-d). Küsimused keskendusid hädaolukordade kontekstis leviva väärinfo mõtestamisele, sellele reageerimisele ning sotsiaalmeediakasutuse institutsionaalsele korraldusele. Lisaks palusime kirjeldada konkreetseid juhtumeid, kus sotsiaalmeediat kasutati kommunikatsiooniga seotud haavatavuste leevendamiseks. Intervjuudes käsitletud juhtumid hõlmasid nii looduslike põhjustega kui inimtegevusest tingitud hädaolukordi: nt maavärin Itaalias (2009), terrorirünnakud Norras (2011), lumetorm Ungaris (2013), üleujutus Saksamaal (2013), veereostus Ungaris (2013), rändekriis Rootsis (2015), terrorirünnak Brüsselis (2016), veereostus Soomes (2017) ja torm Lõuna-Eestis (2019).

**Uuringus 4** katsetasime, kuidas saab hädaolukordade simulatsiooniharjutusi kasutada kommunikatsiooniga seotud haavatavuste tuvastamiseks. Lauaõppusel osales 25 kriisijuhti ja eksperti, kes mängisid läbi eskaleeruva kriisistsenaariumi, kus info kättesaadavus oli häiritud ning levis väärinfo. Kasutasime struktureeritud SWOT-analüüsi (tugevused, nõrkused, võimalused, ohud), et hinnata osalejate arusaami ja võimelinki. Haavatavuse kaardistamiseks kasutasime selleks spetsiaalselt Kati Orru poolt välja töötatud tabelit, mis sisaldas teavet sihtrühma määratlemise, nende haavatavuse iseloomu, infoallikate, abivajaduse kiiruse ja kogukonnatoe kohta.

Doktoritöö üleselt püstitasin neli uurimisküsimust:

1. Kuidas Euroopa riikide kriisihaldajad väärinfot käsitlevad ja sellega seotud ohte maandavad?
2. Kuidas korraldavad Euroopa riikide kriisihaldajad kommunikatsiooni sotsiaalmeedias?
3. Kuidas kasutavad Euroopa riikide kriisihaldajad sotsiaalmeediat kommunikatsiooniga seotud haavatavuste leevendamiseks?
4. Kuidas on võimalik kasutada lauaõppusi kommunikatsiooniga seotud haavatavuste tuvastamiseks hädaolukordades?

## Peamised tulemused

### **Uuring 1: Väärinfo käsitus erineb riigiti**

**Uuring 1** näitas, et kriisihaldajad ei käsitle väärinfot süsteemselt. Esiteks puudus uuritud riikide dokumentatsioonis ametlik definitsioon väärinfost – kuid et midagi tõhusalt ohjata, tuleb see nähtus kõigepealt selgelt piiritleda. Teiseks lähtusid Euroopa kriisihaldajad väärinfoga seotud probleemidega tegelemisel pigem varasemast kogemusest, kuna puudusid ametlikud juhendmaterjalid. Töötajakogemus on aga voolav ressurss – see võib koos inimesega lahkuda (nt Fontanella Pisa, 2024). Institutsionaalne kogemus (tööjuhendid, ülesandekirjeldused jne) seevastu ei kao koos töötajaga. See viis mind edasi uurima kriisihaldajate töökorraldusega seotud dokumentatsiooni ja juhendeid (**Uuring 2**).

### **Uuring 2: Sotsiaalmeediakommunikatsiooni korraldatakse „vanade juhiste“ järgi**

**Uuringus 2** tuli välja, et sotsiaalmeediat ei käsitleta eraldiseisvana traditsioonilistest kanalitest (nt TV, raadio, ajalehed), mistõttu ei ole selle kasutamine eraldi süsteemselt läbi mõeldud. Sotsiaalmeedia kasutusviisid ja tehnilised võimalused arenevad kiiremini kui riikide regulatiivne suutlikkus, ning juhised selle kasutamiseks riski- ja kriisikommunikatsioonis on kas puudulikud või puuduvad sootuks. Sotsiaalmeedia tegelikke kasutusvõimalusi on aga palju, mistõttu võtsin **Uuringus 3** vaatluse alla kommunikatsiooniga seotud haavatavuste leevendamise viisid sotsiaalmeedias.

### **Uuring 3: Kuus viisi kommunikatsiooniga seotud haavatavuse leevendamiseks sotsiaalmeedias**

**Uuringus 3** selgus, et teooria ja tegelikkuse vahel on suur lõhe. Kui teoreetilised uurimused (nt Alexander, 2014; Houston jt, 2015; Imran jt, 2015) on kirjeldanud kümneid erinevaid viise sotsiaalmeedia kasutamisel hädaolukordades, tuvastasid enda analüüsis vaid kuus, mida uuritud riikides inimeste haavatavuse vähendamiseks rakendatakse. Leitud viiside rakendamine on riigiti ebaühtlane ja sõltub asutuste oskustest ja saadaolevatest vahenditest. Selge ja konkreetne juhendmaterjal aitaks seda muuta (nagu järeldati ka **Uuringus 2**). Kuus haavatavust vähendavat viisi:

- Ennetavate juhiste jagamine
- Hoiatamine ja häirete edastamine
- Inimeste murede kaardistamine
- Kadunud isikute otsimine
- Praktiliste juhiste jagamine hädaolukorra ajal
- Vabatahtlike kaasamine

### **Uuring 4: Lauaõppus aitab tuvastada kommunikatsiooniga seotud haavatavusi ja asutuste võimelüki**

Juhendmaterjal (**Uuring 2**) ja kommunikatsioonipraktikad (**Uuring 3**) iseenesest veel ei taga asutuste võimekust haavatavusi leevendada. **Uuringus 4** läbi viidud lauaõppus aitas välja tuua mitmeid puudujääke asutuste võimekuses haavatavusi tuvastada ja neid leevendada:

- Andme- ja õiguspiirangud
- Võrgustike ja koostööstruktuuride puudumine
- Spetsialistide puudus kohalikes omavalitsustes

Teooriapõhine, ent praktiline simulatsioon näitas, et lauaõppuseid saab kasutada ka akadeemilises uurimistöös. Üldiselt on siiski vaja lauaõppuse metoodikat rohkem testida ja arendada.

## **Soovitused ning laiem panus**

See väitekirj on suunatud kolmele sihtrühmale – praktikud, teadlased, poliitika-kujundajad. Hädaolukordade ennetamise ja lahendamise praktikud, sh kriisi- ja riskikommunikatsiooni spetsialistid, saavad selle abil koostada selged juhendmaterjalid (**Uuring 3**), mis sisaldavad väärinfo tüüpide ja mõju eristust, nende käsitlemise viise (**Uuring 1**) ning teaduspõhist strateegiat sotsiaalmeedia kasutamiseks (**Uuring 2**). Nende põhjal saavad kriisihaldusasutused regulaarselt harjutada ja enda võimekust hinnata (**Uuring 4**).

Teadlased saavad selle töö tulemusi edasi arendada ning selle kaudu ka kriisihalduspoliitikat kujundada. **Uuringu 1** najal võiks mõni tulevane võrdlev uurimus vaadelda, kuidas eri riikide riskikultuur (nt Cornia jt, 2016) mõjutab kriisi-





## **PUBLICATIONS**

## CURRICULUM VITAE

Name: Sten Torpan  
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### Academic work experience:

2023– Estonian Military Academy, Chair of Command and Pedagogy – research fellow  
2022– University of Tartu, Institute of Social Studies – junior researcher in crisis sociology  
2021–2023 Estonian Military Academy, Chair of Command and Pedagogy – lecturer of academic writing and communication  
2019–2022 University of Tartu, Institute of Social Studies – analyst in crisis sociology

### Education:

2019– PhD doctoral studies in *crisis sociology*, “European disaster risk reduction institutions’ practices in mitigating communication-related vulnerabilities in disasters”, University of Tartu  
2017–2019 MA, *sociology*, “Stakeholders’ views on the sustainability of the communities related to oil-shale industry”, University of Tartu  
2017 *visiting student*, “Crisis-anthropology”, University of Helsinki  
2010–2015 BA, *theology*, “The Role of Mythological Thinking in the Justification of Authoritarian Ideology”, University of Tartu

### Research:

**Torpan, S.**, Orru, K., Hansson, S., & Klaos, M. (2025). Using a table-top exercise to identify communication-related vulnerability to disasters. *International Journal of Disaster Risk Reduction*, 119, 105264.  
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- Institutional arrangements in resilience and disaster management (D2.5) – Orru K., Hansson, S., **Torpan**, S., Tammpuu, P., Rhinard, M., Gabel, F., Krüger M., Jukarainen, P., Savadori, L., Kazemekaityte, A., Frislid Meyer, S., Lovasz, G., Schiefflers, A. *BuildERS project* (2020)
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**Teaching experience:**

- 2025– *Social Science Simulations* (primary lecturer), University of Tartu
- 2025– *Information Law, Privacy and Data Protection* (co-lecturer),  
University of Tartu
- 2024– *Military and Crises Sociology* (co-lecturer), University of Tartu
- 2024– *Resilience Analysis and Practice* (co-lecturer), University of Tartu
- 2023 *Data Analysis* (co-lecturer), Estonian Military Academy
- 2022 *Psychology of communication* (co-lecturer),  
Estonian Military Academy
- 2022 *Introduction to Media and Communication* (co-lecturer),  
University of Tartu
- 2021–2023 *Introduction to Research and Academic Writing* (primary lecturer),  
Estonian Military Academy
- 2020– *Global and Local Challenges in Community Development*  
(co-lecturer), University of Tartu
- 2019– *Social Change and Intervention* (primary lecturer),  
University of Tartu
- 2019– *Analysis of Social Intervention* (co-lecturer), University of Tartu

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### **Haridus:**

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**Õppetegevus:**

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- 2025– *Infoõigus, privaatsus ja andmekaitse* (kaasõppejõud), Tartu Ülikool
- 2024– *Militaar- ja kriisisotsioloogia* (kaasõppejõud), Tartu Ülikool
- 2024– *Kerksuse analüüs ja praktika* (kaasõppejõud), Tartu Ülikool
- 2023 *Andmeanalüüs* (kaasõppejõud), Kaitseväe Akadeemia
- 2022 *Suhtlemispsühholoogia* (kaasõppejõud), Kaitseväe Akadeemia
- 2022 *Sissejuhatus meediasse ja kommunikatsiooni* (kaasõppejõud), Tartu Ülikool
- 2021–2023 *Teadustöö alused* (vastutav õppejõud), Kaitseväe Akadeemia
- 2020– *Globaalsed ja kohalikud väljakutsed kogukondade arendamisel* (kaasõppejõud), Tartu Ülikool
- 2019– *Sotsiaalne muutus ja sekkumine* (vastutav õppejõud), Tartu Ülikool
- 2019– *Sotsiaalse sekkumise analüüs* (kaasõppejõud), Tartu Ülikool

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