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***H**IGH-RELIABILITY INTERORGANIZATIONAL NETWORKS FOR CASCADING DISASTERS IN  
 THE **N**ETHERLANDS*

*AN EXPLORATION OF SIX VEILIGHEIDSREGIO'S*

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## **Preface**

I am proud to present to you my master thesis "High-Reliability Interorganizational Networks for Cascading Disasters in the Netherlands: An Exploration of Six Veiligheidsregio's". In preparation for this research, I first did an academic internship from February to April 2021 at the university under the supervision of Dr. F. Giardini. The internship was part of the research group SCIO (Sustainable Cooperation, Institutions, and Organizations) where I assisted in the research on high reliability networks and cascading disasters. This thesis is a continuation of that internship and was written as part of my graduation from the Master's program in Sociology of the Network Society at the University of Groningen. The research was conducted at six different veiligheidsregio's in the Netherlands.

Together with my supervisor Dr. F. Giardini I developed the research question dealt with in this thesis. I had to challenge myself by working on a, for me, totally new subject using a method which I have hardly used before. Therefore, I feel extremely proud finishing this thesis I learned a lot during the process.

I would also like to thank my supervisor Dr. F. Giardini for all her help. I was able to brainstorm with you and you were always there for me whenever I had questions. Moreover, with your critical eye you helped me to get the most of myself. It was a pleasure to have you as my internship supervisor as well as my thesis supervisor. *Grazie mille!* I would also like to thank my second reader Dr. M. van Gerner-Haan for her help. Especially regarding the qualitative research and her feedback. It was wonderful that you were available during the summer to brainstorm together and answer my questions. Also, I want to thank my mother for proofreading the thesis and Rob for his mental support.

Last but not least, I would like to thank my participants from the veiligheidsregio's for their participation in the study. Without their cooperation I would not have been able to complete this thesis.

I hope you enjoy reading it.

Bibian Bevers

*Leusden, 26 maart 2022*

## **Abstract**

In the future, cascading disasters will increase in frequency everywhere in the world, including in the Netherlands, which will bring new challenges for the organizations in charge of emergency management. These challenges stem from the fact that cascading disasters are very complex due to the multiplicity of different incidents, simultaneous or in close succession (Pescaroli & Alexander, 2015; Cutter, 2018). This points to the fact that disaster risk preparedness and -management require the existence of a set of interconnected emergency organizations networks to cooperate with each other and coordinate assistance in order to be high reliable and to provide effective crisis management. In the Netherlands, disaster management is an activity performed by the veiligheidsregio's (safety regions). There are 25 networks of different organizations that coordinate their activities for risk preparedness and -management. The present study investigates whether the veiligheidsregio's meet the requirements to be a High Reliability Interorganizational Network, since such a network is able to remain high reliable and continue to operate effectively, which is necessary to be able to deal with cascading disasters. Therefore, this study aims to answer the following research question: *In which way would six selected veiligheidsregio's work as High Reliability Interorganizational Networks during cascading disasters according to their policy- and crisis plans and to the perception of their employees?*

A set of qualitative research methods was used to answer the research question. The policy- and crisis documents of the six selected veiligheidsregio's were analyzed using thematic analysis. Next, six semi-structured interviews were conducted with participants working in crisis management departments. These interviews were also analyzed using thematic analysis.

The findings of this study suggest that the veiligheidsregio's are largely consistent with the theory on High Reliability Organizations and Networks and that the veiligheidsregio's are aware of the cascading disasters, in which they mainly focus on the possible chain effects. Moreover, the veiligheidsregio's hardly differ in whether or not they possess the characteristics. Since many characteristics of High Reliability Interorganizational Networks are present, it is presumed that the veiligheidsregio's that were studied can largely be resilient during cascading disasters and continue to work together effectively, which will likely enable them to provide assistance during cascading disasters. However, the veiligheidsregio's do differ in how they give shape to these characteristics. These are points for them to work on in order to fully become a High Reliability Interorganizational Network. Furthermore, the findings are consistent with previous research on High Reliability Organizations and Networks.

*Keywords: High Reliability Organization, High Reliability Network, High Reliability Interorganizational Networks, resilience, effectiveness, disaster management, emergency network, Dutch veiligheidsregio's*

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## Introduction

In the summer of 2021, the Netherlands, Germany and Belgium, and other parts of Europe were ravaged by catastrophic floods of rivers. Heavy rainfall caused rivers to burst their banks and dikes to fail, resulting in extensive material damage to infrastructure and homes, as well as many injuries and deaths. In Belgium, the assistance provided during these floods was difficult and chaotic. This was not due to incompetent emergency services or the lack of expertise, but due to the fact that coordination and cooperation between the emergency services and the various areas were difficult (Luckerhof, 2021). The lack of harmonization and coordination between the emergency services resulted in poor assistance or no help at all for some of the most severely affected people (Luckerhof, 2021). Quoting Professor Hugo Marynissen, of the Public Management at the Antwerp Management School, from the newspaper *De Volkskrant* about Belgian aid in the summer of 2021: *'We are not well organized to deal with major crises. That is the big problem in this disaster [the flood]. In principle, we have good emergency services. If there is a fire in a factory somewhere, or a house collapses, they can easily cope. But this time it was a major national disaster involving five provinces. That requires coordination. We do not have that.'* (Luckerhof, 2021). The case illustrates that coordination of emergency services is a crucial factor in combating disasters and crises. This was a single disaster, a flood, but cascading disasters (a disaster causing another disaster) require even more coordination between the various emergency services than single disasters. It is necessary because the disasters follow one another and are of different nature.

By way of comparison: the Netherlands has organized its emergency services based on *veiligheidsregio's* (Safety Regions). A *veiligheidsregio's* is an umbrella organization which coordinates the emergency services. At the same time, it ensures that the areas and the working methods of the fire brigade, the medical assistance etc. coordinate with each other. These *veiligheidsregio's* are important, because disasters will increase in frequency in the future. Global warming plays a part in this, causing more frequent weather-related disasters, such as floods, hurricanes and heat waves. Also, disasters cannot be weather related, such as terrorist attacks, pandemics or cyber-attacks. The question is no longer if a disaster will occur, but *when* it will occur (Coaffee, 2019, p. 4,11; Clingendael, 2016). However, it is not possible to predict the exact date or in which combination different disasters will occur. This fact makes it necessary to prepare for the unexpected (Coaffee, 2019, p. 5). We need to think ahead in our response to disasters and enhance our ability to cope with them. (Coaffee, 2019, p. 14).

Not only the frequency, but also the impact of disasters will probably increase, because disasters can cause cascading disasters. This is partly due to the fact that the world is becoming increasingly complex

and has larger organizations and integrated systems such as the critical infrastructure (Coaffee, 2019, p. 6, 19; UNISDR, 2017). Critical infrastructure are systems such as energy supplies, water supplies, chemical plants and transport. These systems are interrelated and do not operate in isolation, for instance water supply depends on energy supply (Coaffee, 2019, p. 95). These systems are necessary to maintain the socioeconomic functions of society (UNISDR, 2017). A possible disaster can affect this critical infrastructure, causing a possible *cascading disaster*. This happened during the eruption of the Eyjafjallajökull volcano in Iceland. The eruption itself caused relatively little damage, but the cascading effects of the eruption were massive. The volcano ash made air transportation impossible for eight days, which disrupted passenger- and cargo transport (Eurocontrol, 2010). This had an impact on individuals, businesses and institutions worldwide. As a result, things like medical resources could not be transported causing shortages and therefore threatening the lives of those in need (CBS News, 2010; Alexander, 2013; Petursdottir, Reichardt, Donovan et al., 2020).

The effects of cascading disasters cause disruption of the social and community life, economy, organizations and institutions and it stresses social systems. In addition, there are many fatalities as a result of (cascading) disasters (Cutter, 2018; Aldrich & Meyer, 2015). As Rousseau also addressed centuries ago, humans are responsible for the great social impact of disasters because society is organized in this way (De Almeida Marques, 2005; Coaffee, 2019). Humans have made themselves vulnerable to (cascading) disasters by living closely together and making themselves dependent on that critical infrastructure, material goods and property (De Almeida Marques, 2005; Coaffee, 2019). This vulnerability should be taken into account in the relief efforts.

Cascading disasters bring challenges for emergency services. It is important for these services to cooperate with each other and coordinate assistance. This is necessary because cascading disasters are complex disasters due to the multiplicity of different incidents, occurring simultaneously or in close succession (Pescaroli & Alexander, 2015; Cutter, 2018). These challenges make clear that disaster risk preparedness and management requires, by definition, the existence of a set of interconnected organizations. In the literature, these kinds of collaborating organizations are called “interorganizational networks” (Borgatti & Foster, 2003; Brass et al., 2004; Provan & Kenis, 2007). Such networks consist of at least three organizations with a common goal (Borgatti & Foster, 2003; Brass et al., 2004; Provan & Kenis, 2007). The emergency services in the Netherlands, an interorganizational network, consists of the fire brigade, GHOR (medical assistance), municipalities, control room, risk- and crisis management and other relevant (external) organizations. As an example, the fire brigade or the GHOR (medical assistance) are unable to fight a disaster on their own. The emergency services need each other in order to provide joint assistance during a disaster (Raab & Kenis, 2009; Kenis & Raab, 2020).



Much research has already been done on functioning of organizations with a high risk of errors, where a single mistake can have fatal consequences for the organization or the general public (Roberts, 1990; Sutcliffe, 2012). Therefore, these organizations focus on high levels of reliability. They try to reach this level of reliability by working with tightly coupled, interdependent units and by working with a decentralized form of authority (Berthod et al., 2017). A nuclear power plant is an example of such an organization. These kinds of organizations are called "High Reliability Organizations" (HRO). In High Reliability Organizations, the emphasis is on reliability *within the organization*. However, it is also possible to look at reliability *between organizations*, as described in the theory of High Reliability Networks (HRN). Both concepts will be further elaborated in the theoretical framework.

The emergency services can therefore be seen as a larger interconnected network, a High Reliability Interorganizational Network in which ties exist between the organizations (nodes). In the Netherlands, the public body for these interorganizational networks are the aforementioned veiligheidsregio's. This study investigates whether the veiligheidsregio's meet the requirements to be a High Reliability Interorganizational Network.

### **The context of this thesis: The veiligheidsregio's in the Netherlands**

The veiligheidsregio's are a public body of the Netherlands. There are 25 veiligheidsregio's, as can be seen on the map (figure 1). Every region is responsible for the safety in its own area, which means that they are responsible for tasks and organizations as diverse as the fire brigade, disaster- and crisis management, medical assistance (GHOR), control room, population care and public order and safety (Rijksoverheid, n.d.). In the case of a disaster or crisis all those organizations will work together, but each of them has its own tasks and responsibilities. If necessary, external parties will join, such as the defence, water-, and energy companies, police etc. Each veiligheidsregio has a board consisting of all mayors in that area. Most of the time the head of the board of a veiligheidsregio is the mayor of the biggest municipality of that area (Rijksoverheid, n.d.). The head of the veiligheidsregio, also called the chair(wo)man of the veiligheidsregio, is authorized to carry out a number of tasks and holds several powers in the event of a disaster or crisis. The chair(wo)man temporarily takes over a number of powers from the mayors in the region. This gives her/him authority over everyone involved in disaster relief and the maintenance of public order. (S)he also obtains

the supreme command in strategic decisions in the event of a disaster or crisis with more than local significance (Rijksoverheid, n.d.).



Figure 1: Map of the veiligheidsregio's in the Netherlands (Rijksoverheid, n.d.)

The board of the veiligheidsregio has various tasks and responsibilities. It prepares for disasters and crises - the preparation phase or time without a disaster or crisis is also referred to as the *cold phase* - by drawing up a risk profile and crisis plan once every four years (Rijksoverheid, n.d.; Resodihardjo, Van Genugten & Ruiter, 2018). The latter is used in this study. A risk profile identifies potentially unsafe situations that may lead to disasters or crises. This also includes an analysis which weighs up and estimates the consequences of the types of fires, disasters and crises (Rijksoverheid, n.d.). The crisis plan includes a description of the organization, their responsibilities, tasks and powers in relation to the measures and facilities that the municipalities implement for disaster response and crisis management, as well as the agreements made with

other parties involved in possible disasters and crises. The crisis plans are coordinated with crisis plans that have been drawn up for the area of neighboring veiligheidsregio's and neighboring countries (Rijksoverheid, n.d.). In addition to writing these plans, the board is also responsible for training and exercising (Rijksoverheid, n.d.). Each veiligheidsregio has a supportive office where the decisions of the board are executed. Representatives of the emergency services and municipalities are also involved. Liaisons from partner organizations are also present here. For example, the military, police, the province or a water company (Resodihardjo et al., 2018).

In the *hot phase*, i.e., when there is a disaster or crisis, the administration is responsible for crisis management. Disasters and crises may vary in nature, size and damage. The emergency services must be able to switch quickly to a multidisciplinary organization that fights the incident together (Resodihardjo et al., 2018). Depending on the degree of severity, there is local crisis management, but it is also possible for several veiligheidsregio's to work together. In order to indicate this, the veiligheidsregio's use the so-called GRIP structure (Coordinated Regional Incident Management). This structure consists of five levels: local (1 to 3), regional (4) and interregional (5). Which level is used depends on the situation (Instituut Fysieke Veiligheid, n.d.). Table 1 gives an overview of the different GRIP levels. Each 'level' also prescribes who participates in which team and where everyone should be. Each GRIP situation requires different emergency teams. This includes the regular and familiar emergency services such as the fire brigade and the police, but municipalities, the GHOR and other external parties also participate (Instituut Fysieke Veiligheid, n.d.). The main structure of disaster relief and crisis management consists of;

- A control room, is usually the place where the emergency call (112/911) of the incident is received. In case of a GRIP situation, the control room is managed by a disaster coordinator (CaCo: calamiteiten coördinator). The control room receives calls, assesses the situation and then coordinates and alerts the emergency services (Instituut Fysieke Veiligheid, n.d.).
- The incident site command CoPI (Commando Plaats Incident) directs the multidisciplinary coordination of the emergency services at the scene. The CoPI leader has officers on duty from the emergency services, an information officer and an information manager. Together with the officers, a plan of approach is formed. In some situations, more CoPI's can be present (Instituut Fysieke Veiligheid, n.d.).
- Regional operational team ROT (Regionaal Operationeel Team) is 'charged with the operational leadership, the coordination with other parties involved in the disaster or crisis and advising the municipal or regional policy team' (Instituut Fysieke Veiligheid, n.d.). The ROT has general commanders of the emergency services, an information officer and an information manager. The

Regional Operational Leader ROL (Regionaal Operationeel Leider) leads the ROT. The general commanders advise the ROL in taking tactical decisions.

- Municipal policy team GBT (Gemeentelijk BeleidsTeam) or the regional policy team RBT (Regionaal BeleidsTeam). The GBT 'supports the mayor in disaster response and crisis management and advises the mayor on administrative considerations when taking policy decisions'. The GBT includes the mayor, (chief) public prosecutor, crisis partners at the administrative level, ROL, support to the GBT and any other important officials. The GBT advises the mayor on policy areas of public order and safety. The mayor can then give orders to the operational leaders (Instituut Fysieke Veiligheid, n.d.).

When there is a (possible) disaster of more than local significance, the chairman of the veiligheidsregio can set up a Regional Policy Team (RBT) (Instituut Fysieke Veiligheid, n.d.). The RBT consists of the chair(wo)man of the veiligheidsregio, mayors of the municipalities involved, the chief public prosecutor, crisis partners on an administrative level, ROL, communication advisor RBT, information management, resource management and any other important officials. The RBT advises the chairman on the policy areas of public order and safety but the RBT is not a decision-making body. The chair(wo)man takes decisions after consulting the RBT. The chair(wo)man gives orders to the ROL for the execution of decisions taken by him/her.

GRIP does not have to be applied rigidly but can be used flexibly. For example, there may be an ROT, without a CoPI, or the mayor may be very involved, without scaling up (Cools, Van Duin & Wijkhuis, 2017). Structure and operational leadership differ per GRIP level, as does the competent authority. The higher in the GRIP scale, the higher in the hierarchy of the veiligheidsregio the operational leadership and authority is.

This is a rough explanation of the crisis structure of the veiligheidsregio. A more detailed explanation is not relevant to this study and will make it unnecessarily complicated. The aim of GRIP is to ensure that everyone knows what to do and that assistance runs smoothly (Veiligheidsregio Groningen, n.d.).

Table 1: GRIP levels and the authorized authority (Instituut Fysieke Veiligheid, n.d.).

Niveau	Operationeel crisisteam	Operationele leiding	Advisering bevoegd gezag	Bevoegd gezag
GRIP-1	CoPI	Leider CoPI	Leider CoPI	Burgemeester
GRIP-2	ROT, al dan niet met één of meerdere CoPI's	Operationeel leider	Operationeel leider	Burgemeester
GRIP-3	ROT, al dan niet met één of meerdere CoPI's	Operationeel leider	Operationeel leider en GBT	Burgemeester
GRIP-4	ROT, al dan niet met één of meerdere CoPI's	Operationeel leider	Operationeel leider en RBT	Voorzitter Vr
GRIP-5	ROT's in elke betrokken regio, naar behoefte al dan niet met één of meerdere CoPI's. De voorzitters wijzen één coördinerend ROT aan (in principe dat van de bronregio)	Door voorzitters Vr aangewezen coördinerend Operationeel Leider (in principe die van de bronregio)	Operationeel Leiders en RBT's in alle betrokken regio's, waarvan één wordt aangewezen als coördinerend Operationeel leider en één als coördinerend RBT (in principe die van de bron-regio)	Voorzitters Vr, elk voor zich. De voorzitters maken afspraken over coördinerend voorzitterschap (in principe de voorzitter uit de bronregio)

In this study, five - another one was added after the selection- veiligheidsregio's were non-randomly selected on the basis of distinctive characteristics (more about this in the methodology) due to time and capacity restrictions. The five chosen regions are Groningen, Noord-Holland Noord, Zeeland, Amsterdam-Amstelland and Zuid-Limburg. A sixth region, Limburg-Noord volunteered and was included to the study. This study will investigate whether, according to policy documents and employee's perception (expert interviews), the veiligheidsregio's are able to maintain their effectiveness, resilience and reliability during cascading disasters. Effectiveness is about positive network outcomes that cannot normally be achieved by one organization acting independently of the other organizations (Provan & Kenis, 2007). If you apply this to the veiligheidsregio's, it is about the GHOR (medical assistance), fire brigade, disaster- and crisis management, control room, population care and public order and safety and if necessary external partners (Rijksoverheid, n.d.). They need each other in achieving disaster management. This will be investigated by analyzing the policy plans of each veiligheidsregio in combination with semi-structured interviews with experts within the veiligheidsregio's.

In the report 'the state of disaster management 2016 national view' (Rijksoverheid, 2016) it is mentioned that the veiligheidsregio's foresee problems when multiple incidents occur in several veiligheidsregio's because they expect that there will be gaps in the multidisciplinary teams. It is therefore extremely important to understand whether and to what extent the veiligheidsregio's are ready to deal with cascading disasters. No research has yet combined the concepts of cascading disasters and High Reliability

Networks & Organizations and the rapidly evolving climate crisis makes this research more and more urgent (Nohrstedt, Bynander, Parker et al., 2018).

The aim of this research is to contribute to the development of the theory of High Reliability Networks by exploring how cascading disasters are framed and perceived in the six veiligheidsregio's in the Netherlands. The following research questions arises from this:

*In which way would the selected veiligheidsregio's in the Netherlands work as High Reliability Interorganizational Networks during cascading disasters according to their policy- and crisis plans and to the perception of their employees?*

In chapter two the different theories and concepts regarding high reliability and disasters will be elaborated. In chapter three the research methods used in this study will be elaborated. Also, the research, the ethics and positionality will be discussed in that chapter. In chapter five, the results of this study will be presented. And finally, in chapter six the research question will be answered. Also, limitations will be discussed and recommendations will be given in that chapter.

## Theoretical Framework

### Organizational networks

As mentioned in the introduction, each veiligheidsregio consists of various collaborating organizations that together ensure physical security in their own area. These collaborating organizations in the veiligheidsregio can be seen as an organizational network. This concept consists of several parts that must first be explained, namely the meaning of an organization, of a network and finally of an organizational network.

Firstly, an *organization* is ‘a system of coordinated action among individuals and groups whose preferences, information, interests or knowledge differ. Organization theories describe the delicate conversion of conflict into cooperation, the mobilization of resources and the coordination of effort that facilitate the joint survival of an organization and its members’ (March & Simon, 1958; Kenis & Raab, 2020).

The second concept is a *social network*. ‘A social network comprises - at least - a set of social actors, such as individuals and organizations, and a relationship among them in the form of dyadic relational ties, the tie between the social actors or absence. A network can be represented as a mathematical object known as a graph with nodes and edges.’ (Robins, 2015). A graph can visualize and represent a network, but it is not the social network. ‘The nodes represent social actors and the edges between the ties between them.’ (Robins, 2015). A social network can be used to study the structure of social entities, like the veiligheidsregio. The social network of the veiligheidsregio consists of different organizations, namely the population care, fire brigade, GHOR (medical assistance), the control room and risk- and crisis management.

The last concept, which combines the two above, is the *organizational network*. An organizational network is a social network consisting of at least three organizations with a common goal (Borgatti & Foster, 2003; Brass et al., 2004; Provan & Kenis, 2007). An organizational network is often used when several organizations are needed to achieve not only their own goal, but also a common goal. This is a collective action. In many cases this cooperation is also necessary, because the common goal cannot be achieved by a single organization, because the goal is too complex (Kenis & Raab, 2020). The organizations must join forces in order to achieve their goal, as in this case, providing crisis and disaster management (Raab & Kenis, 2009; Kenis & Raab, 2020). In the case of this research, the common goal is to ensure physical safety for Dutch citizens, for example during disasters or crises. Organizational networks are present not only in crisis and disaster management, but also in sectors such as healthcare, education or product service innovation (Kenis & Raab, 2020).

Combating disasters and crises requires efficient and rapid action, but it also requires some stability of the organizations involved. This is also known as being 'light on their feet' (Provan & Kenis, 2007). Organizations are able to collaborate quickly and efficiently through social networks, in order to share expertise and resources with each other while needs and tasks are constantly changing (Provan & Kenis, 2007). These features are ideal for disaster risk reduction, as disasters and crises are constantly changing, which means that tasks and needs also change. Organizations must be able to respond to this. Moreover, a fire brigade or a GHOR, for example, cannot fight a crisis or disaster on its own, but needs help and cooperation from and with other organizations from the veiligheidsregio. Dealing with disasters requires collective action through an organizational network, like the veiligheidsregio to achieve the common goal: disaster risk reduction (O'Toole, 1997; Provan & Kenis, 2007; Raab & Kenis, 2009; Kenis & Raab, 2020).

Some research has been done on organizational networks for disaster risk reduction (e.g., Berthod et al., 2017; Resodihardjo et al., 2017), but very little research has been done on cascading disasters and organizational networks. In order to improve our understanding of these increasingly frequent and deadly disasters this qualitative study has been designed. The next section will clarify what exactly is meant by disasters and cascading disasters.

### **What is a disaster?**

The word 'disaster' is often used in society, without it being laid down very clearly what it exactly means. According to the IPCC disasters are: “*Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.*” (Intergovernmental Panel on Climate Change, 2014, p. 1763; Cutter, 2018).

The United Nations Office for the Coordination of Humanitarian Affairs (UNDHA, 1992; Pescaroli & Alexander, 2015) makes use of the following definition: ‘*A serious disruption of the functioning of society, causing widespread human, material or environmental losses, which exceed the ability of affected society to cope using only its own resources. Disasters are often classified according to their cause (natural or manmade)*’ (UNDHA, 1992; Pescaroli & Alexander, 2015). In 2009 the United Nations International Strategy for Disaster Reduction (UNISDR, 2009) came up with a slightly different definition; ‘*a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources*’ (UNISDR, 2009; Pescaroli & Alexander, 2015).



The UNHCR and UNISDR definitions focus mainly on the disruption of a disaster on society and it implies that help or cooperation from other organizations or countries is needed because there is insufficient capacity to cope with a disaster. The IPCC definition also focuses on disruption, but emphasizes the combination of society and the event itself. They take the vulnerability of the society to physical events more into consideration (Pescaroli & Alexander, 2015).

The veiligheidsregio's make use of their own definition of a disaster: *'a major accident or other event in which the life and health of many persons, the environment or major material interests are seriously damaged or threatened and where the coordinated deployment of services or organizations from different disciplines is required to remove the threat take or limit the harmful effects.'* (Wet Veiligheidsregio's article 1.1, consulted on October 4th 2021). With this definition, the veiligheidsregio's emphasize that a coordinated response between the various disciplines (emergency services) and organizations is necessary to remove the threat of the disaster or to limit its effect.

What is striking is that the definitions from the scientific literature refer to the interaction between natural and human systems. As mentioned in the introduction, people are very dependent on the disaster vulnerable- human systems, like critical infrastructures (power, water, transportation etc.). There is a certain interdependence (Pescaroli & Alexander, 2015) and it is precisely this dependence on human systems that may cause (the disruptive effect of) cascading disasters.

## **Cascading disasters**

As mentioned in the introduction, a disaster might result in a cascading disaster. This can easily happen because of our own complex design of the world (Coaffee, 2019; UNISDR, 2017). A cascading disaster is a single event with large-scale effects which triggers one or more other unexpected event(s) of strong impact; this cascading (or compound or multiple) disaster triggers social cascades that have a disruptive effect on community or social life (Pescaroli & Alexander, 2015; Cutter, 2018). The effect of these cascading disasters increases in progression over time (Pescaroli & Alexander, 2015). Whereas the cause-and-effect relationship of cascading disasters does not need to be linear (Cutter, 2018). A cascading effect can arise because there was already a weakness in society beforehand, for example a weakness in the critical infrastructure, evacuation processes or land use planning (Pescaroli & Alexander, 2015; Cutter, 2018). The initiating disaster itself does not need to be extreme, but it can have an extreme impact through its cascading effects (Cutter, 2018). In the scientific literature cascading disasters are also called compound- or complex disasters, domino- or conjoint events, but all these labels refer to the same phenomenon (Cutter, 2018). Cascading disasters are a relatively new topic in the scientific literature, in which the main focus is now on

the definition of cascading- /compound-/multiple disasters. More extensive research is needed in order to fully understand how to prepare for and manage this new kind of phenomena.

An example of a cascading disaster is the Tōhoku earthquake of 11 March 2011 in Japan: first an earthquake hit the area and as a consequence a tsunami hit the land causing damage to the Fukushima nuclear reactors resulting in radioactive contamination. These kinds of cascading disasters are not only possible on the other side of the world, but also here in the Netherlands. Hypothetical disasters in Groningen might be earthquakes and the breach of dikes, or a cyber-attack which causes large-scale failure of the financial system or the communication system for emergency services. In other provinces a flood might trigger the failure of critical infrastructures like water- and power supply with unimaginable consequences.

It is therefore important to align the emergency assistance to the possibility of a cascading disaster that happens in the Netherlands. The first part of the theoretical framework explained that organizational networks may be a suitable organizational structure for disaster risk reduction. In cascading disaster management, however, it is even more important that the risk and crisis management of the country, in this case the veiligheidsregio, is able to act effectively, to have a high level of reliability and to be resilient. These three requirements are reflected in the theory about High Reliability interorganizational networks, which will be explained below (Berthod et al., 2017; Resodihardjo et al., 2018). High Reliable interorganizational networks are a specific form of organizational networks.

### **High Reliability Organization**

The 25 veiligheidsregio's are responsible for safety and emergency-assistance in the Netherlands. A veiligheidsregio consists of different organizations which need to work together to deal with disasters. Other research focused already on organizations with a high risk of errors, such as a nuclear power plant where a single mistake can have fatal consequences for the organization or the general public (Roberts, 1990; Sutcliffe, 2012). Therefore, these organizations focus on high levels of reliability. They try to reach this level of reliability by working with tightly coupled, interdependent units and by using a decentralized form of authority (Berthod et al., 2017). A nuclear power plant is an example of such an organization. These kinds of organizations are called "High Reliability Organizations" (HRO). This concept could also apply to the aforementioned veiligheidsregio's, as the veiligheidsregio's core tasks involve disaster management.

Before explaining the theory of High Reliability *Networks* (HRN), it is important to explain High Reliability *Organizations* (HRO). This is where the theory of High Reliability Networks is based and builds upon. HROs generally work with error-prone technologies. HROs focus on *reliability* in order to make as few errors as possible (Sutcliffe, 2012). Reliability is a twofold concept. It refers to the prevention of possible errors during the 'cold phase' in the veiligheidsregio, e.g., they work with many protocols and

guidelines, but it also refers to maintaining the effectiveness of the organization and its routines during the 'hot phase' of an emergency (Sutcliffe, 2012; LaPorte & Consolini 1991; Roberts, 1990; Weick, Sutcliffe & Obstfeld, 1999; Berthod et al., 2017). This means that they can continue to function stably during periods of stress (Sutcliffe, 2012). HROs therefore try to achieve reliability by preventing errors, but also by controlling errors when they are made.

Moreover, decentralized decision-making processes are also used (Sutcliffe, 2012; Frederickson and LaPorte 2002; Berthod et al., 2017). This means that hierarchy is subordinate to a person's expertise. Decision-making is made by an expert during a problem rather than by a central authority. This flexibility ensures that skills and expertise can be used more intelligently when the (acute) situation requires it.

In order to be able to respond to cascading disasters as a *veiligheidsregio*, they must be *resilient*. This is the ability 'to persist in the face of, absorb, and bounce back from unexpected emergencies' (Resodihardjo et al., 2018). The principles of High Reliability Organization may help the *veiligheidsregio*'s to deal better with the unexpected to achieve resilience in times of cascading disasters. In short, the High Reliability Organizations focus on achieving reliability and resilience. They try to achieve this through five characteristics. The first three characteristics focus on awareness, which is comparable with the cold phase in the *veiligheidsregio*'s and the last two principles focus on containment, which is comparable with the hot phase in the *veiligheidsregio*'s (Weick & Sutcliffe, 2007; Berthod et al., 2017; Resodihardjo et al., 2018);

### **(1) Reluctance to simplify**

Organizations can be too complex, therefore to make it manageable they simplify certain parts of their organization. But there is also a danger to simplification, namely oversimplification. For instance, by using categories and labels to describe something abnormal. This may cause a failure by missing important details due to the oversimplification (Resodihardjo et al., 2018). High Reliability Organizations prevent oversimplification by making use of teams with opposing views and expectations and by making teams which consist of people with a wide range of experience. They are critical of categories by making use of subcategories and they are also aware of the fact that categories might be incorrect (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).

### **(2) Preoccupation with failure**

High Reliability Organizations focus on failures because they are aware of the fact that one small failure can cause big problems. They are extremely focused to find any deviation or occurrence of a failure. High Reliability Organizations therefore encourage employees to report any failure, even if the person itself made the mistake. Employees also know exactly on what they should focus on, because there is frequent communication about which failures need to be avoided. Moreover, High

Reliability Organizations are not satisfied with their own successes. They remain alert to errors (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).

**(3) Sensitivity to operations**

High Reliability Organizations are aware of their operations so they can spot any deviations, which may cause failures. To ensure mistakes are revealed, they make sure there is room to admit mistakes and also encourage their employees to admit their mistakes (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007). Sensitivity to operations also includes being aware why people do things in a certain way. They do this, because High Reliable Organizations do not want to work on an auto-pilot. To notice deviations and people working on auto-pilot, High Reliable Organizations communicate frequently within their teams and also with people outside the team. They also try to detect near misses, because this may be a signal of a failing system (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).

**(4) Commitment to resilience**

High Reliability Organizations are committed to resilience, therefore they focus on the way the organization works, including the technology and the people working there. It may sound like a circular reasoning, but to be resilient, one should truly commit to resilience. This commitment makes them able to better respond to unexpected events. Commitment to resilience can be achieved by training the employees, by hiring employees with a wide variety of experience, by stimulating creative thinking, by learning from setbacks, e.g., with evaluations and also by allowing conceptual slack. Conceptual slack means that employees have different analytical perspectives together with the willingness to ask questions about the current state of affairs. The other employees hereby accept that these questions are asked. Together, this can lead to new solutions (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018).

**(5) Deference to expertise**

In High Reliability Organizations the decisions during an unexpected event will be made by people of the frontline with the expertise to act, instead by some manager higher in the hierarchy. They do this, because they are aware that people at the top of the organization do not have the best knowledge to decide what the best decision is, unlike the employees in the frontline with the expertise who know how to respond on the spot. It is important to note that it is not always one single individual of the frontline who makes the decision, but instead a group who has expertise. It is about expertise (group) and not about an expert (one individual) (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018).

## **High Reliability Network**

At High Reliability Organizations, the emphasis is on reliability *within the organization*. However, it is also possible to look at reliability *between organizations*. High Reliability Networks are networks of three or more different organizations, which are able to effectively control and anticipate on a crisis (Berthod et al., 2017; Weick et al., 1999). This concept is used because a network is high reliable when they are able to anticipate and contain incidents during their operations, but are also able to maintain their *effectiveness* during crises (Berthod et al., 2017). Emergency management organizations are designed as networks of actors with different roles, expertise and skills that need to coordinate their decisions and actions in an effective and reliable way. In the veiligheidsregio's these organizations are the GHOR (medical assistance), population care, control room, risk- and crisis management and the fire brigade. The aim of this research is to contribute to the development of the theory of High Reliability Networks by exploring how cascading disasters are framed and perceived in the six veiligheidsregio's in the Netherlands.

Network effectiveness means that the network is able to generate a positive network outcome cooperatively. This outcome would not be possible if the different organizations worked independently of each other instead of in an organizational network (Provan & Kenis, 2008; Resodihardjo et al., 2018). The network outcome of a veiligheidsregio can be framed as the ability to succeed in preparing for a crisis or disaster and giving assistance and care during a crisis or disaster (Wet Veiligheidsregio's, 2020). Veiligheidsregio's must succeed in both protecting civilians against disasters and crises and assisting and caring during a disaster. The question is how the veiligheidsregio could achieve network effectiveness, according to the High Reliability Network theory which predicts that the presence of five different characteristics will affect the ability of networks to achieve effectiveness.

### **1) Size and composition**

To reach agreement in a network it is easy when a network is homogenous and small (Nohrstedt, 2016; Moynihan, 2009). Therefore, they should carefully select the members and limit the amount (Resodihardjo et al., 2018). But, the veiligheidsregio's are by definition large and heterogeneous, because they consist of different large emergency services and other assisting teams.

### **2) Flexibility**

The veiligheidsregio cannot rely only on their training on possible disasters, although they need a certain level of preparedness through training, planning and structure (Resodihardjo et al., 2018). They simply cannot train for every possible combination of disasters. If a single disaster can be unpredictable, a combination of multiple disasters creates even more unimaginable consequences. Hence, they need flexibility and improvisation from their employees to deal with unknown, new

situations (Waugh and Streib, 2006; Choi and Brower, 2006; Comfort, 2007; Comfort and Kapucu, 2006; Oh, 2012; Ansell et al., 2010; Resodihardjo et al., 2018). The veiligheidsregio needs to be able to be flexible in their plans when the situation differs from their training (Resodihardjo et al., 2018).

### **3) Share information and communicate effectively**

To effectively coordinate during a disaster, it is necessary that the members of the network [veiligheidsregio] share information and communicate effectively (Davis and Robbin, 2015; Comfort, 2007; Bharosa et al., 2010; Oh, 2012; Waugh and Streib, 2006; Ansell et al., 2010; Resodihardjo et al., 2018). One cannot coordinate without information. To be able to do this, the organizations part of the veiligheidsregio need to have a shared language and meaning, so they can understand each other (Comfort, 2007; Comfort and Haase, 2006; Resodihardjo et al., 2018). And to be able to communicate this information, they also need to have adequate information technology and communication systems (Bharosa et al., 2010; Comfort and Haase, 2006; Oh, 2012; Resodihardjo et al., 2018).

### **4) Trust**

Trust between the members of the network, i.e., the different organizations part of the veiligheidsregio is needed to make stronger bonds (linkages) (Provan & Kenis, 2007). Trust can be explained as ‘an aspect of a relationship that reflects the willingness to accept vulnerability based on positive expectations about another's intentions or behavior’ (McEvily, Perrone & Zaheer, 2003; Provan en Kenis 2007). These stronger linkages between the organizations foster network stability and can lead to improved access to new know-how, learning and technologies (Turrini et al., 2010). The learning ability part is also relevant for the flexibility characteristic, because it helps to respond to unexpected events (Moynihan, 2008). The degree of mutual trust can grow over time (time spent in the network), but also by working together. When the outcome of this collaboration meets their expectations, mutual trust grows (Nohrstedt, 2016; Oh, 2012; Resodihardjo et al., 2018).

### **5) Integration and coordination**

Integration and coordination are contributed by training, joint preparation and planning. It helps the organizations in the veiligheidsregio to collaborate during a disaster (Nohrstedt, 2016). Coordination is fostered by a centralization of command, get-togethers, formalization and decision-making procedures (Moynihan, 2009; Nohrstedt, 2016; Klijn et al., 1995; Ansell et al., 2010; Resodihardjo et al., 2018).

### **6) Accountability**

The final characteristic for an effective emergency network is accountability (Davis and Robbin, 2015; Koliba et al., 2011; Resodihardjo et al., 2018). It can help employees of the veiligheidsregio to have expectations from external stakeholders to attain the expected results (Turrini et al., 2010; Resodihardjo et al., 2018). Moreover, it also helps the veiligheidsregio if there are supervisory measures, for example from the government, to have effective crisis management (Davis and Robbin, 2015; Resodihardjo et al., 2018).

### **Contradictory characteristics in theory on High Reliability Organizations and High Reliability Networks**

The characteristics can thus be classified under two different branches, namely; High Reliability Organizations and High Reliability Networks. However, the characteristics can contradict each other in some areas (Resodihardjo et al., 2018). For example, one characteristic from HRO suggests decentralization while one from HRN suggests centralization. This contradicts each other. These and the other contradictions will be explained below. This study will explore the extent to which these contradictions are present in the studied organizations and whether they can create problems for the veiligheidsregio's.

The first contradiction is between the characteristics *'integration and coordination'*, specifically *the aspect centralization of command VS 'deference to expertise'*. So, the issue here is *centralization and decentralization*. The larger the network, the greater the need to centralize the command so that everyone does his or her job. If everyone does his or her job, this together can ensure that they can end the crisis as effectively as possible (Resodihardjo et al., 2018). This characteristic is contrasted with decentralization characteristic *'deference to expertise'*. Whereby the decision-making authority lies with the expertise rather than the highest authority. There is centralization and decentralization in the veiligheidsregio. The idea of the veiligheidsregio's is to centralize emergency services in order to integrate and coordinate them (Resodihardjo et al., 2018). In order to achieve centralization, they use, among other things, crisis plans in the cold phase that state how work should be done, with the Chair of the veiligheidsregio having the final authority to make the strategic decisions (Resodihardjo et al., 2018). It should be examined in this study whether the veiligheidsregio's, according to the participants and documents, also give room for decentralization, in other words, whether there is also deference to expertise (Resodihardjo et al., 2018).

The second contradictory characteristics are *'flexibility'* VS *'integration and coordination'*, specifically formalization of the crisis plans. Flexibility, in the form of deviating from (crisis) plans, is needed in crisis management (Resodihardjo et al., 2018). Sometimes plans don't work out in reality and conceptual slack and creative thinking are necessary to offer good relief efforts. This contradiction does not

need to be a problem as crisis plans can also include flexibility, so that flexibility can be formalized. This could amount to: you stick to the protocol, but think about other possibilities yourself. Is the protocol appropriate for this case? There is a little more opportunity for improvisation and creative thinking which may help to bridge these contrasting characteristics (Resodihardjo et al., 2018). Whether this is actually the case needs to be investigated. Answers will be sought in the interviews and in the policy documents.

The characteristic of '*size and composition*': a limited and homogenous network cannot be met, because veiligheidsregio's are big and heterogeneous (many different organizations and employees) (Resodihardjo et al., 2018). This has an advantage because it means that there is a wide range of experience, which in turn is good for resilience. This has a disadvantage in terms of effectiveness (requirement), since it is more difficult to reach agreement in a heterogeneous, large network (Nohrstedt, 2016; Moynihan, 2009; Resodihardjo et al., 2018). One way to limit the members of the veiligheidsregio's - to the extent that it is possible - could be to limit board meetings to core actors, who must always be present, and peripheral actors, who only come when they are needed (Resodihardjo et al., 2018; Wet Veiligheidsregio, 2020). Such a kind of adaptation of the veiligheidsregio's would ensure that they can meet the set characteristic to achieve effectiveness to a greater extent. As a result, they can be characterized more likely as a High Reliability Network. This study can look at the extent to which this emerges in the crisis plans and interviews. The study by Resodihardjo et al. (2018) suggests this contradiction, but it is important to also verify this through interviews, as in this study. This study examines, on the basis of the interview, crisis and policy plans, to what extent the veiligheidsregio's are taking measures to reduce their size.

To summarize the content of this study: in the Netherlands cascading disasters will occur more frequently in the future and have a major impact on society. In the Netherlands, the veiligheidsregio's, an organizational network, are responsible for risk and crisis management. To be able to cope with cascading disasters, the veiligheidsregio's must be reliable, resilient and able to maintain their effectiveness. High Reliability Organizations focus on reliability and resilience. High Reliability Networks focus on maintaining their effectiveness. This study examines to what extent the veiligheidsregio's operate as High Reliability Organizations and Networks during cascading disasters, in the perception of employees and according to their policy plans. In figure 2 an overview of the theory is given in a conceptual model. Since there are no studies of HRO and HRN in the context of cascading disasters, and in terms of the perception of the veiligheidsregio's, an exploratory analysis will be conducted.



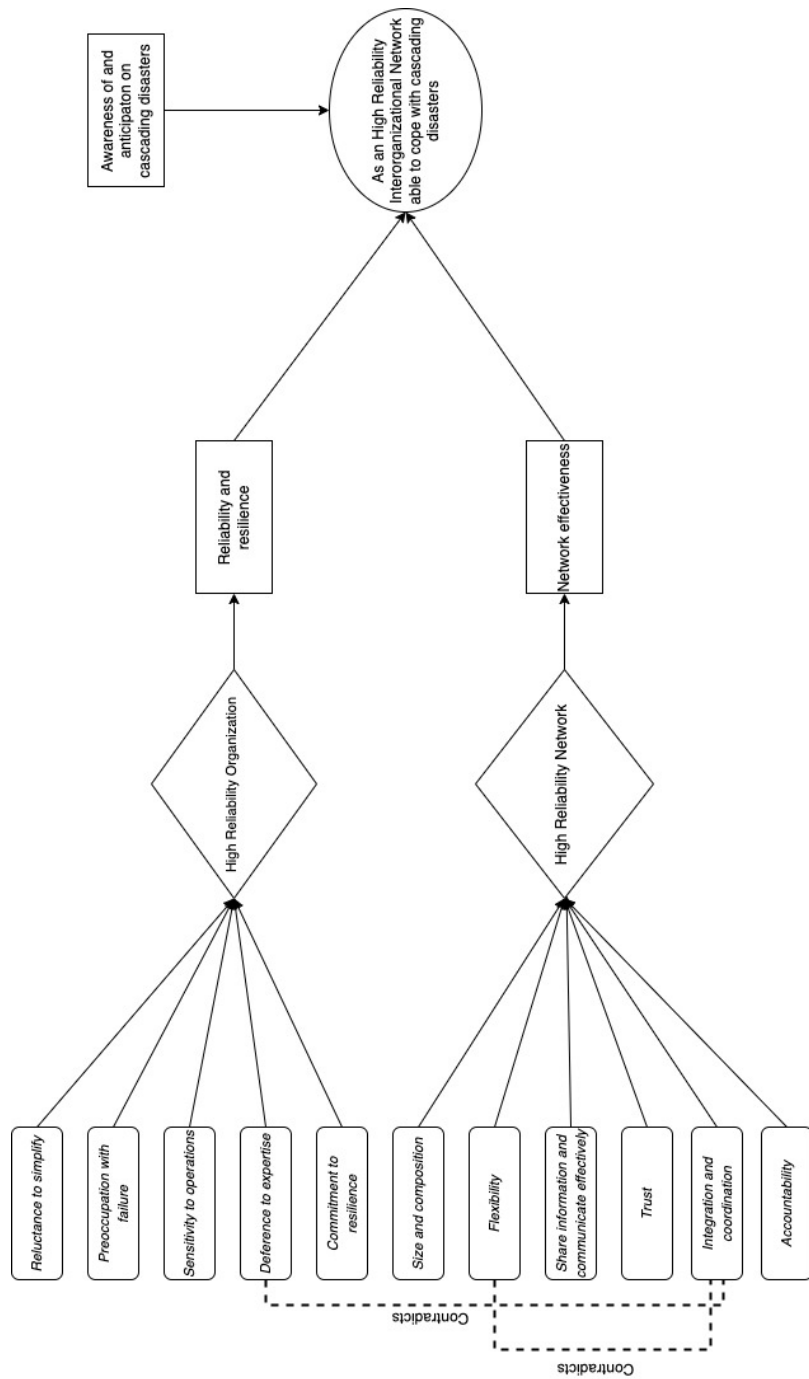


Figure 2: Conceptual model of the theoretical framework

## **Methodology**

In this study, an exploratory research on High Reliability Interorganizational Networks and cascading disasters in the Dutch veiligheidsregio's is carried out using a qualitative approach. In the first section, the qualitative approach will be explained. Next, the policy documents and interviews - will be explained. After that, the selection criteria will be presented following the recruitment of participants for the interviews. Subsequently, the operationalization of the interview guide will be elaborated and the data analysis will be explained. Hereafter the ethical considerations, the trustworthiness and lastly, the positionality of the researcher.

### **Qualitative approach**

The aim of this research is to identify if the veiligheidsregio's in the Netherlands work as High Reliability Interorganizational Networks during cascading disasters according to their policy- and crisis plans and to the perception of their employees. Attempts are made to understand (verstehen) the views of the veiligheidsregio's and how they operate (Hennink, Hutter & Bailey, 2011, p. 17). Therefore, a qualitative method with triangulation was particularly suitable for this study, as it has an exploratory character, since very little is known about veiligheidsregio as High Reliable Interorganizational Networks in combination with cascading disasters. This approach involves looking at what subjective meaning the veiligheidsregio's attach to their experiences; the emic perspective (Hennink et al., 2011). Two different qualitative methodologies were used in this study namely policy document analysis, consisting of eleven documents from six veiligheidsregio's and six semi-structured interviews with veiligheidsregio's employees from six regions. Both methods study the same phenomenon. With this form of triangulation an attempt was made to provide a confluence of evidence that breeds credibility because they examine information collected through different methods (Bowen, 2009). This helps to corroborate findings across the crisis- & policy plans and the interviews - and thus reduce the impact of potential biases that exist in this study (Eisner, 1991; Bowen, 2009). The following subsections will elaborate on the two different methodologies.

### **Policy documents**

First, a document analysis of the policy documents of the veiligheidsregio's was done. The document analysis is a good way to gain understanding and develop empirical knowledge in an efficient way (Corbin & Strauss, 2008; Bowen, 2009). The documents can be seen as 'social facts, which are produced, shared and used in socially organized ways' (Aktison & Coffey, 1997; Bowen, 2009). In addition, they provided background information and context to the studied topic of veiligheidsregio's and cascading disasters.

Furthermore, they were used to verify findings or corroborate findings from other sources, like the interviews. This form of triangulation gave greater trustworthiness of the findings in this study (Bowen, 2009). However, it should be noted that policy documents exist independently from the research, and they are aimed for the general public and stakeholders, and not strictly for research purposes.

The analysis specifically concerned *policy* documents drawn up by the veiligheidsregio's themselves. The documents studied consist of two types: the general policy plan and the crisis plan. Every veiligheidsregio is obligated by law (Wet Veiligheidsregio's, 2020) to draw up a general policy plan and a crisis plan every four years. This is done by the board of every veiligheidsregio. The policy plan focuses on the broader concept of crisis management and disaster relief. It gives direction to the tasks and to the efforts of the collaborating municipalities and partners of the veiligheidsregio. Furthermore, it describes how the veiligheidsregio deals with and prepares for physical risks. Whereas the crisis plan describes the main structure of the organization, the tasks, responsibilities and qualifications of the main structure and the actors participating in it, in the context of crisis management and disaster relief (Rijksoverheid, 2016). This document also states the agreements with external parties, e.g., water supply- or nuclear reactor companies. The crisis plan must be harmonized with the surrounding veiligheidsregio's or neighboring country(s). Since there is no fixed format for the plans, the documents differ per veiligheidsregio. They only have a few requirements that the plans must meet as stated in article 3 of the veiligheidsregio act. The policy- and crisis plans varied from 27 pages up till 75 pages. A total of 502 pages were analyzed.

So, every of the six selected veiligheidsregio's has a general policy plan and a crisis plan. In total there are eleven documents which (most of the time) have been found on the website of every veiligheidsregio or on the website of Instituut Fysieke Veiligheid (Institute Physical Safety). The Instituut Fysieke Veiligheid is the national support organization for the veiligheidsregio's and their safety partners. Veiligheidsregio Groningen combined the general policy plan with the crisis plan (and the risk profile) in one document. Veiligheidsregio's Noord-Holland Noord, Zeeland, Zuid-Limburg have a general policy plan and a crisis plan. Amsterdam-Amstelland has a crisis plan and a *concept* general policy-plan.

If a document could not be found, an email was sent and a call was made to the relevant region to check if the document was available. In some cases, when a document was not available, the veiligheidsregio's were still in the process of writing a new document. Sometimes, it was necessary to wait for the new document or, in the case of veiligheidsregio Amsterdam-Amstelland, a concept version was sent. A conscious decision was made to use the draft version of the policy plan rather than an outdated document. It was more important for the document to be as recent as possible, Missing topics in the document could come up in the interview. It was not an option to wait for the official new document, since this would take up too much time.

## **Interviews**

After coding and analyzing (a detailed description of the analysis will be given later on) the policy documents, semi-structured interviews were added to the study to explore the perception of the veiligheidsregio's on the Interorganizational Networks and their perception of the key-elements of High Reliability Interorganizational Networks. These interviews could complement the policy plans and vice versa. If these complement each other, this will reduce any impact of possible biases (Eisner, 1991; Bowen, 2009). This is an important contribution since this form of triangulation increases the credibility of the study. However, since documents and interviews are completely different types of data, it is to be expected that some topics do not appear in the documents but do in the interviews, or the other way around. It is likely that the interviews will be more nuanced than the documents. This could be interesting for the deference to expertise characteristic, for example.

Before the actual interviews were held, a discussion session was held with an employee of the veiligheidsregio Groningen. This was done to find out to what extent certain concepts from the theory used in the interview needed to be explained or clarified when they are incorporated in a question. After that, it was tried to interview five people: one per region. One region, Limburg-Noord, volunteered to be interviewed. So, eventually six persons from six regions were interviewed. The interviews were conducted between October 18<sup>th</sup>, 2021 and November 25<sup>th</sup>, 2021. And the duration ranged from 43 minutes to 76 minutes. Of the participants, five were male and one was female. Most of the participants were employees of the risk and crisis management team. This team deals with crises and disasters and is responsible for the multidisciplinary organization in the hot and cold phase. The team also works together with external partners, municipalities and other governmental organizations. In the Noord-Holland Noord region, it was not possible to interview someone from the risk and crisis management team due to extreme work load caused by the ongoing Covid-19 crisis. It was therefore decided, after recommendations from veiligheidsregio Noord-Holland Noord, to look for a person in another organization of the veiligheidsregio, but with the criteria that this person had to deal with crises and disasters in his or her work. The GHOR was approached with the same e-mail that the veiligheidsregio's received. And here too, the organization itself, in this case the GHOR, acted as gatekeeper. In the end, an employee of the GHOR was found willing to take part in the study. This person has experience with crises management but with a focus on healthcare.

Five interviews were held online due to the long travel time and the Covid-19 situation. Beforehand, the participants were asked if they were in a room where they could speak freely. This question was asked because during a video-call it was impossible for the interviewer to judge if the environment was safe for the participant. Only the interview with the veiligheidsregio Groningen was not conducted online, but at the participant's office.

After each interview, the audio recording was uploaded to the university's secured Y drive, which was created especially for this research. Only the supervisors and the researcher have access to this disk. The audio recording was then erased from the audio recording device. The recordings were numbered, so that it was not possible to determine from the name of the file who was being interviewed. In a file in another location, a record was kept of who was which number.

### **Selection criteria veiligheidsregio's**

A non-random sampling strategy was chosen to select the veiligheidsregio's participating in the research, since it was not possible to include all 25 regions in this relatively small study. The selection was done on the basis of characteristics of the veiligheidsregio's in order to get a diverse set of veiligheidsregio's with different disasters threats. The characteristics were:

*Address density:* A region with a high address density was included. This characterization, in fact, showed that there are many people living in a small area. Combined with a high building density and therefore many vulnerable objects such as schools, hospitals and care homes. The people in these buildings are generally more dependent than self-reliant citizens (Veiligheidsregio Amsterdam-Amstelland, 2021). Due to the high population density, incidents and disasters have a greater impact as they affect more people at once (Veiligheidsregio Amsterdam-Amstelland, 2021). Amsterdam-Amstelland is a region with the highest population density in the country, which will continue to grow in the coming years, making it one of the most densely populated areas in the country (Veiligheidsregio Amsterdam-Amstelland, 2021).

*Rivers:* Regions which include rivers, and thus possible floods, were included in this study. This is important because climate change means that the Netherlands will experience more frequent flooding and extreme weather. This may cause rivers to overflow and dikes to breach (Veiligheidsregio Zuid-Limburg & Veiligheidsregio Limburg-Noord, 2019). Because of the presence of rivers and the associated possible incidents, Zuid-Limburg (and later Noord-Limburg) was selected.

*Neighboring countries:* Regions with several neighboring countries were included. Since, other cultures, working methods and customs of the neighboring countries have to be taken into account when a region is connected to other countries. This variety makes it a complex environment to work in (Veiligheidsregio Zuid-Limburg Beleidsplan, 2020). Therefore, Zuid-Limburg was included in the study since it is only connected to the rest of the Netherlands for six kilometers. For the most part, the region borders on Germany and Belgium. At a later stage in the study, the region of Limburg Noord was also included, which borders on two countries: Belgium and Germany.

*Islands:* A region which includes an island was also added to the study. The presence of an island in a veiligheidsregio may make it more difficult to combat any crises or disasters because of its accessibility. For this reason, among others, the Noord-Holland Noord region was included in this study.

*Sea (dikes):* Regions with sea (dikes) present were selected. Since climate change means that the Netherlands will experience more frequent flooding and extreme weather. This causes sea level risings and might lead to sea dikes breaching. Because of the presence of the sea and dikes and the associated possible incidents, Noord-Holland Noord and Zeeland were selected.

*Number of industrial activities:* A region with a good number of industrial activities was included. The presence of industrial activities increases the risk of possible disasters or crises (Veiligheidsregio Zuid-Limburg beleidsplan, 2020). For this reason, Zuid-Limburg was included in the study.

*Terrorism:* Regions with a high chance of terrorism were included. The present state is 3 in the whole country (1= minimal, 5= critical). The present risk of terrorism is the same throughout the country, i.e., in all Veiligheidsregio's, at level 3 (AIVD, n.d.).

*Nuclear installation:* Regions with a nuclear installation were included in the study. Since, a nuclear reactor in a region carries potential dangers, such as a meltdown. There are nuclear reactors in the Noord-Holland Noord and Zeeland regions.

*Earthquakes:* A region with common earthquakes was selected. Earthquakes (induced by gas drilling) cause not only physical damage, but also long-term mental health problems among the residents. The fact that this is a political issue (whether or not to continue drilling, and damage claims) makes it very sensitive and has a major impact on residents (Veiligheidsplan Groningen, 2019). In the Groningen region, earthquakes occur on a regular basis, therefore this region was included in the study.

Eventually, the Veiligheidsregio's Groningen, Noord-Holland Noord, Zeeland, Amsterdam-Amstelland and Zuid-Limburg were chosen. Limburg-Noord volunteered to be interviewed and was eventually interviewed as well. The characteristics per region can be found in table 2 below.

Table 2: Characteristics per veiligheidsregio

	<i>Groningen</i>	<i>Zeeland</i>	<i>Amsterdam-Ansteland</i>	<i>Limburg Noord</i>	<i>Zuid-Limburg</i>	<i>Noord-Holland Noord</i>
<i>High address density</i>			■			
<i>Rivers</i>				■	■	
<i>Several Neighbouring countries</i>				■	■	
<i>Presence of an Island</i>						■
<i>Presence of sea (dikes)</i>		■				■
<i>High number of industrial activities</i>					■	
<i>High chance of terrorism</i>	■	■	■	■	■	■
<i>Presence of nuclear installation</i>		■				■
<i>Earthquakes</i>	■					

**Recruitment of participants for the interviews**

Because the policy documents were analyzed first, some veiligheidsregio’s had already been contacted about the documents by email. Therefore, for the interviews, it was decided to email these same people again. The regions that had not yet been contacted also received an invitation on their general e-mail address. It explained the purpose of the research and the regions themselves could suggest a suitable person to interview. The veiligheidsregio’s fulfilled the role as gatekeepers to recruit participants. The e-mail

contained specific criteria for the possible future participant. This helped to recruit similar participants (homogeneity) across the different veiligheidsregio's (Hennink et al., 2011). This strategy was chosen because the organization itself probably knows best who meets the criteria. Moreover, it is virtually impossible for an outsider to find out who works in the veiligheidsregio and who would therefore be most suitable for the study. These were the criteria in the mail for a participant: *‘For this research, I am looking for a veiligheidsregio employee who would like to be interviewed about the veiligheidsregio's disaster management. This employee should preferably have experience in making policy regarding crises and disasters, but also have experience in fieldwork during a disaster. The veiligheidsregio of Groningen recommended employees with a picket function, but perhaps you know of a function that would be more suitable.’*

In general, the regions responded quickly and almost every veiligheidsregio wanted to participate in the survey. Only Noord-Holland Noord was too busy, as mentioned earlier. Therefore, an employee of the GHOR, part of the veiligheidsregio of Noord-Holland Noord, was included in the study.

### **Operationalization interview guide**

The semi-structured interview was conducted in the native language of the interviewer and interviewee (Dutch) and consisted of open-ended questions, follow-up questions and probes. It was designed to be semi-structured, so that there was room for the participant to partly give their own direction to the interview. They were able to bring up important topics for them. The open questions and the possibility of changing the order of the questions made the interview more like a dialogue (Hennink et al., 2011). Simultaneously, structure was partially provided in the interviews by the prearranged questions and topics.

The interview started with an introduction in which the interviewer introduced herself and explained what the research was about and what cascading disasters are. Herein, was also made clear what would happen to their answers. Also, it was explained that everything would be treated confidentially and their answers would be processed anonymously (see the appendix IV for the informed consent form). The participant was free to stop the interview whenever he or she wanted to. This did not happen during one of the interviews. In order to process the interviews properly, audio recordings were made with an audio recorder of the university. All participants gave their permission for this (verbally and in the informed consent form).

After the introduction, some simple questions were asked to put the participant at ease and get familiar with the setting and the interviewer (Hennink et al., 2011). These questions focused on their main occupation and experiences during a workday. These questions not only served to build trust, but also gave a good idea about the characteristics of the participants – such as their daily work. After the introduction,



the main topics and corresponding questions were presented. The main topics were: the working method of the veiligheidsregio, cascading disasters and the network of the region. To almost every question, 'probes' were added. These probes served as a reminder for the interviewer as they were concerned with the most important topics of this study (Hennink et al., 2011). These probes also gave the interviewer room to come up with questions on the spot if the situation called for it or let the interviewee talk about that specific topic.

After the opening questions, the main questions with their sub-themes were addressed. The questions about their working methods served to get a picture of how they work. For example, it was asked who makes decisions during disasters. The subject of cascading disasters served to find out to what extent the regions are prepared for or have experienced cascading disasters. For example, they were asked whether they held exercises with cascading disasters. The third topic was the interorganizational network. Here, questions were asked about the cooperation within the veiligheidsregio and with any external partners. For example, they were questioned how they ensure a relationship of trust within the veiligheidsregio and with external partners. Finally, the question 'In your perception, why do you think the veiligheidsregio can or cannot cope with an unexpected cascading disaster when it occurs tomorrow?'. With this question, the hope was to get some kind of natural conclusion from the participant. After this, the participants were thanked for the interview and an opportunity was given for questions and comments.

The questions were partially based on the inductive and deductive codes from the codebook and themes which were used or found in the previously studied policy documents, such as 'external partners' and 'information and communication'. As an example, 'external partners' was something that did not occur in the theory, but did appear frequently in the documents. Therefore, the choice was made to include 'external partners' in the interview. Appendix V contains the interview schedule. Above each question, the intended subject of the question(s) was indicated in brackets.

## **Data analysis**

In order to find out any key-elements of High Reliability Interorganizational Networks and cascading disasters in the policy documents and the interviews, it was necessary to analyze it in a structural way. This was done by making use of (thematic) coding. This is a qualitative method to analyze texts. Before the coding and subsequent analysis could take place, the interviews were transcribed. This means that the audio recordings were written out in a transcript (Hennink et al., 2011). In this case, all spoken words were transcribed, but not every 'uhm', pause or cough. Since, an analysis on this small level was not necessary for this study.

Thematic analysis was used to analyze the documents and the interviews, so patterns could be sought in the documents and interviews (Braun & Clarke, 2020). The documents and interviews were coded

inductively and deductively using the ATLAS.ti programme version 9.1.3 for Mac (ATLAS.ti, 2021), based on the codes and themes identified in the codebook (see appendix I). An attempt was then made to relate these themes in order to answer the research question.

The thematic analysis consisted of six different steps that had to be completed. In practice, these steps overlapped and were sometimes carried out simultaneously. Since the policy documents were coded and analyzed first and subsequently the interviews were held and analyzed, the steps were conducted separately for both the policy documents and the interviews. It was decided to code the interviews only on a thematic level. It was not considered relevant to code the interviews at a small level (with the first codebook). This was decided in consultation with the supervisor.

As a first step, it was important to become familiar with the documents and the interviews (Braun & Clarke, 2012). This was done in this study by first reading the policy documents and transcripts of the interviews and making initial notes. Which were used to write down remarkable and interesting things that appeared in the policy documents and interviews, and to which topics extra attention had to be paid to while coding. For instance, a note was made when a veiligheidsregio's wrote about cascading disasters in the policy documents. Sometimes notes were also made about which pieces of text needed to be removed and/or anonymized from the transcripts before they could be coded.

The second step consisted of coding the policy documents (Braun & Clarke, 2012). The purpose of the coding was to arrange the information per subject so that it could be analyzed for the benefit of the research question. The coding was developed in two stages. The first round of coding was done using deductive codes derived from the theory. An example of a deductive code could be 'awareness and/or anticipation on cascading disasters'. First, the policy documents were coded according to the pre-made deductive codes, while keeping the option open for new codes emerging from the policy documents. New, relevant topics were then coded as inductive codes (Hennink et al., 2011, p. 218). Both the deductive codes and the inductive codes can be found in the codebook (appendix I).

In the third step, a broader and more inclusive coding scheme was developed. Which is called 'searching for themes' (Braun & Clarke, 2012). In the process of thematic coding, the first codebook was set aside for a while. Initially, a theme was formed and assigned on the spot based on the text to be coded. However, this was done with the theory and previous codes in mind. This way a new thematic codebook was created. Finally, the policy documents and interviews were coded based on this new thematic codebook (appendix I). Some examples of thematic codes are: 'flexibility of the veiligheidsregio' and 'awareness and/or anticipation on cascading disasters'. Ultimately, the thematic codebook is based on themes which emerged in the policy documents and interviews, as well as on the theory and the first codebook.

In the fourth step, the themes were evaluated (Braun & Clarke, 2012). They had to be informative enough so that another researcher could also use them. Moreover, it was checked whether the themes form a coherent entity. This entails that during the analysis of the policy documents and the interviews it appeared that new themes had to be added or that some old themes had to be adjusted or deleted, making the development of the codebook and coding a fluid and iteratively activity. Like the rest of this study, this step was also performed by a single researcher.

The fifth step was actually carried out at the same time as the fourth step. In this step, an informative name for the themes was chosen and the themes were clarified. In this phase, the results were already written based on the themes. Writing helped to get a grip on the themes and the (overarching) story they tell (Braun & Clarke, 2012). To start this process, an excel file with all the coded themes was extracted from ATLAS.ti. The themes were used as a kind of thread through the results chapter. The codes (1st codebook) from the first round of coding were sometimes helpful in the process of writing the results since these codes were a bit more detailed than the themes from the second codebook, for example the code 'GRIP'. This step eventually resulted in a first version of the results chapter.

In the sixth step, the results of the interviews and documents were reported in an orderly and accessible way to create a clear narrative (Braun & Clarke, 2012). To reinforce the results, quotes from the documents and interviews have been used.

## **Ethics**

The ethical aspects of the research have been well considered, because it is necessary to be careful with the acquired information and the anonymity of the participants (Hennink et al., 2011). The interviews were conducted with experts who were asked about the functioning of their organizations. The subjects were related to the functioning of their organization, so no personal, sensitive issues were raised. Therefore, the group of participants was not considered to be a vulnerable group. Yet, some points were taken into account to safeguard ethics. These ethical points will be discussed using the phases of Hennink et al. (2011); the design cycle, the ethnographic cycle and the analytical cycle.

In the design cycle there are several ethical issues which were considered. First, it was important to consider who would benefit from the research (Hennink et al., 2011). This study is not solely meant for academic purposes, but is also relevant for the participants from the veiligheidsregio's. Cascading disasters will become increasingly common in the future. This fact makes it necessary to prepare for the unexpected (Coaffee, 2019, p. 5). It is necessary for veiligheidsregio's to think ahead in their disaster response and increase their ability to deal with cascading disasters (Coaffee, 2019, p. 14). This research may help them improve their ability to deal with cascading disasters or at least increase awareness. Therefore, it was also

offered to share the results with them so that they can make use of this research. In this regard, this research will be useful to the participants.

Secondly, it is important to ensure that the participants do not feel exploited or deceived. Therefore, it was made clear from the beginning that they were participating in an academic study, so they were able to freely decide for themselves to participate or not (Hennink et al., 2011).

In the ethnographic cycle, a number of ethical issues also arose. Participant recruitment started with sending an email with information about the research project. In this email permission was sought by asking if the veiligheidsregio wanted to participate in the study (Hennink et al., 2011). The veiligheidsregio's served as gatekeepers, as mentioned before. One danger of using gatekeepers is that participants may feel pressure from their employer to participate in the study. By means of an informed consent form for the participants it was tried to prevent this as much as possible. It was also told during the interview and in the information letter that the researcher would not talk to their colleagues about their participation in the study. Moreover, the gatekeepers were not senior managers as far as known. Also, since the research is not about personal and sensitive issues but is work related for the participants, there is probably a minimal form of mental or social harm here (Hennink et al., 2011). Another drawback is that gatekeepers can choose which potential participants they want to put forward (Hennink et al., 2011). With the criteria set for participants, this problem is avoided as much as possible.

During data collection, it was also important to consider ethical issues. The participants had to be able to participate without constraint. In addition, the researcher was transparent to the participants so that he or she could have decided to participate or not (Hennink et al., 2011). Therefore, an information letter was sent in advance explaining the purpose of the study, what would happen to their answers and how anonymity and confidentiality were guaranteed (Hennink et al., 2011). The participants and the researcher also signed a so-called 'informed consent form' concerning confidentiality and anonymity. An example of this can be found in appendix IV. The issues mentioned in the informed consent and the information letter were also discussed in the interview, where consent was also requested verbally. In the letter, in the informed consent form and during the interview, it was emphasized that the participant had the right to end the interview at any time, without any consequences. In the informed consent form and during the interview, it was explained that they could withdraw from the study up to two weeks after the interview.

Furthermore, confidentiality and anonymity were guaranteed in the study. Confidentiality entails that information discussed during the interview should be kept carefully and not shared openly (Hennink et al., 2011, p. 71). As mentioned earlier, the audio recordings are kept in a protected and shielded environment of the university. Yet it is not possible to guarantee complete confidentiality, as the shared information is used in the research. In practice, this means that sometimes quotes were used to reinforce the study. The

second aspect, anonymity, partly overlaps with confidentiality. This specifically means that the participant cannot be identified (Hennink et al., 2011). In this study, this was done by not using the names of the participants, only the name of the veiligheidsregio is mentioned. Also, characteristics of the participants which could lead to their identification were anonymized so that the names could not be identified. The handling of confidentiality and anonymity were also discussed verbally with the participants and were documented in an informed consent form (Appendix IV). Anonymization and confidentiality of the data is part of the ethnographic cycle, but also part of the last cycle, the analytical cycle (Hennink et al., 2011).

In the analytical cycle it was important to pay attention to the benefit for the participants. During every interview it was discussed with the participants to share the results of the study with them. On top of that, Groningen suggested that a short presentation could be given after the completion of the study. This was agreed to.

Some participants told during the interviews that they found it very interesting to participate in the research because it made them think critically about important topics for the veiligheidsregio's that they normally do not think much about. This is also a form of benefit for the participants.

Finally, it has been taken into account to not sensationalize the results too much. It is important to give a fair picture of the results.

## **Trustworthiness**

In order to make statements about the quality of this study, trustworthiness is used. This includes four criteria that should be considered during the design, implementation and evaluation of the study. The criteria are: credibility, transferability, confirmability, and dependability. With these criteria it is possible to demonstrate that the study is trustworthy (Shenton, 2004). For a detailed description, the criteria sometimes refer to other sections in this study to avoid repetition. Missing criteria for trustworthiness will be discussed in the discussion.

The first criterium credibility involves examining the extent to which the measured corresponds to reality (Shenton, 2004). There are several things that ensured credibility for this study. First, well established (analyzing) methods were used, semi-structured interviews and a document analysis which were both analyzed using a thematic analysis (Braun & Clarke, 2012).

Secondly, with the use of triangulation (interviews and policy document analyses) in this study an attempt was made to provide a confluence of evidence that breeds credibility because they examine information collected through different methods (Shenton, 2004; Bowen, 2009). This helps to corroborate findings across the crisis- & policy plans and the interviews - and thus reduce the impact of potential biases that exist in this study (Eisner, 1991; Bowen, 2009).

Thirdly, before the semi-structured interviews were held and the policy documents were analyzed, it was tried to get familiar with the veiligheidsregio's by reading websites, documents and by doing an e-learning (Instituut Fysieke Veiligheid, n.d.; Shenton, 2004). Also, a discussion session about the interviews was held with veiligheidsregio Groningen, this helped to get familiar with the organization.

Another way credibility was achieved is by using iterative questioning, to find out if the participants contradicted themselves in their answers (Shenton, 2004). To uncover these possible contradictions several questions on the same topic were made. For instance, multiple questions about cascading disasters were asked to the participant (appendix V). However, this was not done for every topic, due to the fact that there was a strict time limit for the interviews. A follow-up study could conduct a more extensive interview where more iterative questioning is possible.

A fifth method by which credibility was achieved is by making sure that the participants only participated if they genuinely wanted (Shenton, 2004). This was done, for example, by indicating that they were completely free to participate in the study and by indicating that they could stop at any time. Moreover, the participants and the interviewer had to sign an 'inform consent form' (appendix IV). A more detailed description is given in this chapter, section ethics.

Since this is a master's thesis, constant feedback on the research was given by the supervisors in a written form but also in the form of frequent debriefing sessions (Shenton, 2004). This allowed some room for discussion about, for example, the data collection. Ultimately, this created a better study. Furthermore, peer scrutiny also occurred because a presentation was made to other scientists at the University of Groningen (SCIO group) at the beginning of the study. Based on the presentation, advice was given by the scientists. Getting feedback and sparring with 'colleagues' and supervisors helped to increase the credibility of this study.

The second component that belongs to trustworthiness is transferability (Shenton, 2004). Transferability is about the applicability of the results to other situations (Shenton 2004). Therefore, it is important to describe the context of the interviews as good as possible (Shenton, 2004). The outcomes of this qualitative research can then provide insight into High Reliability Interorganizational Networks and cascading disasters in the context of this research. These outcomes can serve as background information for other studies (Shenton, 2004). Therefore, an attempt was made to provide as much information about the participants as possible while considering their anonymity. A detailed description of the veiligheidsregio's and what their policy documents look like was also provided in the introduction. In the methodology is also explained how the veiligheidsregio's were approached, how many participants were involved and which data collection methods were used. Also, the time period the data was collected is

illustrated as well as the number and length of the data collection sessions. A more detailed explanation of these issues can be found in the methodology.

The third component that helped to achieve trustworthiness is dependability. This means that if this research is repeated, in the same context, with the same methods and with the same participants, the same results will be obtained (Shenton, 2004). Therefore, it is important to give a detailed description of the process of the study. In the methodology a description of the research design and its implementation is given. Herein, a description of the data collection can also be found. It is also necessary to reflect on the effectiveness of these methods. Hence, a reflection on the use of policy documents and on the interviews is given. This can be found in the discussion. With the help of this information, it is possible to reproduce the steps followed.

The last component, confirmability, involves the extent to which the researcher is objective. The opinion of myself must be minimized. However, it is necessary to recognize that I always have something of an influence, this is called reflexivity (Shenton, 2004). A separate section 'positionality of the researcher' where reflexivity is discussed is added in the methodology. Second, for confirmability, the triangulation mentioned earlier is also important, since this helps to reduce the effect of the researcher's bias (Shenton, 2004).

### **Positionality of the researcher**

As a researcher, it is also important to apply reflexivity. This implies that I, the researcher, need to reflect on myself and be aware of the influence I can exert on the research (Hennink et al., 2011, p.19). This also includes positionality. This refers to the way in which I portray myself in the study. My attitude, appearance, gender and behavior could all have an influence on the participant and therefore influence the information given by the participants (Hennink et al., 2011). So, it is important in this research to reflect on myself.

First, five of the six interviews were online. This could have been an advantage for the participant because he or she was in a familiar environment. I also tried to make sure that I was in a neutral, quiet environment. For each online interview I conducted, I had booked a space at the university. So, there were no disturbing factors such as noise pollution or distracting backgrounds on the screen. An online interview does not have only advantages, because it is harder for the participant and for me to read each other's body language, attitude and behavior than if this had been 'in real life'. The online world creates a certain amount of distance, which made it harder for me as a researcher to get close to the participant figuratively. This might have made the participant feel less comfortable to share all the information. However, this need not be too much of a problem, as it concerned his or her work and not so much about him or herself. This may have made it easier for the participant to talk freely.

Another thing that might have affected the study is that I do not have a lot of experience in conducting interviews. Interviewing is a skill that not everyone masters immediately, it might require training. It is therefore possible that this caused the interviews not to be conducted in the best possible way, despite the fact that this was, of course, being attempted. I noticed, for example, that in the beginning it was more difficult for me to ask good follow-up questions (Shenton, 2004).



## Results

The results are presented by theme. Within each theme the results of the documents and the interviews are presented and a distinction is made between every veiligheidsregio. When there is a relevant difference between veiligheidsregio's this will be made clear in the text. An overview of the themes is presented in table 3. They are placed in the same order as they are presented in the results. In table 4 an overview of the materials used in this study, such as the policy documents and the interviews, is given.

Table 3: Overview of the themes in the results

<b><i>Themes in the documents and interviews in the same order as they are presented and used in the results</i></b>	<b><i>Characteristic of HRO or HRN</i></b>
Awareness and anticipation of cascading disasters	INDUCTIVE
Governance & deference to expertise	HRO
Integration and coordination	HRN
Striving for resilience	HRO
Size and composition of the team	HRN
Flexibility of the veiligheidsregio	HRN
Trust among employees in the veiligheidsregio & with external partners	HRN
Information and communication	HRN
Reluctance to simplify	HRO
The veiligheidsregio is sensitive to operations (& situational awareness)	HRO
Dealing with failures (made)	HRO
Accountability	HRN

Table 4: Overview of the materials used in this study

<i>Veiligheidsregio</i>	<i>Documents</i>		<i>Interview</i>
<i>Groningen</i>	Veiligheidsplan Groningen (consists of policy and crisis plan)		Participant is part of crisis management in that veiligheidsregio
<i>Zeeland</i>	Samen sterk voor een veilig Zeeland, Meerjarig beleidsplan veiligheidsregio Zeeland.	Regionaal crisisplan 2018-2021	Participant is part of crisis management in that veiligheidsregio
<i>Amsterdam-Amstelland</i>	<i>Concept</i> Beleidsplan 2021-2024 Buitengewoon veilig.	Regionaal crisisplan 2016-2020 up to date crisisaanpak	Participant is part of crisis management in that veiligheidsregio
<i>Limburg Noord</i>	Beleidsplan 2020-2023	Regionaal crisisplan	Participant is part of crisis management in that veiligheidsregio
<i>Zuid-Limburg</i>	Samen Veilig - Meerjarenbeleidsplan 2020-2023	Regionaal crisisplan 2020-2023	Participant is part of crisis management in that veiligheidsregio
<i>Noord-Holland Noord</i>	Samen hulpvaardig Beleidsplan veiligheidsregio Noord-Holland Noord 2020-2023	Regionaal crisisplan Noord-Holland Noord 2021	Participant is part of the GHOR (medical assistance) in that veiligheidsregio

Not every theme has a separate subheading in the results. Some can also be incorporated in other themes because there is an overlap. If that is the case those themes will be **made bold** in the text. This is, for example, the case with ‘resilience’ and ‘integration & coordination’. For both themes, training is important. So, in both themes training will be discussed. Also, in order to provide some structure in the results, it was decided to write the results as much as possible based on themes, even though some themes overlap in their subjects. Moreover, an attempt has been made to place themes that are related in terms of subject matter closer together.

## Thematic Analysis

### Awareness and anticipation on cascading disasters

#### *Documents*

In the analyzed policy documents of the six veiligheidsregio’s, the only veiligheidsregio which writes about cascading disasters, is Groningen. As a reminder, a cascading disaster is a single event with large-scale effects which triggers one or more other unexpected event(s) of strong impact, this cascading, compound or multiple disasters trigger social cascades that have a disruptive effect on community or social life (Pescaroli & Alexander, 2015; Cutter, 2018). The effect of these cascading disasters increases in

progression over time (Pescaroli & Alexander, 2015). However, the veiligheidsregio's often do not refer to them as *cascading disasters*, but as *chain effects*. They describe this as an event that influences another succeeding event. In the policy document, the veiligheidsregio Groningen writes about possible situations in which cascading disasters may occur. These situations can be divided into two categories: gas production and critical infrastructure. The situation of gas production concerns gas production which causes earthquakes. The cascading disasters can be an earthquake which causes a subsequent disaster. The cascading disasters they mention are diseases, social unrest and vital infrastructure disruptions. The second situation, focusses on the failure of vital infrastructure. This failure may be caused by another disaster, such as a flood. The causes of possible cascading disasters are well presented in the policy document. They illustrate that cascading disasters, in which the vital infrastructure is affected, can have a serious impact on society. What striking is here, is that they can map out the possible *causes* well, but they fail to map out the *consequences*. It is written that it is unclear what effect the failure of a vital infrastructure will have on (chemical) industries, hospitals and other companies:

*'A world without data and internet and a world without GPS positioning is almost unimaginable. Failure of one or more of these systems can therefore have a potentially serious effect on society. The consequences are not always clear. It is not known to what extent (chemical) industries, hospitals and other companies depend on these services and to what extent the failure can lead to consequential damage such as emissions of hazardous substances or the inability to provide care.'* (Veiligheidsplan Groningen, 2019, p. 50).

### *Interviews*

In the interviews, it appears that all the participants are familiar with the concept of cascading disasters. For instance, Amsterdam-Amstelland gives an illustration of a burst of a water pipe which subsequently caused the hospital to flood and an evacuation of the patients. However, it is striking that they generally apply the concept of cascading disasters more broadly to situations than is done in the literature. For instance, all *chain effects* of a disaster are seen as a 'cascading disaster'. The participants often use the examples of power cuts or cyber-attacks. This indicates, that apparently there is attention for the possible chain effects of a disaster. The participants are certainly concerned about that. Furthermore, the participants also explain that no specific exercises are held concerning cascading disasters, but that these chain effects are always included in an exercise. The following two citations illustrate how the participants spoke about cascading disasters. The participant from Noord-Holland Noord indicated that there is always a cascading effect:

*'I am just thinking. Yes, actually it is never just an incident. So, there is always a cascading effect. An electricity failure has the effect of affecting the continuity of healthcare. It also has the effect of possibly*

*doing something to the drinking water. It has an effect on telephony. So, there are always cascading effects.'*  
(Interview Veiligheidsregio Noord-Holland Noord)

The participant from Zuid-Limburg also indicated that there is always a cascading disaster:

*'I think every incident is a cascading disaster. I think there is always something that has an effect on other things. And whether you have a collision of a car with a tree that temporarily closes the road, that also has an effect on your mobility, or whether it is as big as ionized radiation in a cloud, which also happened after Chernobyl. I think most causes of incidents are always a confluence of several circumstances, yes.'*  
(Interview Veiligheidsregio Zuid-Limburg).

In the case of a chain effect or cascading disasters, it appears from the interviews that the veiligheidsregio's of the participants do not have separate protocols or plans for cascading disasters. All the participants indicated that it is not feasible to make a plan for every possible combination. So, for each disaster there is a separate plan/checklist that the participants will combine during a cascading disaster. The participant from veiligheidsregio Limburg-Noord indicates that they always use the GRIP structure:

*'Uhm, we actually approach everything according to our GRIP structure. We are all in the field, but that is also a generic approach which can be applied to almost all disasters and crises. And depending on the type of disaster or crisis, you then call-in people [...]'* (Interview Veiligheidsregio Limburg Noord).

Although there are no specific plans, all veiligheidsregio's do make use of scenario thinking. This involves thinking about the possible consequences of an incident. This scenario thinking of the veiligheidsregio's indicates that they do have an eye for identifying cascading disasters, although it seems as if the veiligheidsregio categorize every effect of a disaster as a cascading disaster. Overall, there is not really a clear difference between the various veiligheidsregio's in terms of anticipation and awareness of cascading disasters.

In several interviews, participants began brought up the use of employees during disasters. How they formed teams and whether there would be enough staff. Veiligheidsregio's Groningen and Limburg Noord suggest that if there are two or more major disasters at the same time, parallel teams may be formed. Although, Limburg Noord and Groningen wonder whether this is feasible in practice. After all, there is not an infinite number of additional employees that can help. So, the parallel teams may cause shortage in the regular work teams. Groningen explains that they cannot hire another group of people especially for rare disasters. In the interviews with Zeeland, Amsterdam-Amstelland and Limburg Noord, the participants also

indicated that there is always a shortage of employees, which makes it difficult for them to provide assistance during a crisis or disaster.

In each interview, participants were asked to what extent they thought their region would be able to cope with cascading disasters if they were to occur tomorrow. Groningen is confident that they can handle cascading disasters, since that is ‘their right to exist’ and that they have the right structure to respond. However, Groningen thinks that their relief effort is not going to be perfect.

The participant from Zeeland explains that it depends on the types of disasters whether they are able to provide the right emergency assistance during cascading disasters. (S)he also indicated that they would like to make more use of the knowledge of external parties, for example during a system failure. Furthermore, concerns were expressed as to whether there is enough staff available during cascading disasters.

The participant from Amsterdam-Amstelland is convinced that they are able to deal with cascading disasters, because of their methods which are generically applicable. This means that if there are multiple incidents they prioritize and if necessary, they improvise. However, this participant also mentions that not everything is possible because of a possible shortage of personnel.

Limburg Noord believes that they can deal with cascading disasters, but under the condition that they can use their normal resources. For example, if the coordination center of the veiligheidsregio goes down, including all backups, they can no longer reach the emergency responders on the street. In that case, it would become difficult to be able to deal with cascading disasters.

The participant from Zuid-Limburg thinks that the Netherlands has its organization in order, but that there is a limit to what they can do during cascading disasters. A three-week power failure is given as an example of a situation that cannot be solved by the veiligheidsregio. One hundred percent safety does not exist according to the participant. You cannot protect citizens against everything.

Finally, the participant from Noord-Holland Noord believes that the veiligheidsregio can deal with cascading disasters. Continuous evaluation of such incidents is mentioned as an important point.

## **Governance & Deference to expertise**

The (cascading) disasters need to be governed. In the interviews, the participants spoke about how governance works during disasters. Who has which mandate? And can expertise play a role here?

### *Documents*

The policy documents of the regions illustrate in detail how the organization works, including who has which mandates. An explanation can be found in the introduction of this study. All veiligheidsregio’s make use of the standard governance structure for veiligheidsregio’s. This form of governance is strictly

hierarchical. In short, this means that at a low level, the decisions are taken by the organizations themselves, and the higher the GRIP level is, the higher in the hierarchy the main decisions are taken. It ranges from Commando Place Incident (GRIP 1), Regional Operational Leader (GRIP 2), the mayor (GRIP 3), the chair(wo)man of the veiligheidsregio (GRIP 4) till the chair(wo)man of the source region of the disaster. The mayor or chair(wo)man takes decisions on an administrative management level. So, the mayor or a chair(wo)man of the veiligheidsregio will not decide, e.g., in the case of GRIP 4, how a functional/operational chain, such as the fire brigade, should extinguish a certain fire (Crisisplan Veiligheidsregio Zuid-Limburg, 2018, p. 13).

In the documents of Limburg Noord, they also wrote about governance and the changes they want to implement. It emerges from this document that the hierarchical line is sometimes too long to respond quickly. Therefore, they want to use a functional form of leadership and coordination. They make use of the, as they call it, ‘netcentric principle’, to optimize response capacity. In which the focus is on coordination and not necessarily on the formal hierarchical leadership:

*‘All teams and processes are interconnected in a network. In this model, the management and coordination process does not strictly follow the line of the hierarchy, but is shaped in each individual team based on (predetermined) strategic frameworks and good preparation. The interfaces and contacts between the teams are not primarily focused on "leadership" (top-down assignment and bottom-up feedback), but on "coordination" (net-centrally available information about collective goals, decisions, execution and needs from each team [...]) (Crisisplan Veiligheidsregio Limburg Noord, 2018).*

### *Interviews*

Veiligheidsregio Amsterdam-Amstelland sketched a nice picture of the hierarchy and mandates in their veiligheidsregio. The veiligheidsregio tries to take the decisions as low as possible. Small decisions can be made by the employees working on the streets, whereas the managerial, strategic decisions are made by the PBT or the mayor:

*‘Look, it's about what kind of decision you are asking for. If it's a small decision, the employees on the streets can do it just fine. Just to give you an idea: The most important decisions are made by the emergency responders on the street. That's where life and death are at stake and where the decisions are made in the first five minutes. [...] She (the mayor) has the final responsibility. So small decisions are of course taken as low down in the organization as possible.’ (Interview Veiligheidsregio Amsterdam-Amstelland).*

In contradiction to the quote above, a strong hierarchy is present in veiligheidsregio Noord-Holland Noord according to the participant. But (s)he indicates that this does not get in the way of raising issues. Every member of the veiligheidsregio is trained to pinpoint a failure to another member, regardless of hierarchy.

Veiligheidsregio's Groningen, Zuid-Limburg and Noord-Holland Noord indicated that expertise plays a major role in the, decision making but the final decision always lies with the persons who have the mandate. Only the participant of veiligheidsregio Zeeland states that 'the one who knows' (expertise) is often in control.

Remarkably, the participant from Zuid-Limburg had a strong opinion about the fact that the chair(wo)man of the veiligheidsregio is a mayor. The participant believes that the political color of the mayor influences the role of the chair(wo)man of the veiligheidsregio. The participant indicates that the highest-ranking official within the veiligheidsregio should be politically uncolored, just like it is in the lower GRIP levels:

*'I've seen a lot of examples, including during covid, of mayors simply playing games of administrative opportunism to make themselves look good to the public. And very much staying away from any decision that might affect their position in the future. So, I don't think that's wise. I don't think that, in the spirit of Montesquieu's distinction of powers, that we should do that differently.'* (Interview Veiligheidsregio Zuid-Limburg).

Overall, this indicates that the veiligheidsregio's use a centralization of command, and that deference to expertise is very limited. There is no flexibility in who has the mandates. This outcome can be linked to the other theme '**integration and coordination**', since centralization of command is an aspect of it. However, veiligheidsregio's Groningen, Zuid-Limburg and Noord-Holland Noord indicated that expertise plays a major role in the decisions that are made, but that the final decision always lies with the persons with the mandate. And only Zeeland states that the ones who knows is in control (deference to expertise). In this they differ from the other veiligheidsregio's.

### **Integration and Coordination**

Integration and coordination are promoted through training, joint preparation and planning. It helps the organizations in the veiligheidsregio to work together during a disaster (Nohrstedt, 2016). Coordination is promoted through centralization of commands, meetings, formalization and decision-making procedures (Moynihan, 2009; Nohrstedt, 2016; Klijn et al., 1995; Ansell et al., 2010; Resodihardjo et al., 2018). The

aspect of coordination is mainly discussed under the topic of governance and will partly be explained here. Also, training, joint preparation and planning that contribute to the aspect of integration will be discussed.

### *Documents*

Nearly all the veiligheidsregio's, except for Noord-Holland Noord, discuss in their documents that they practice, train and exercise together to handle crises and disasters in order to be prepared and to keep their staff competent. All veiligheidsregio's train together, with Groningen and Zeeland stating that they train specifically on multidisciplinary (MOTO). This is interesting because multidisciplinary is especially important when facing cascading disasters.

Through these training, practice and learning, Zuid-Limburg wants to create professional competence (Beleidsplan Zuid-Limburg, 2020, p. 17, 18, 22, 25, 32). Also in Groningen, each discipline is responsible for exercises, training and evaluations for their functionaries. This is carried out monodisciplinary and multidisciplinary (Veiligheidsplan Groningen, 2019, p. 30, 40). Results after an incident are evaluated and mapped out using an app (Veiligheidsplan Groningen, 2019, p. 29). Groningen wants to maintain good cooperation with its permanent external crisis partners like the regional water authorities, police, defence etc. To this end, they are in frequent contact, but also practice and plan together (Veiligheidsplan Groningen, 2019, p. 26). The training of these external partners can be linked to the theme of external partners.

In Zeeland too, each discipline is responsible for the delivery of competent officers. Multidisciplinary exercises and training are held, using evaluations from actual incidents. Unexpected system exercises are also held (Beleidsplan Zeeland, 2016 p. 19-20). Zeeland insists on exchanging knowledge. First of all, they do this by organizing 'rookie days', when officers shadow another organization for a while to gain knowledge and skills (Beleidsplan Zeeland, 2016, p. 30). Secondly, they share knowledge and experience in the organization (Beleidsplan Zeeland, 2016, p. 9).

Noord-Holland Noord does not write much about the various aspects of training and practicing. What they do write about it is that they continuously monitor and improve. This means that they evaluate multidisciplinary and then implement the recommendations and improvements (Crisisplan Noord-Holland Noord, 2021, p. 5).

Just like Noord-Holland Noord, Amsterdam-Amstelland wants to be a learning organization by learning from mistakes and by sharing knowledge, skills and ideas (Amsterdam-Amstelland Beleidsplan, 2021, p. 25). They attune their education, training and exercise program to the needs of the crisis organization, but also to the needs of the officers themselves (Amsterdam-Amstelland Beleidsplan, 2021, p. 15). Personal development is supported (Amsterdam-Amstelland Beleidsplan, 2021, p. 25). The



veiligheidsregio does not only focus on their employees 'on the street', but also on the professional competence of their leader through a multi-year leadership program (Amsterdam-Amstelland Beleidsplan, 2021, p. 17). Just like the other veiligheidsregio's, there is also joint education and training and expertise is shared with external crisis partners, including the surrounding regions (Amsterdam-Amstelland Policy Plan, 2021, p. 15).

Lastly, Limburg Noord prioritizes professionalism and expertise of employees. This is also necessary because 'not all risks can be eliminated or all scenarios can be prepared for to the same extent.' But expertise allows them to improvise **resiliently** when an unknown crisis arises (Beleidsplan Limburg Noord, 2020, p. 15, 24).

### *Interviews*

The veiligheidsregio's were founded in the Netherlands with the idea of improving the coordination and cooperation of the various emergency services. The participant from Amsterdam-Amstelland agrees with this. Integration and coordination is also featured in all other interviews. Integration and coordination are partly reflected in the cold phase where plans are made and training is provided with internal and external partners. Tasks are also defined, so that coordination and tasks are carried out in a prearranged manner. Furthermore, there is a clear hierarchical line. The participant from Groningen illustrates this as militaristic, tight organization.

Nevertheless, not everything can be prepared. Therefore, all participants consider it important that there is room for **flexibility** during the hot phase. The employees are also expected to be capable of this as 'skilled professional employees'. Also, the participants from veiligheidsregio Groningen and Amsterdam-Amstelland do not want a fixed framework for which employees should be present at a given time during a disaster. But rather that their presence depends on what is needed in the situation. In other words, a more flexible scaling-up is preferred. This way, you also limit the composition of the team during the hot phase. This is related to the themes **flexibility** and **size & composition**.

Decision making procedures are also part of integration and coordination. Zuid-Limburg and Limburg Noord said that they have a system for this decision making. The discussions about decisions during a disaster are conducted according to the BOB; image formation, judgment and decision-making (BOB: beeldvorming, oordeelvorming en besluitvorming) (Veiligheidsregio Zuid-Limburg). The participant from Zuid-Limburg explains that the ultimate decision will be taken by the chair(wo)man, but this decision is almost always supported by the rest of the crisis team:

*'And then comes the decision. And that decision is ultimately taken by the chair(wo)man, who is jointly responsible for that decision. But that is based on the discussion and actually in all cases broadly supported by the rest of the crisis team.'* (Interview Veiligheidsregio Limburg-Noord)

All veiligheidsregio's are looking for a certain degree of stability in their organizations. During the interviews, this became clear due to the fact that they use plans, scripts and protocols for different types of disasters. However, what these look like and how extensive they are varies from region to region. Participant from Zeeland explains that they use plans that lists all kinds of consequences of a disaster. They can then work through this list per incident. All elements are included in this list. Also, the participant from Amsterdam-Amstelland explains that the fire brigade in their region uses protocols and checklists, but the participant adds that (s)he is aware that the more complex a disaster is, the more difficult it is to use them. Something else that this region, and Limburg Noord, use are short checklists: multi-information cards (MIK). They try to make a MIK for all the different disasters or crises that provides a certain basic knowledge of that incident type. The cards focus on their five crisis themes: leadership and coordination, information management, crisis communication, reporting and alerting and scaling up (GRIP):

*'That is actually the fixed, what do you call it, the basis during crisis management and that is where I try to give the crisis official the best start as possible. More of a certain basic information level about that type of incident. So yes, we have plans and protocols, but the further up the scale you go, the less they are used. But more use is made of information cards and basic knowledge. Knowledge about the source incident.'* (Interview Veiligheidsregio Limburg Noord).

A second way in which this stability and plans, scripts and protocols are reflected in Limburg Noord is through the fact that they use a fixed basic crisis structure that can be adapted according to the type of crisis. This illustrates that they are looking for a certain degree of stability/formalization, but at the same time they want to be flexible. Therefore, Limburg Noord always uses the same generic working method that is applicable in every situation. They train and educate themselves so they can always fall back on the basics they have learned. This gives them a certain flexibility to adapt to every situation.

Thus, all veiligheidsregio's use plans and protocols for the various disasters. But, the veiligheidsregio's differ in the form of these plans. Most of them are not that extensive, leaving room for improvisation. The veiligheidsregio's have found a way to incorporate flexibility into their plans. In other words, flexibility has been formalized. Here, the theme of integration & coordination meets the theme of **flexibility**. Also, it appears that all regions train and practice. Whereas Groningen and Zeeland train specifically on multidisciplinaryity (MOTO).

## **Striving for Resilience**

Commitment to resilience can be achieved by training the employees, by hiring employees with a wide variety of experience, by stimulating creative thinking, also by allowing conceptual slack and by learning from setbacks, e.g., with evaluations. Conceptual slack means that employees have different analytical perspectives together with the willingness to ask questions about the current state of affairs. The other employees hereby accept that these questions are asked. Together, this can lead to new solutions (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018). In the documents, striving for resilience is mainly reflected in the fact that the regions train and practice. As this is already dealt with under the theme of **integration and coordination**, it will not be covered here as well. This demonstrates that these two themes overlap to a large extent.

### *Interviews*

Resilience is visible in the veiligheidsregio's in several facets. One of them is resilience during disasters itself and the other is learning to deal with adversity. Groningen gives the example of the death of a person; this is a setback during the emergency assistance which the people must overcome. A second example is a disaster that lasts a while, so that long days have to be worked. Another example is the psychological distress of employees after the flood in the summer of '21 (Interview Veiligheidsregio Zuid-Limburg). Groningen, Zeeland and Amsterdam-Amstelland see this capacity for resilience as a condition for being able to do this work.

A second facet in which resilience is visible, is creative thinking and improvising as a veiligheidsregio during unknown situations (Veiligheidsregio's Groningen, Amsterdam-Amstelland and Noord-Holland Noord):

*'[...] Well then, you improvise. On the basis of the methods you have. So, about the organization, about the structure of your meeting, for example. They are more or less the same for any type of disaster. The next approach is tailor-made. [...]'* (Interview Veiligheidsregio Amsterdam-Amstelland).

Creative thinking and improvisation overlaps with the theme of **flexibility**, as this theme focuses on deviating from plans when necessary. So, as with flexibility, creative thinking and improvisation stand in sharp contrast to the theme of integration and coordination, because the emphasis there is on planning and formalization.

A third facet is 'training and practice' to ensure resilience. This theme will not be discussed in detail as this is already discussed in the overlapping theme integration and coordination. Also, the fourth facet,

'wide variety of experience' in order to build resilience will not be elaborated here, since it is the core of the veiligheidsregio that it consists of various specialized relief organizations.

The last facet that helps to build resilience is conceptual slack. Only Noord-Holland Noord states that they try to stimulate this in their employees by giving space to question things that you think are not right, regardless of the hierarchy. This illustrates that hierarchy should not get in the way of raising failures.

## **Size and composition of the team**

### *Documents*

A characteristic of high reliability is having a selective number of people in your organization. The veiligheidsregio is by definition an interorganizational network with a lot of people, so on the whole this characteristic does not apply to any of the veiligheidsregio's. But still, Zuid-Limburg indicates that in some cases small teams may be more effective (Zuid-Limburg Crisisplan, 2020, p. 15). They mainly train the core teams and not everyone (Beleidsplan Zuid-Limburg, p. 25).

The veiligheidsregio's found another way to limit the size and composition is by the use of external, peripheral parties. **External partners** may be involved in the emergency response when their specialist knowledge is needed. Think, for example, of companies in the critical infrastructure such as the supply of electricity. Also, when disasters cross national borders, it is sometimes necessary to cooperate with emergency services from abroad. External partners can thus provide assistance during (cascading) disasters.

Zuid-Limburg works with regular external crisis partners (often involved) and with ad hoc external partners who are occasionally involved. Ad hoc partners will occur more often as the number of stakeholders in an incident increase (Crisisplan Zuid-Limburg, 2020, p. 31; Beleidsplan Zuid-Limburg, 2020, p. 30). Covenants are established with the vital crisis partners and plans are made to get to know each other's working methods and interests. (Beleidsplan Zuid-Limburg, 2020, p. 30). There is also cooperation with other surrounding veiligheidsregio's like Limburg-Noord, with foreign countries and with national crisis bodies in working groups and committees (Crisisplan Zuid-Limburg, 2020, p. 8, 30; Beleidsplan Zuid-Limburg, 2020, p. 29). Foreign countries are an important factor here, as Zuid-Limburg is part of the Meuse-Rhine Euroregion. Several languages are spoken in this area and there are many different ways of working. This makes it a complex area for crisis management. That is why a special team has been established, the EMRIC: Euregio Meuse-Rhine Incident and Crisis Management (Beleidsplan Zuid-Limburg, 2020, p. 9).

Limburg Noord as well as Zuid-Limburg are aware that the number of stakeholders per incident are increasing due to the increased complexity of disasters. That is why they, too, have intensive contact with vital crisis partners and make covenants and plans (Beleidsplan Limburg Noord, 2020, p. 37). They

also coordinate their crisis plans with neighboring veiligheidsregio's and countries (Crisisplan Limburg Noord, 2018, p. 5).

Groningen wants to maintain their cooperation with regular crisis partners such as the water authorities, energy- or railway companies by practicing and planning together (Veiligheidsplan Groningen, 2019, p. 40). The veiligheidsregio wants to strengthen the relationship with new unknown (private) parties. For instance, a bank with a cyber-attack on its payment system. The knowledge for this usually has to come from the private sector (Veiligheidsplan Groningen, 2019, p. 20, 22). Cooperation also takes place with the surrounding veiligheidsregio's of Drenthe, Friesland and Lower Saxony (Germany) (Veiligheidsplan Groningen, 2019, p. 26).

Zeeland uses a cooperation platform for the regional partners and external partners to prepare for known and unknown crises (Beleidsplan Zeeland, 2016, p. 4). These are companies and organizations such as the port authorities, industry, education and a tunnel operator (Beleidsplan Zeeland, 2016, p. 31; Crisisplan Zeeland, 2017, p. 37-38). There is also a multidisciplinary exchange of information, joint training and communication with neighboring regions: Midden- and West-Brabant, Zuid-Holland Zuid and Rotterdam-Rijnmond (Beleidsplan Zeeland, 2016 p. 30; Crisisplan Zeeland, 2017, p. 15). In addition to national cooperation, Zeeland is also cooperating by exchanging information with Flemish parties such as the ports and the fire brigade (Beleidsplan Zeeland, 2016, p. 30).

Noord-Holland Noord works together with their partners, residents and entrepreneurs (Beleidsplan Noord-Holland Noord, 2020, p. 3, 10). In doing so, they maintain relations with institutions and organizations such as neighboring regions, defence and the vital infrastructure. They make agreements with the relevant crisis partners regarding the leadership and coordination, information management and crisis communication. (Crisisplan Noord-Holland Noord, 2021, p. 28).

In Amsterdam-Amstelland, for each type of crisis, they look for the necessary people or organizations to prepare together. They also look beyond their own veiligheidsregio. Interregional exercises are held with neighboring regions to build up expertise together (Beleidsplan Amsterdam-Amstelland, 2021, p. 15). As mentioned earlier, Amsterdam-Amstelland uses a Safety Information Point (VIK). They also want to share this hub with partners in and outside the region (Beleidsplan Amsterdam-Amstelland, 2021, p. 20).

### *Interviews*

It emerged in the interviews that an attempt is made to only have the relevant employees present during an incident. Participant Zeeland put it this way:

*'We are now very much stuck with: operational team consisting of... And then there's a whole list of officers. What we're moving towards is: there is an operational team. There's someone on it and he's in charge, coordinating that team. Support staff there to keep that team going. But who is on that team depends on what is going on [...] So, we are actually looking for much more flexibility when it comes to the composition of those levels.'* (Interview Veiligheidsregio Zeeland).

Also, Limburg Noord wants to work with "core teams" in which the necessary emergency services or persons are present depending on the scenario (Beleidsplan Limburg Noord, 2020). In the fire brigade, too, they want to work with a 'basic' fire brigade where not every (wo)man is trained as a specialist. If specific knowledge is needed during a disaster or crisis, they call in this special post. This way, they are trying to limit the size of the organization and to reduce the burden on volunteers (Beleidsplan Limburg Noord, 2020). So overall, it is not possible to have a small team, but Zeeland and Limburg try to achieve it as much as they can.

Most participants (Zeeland, Limburg-Noord, Zuid-Limburg and Noord-Holland Noord) indicated that during the cold phase they work on establishing a good relationship with external partners such as Tennet, Enexus, Pro-Rail, Rijkswaterstaat or the regional drinking water company. When external partners are needed, there is already mutual trust and they know each other's working methods. The participant from Limburg Noord describes this very clearly:

*'And because we have invested in that network, you see that people know each other, get to know each other in the cold phase, as we call it. And that helps during the hot phase, because then I run into the same colleague and I've already spoken to him once and when I call and they say 'oh that's no problem, coming right up'. Instead of 'ooh, I have to ask if I can share that first'. So, I think the investment we have made in maintaining our networks is paying off in the hot situation.'* (Interview Veiligheidsregio Zuid-Limburg).

During a disaster or crisis, external partners can be called in to use their knowledge and expertise, for example, the external parties responsible for the vital processes such as electricity or a partner like a hospital (veiligheidsregio's Amsterdam-Amstelland and Zuid-Limburg). Participant Amsterdam-Amstelland reported that during the Covid-19 crisis a special working-group maintained contact with these partners to investigate whether they foresaw any problems (Interview Veiligheidsregio Amsterdam-Amstelland). According to participants Groningen and Zuid-Limburg, external partners can connect to the LCMS information system. And as stated by the participant Amsterdam-Amstelland, delegates are sent to external partners for information and vice versa (Interview Veiligheidsregio Amsterdam-Amstelland).

## **Flexibility of the veiligheidsregio**

### *Documents*

Flexibility is present in all studied veiligheidsregio's. This will be outlined for each region. First, veiligheidsregio Zuid-Limburg, it states that the crisis organization can be deployed flexibly. The aforementioned GRIP structure serves as a guideline, but within the teams the leaders can make decisions and adjust the teams. There is also a fixed structure for 'classic' disasters with a fixed core, but this is flexible and scenario-dependent so that new threats can be anticipated by means of skillful improvisation (Crisisplan Zuid-Limburg, 2020, p.8, 15; Beleidsplan Zuid-Limburg, 2020, p. 17). Moreover, Zuid-Limburg wants to respond to a crisis effectively and quickly; to ensure this, it is sometimes necessary to deviate from the plan, so to be flexible (Crisisplan Zuid-Limburg, 2020, p.8, 15). What is striking is that there is a contradiction in the policy documents (crisis plan and the policy plan) regarding flexibility, while both documents are from 2020. The policy plan describes the organization as cumbersome and inflexible, while the crisis plan states that the organization can be deployed flexibly. Moreover, the scaling-up structure (GRIP) is still focused on classic disasters. The policy plan does express the desire to make the organization more flexible around the main structure (Crisisplan Zuid-Limburg, 2020, p.8, 15; Beleidsplan Zuid-Limburg, 2020, p. 20). They want to do this by ensuring a low-threshold scaling up of core teams/scenario teams, a demand-oriented set-up of teams, to realize faster and more effective decision-making, communication and deployment. Using safety information which is quickly available. They also want to be more flexible by exploring the possible deployment of parts of the crisis organization in social crisis, unprecedented risks and for the purpose of the recovery phase (Beleidsplan Zuid-Limburg, 2020, p. 24).

Groningen and Limburg Noord also indicated that they want to be flexible in the organization and especially in the application of the GRIP structure. They want to let go of the rigidity of the GRIP structure, so GRIP can be partially 'activated' according to what is needed for that specific crisis (Veiligheidsplan Groningen, 2019, p. 38; Crisisplan Limburg Noord, 2018, p. 22). Furthermore, Groningen carefully examines which crisis teams should be activated in which situation (Veiligheidsplan Groningen, 2019, p. 21, 38):

*'This flexible organization consists of a solid base that is responsible for leadership and coordination. This solid basis is supplemented with knowledge, experience and competencies needed to manage (threatening) crises. This means that, in addition to the basis, only what is necessary is scaled up. The scaling up is based on the type of incident, disaster or crisis.'* (Groningen Veiligheidsplan, 2019, p. 38).

Zeeland wants to move flexible with society. By this they mean that they want to respond to a changing society with additional (new) risks (Veiligheidsplan Zeeland, 2016 p. 5, 12, 35). The veiligheidsregio wants to be able to offer tailor-made solutions and act quickly and decisively in all situations (Veiligheidsplan Zeeland, 2016, p. 16). Zeeland also wants to apply the GRIP levels flexibly (Veiligheidsplan Zeeland, 2016, p. 21). At first, the main structure will be set up, but if the situation requires it, it will be deviated from. For instance, the composition of the teams. Certain specific support can be requested via the regional operational leader (ROL). (S)he can advise the competent authority or refer to experts (Crisisplan Zeeland, 2017, p. 21). In addition to GRIP, use is also made of the 'multidisciplinary button model'. This model establishes a relationship between the nature of the incident and the capacity to be adjusted accordingly. Each emergency service column within the veiligheidsregio determines for itself which 'buttons'/processes should be activated. So, it can happen that not everything is activated. In first instance, a GRIP level will provide an indication of the multidisciplinary scaling-up requirement (coordination and harmonization) as a kind of basis where certain buttons of the button model have already been pushed (Zeeland Crisisplan, 2017, p. 22). The crisis plan is mainly aimed at classic disasters, but at the same time they want to be able to respond to any other type of crisis. However, if one wants to deviate from the plan, an explicit decision must first be made by a chair(wo)man of the highest team (Crisisplan Zeeland, 2017, p. 21).

Just like Zeeland, Noord-Holland Noord wants to be able to respond adequately to new types of crises. They therefore feel it is necessary to set up a flexible crisis organization. What they mean by this is an organization that does not assume standard cooperation between the same parties. Instead, they want to look at what expertise is needed for that specific incident. They get this expertise from the network of people with specific skills (Beleidsplan Noord-Holland Noord, 2020, p. 21-22; Crisisplan Noord-Holland Noord, 2021, p. 2, 11).

Amsterdam-Amstelland is also aware that new types of crises will arise in which the traditional allocation of responsibilities will not be sufficient to combat the crises (Amsterdam-Amstelland Beleidsplan, 2021, p.15). However, they do not specifically address flexibility of plans or teams.

The documents illustrate, therefore, that flexibility is abundantly present in the documents, except for Amsterdam-Amstelland. There is flexibility in the composition of the teams, this corresponds with **size and composition**, and there is flexibility in the GRIP structure, i.e., in the plans (**integration and coordination**).

### *Interviews*

Groningen thinks that with **cascading disasters**, the flexibility of the veiligheidsregio will play a role, since it is probably different from what is trained for:



*'We practice, we train, but we also know that it is always different from what you have just practiced and trained for. And what you say about cascading disasters requires even more coordination. Perhaps people need to be deployed for a long time. Which is where it gets exciting, I think, which is an important point.'* (Interview Veiligheidsregio Groningen).

Participants from Groningen, Zeeland, Amsterdam-Amstelland and Limburg Noord also told that they recently started using a flexible GRIP scaling system. This can also be useful in the event of a **cascading disaster**. For each crisis, they then examine what and who is needed to deal with the crisis. This is something that employees from veiligheidsregio Groningen still find exciting. The participant from Noord-Holland Noord thinks that flexible thinking is part of the competences of the employees. The best choices must be considered for each situation. According to the participant, the knowledge and skills of the emergency services workers play a major role in this (Veiligheidsregio Noord-Holland Noord).

All regions are aware that you cannot plan everything, but that everything is situation-dependent and requires flexibility from the veiligheidsregio. Just like veiligheidsregio's Groningen and Zeeland is Amsterdam-Amstelland aware that you cannot write out all scenarios and disaster plans. They keep the plans very basic because *'thick books won't be read during an incident, you don't have time for it'* (Interview veiligheidsregio Amsterdam-Amstelland). And besides, participant Amsterdam-Amstelland states, reality is always different from your prepared scenario. Therefore, they practice the way they work, which they can implement on every situation, along with any necessary modifications or additions. If the situation is such that there are no plans for an unknown disaster - some participants state - the flexibility, expertise and professionalism of its employees will be used (Interviews Veiligheidsregio's Amsterdam-Amstelland and Limburg Noord). According to participant Limburg-Noord, the fixed structures offer something to hold on to.

This flexibility is not only found in the GRIP scaling up and the planning, but also in the use of information facilities. In principle, LCMS is used. Should this system fail, all veiligheidsregio's still have various back-up plans to keep in contact with all partners. This can be seen as a kind of built-in flexibility regarding information and communication facilities.

It is noteworthy that the interviews clearly show that the participants are aware that flexibility is needed to cope with (cascading) disasters. This flexibility is built into the plans. In this way, formal plans (integration and coordination) can go hand in hand with flexibility. So, they do not necessarily have to contradict each other.

## **Trust among employees in the veiligheidsregio & with external partners**

### *Documents*

One of the things - according to the theory - that contributes to high reliability is trust among employees and external partners. Trust is a topic that emerged strongly in the interviews, but less so in the documents. In the documents, it is the relationship of trust with **external partners** that is more pronounced. It appears that all the veiligheidsregio's consider trust to be an important aspect within their organization(s). Only in the documents and interviews of Limburg Noord this was not discussed. They mainly want to build up this trust with each other in the cold phase. For example, by having frequent contact with each other or by getting to know each other. This can then be used in the hot phase so that, for instance, information can be exchanged more easily. This relationship between partners also helps to gain knowledge about how each other's organization structure looks and works.

Zuid-Limburg emphasizes in its documents the bond of trust with external partners. They work with *permanent* external crisis partners (often involved) and with *ad hoc* external partners who are involved incidentally. Ad hoc external partners will occur more often because the number of stakeholders in an incident is increasing (Crisisplan Zuid-Limburg, 2020, p. 31; Beleidsplan Zuid-Limburg, 2020, p. 30). In the cold phase covenants are made with the vital crisis partners and plans are made to get to know each other's working methods and interests (Beleidsplan Zuid-Limburg, 2020, p. 30). Therefore, the veiligheidsregio organizes network moments:

*'At these moments, we learn about each other's crisis management, working methods and interests. Our ambition is to secure these networks more firmly by cooperating on added value, structurally exchanging safety information and contributing to more network meetings at various levels.'* (Beleidsplan Zuid-Limburg, 2020, p. 30).

Zuid-Limburg also cooperates with other surrounding veiligheidsregio's such as Limburg-Noord, neighboring countries and with national crisis organizations in working groups and committees (Crisisplan Zuid-Limburg, 2020, p. 8, 30; Beleidsplan Zuid-Limburg, 2020, p. 29).

Like the other regions, Limburg Noord also emphasizes its extensive network of external partners. These partners will become increasingly important since *'new types of crises will emerge'* (Beleidsplan Veiligheidsregio Limburg Noord, 2020). With the vital external crisis partners, Limburg Noord wants to ensure that officials know each other. They try to stimulate this by sharing safety information and organizing network meetings. Just like Zuid-Limburg, Limburg Noord works closely with foreign emergency services (Beleidsplan Veiligheidsregio Limburg Noord, 2020). Events are also organized for

these external partners so that officials can speak to each other (Beleidsplan Veiligheidsregio Limburg Noord, 2020; Crisisplan Veiligheidsregio Limburg Noord, 2018). So, Zuid-Limburg and Limburg Noord are very much aware of the fact that for the most part they border on other countries. They are therefore very conscious of maintaining ties with the emergency services of the neighboring countries. This is where they differ from the other veiligheidsregio's.

Also, Groningen wants to maintain the bond and collaborations with their regular external crisis partners - such as utility companies, railway companies, etc.- by practicing and planning together (Veiligheidsplan Groningen, 2019, p. 40). With new unknown (private) parties, the veiligheidsregio wants to strengthen the relationship. Think, for example, of a bank with a cyber-attack on the payment system. The knowledge for this usually has to come from the private sector (Veiligheidsplan Groningen, 2019, p. 20, 22). Groningen also cooperates with the surrounding veiligheidsregio's of Drenthe, Friesland and Lower Saxony (Germany) (Veiligheidsplan Groningen, 2019, p. 26). Finally, the veiligheidsregio is also in close contact with the municipalities in the region, as they are in charge of the integral safety picture of the area (Veiligheidsplan Groningen, 2019, p. 25).

Zeeland uses a cooperation platform for the regional partners and those outside of Zeeland to prepare for known and unknown crises (Beleidsplan Zeeland, 2016, p. 4). These are companies and organizations such as the port authorities, industry, education and a tunnel operator (Beleidsplan Zeeland, 2016, p. 31; Crisisplan Zeeland, 2017, p. 37-38). There is also a multidisciplinary exchange of information, joint training and communication with the neighboring regions: Midden- and West-Brabant, Zuid-Holland Zuid and Rotterdam-Rijnmond (Beleidsplan Zeeland, 2016, p. 30; Crisisplan Zeeland, 2017, p. 15). In addition to national cooperation, Zeeland also cooperates by exchanging information with Flemish parties such as the ports and the fire brigade (Beleidsplan Zeeland, 2016, p. 30).

Also, Noord-Holland Noord works together with external partners, residents and entrepreneurs (Beleidsplan Noord-Holland Noord, 2020, p. 3, 10). They maintain the relationship with institutions/organizations such as neighboring regions, defence and the vital infrastructure. They make agreements with the relevant crisis partners regarding the leadership and coordination, information management and crisis communication (Crisis Plan Noord-Holland Noord, 2021, p. 28).

In Amsterdam-Amstelland, for each type of crisis, they look for the necessary people or organizations to prepare together. They also look outside their own veiligheidsregio. For instance, interregional exercises are held with the surrounding regions to build up expertise together (Amsterdam-Amstelland Beleidsplan, 2021, p. 15). As mentioned earlier, Amsterdam-Amstelland uses a Safety Information Point (VIK). They also want to share this hub with partners in and outside the region (Amsterdam-Amstelland Beleidsplan, 2021, p. 20).

### *Interviews*

Trust can also be observed in the interview with Groningen. According to the participant trust is necessary, because you have to be able to trust that people know what they are doing. According to the participant from Groningen you can't deal with a crisis otherwise. A trust relationship can also be built with external partners. In the view of the participants from Zeeland and Amsterdam-Amstelland, it is important to gain the trust of *external partners* during the cold phase. They try to gain trust in an informal way. For example, they have dinner together with Belgium instead of holding a meeting, or they drink coffee together. Participant from Limburg Noord sees the advantage of this network. People (get to) know each other in the cold phase and this pays off in the hot phase, because there is a certain bond of trust. For example, this makes it easier to share important information with each other,

The participant from Amsterdam-Amstelland explains that the more often the different people and parties see each other, the greater the bond of trust becomes. Also, the participant emphasizes why trust is important. As a result of this bond of trust, he says, quite a lot of information is shared during the hot phase.

Just like the other veiligheidsregio's, the participants from Limburg Noord and Noord-Holland Noord also explain that it is important to continue to visit external partners during the cold phase in order to build a relationship of trust. But these participants also indicated that it is difficult to establish a relationship of trust with external parties. The first reason given was the fact that there are many changes in the job positions within the veiligheidsregio that have contact with external parties. The second reason is the fact that both the veiligheidsregio and the external parties do not always have the same people working due to the different shifts. As a result, there is a good chance that the person with whom you have a relationship of trust is not working during a disaster. The participant also stated that this does not necessarily have to be a problem:

*'I had a liaison from [grid manager] who did a fantastic job. He understood our structure, he brought in what was needed, he knew the scenarios right away. He always had the right updates, he was really perfect. And I had never seen this man before. So, it doesn't necessarily have to be that you know and trust each other to be a successful crisis team. [...] On the one hand, trust is extremely important during a disaster or crisis, but on the other hand, it need not stand in the way of a successful incident response, in my opinion.'* (Interview Veiligheidsregio Limburg Noord).

So, trust is important for all veiligheidsregio's. But, neither the documents nor the interviews of all veiligheidsregio's focus very much on trust within the organizations. From the way the participants in the interviews illustrated this internal trust, it seemed that trust in the organization was seen as something self-

evident. They were generally very brief and clear about it: 'it is there' or 'it is necessary in order to be able to function'. Whereas trust with external partners was seen as something that needs to be worked on harder. Therefore, perhaps trust with external partners comes up more in the documents and interviews. The regions need these external partners for specific knowledge or expertise they do not have themselves. The trust bond with external partners is mainly built during the cold phase.

### **Information and communication**

To effectively coordinate during a disaster, it is necessary that the members of the veiligheidsregio share information and communicate effectively (Davis and Robbin, 2015; Comfort, 2007; Bharosa et al., 2010; Oh, 2012; Waugh and Streib, 2006; Ansell et al., 2010; Resodihardjo et al., 2018). One cannot coordinate without information. To be able to do this, the organizations part of the veiligheidsregio need to have a shared language and meaning, so they can understand each other (Comfort, 2007; Comfort and Haase, 2006; Resodihardjo et al., 2018). And to be able to communicate this information, they also need to have adequate information technology and communication systems (Bharosa et al., 2010; Comfort and Haase, 2006; Oh, 2012; Resodihardjo et al., 2018).

#### *Documents*

'Information and communication' is well reflected in the documents, likewise in Zuid-Limburg. The region Zuid-Limburg uses information management to be able to sketch a multidisciplinary overall picture on basis of received, relevant and correct information about a disaster in order to be able to make it available to the crisis partners. Zuid-Limburg states that correct information is actual and consists of essential facts needed for fighting the disaster. In order to guarantee effective disaster management, they share what expertise is needed in the disaster response (Crisisplan Zuid-Limburg, 2020, p.32). To share this information, it is necessary to share the same standardized language, to enhance interoperability (Comfort, 2007; Comfort and Haase, 2006). Therefore, the law stipulates what an overall picture should look like. It must consist of the following parts: data about the incident, the assistance, the prognosis, the approach, the measures taken and the results thereof (Article 2.4.1, paragraph 2 Besluit Veiligheidsregio's). Zuid-Limburg writes how this looks like in their region: The information for this overall picture comes from the information officers in each crisis team, services and organizations involved (Crisisplan Zuid-Limburg, 2020, p.32). Before sharing the information for the overall picture, an attempt is made to verify the information. The various crisis teams that together form an overall picture must ensure their own information organization within their own team. To determine which persons and organizations are needed for disaster relief, they use a network analysis (it is not explained exactly what they mean by this). An example given is of an

organization that can be involved in disaster relief is a vital sector, as these sectors are often threatened during a disaster (Crisisplan Zuid-Limburg, 2020, p.32). When relevant information has been collected from the 'eigenbeeld' (own image), e.g., sketch of the current situation of the fire service, this is shared in the Landelijk Crisismanagement Systeem LCMS. The so-called information manager ensures that a total picture is formed of all information received. From that moment on, the current information is available to the other parties involved (Crisisplan Zuid-Limburg, 2020, p. 33-34).

Veiligheidsregio Zuid-Limburg is aware of the usefulness of good information management. They call it one of the most important components for effective and efficient task performance in the long run (Beleidsplan Zuid-Limburg, 2020, p. 39). That is why they continuously try to improve information management. They have different plans for the future. The information service may look different in the future. Veiligheidsregio Zuid-Limburg is aware of the latest developments in technology. They want to make use of these new technologies in the future in order to get an idea of the situation faster. For example, sharing images during a notification of a disaster (Beleidsplan Zuid-Limburg, 2020, p. 12). This indicates that they are continually trying to improve.

The veiligheidsregio Groningen believes that crisis communication stands for 'correct, timely and comprehensible information and offering a perspective for action during an (imminent) crisis. To this end, it is important that the key functions of crisis communication work uniformly and in line with each other.' (Veiligheidsplan Groningen, 2019, p. 39). And by information management they mean the collection, analysis, selection and making available of information. Like the veiligheidsregio Zuid-Limburg, they work with an overall impression. This impression is arranged according to the principles of GOGME. GOGME stands for Event, Cause, Effect, Measure and Effect. The purpose of this is to recognize available intervention capacity and (latent) system errors (Veiligheidsplan Groningen, 2019, p. 54). The same method is used for the measures that can be taken and that have been taken in the event of a crisis/disaster. In this way, they can also evaluate and learn from plans that have been made ('Plan-do-check-learn-cycle' PDCA) (Veiligheidsplan Groningen, 2019, p. 54).

When there is a multidisciplinary scaling up, a disaster, the information manager is responsible for the overall picture. This overall picture is shaped by the data that comes in. First, the data will be identified, analyzed and assessed according to a netcentric method (here too it is unclear what is meant by a netcentric method). This data is then made available via the National Crisis Management System LCMS (Veiligheidsplan Groningen, 2019, p. 41). The veiligheidsregio Groningen also uses 'VINN' to collect and share information. In which information is collected and shared from the adjacent veiligheidsregio's of Friesland and Drenthe (Veiligheidsplan Groningen, 2019, p. 22). With this special information system for surrounding veiligheidsregio's, Groningen distinguishes itself from the other regions. In the future, the

veiligheidsregio Groningen wants to be flexible and demand-driven when it comes to crisis communication. How exactly they envisage this is not explained in the policy document (Veiligheidsplan Groningen, 2019, p. 39).

The veiligheidsregio Zeeland states that information exchange is the basis of effective incident response. In order to make this information exchange as effective as possible, they ensure that everyone speaks the same 'language'. All information that comes in is collected, linked and analyzed before being shared with the staff (Beleidsplan Zeeland, 2016, p. 33). This information is then used to prevent risks and improve crisis management. The veiligheidsregio Zeeland does not only want to exchange information during the hot phase, but also during the cold phase in order to form a continuous picture so as to be prepared for possible disasters. The fact that they are already gathering information in the cold phase shows a proactive attitude on the part of the region. It may be possible that this approach will allow them to identify any cascading disasters sooner:

*'On the basis of information gathered (through the use of big data, among other things), we fulfill a key role in the information position internally and externally. [...] This is not only true in the hot phase of a disaster, but also in the cold phase, when we ensure a good information position in order to be well prepared for possible realistic scenarios. We visualize the threats, how serious they are, what we can do about them and who we need to do it.'* (Zeeland Beleidsplan, 2016, p. 18).

Like the veiligheidsregio Groningen, Zeeland also has liaisons with neighboring veiligheidsregio's, including Belgian regions. Liaisons are also exchanged with functional chains (water supply, electricity, etc.). The information exchange takes place during a disaster (scaled up to GRIP 5). This concerns information exchange during the hot phase, i.e., when the disaster is already taking place.

By working in an information-driven way, veiligheidsregio Noord-Holland Noord wants to gain more insight into the risks and effectiveness of their activities (Beleidsplan Noord-Holland Noord, 2019, p. 11). The information is done according to a netcentric working method (Crisis Plan Noord Holland Noord, 2016, p. 4). The aforementioned Landelijk Crisis Management Systeem (LCMS from now on) is used for this purpose (Crisis Plan Noord-Holland Noord, 2016, p. 18).

The policy documents of Amsterdam-Amstelland do not explicitly explain how the information flow proceeds from the notification to the continuous imaging, as is explained in some other veiligheidsregio's. What is mentioned is that a continuous image is shared during a disaster through the National Crisis Management System LCMS (Amsterdam-Amstelland Beleidsplan, 2021, p. 19). The veiligheidsregio values information-driven safety. The VIK functions as an information hub where all

safety partners can check and add what is going on and get an up-to-date safety picture with data from various sources (municipalities, veiligheidsregio's, environmental services, GGDs, police, water boards, etc.), collect, combine, analyze, research and publish information. VIK helps the veiligheidsregio to get a safety image by combining data:

*'Users of the VIK (administrators, directors and employees of the veiligheidsregio and its partners) can use this safety image to make decisions to ensure safety in society. The VIK not only brings together data and converts them into information. It also refines information into knowledge. As a result, the VIK is also a platform for talking to each other about the risks and vulnerabilities in the region and for considering possible measures together.'* (Amsterdam-Amstelland Beleidsplan, 2021, p. 20).

Amsterdam-Amstelland therefore uses a central information point instead of a one-man information manager as in other regions. The central information point is used in both the hot and cold phase and is also shared with external partners within and outside the region (Amsterdam-Amstelland Beleidsplan, 2021, p. 20).

Veiligheidsregio Limburg Noord wants to work information driven just like Noord-Holland Noord and Amsterdam-Amstelland. This will help them to focus on the most important risks and to think proactively. Through the technology Safety Information Centre (VIC), they want to achieve this. With this system the veiligheidsregio will be able to form a picture of a situation more quickly by sending images. In the Safety Information Centre (VIC), they will be able to enhance these images with information from public information sources or sources shared with our network partners.

The pre-established plans on how information should be shared shows that the veiligheidsregio's want to have a certain degree of stability and formalization of the information and communication provision. This is in line with the theme '**integration and coordination**'.

### *Interviews*

It was also evident in the interviews that in order to coordinate the various emergency services, it is important to share information and communicate with each other. All participants indicate that the current picture of the disaster(s) is mainly communicated via 'LCMS'. In this system, all parties involved - including external parties - can gain and share information. As soon as there is a disaster, information must be collected to share with the emergency services. All regions have an information manager and organization for this. The participant from Limburg Noord uses the clapboard of the control room, so all the notes made by the control room operators can be seen. In addition, s(he) calls the control room and with the employees



on the street to check the facts. There is a continuous information collection. The participant called this 'netcentric working'.

Also, Zuid-Limburg illustrates how they create an overview during a disaster with the help of netcentric working:

*'[...] That means active imaging at the source location and in the effect area. Information is collected, filtered, interpreted and entered into the system, so that in a cycle, which they also call 'netcentric', you share it constantly, but at intervals of fifteen minutes, ten minutes, an hour, or whenever it is necessary. You get a new picture of the situation. So how do we do that? Well through the information management method. And the people in the team who are responsible for that. But that picture is collected from all members. So, in fact everyone is there, contributing to it.'* (Interview Veiligheidsregio Zuid-Limburg).

In these examples, it can be seen that outside the official way of communication, as mentioned in the documents, there is also communication with the emergency workers on the street by calling with the control room (who are in contact with the emergency services). Several other participants also mention using apps such as Whatsapp and Signal or just old-fashioned calling (Interviews Veiligheidsregio's Groningen, Zeeland, Limburg Noord and Noord-Holland Noord). Whatsapp or Signal is mainly used for the operational image and LCMS for the situational image, according to the participant from Zeeland. As reported by the participant from Limburg Noord, other resources such as C2000 with walkie-talkies and the control room are also used for the short lines. In the event of a LCMS failure, all the participants indicated that they had back-ups. This ranges from a practice environment in LCMS that can be used to an emergency communication facility via copper cables or working with couriers. This is a form of **flexibility** in the way of communicating.

Participant Amsterdam-Amstelland explains that in their region they are in the process of setting up a new thing, the Safety Information Exchange (VIK). This is used to collect as much information as possible in the cold phase. If there are any peculiarities that week, they are entered into the system. Then a briefing can also be linked to this for the crisis officials (Interview Veiligheidsregio Amsterdam-Amstelland). The VIK is therefore a new way of proactively collecting information and communicating in advance with crisis officials. The fact that they are already gathering information in the cold phase shows a proactive attitude on the part of the region. It may be possible that this approach will allow them to identify any cascading disasters sooner. Zeeland and Amsterdam-Amstelland are unique in this.

Not all information can always be shared, such as commercially sensitive information or drinking water data, with everyone in the veiligheidsregio according to participant Amsterdam-Amstelland.

However, this applies during the cold phase. Due to the trust that has been built up, the necessary information is shared during the hot phase (Interview veiligheidsregio Amsterdam-Amstelland).

### **Reluctance to simplify**

To prevent oversimplification from happening organization can make use of teams with opposing views and expectations and by making teams which consist of people with a wide range of experience. They are critical of categories by making use of subcategories and they are also aware of the fact that categories might be incorrect (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).

#### *Documents*

In the documents, reluctance to simplify does not occur very explicitly. Only Zeeland illustrates that the veiligheidsregio analyses safety risks. This is a dynamic process, because risks are never the same. They make a good distinction of the impact of the risk, who or what is causing the risk. Differentiation is necessary in the approach to be able tailor-made solutions. This illustrates that they are critical of the use of categories. Indeed, these are not always applicable.

#### *Interviews*

As mentioned in the other themes, the veiligheidsregio's use protocols and plans for disasters. Participants from Groningen and Limburg Noord state in the interview that they do not rigidly adhere to a plan such as GRIP. They use the GRIP scaling-up flexibly. This means that the GRIP plan can be used in part, for example not all emergency services are called in.

In the interview with participant from Zeeland it is mentioned that they use a very extensive checklist during disasters to map out all possible consequences of a disaster:

*'I dare say they are so comprehensive that every element is always there. I don't know what is missing from it. [...] It is set up in such a way that you... It is also much more about the mindset, to think of where are our dilemmas, where are our issues. Then, of course, I can say I'm going to do this or that to tackle the problem. But that still doesn't give you a clear picture of the effects. So, it's mainly about visualizing the consequences.'* (Interview Veiligheidsregio Zeeland).

This is a bit of a debatable issue as to whether they are thinking too much in sub-categories or not, regarding the consequences of disasters. But they are very aware that extensive planning is not suitable for disasters,

because an actual disaster always turns out differently than could have been anticipated. Therefore, they use basic plans with a rough outline.

Also, the participants from Amsterdam-Amstelland and Limburg Noord are critical about the use of (sub) categories. They use planning that is a little more outline oriented. Amsterdam-Amstelland compares a lot of plans with a thick book, something you will not have the time for to read once a disaster takes place. On top of that, the prepared scenario will always be different from the actual disaster. Therefore (s)he states that the use of plans with a rough outline is sufficient.

The participant from Limburg-Noord said that the very short MIK information cards (multi-information cards) mainly serve as quickly available basic information for that type of incident. The participant from Limburg Noord is afraid that the context of the incident is overlooked because of these checklists. But the further the GRIP is scaled up, the less this is used because the disaster is too complex. The participant from Noord-Holland Noord also says they use plan formation in the cold phase, but that they do look carefully at that specific incident to see if they themselves still need to bring something in.

Reluctance to simplify is thus mainly reflected in the fact that all regions are flexible in the use of their plans and protocols. Therefore, the theme of reluctance to simplify can be seen somewhat as an extension of the theme of **flexibility**. The other aspect of reluctance to simplify, 'teams with opposing views and expectations', is not really emphasized in the documents and interviews itself. Yet it can be reasoned that all veiligheidsregio's contain a wide range of experience. After all, by definition they consist of several specialized organizations.

### **The veiligheidsregio is sensitive to operations (& situational awareness)**

Being sensitive to operations means that they can spot any deviations, which may cause failures. This can be achieved by a few things: communicate frequently within and outside the team. This has been discussed at length in the section on communication and information. The second thing that helps is giving space to point out mistakes. This too will be discussed after this in the them 'dealing with failures (made)' and will not be covered here. Thirdly, attention can be paid to *possible* errors, so is the assistance continuing to flow as it should? And finally, it is important that there is awareness of 'why people do things in a certain way', so not working on auto-pilot. The latter two will be highlighted in here. In this theme, only the results of the interviews are discussed, because the few aspects of sensitivity to operations discussed in the results, 'attention to possible errors' and 'awareness of why people do things in a certain way', are not present in the documents.

### *Interviews*

All veiligheidsregio are really sensitive to operations. In order to prevent mistakes from being made during assistance - in other words, to ensure that assistance continues to be provided properly - all participants agree that communicating (**theme information and communication**) with each other is the way to achieve this. This is done through the LCMS information system in which each emergency service passes on the state of affairs or through multidisciplinary consultations in which the various emergency services participate. Participant Limburg Noord keeps an eye on the progress of the emergency assistance. In the case of a scaled-up situation (GRIP) there are very short lines of communication with people in the field, the ones who provide the actual assistance, through C2000, walkie talkies and the control room. In the main building of the veiligheidsregio (s)he is concerned with the effects on a tactical level.

And finally, it is important that there is awareness of 'why people do things in a certain way', so not working on auto-pilot. In the interviews, the participants state that they make use of a number of prearranged teams and plans etc. (see also theme quest for stability), But they also show that they want to be **flexible** by looking at what is needed per disaster and adjusting the assistance to it, e.g., flexible GRIP scaling-up and flexible use of plans and protocols. All participants have a great deal of situational awareness, so that they do not work on 'automatic pilot' in every disaster. Participants Groningen and Limburg Noord explain during the interview how they try not to work on auto-pilot. Here the participant from Groningen compares two crises that are similar:

*'[...] So we do look like... We learn from Fort Oranje. What worked there? But at the same time, you also have to see that there is a substantial difference with what is happening here now. So, in that sense you take your experiences with you, you also have to be very alert to that. That's what the literature says, of course. And psychology. You also have a certain prejudice. Like, oh, we did it that way then, so it would be appropriate to do it again now.'* (Interview Veiligheidsregio Groningen).

### **Dealing with failures (made)**

It may happen that, despite all precautions, something goes wrong. In the documents and interviews is examined how the veiligheidsregio's deal with reporting failures.

#### *Documents*

The Zuid-Limburg veiligheidsregio accepts that no such thing as error-free exists. It is written that errors must be accepted, without damaging the reputation. It must be possible to communicate openly and transparently about points for improvement. In order to learn from mistakes, it is important, according to Zuid-Limburg, that the organizations allow room for this:

*'Without acceptance of mistakes and protection of the learning environment, fear of reputational damage (personal and for the organization) sets the tone for the learning process. That is counterproductive. [...] By also communicating openly about our limitations and lessons learned, we contribute to the image that the people working in the crisis organization are not 'supermen', but that we want to use our imperfection to become better at what we do'. (Beleidsplan Zuid-Limburg, 2020, p. 26).*

It can be said that Zuid-Limburg has a pro-active attitude to mistakes. They want to learn continuously as an organization. They do this by testing systems, for example, or by communicating expectations to each other.

The regions of Groningen, Zeeland and Amsterdam-Amstelland focus on learning from mistakes. In Groningen, a quality management system is used with the aim of strengthening the veiligheidsregio. Within this system, employees are held accountable for their performance and activities are upgraded. It does not address how and whether employees can discuss errors themselves (Groningen Veiligheidsplan, 2019, p.40). Zeeland wants to be a learning organization. They do this by periodically measuring performance on an operational, tactical and strategic level. In this manner, they hope to be able to reflect and see what is going well and what is not. Zeeland also encourages dialogue in order to learn from each other. Moreover, incidents, disasters and crises are evaluated. The current policy plan is partly based on these evaluations. Also, Amsterdam-Amstelland wants to be an organization that encourages learning. They want to learn from mistakes. It is not written how errors are/can be addressed.

Limburg Noord accepts that there is no such thing as being faultless. In order to learn from mistakes made, they therefore want to offer a safe learning environment where acceptance is paramount, because otherwise fear of reputational damage will be counterproductive.

Thus, in the documents, for all the regions, it mainly emerges that they want to learn from mistakes. How these failures should then be addressed is only discussed in the documents of Zuid-Limburg, Limburg Noord and Amsterdam-Amstelland.

### *Interviews*

Amsterdam-Amstelland considers training and practicing (related to the theme **resilience**) on a regular basis as the best method of preventing mistakes from being made. Zuid-Limburg, on the other hand, refers to the standardization of working methods (relates to the aspect formalization of the theme of **integration and coordination**) because that can serve as 'a kind of checklist to make sure that you haven't forgotten anything'.

The interviews revealed that there is a difference in perception between the participants as to whether there is room to report an error to the veiligheidsregio. Zeeland thinks that there is room to do so, but wonders whether this actually happens because of the prevailing culture:

*'[...] But we are in an official world and it is not. Let me say, the culture is not like that. It is an element of culture. So, you can have all sorts of nice procedures and all sorts of protections and protocols. It's a bit like the whistleblower story. You can do everything, but whether it is actually done is another question. That's another matter.'* (Interview Veiligheidsregio Zeeland).

Limburg Noord paints a different picture and thinks that the culture to report mistakes is good. (S)He illustrates that more attention is paid to this in their training. Also, the participant said there is an acceptance to make mistakes, since the perfect crisis response does not exist.

In veiligheidsregio's Groningen and Limburg Noord, the participants stated that preventing and dealing with errors is something that has to be arranged in the mono process and that they therefore do not know. With this mono process, the participant refers to the responsibility of an individual veiligheidsregio organization such as the fire brigade. Groningen does have the impression that there is a climate in the organization where employees dare to report mistakes. But the participant also said that it still feels 'exciting' sometimes. Because, people might be afraid for negative gossip. The participant states that this is what they have to keep working on.

Also, Amsterdam-Amstelland states that the errors must also be solved within the mono processes, but the reporting of the bottleneck can start at the multi-meeting.

According to Zuid-Limburg, there is no unequivocal answer as to whether there is room for reporting failures. The participant says that this depends a lot on the organization, because the culture of the police is very different from that of the medical assistance. But it can also depend on the character. They do try to teach their employees how to express their gut feelings and give feedback through training and practice. Limburg Noord also illustrates that they are busy training their employees in soft skills such as learning to report mistakes. This training is carried out by 'Team Resource Management'. Noord-Holland Noord already makes use of this training and has also developed it in the GHOR of Noord-Holland Noord, as a result of which there is now a culture where it is possible to report mistakes.

It is striking that many participants (Zeeland, Amsterdam-Amstelland and Zuid-Limburg) say they would rather not call it a mistake or failure - but rather something like bottlenecks or points for improvement - because it is not something that is done on purpose and because of the reason that there are different types of failures. It is interesting to include this nuance in the theory on HRO and HRN:

*'Well, not every mistake is the same mistake. It can be a mistake because someone does something as agreed, but it didn't work in the situation that was there. It could be a mistake because of the circumstances or the resources that were available or not. Or it could just be a stupid mistake. And then there are deliberate mistakes, too. There are different categories [...]'* (Interview Veiligheidsregio Zeeland).

Overall, the participants of Zeeland, Limburg Noord, Zuid-Limburg and Noord-Holland Noord say that during evaluations of incidents there is room to discuss mistakes made. Thus, these interviews reveal that perceptions of the prevailing culture in the veiligheidsregio's differ across the regions. In one culture, raising issues is not a problem and in another culture, raising issues causes reputational damage. But this is the perception of a single person from that region. The individuals who made a mistake are not spoken to in this study. Therefore, this may give a distorted picture. For this reason, it would be interesting to conduct a separate study on the prevailing cultures within the veiligheidsregio's.

### **Accountability**

It can help employees of the veiligheidsregio to have expectations from external stakeholders to attain the expected results (Turrini et al., 2010; Resodihardjo et al., 2018). Accountability to external stakeholders was almost non-existent in the documents and in the interviews. Noord-Holland Noord discusses briefly how the public has a little influence where the essence of the assistance lies:

*'And partly, in my opinion, this is also due to the influence of public opinion. So where does the essence lie [in the risk profile]? I think if we look at terrorism around 2010, 2015, yes, that is in the public mind. And so, something else comes back to it and now it's the pandemic story. So, you see different choices being made in the region, but also within the country. And that, of course, is interesting.'* (Interview Veiligheidsregio Noord-Holland Noord).

In the results, for each theme it was presented which other themes were overlapping. Table 5 below, depicts this overlap between the different themes. As can be seen, the themes overlap to a very large extent. The themes, and thus the characteristics, that overlap reinforce each other. This makes them probably easier to use in practice.

The conclusion will explain to what extent the veiligheidsregio's differ from each other in terms of the presence of the characteristics from the theory.

Table 5: Overlap of themes

	<i>Awareness and anticipation of Cascading disasters</i>	<i>Governance &amp; Deference to expertise</i>	<i>Integration and coordination</i>	<i>Striving for Resilience</i>	<i>Size and composition</i>	<i>Flexibility of the veiligheidsregio</i>	<i>Trust among employees in the Veiligheidsregio &amp; with External partners</i>	<i>Share information and communicate</i>	<i>Reluctance to simplify</i>	<i>The Veiligheidsregio is sensitive to operations (&amp; situational awareness)</i>	<i>Dealing with failures (made)</i>	<i>Accountability</i>
<i>Awareness and anticipation of Cascading disasters</i>												
<i>Governance &amp; Deference to expertise</i>												
<i>Integration and coordination</i>												
<i>Striving for Resilience</i>												
<i>Size and composition</i>												
<i>Flexibility of the veiligheidsregio</i>												
<i>Trust among employees in the Veiligheidsregio &amp; with External partners</i>												
<i>Share information and communicate</i>												
<i>Reluctance to simplify</i>												
<i>The Veiligheidsregio is sensitive to operations (&amp; situational awareness)</i>												
<i>Dealing with failures (made)</i>												
<i>Accountability</i>												



## **Conclusion and Discussion**

The future will bring more disasters and cascading disasters. This, and especially the cascading disasters, will bring challenges for emergency management services. The coordination of the different emergency services is a crucial factor in dealing with (cascading) disasters and crises. This challenge makes clear that disaster risk preparedness and management requires, by definition, the existence of a set of interconnected organizations. The emergency services in the veiligheidsregio's are structured as interorganizational networks. This study investigates if they meet the requirements of a High Reliability Interorganizational Network as stated in the theoretical framework. The aim of this explorative, qualitative study was to contribute to the development of the theory of High Reliability Networks. Doing so by exploring how cascading disasters are framed and perceived in the six veiligheidsregio's in the Netherlands and how the experts see their organizations in terms of their reliability. The following research question was formulated: *In which way would the selected veiligheidsregio's in the Netherlands work as High Reliability Interorganizational Networks during cascading disasters according to their policy- and crisis plans and to the perception of their employees?* To get an answer to this question eleven policy documents were analyzed and six interviews were held with employees of the veiligheidsregio's Groningen, Zeeland, Amsterdam-Amstelland, Limburg Noord, Zuid-Limburg and Noord-Holland Noord.

### **Conclusion**

#### **Cascading disasters**

The interviews revealed that there is awareness for cascading disasters in all veiligheidsregio's. But, it seems that the veiligheidsregio's see every possible effect of a disaster as a cascading disaster. They often used the examples of power cuts or cyber-attacks. This indicates that there is attention for the possible chain effects of a disaster. The participants also explained that no specific exercises are held with cascading disasters, but that these chain effects are always included in an exercise. It appeared that none of the veiligheidsregio's had separate protocols for cascading disasters, nor a plan or protocol with specific anticipation of cascading disasters. But, the veiligheidsregio's do think constantly about possible effects of a disaster. Also, there are some differences among the regions. The one region that had included cascading disasters in its documents was Groningen. In the documents Groningen mapped out the possible causes of cascading disasters well, but they failed to map out the consequences of the cascading disasters. It is written that it is unclear what effect the failure of a vital infrastructure will have on (chemical) industries, hospitals and other companies. It also appeared that Groningen uses separate plans for every type of disaster which they 'glue' together if there would be a cascading disaster.

Another thing that came up is that during cascading disasters, Groningen and Limburg Noord suggested that perhaps parallel teams could be set up: a different team for each separate disaster. But the regions of Zeeland, Amsterdam-Amstelland and Limburg Noord already indicated that during a disaster there actually always is a shortage of employees, which makes it difficult to provide all the assistance you would like to give.

Although there are no specific plans for cascading disasters, all veiligheidsregio's do make use of scenario thinking. This involves thinking about the possible consequences of an incident or disaster. This indicates that the veiligheidsregio's do have an eye for identifying cascading disasters. Overall, there is not really a clear difference between the various veiligheidsregio's in terms of anticipation and awareness of cascading disasters.

### **High Reliability Organizations: characteristics to achieve resilience and reliability**

#### *Reluctance to simplify*

To prevent oversimplification from happening the veiligheidsregio's took various precautions. One of the forms for reluctance to simplify is having a wide range of experience. By definition, veiligheidsregio's consist of organizations with a wide range of experience. They supplement this with the necessary expertise from external parties if the situation requires it. This is also reflected in the trust characteristic.

In the documents and interviews, reluctance to simplify mainly appeared in the form of criticism of categories. Groningen and Limburg Noord did not rigidly adhere to predefined plans such as GRIP. Other veiligheidsregio's, such as Amsterdam-Amstelland, Zeeland and Limburg Noord, tried to keep their plans at a basic level because larger disasters are too complex to use such predefined (information) plans. Moreover, Zeeland, Limburg Noord and Noord-Holland Noord did not want to forget the context of the incident. Since the context determines what kind of assistance is needed. In the interview, Zuid-Limburg illustrated in a slightly different way to provide situation-dependent emergency assistance. They explained that they do use a generic working method, but it is flexible enough to be applicable to any situation. It appeared that Zeeland has a flexible plan for providing emergency assistance, but for mapping the situation, they have an extensive checklist in which all the possible consequences of a disaster are listed. It is striking that they do use simplification here. In practice, it must be determined whether oversimplification actually occurs.

Thus, in all the documents and interviews is reflected that the veiligheidsregio's try to avoid oversimplification, each in their own way. This is especially evident in the fact that they are 'critical of categories' and that the veiligheidsregio's contain 'a wide range of experiences'. The other aspect of reluctance to simplify, 'teams with opposing views and expectations', is not really reflected in the documents and interviews.

### *Preoccupation with failure*

A third characteristic is preoccupation with failure. To prevent one small mistake from causing a big problem, a focus on failures is necessary. In the interviews, it emerged that the participants want to add a nuance to the concept of failure. It is striking that many participants (Zeeland, Amsterdam-Amstelland and Zuid-Limburg) said they rather would not call it an error - but more something like bottlenecks or points of improvement - because it is not something that is done consciously. And for the reason that there are different types of errors. This is a nuance that needs to be considered in the future of the theory of high reliability.

Limburg Noord explained they want to create an environment in which it is safe to bring up mistakes, without damaging reputations. Zeeland and Groningen think they have created that safe environment, but wonder if it is really happening in de current –as they called it- prevailing culture. Groningen Amsterdam-Amstelland Zuid-Limburg and Limburg Noord illustrated that raising failures is a mono-process, which is arranged by each organization in the veiligheidsregio itself. However, participants from Zeeland, Limburg Noord, Zuid-Limburg and Noord-Holland Noord explained that during evaluations of incidents there is room made to discuss mistakes. As a result, they indicated that they do not know whether there is an environment in which people dare to bring up mistakes. To change this culture, Limburg Noord and Noord-Holland Noord have used, or will use in the future, training sessions.

From the documents and interviews, it appeared that preoccupation with failure is something that is not strongly present in the studied veiligheidsregio's. What is striking, is that some regions are aware that there is no culture where it is possible to point out mistakes made. This is something that can be worked on by the veiligheidsregio's. This is important since pointing out failures will help the veiligheidsregio to identify failures sooner so they can act on them, or to prevent failures from happening.

### *Commitment to resilience*

Resilience can be seen in the veiligheidsregio's in a number of things: training and exercising, hiring employees with a wide variety of experience, stimulating creative thinking, learning from setbacks via evaluations and allowing conceptual slack. The veiligheidsregio's all train and practice, this corresponds with the characteristic 'integration and coordination' where training and practice are important. Also, 'wide variety of experience' in order to build up resilience is something that emerges in the veiligheidsregio's. Since it is the characteristic of the veiligheidsregio to consists of various specialized emergency organizations. The creative thinking aspect of resilience emerged in the interviews with Groningen, Amsterdam-Amstelland, Zeeland and Noord-Holland Noord by improvising during unknown situations.

Conceptual slack only came up in the interview with Noord Holland Noord, in which was indicated that the region makes an effort to give employees room to raise issues or ask questions about the current state of affairs. Based on this study, it can be argued that the veiligheidsregio's all have the characteristic 'commitment to resilience' to a certain extent. This is especially evident in the training and the wide variance of experience. The aspects conceptual slack and stimulate creative thinking were less evident in the documents and interviews. It might be the case that these are aspects that are hard to find in documents and interviews and is more something that lends itself to fieldwork, because the aspects are so specific.

#### *Deference to expertise & Governance*

Factually speaking, there is no deference to expertise in the veiligheidsregio's. As emerged from the documents and the interviews, the veiligheidsregio's are hierarchically organized. Nevertheless, in the interviews with Groningen, Zuid-Limburg and Noord-Holland Noord it emerged that "the people who know" play a major role in the decisions that have to be made. The participant from Zeeland even stated that the person with the expertise is usually in control. As Amsterdam-Amstelland mentioned, the emergency services workers on 'the street' make the most important decisions about life and death. The mayor will not interfere with a resuscitation or the rescue of a person out of a burning building. But, this form of deference to expertise is very limited, because ultimately a centralization of command is used. There is no flexibility in who has the mandates. However, the input from the expertise is almost always adopted by the person with the right to make the choice (Veiligheidsregio's Groningen, Zuid-Limburg and Noord-Holland Noord).

This is a characteristic that could still be worked on by the veiligheidsregio's. Presumably, 'deference to expertise' is not feasible at the current moment because the veiligheidsregio's are an incredibly large body. So, to what extent it might be possible for the veiligheidsregio's to *not* have appointed persons who have the mandate, is something that still has to be figured out in further research.

#### *Sensitivity to operations*

Sensitivity to operations is a characteristic which overlaps with many other characteristics, such as preoccupation with failure, information and communication, and flexibility. These characteristics all contribute to sensitivity to operations, i.e., being aware of the operations and any deviations that may cause failures. Just like the other characteristics sensitivity to operations consists of some aspects, like 'being aware why people do things in a certain way', so not working on auto-pilot. It appeared that all veiligheidsregio's make use of fixed plans and structures, however they do not work with these plans on auto-pilot. They use them in a flexible way. This overlaps with the characteristic flexibility. Another aspect of sensitivity to operations is 'try to detect near misses' in which attention is given to possible errors, i.e., is

the emergency assistance proceeding as it should? According to the documents and interviews all veiligheidsregio's tried to detect near misses through communication via LCMS.

The other two aspects 'room to admit mistakes' and 'communicate frequently with the team and outside the team' overlap completely with the characteristics 'preoccupation with failure' and 'information and communication' respectively.

The documents and interviews indicated that all veiligheidsregio's are sensitive to operations. They possess the necessary aspects of this characteristic to be labelled as such. This will help the veiligheidsregio's to operate together.

## **High Reliability Network**

### *Size and composition*

One of the characteristics of high reliability is having a selective number of people in your organization. The veiligheidsregio is by definition an interorganizational network with a lot of people, so on the whole this characteristic does not apply to any of the regions. Nevertheless, it emerged in the interviews that an attempt by Zeeland and Limburg Noord was made to have only the relevant employees present during an incident. The documents and interviews of the other regions did not reveal anything about 'size and composition'.

Another way found by the veiligheidsregio's to limit the size and composition is through the use of external, peripheral parties. The veiligheidsregio does not always have all the relevant knowledge or expertise such as energy companies, banks or cyber security etc. do. Therefore, veiligheidsregio's have built up ties and trust with external partners such as water- and energy companies or banks during the cold phase. During a crisis or disaster, i.e., the hot phase, they are therefore able to expand their core network, which only includes the organizations of the veiligheidsregio, with the necessary external partners with relative ease. Since the trust relationship was built up in the cold phase, they benefit from smooth cooperation during a disaster. It appeared that in some cases, the veiligheidsregio and external parties use a liaison, which helps the external partners understand how crisis and disaster management works at the veiligheidsregio. External partners often join veiligheidsregio meetings and know exactly what to say to be helpful. In the regions Groningen and Zuid-Limburg the participants explained that external parties can connect to LCMS.

So, in short, it appeared that the fixed network of the veiligheidsregio's is able to allow new external parties in to their network during a disaster. Another approach is that the relationship with fixed and known external partners are sort of 'paused' during the cold phase. They are reactivated in times of disaster or crisis. Working together this way ensures a certain degree of reliability at times of stress.

### *Flexibility*

Flexibility is strongly present in all studied veiligheidsregio's. In the documents and interviews, flexibility is mainly concentrated on the structure and deployment of the teams and the ability to improvise. First, the flexibility of the structure. The GRIP includes structures and deployment of teams that have been formed in advance. It appeared that neither of the veiligheidsregio's make rigid use of this fixed deployment of these teams. They want to be able to flexibly deploy the teams and employees, depending on the scenario. What is striking is that there is little to no flexibility in the mandates and final responsibility.

The second form of flexibility is the use of the improvisational capacity, thus flexibility, of the employees. It emerged that all regions are aware that you cannot plan everything, but that everything is situation-dependent and requires flexibility from the Veiligheidsregio. This improvisational ability is also reflected in the resilience characteristic. Since (cascading) disasters are mostly unpredictable, flexibility is a characteristic which is certainly necessary during relief efforts.

### *Share information and communicate*

How information is shared and how it is communicated is secured by law and is broadly the same in all veiligheidsregio's. They share a common language and interpretation which is communicated - by the information managers - in the National Crisis Management System 'LCMS', an information and communication system. 'Information and communication' is, however, a component in which some veiligheidsregio's wish to advance. Groningen, for instance, has a special system (VINN) for communicating with the surrounding veiligheidsregio's. Also, Zeeland and Amsterdam-Amstelland made clear they want to focus on information gathering during the cold phase in order to be properly and proactively prepared for a possible disaster. Amsterdam-Amstelland uses 'safety nodes' (VIK) for this, a platform in which information can be exchanged between the various organizations and external partners during the cold phase and hot phase. Limburg Noord also uses another new system: the Safety Information Centre (VIC), in which visual material can be sent. Apart from these special systems, many veiligheidsregio's (Groningen, Zeeland, Limburg Noord and Noord-Holland Noord) use also well-known apps such as WhatsApp and Signal to communicate, or they call each other. These also function as a back-up system should LCMS fail. Other back-ups are also provided, such as copper pipes or couriers. This anticipation overlaps with the theme of flexibility.

When a disaster occurs, i.e., the hot phase, and external partners or neighboring countries are needed, the regions exchange liaisons in order to share information with each other. In some veiligheidsregio's, the external partners can also connect to the LCMS system.

In short, the system of 'information and communication' is certainly present in all the veiligheidsregio's. They use a shared language and a collective communication system. Moreover, it is a subject in which a number of veiligheidsregio's want to be progressive, by means of new ways of proactively sharing information.

### *Trust*

All participants are working with the external partners of the veiligheidsregio's to build up trust. Limburg Noord, Groningen and Zuid-Limburg are aware of the fact that there will be new types of crises in which help from external organizations will be needed. That is why they want to ensure that a bond of trust is created during the cold phase, so they can work well together during the hot phase.

The veiligheidsregio's of Zuid-Limburg and Limburg Noord appeared to be very much aware of the fact that they border for the most part on foreign countries. They are therefore very conscious of maintaining connections with the emergency services of the neighboring countries. This is where they differ from the other veiligheidsregio's in this study.

The documents illustrated that the veiligheidsregio's consider trust to be an important aspect within their organizations (only in the documents and interviews of Limburg North this was not discussed). They mainly want to build up this trust with each other in the cold phase. For example, by having frequent contact with each other or by getting to know each other. So, during a hot phase contacts run more smoothly. For example, information can be exchanged more easily. And there is knowledge about how each person's organization (structure) looks like and how it works.

Neither the documents nor the interviews focused very much on trust *within* the organizations. From the way the participants in the interviews talked about this internal trust, it appeared that trust in the organization was seen as something self-evident. They were generally very brief and clear about it: 'it is there' or 'it is necessary in order to be able to function'. Whereas trust with external partners is seen as something that needs to be worked on harder.

So, according to the documents and the interviews, trust is something that the veiligheidsregio's are very concerned about. They also illustrated that the main reason for keeping the bond of trust is to create a stable network relationship from which know-how can be drawn. And so that they can act collectively during a disaster or crisis.

### *Integration and coordination*

The documents and interviews made clear that all regions train together, with Groningen and Zeeland stating that they train specifically on multidisciplinary (MOTO). In addition to these training sessions, the

regions also use plans and protocols for the various disasters. The form of these plans differs per region. Zeeland, for instance, uses a checklist that lists all possible consequences, while Amsterdam-Amstelland and Limburg Noord use Multi Information Cards (MIK) that lists basic information for each type of incident. The component 'coordination' also appeared in the documents and interviews. There is a centralization of commands, since a hierarchical structure is used (this is also discussed under 'governance'), where a few people have the mandates. Also, fixed decision-making procedures are used, such as BOB; image formation, judgment and decision-making, in the regions of Limburg Noord and Zuid-Limburg. Based on the documents and interviews, it can be stated that there is probably integration and coordination within the veiligheidsregio's.

#### *Accountability*

The characteristic 'accountability' to external stakeholders was almost non-existent in the documents and interviews. Only Noord-Holland Noord mentioned that the public opinion has an influence on the emphasis given by the veiligheidsregio.

An overview of the presence of the characteristics per veiligheidsregio is given in table 6.



Table 6: Presence of characteristics in the veiligheidsregio's

Veiligheidsregio	Characteristics										
	<i>Reluctance to simplify</i>	<i>Preoccupation with failure</i>	<i>Commitment to resilience</i>	<i>Deference to expertise</i>	<i>Sensitivity to operations</i>	<i>Size and composition</i>	<i>Flexibility</i>	<i>Share information and communicate</i>	<i>Trust</i>	<i>Integration &amp; coordination</i>	<i>Accountability</i>
Groningen	x		x		x	-	x	x	x	x	
Zeeland	x		x		x	-	x	x	x	x	
Amsterdam-Amstelland	x		x		x	-	x	x	x	x	
Limburg Noord	x	-	x		x	-	x	x	x	x	
Zuid-Limburg	x		x		x	-	x	x	x	x	
Noord-Holland Noord	x	-	x		x	-	x	x	x	x	-

Note: x = present, - = present to a small extent

### Contradictions

As had been determined in the theoretical framework of this study and in the work by Resodihardjo et al. (2018), there might be some contradictions in the requirements of High Reliability Organizations and High Reliability Networks. Using this study, it is possible to identify to what extent these contradictions are revealed in the documents and interviews.

The first contradiction is between the characteristic *size and composition* and the composition of the veiligheidsregio's: they are big and heterogeneous, since they consist of many different organizations (Resodihardjo et al., 2018). This has an advantage because it means that there is a wide range of experience, which in turn is good for resilience. The big size is a disadvantage in terms of effectiveness (requirement) (Resodihardjo et al., 2018). Another way veiligheidsregio's have found to limit the size and composition is by using external, peripheral parties. These are parties with specific expertise, which are not needed in the permanent staffing of the veiligheidsregio's. They are only called in when necessary. This way, the veiligheidsregio's try to keep the size limited.

The second clash is between the characteristics *integration and coordination*, more specifically the aspect *centralization of command*, and the characteristic *deference to expertise*. The larger the network, the greater the need to centralize it, so everyone does his or her job. If everyone does his or her job, this together can ensure that they can end the crisis as effectively as possible (Resodihardjo et al., 2018). This characteristic is contrasted with decentralization characteristic *deference to expertise*. Whereby the

decision-making authority lies with the expertise rather than the highest authority. This study shows that the veiligheidsregio's use a centralization of command, but that deference to expertise is very limited. There is no flexibility in who has the mandates. However, the input from the expertise is almost always adopted by the person with the mandates. So, this contradiction still exists.

The third contradiction is between *flexibility and integration and coordination*, specifically the *formalization (crisis plans)* aspect. Flexibility, in the form of deviating from (crisis) plans, is needed in crisis management (Resodihardjo et al., 2018). This contradiction does not need not be a problem as crisis plans can also include flexibility formally. The studied documents and interviews revealed that plans and protocols are formalized, but there is also room for flexibility in their use. For instance, improvisation is allowed during disasters. This room for flexibility helps to bridge these contrasting characteristics. This contradiction has been "solved" by the veiligheidsregio's in the same way as suggested earlier in the theory. So, the contradiction is no longer as strong.

This study focused on the following research question: *In which way would the selected veiligheidsregio's in the Netherlands work as High Reliability Interorganizational Networks during cascading disasters according to their policy- and crisis plans and to the perception of their employees?*

First, this study examined the extent to which veiligheidsregio's have anticipated cascading disasters. Based on the examined documents and interviews, it can be said that the veiligheidsregio's Groningen, Zeeland, Amsterdam-Amstelland, Limburg Noord, Zuid-Limburg and Noord-Holland Noord are aware to some extent of cascading disasters. Although, it only seemed that they see every possible effect of a disaster as a cascading disaster. What this indicates, is that there is apparently attention for the possible chain effects of a disaster.

One way for the veiligheidsregio's to deal with these cascading disasters is to work as a High Reliability Interorganizational Network. Therefore, it was studied how the veiligheidsregio's work as a High Reliability Organizational Network and as a High Reliability Organization. Based on the examined documents and the interviews, it can be said that the veiligheidsregio's Groningen, Zeeland, Amsterdam-Amstelland, Limburg Noord, Zuid-Limburg and Noord-Holland Noord largely work as a High Reliability Interorganizational Networks. This conclusion was drawn by looking at the presence of the characteristics associated with High Reliability Interorganizational Networks. How these characteristics are expressed can differ per veiligheidsregio. However, not all of the characteristics are present. For example, there is no *'deference to expertise'* in any veiligheidsregio and *'accountability'* is only present to a small extent in Noord-Holland Noord. *'Preoccupation with failure'* was also moderately present, but the interviews and

documents from Limburg Noord and Noord-Holland Noord show that they are working towards ensuring that in the future, a culture will prevail in which it is possible to report mistakes without damaging an image. These are points for the veiligheidsregio's to work on to fully become a High Reliability Interorganizational Network

Because there are many characteristics present of High Reliability Interorganizational Networks, it is presumed that the veiligheidsregio's studied, can largely be resilient during cascading disasters and continue to work together effectively. Which will likely enable them to provide assistance during cascading disasters.

However, a note should be made here since several veiligheidsregio's indicated that staff shortages could be a tricky issue during cascading disasters. Although this is not included in the theory, it is something to take into account in future studies on high reliability in emergency management.

## **Discussion**

This study examined the extent to which veiligheidsregio's function as High Reliability Interorganizational Networks during cascading disasters. Regardless of its exploratory nature, the findings of the study have provided interesting insights that require further research. Before presenting possible future research and policy implications, it is necessary to reflect on the limitations of this study.

First, some limitations of gathering the documents and conducting the interviews will be given. Due to long commuting time and because of Covid-19, it was decided to conduct five of the six interviews online. Sometimes these online interviews made it more difficult to read each other's body language, as it would be in 'real life'. This may have had a negative impact on feeling comfortable with each other during the interview and thus on the outcomes. At least, it gave me, the interviewer, a less comfortable feeling to do the interview online. I have a feeling there is a greater chance that certain sensitive information would have been shared easier with me if the interviews would have been offline. However, this need not be too much of a problem, as it concerned mostly his or her work and not so much about personal subjects. This may have made it easier for the participant to talk freely. Also, it was emphasized that the interview could be stopped at any time. Before the start of the interview, the participant was also asked whether he or she was sitting in a comfortable place where it was possible to talk freely. Additionally, it was tried to make the online interview as enjoyable and relaxed as possible for the participants by making sure that I was in a neutral, quiet environment. Therefore, for each online interview that was conducted, a room at the university was booked. Here, no disturbing factors such as noise pollution or distracting backgrounds on the screen.

In addition to interviews, document analyses were used in this study. There are some minor drawbacks to document analyses. First, the policy documents studied were not written for the purpose of this research, so they sometimes missed details, which would have been useful to this study (Bowen, 2009). However, the documents can be seen as ‘social facts (for the veiligheidsregio’s), which are produced, shared and used in socially organized ways’ (Aktison & Coffey, 1997; Bowen, 2009). The use of these policy documents is still a good way to gain understanding and develop empirical knowledge about the veiligheidsregio’s in an efficient way (Corbin & Strauss, 2008; Bowen, 2009).

Secondly, it was sometimes difficult to find or receive the policy documents. In certain cases, documents were not available or were still being written. For this reason, a preliminary version of the Amsterdam-Amstelland policy plan was used in this study. It was preferred to have this most up to date version of the document, rather than an old document.

The researcher is in this study one of the ‘instruments’ in the data collection. With one researcher, as in this study, it is impossible to carry out an inter-coding agreement check (Shenton, 2004). A second coder could be used so that an inter-coding check could be carried out. This would strengthen the trustworthiness (more specific the credibility) of the study, because such a check helps to find out if there is consistency between the codings of the different researchers (Hennink et al., 2011). It will reduce the effect of researcher bias. A second researcher could also help to cross-check the data which is also a form of triangulating (Lincoln & Guba, 1986). To ‘compensate’ for these problems, well established (analyzing) methods were used. Semi-structured interviews and a document analysis were conducted, which were both analyzed using a thematic analysis (Braun & Clarke, 2012). Therefore, it is recommended that a second coder will be included in a follow-up study.

Another point of discussion is ‘member checks’ in the form of the participants reading the transcripts (Shenton, 2004). It was decided not to do so because of the time-consuming nature of the process for the participants and the researcher. However, a discussion session was performed where veiligheidsregio Groningen gave advise on the topics in the interview. So, at the beginning of data collection, a participant checked the interview.

Another consequence of the lack of time is that it was chosen to interview only one person of each veiligheidsregio. This had as a consequence that no point of information saturation was reached (Hennink et al., 2011). Since documents were analyzed in addition to the interviews, this lack of participants is somewhat compensated for, thereby preserving more of the quality of this study.

## **Future research**

As mentioned in the conclusion, the findings from this study are largely consistent with the theory on High Reliability Organizations and Networks. Moreover, the veiligheidsregio's hardly differ in whether or not they possess the characteristics (see table 6). However, they do differ in how they give shape to these characteristics. Furthermore, this research also served as a continuation of the research of Resodihardjo et al. (2018) partly to verify the earlier findings based on interviews. It appears that the earlier findings are consistent with this study. Still, it is necessary to do further research, after all, one cannot make hard statements about how a veiligheidsregio actually operates based on documents and interviews alone.

In this study, it was decided – due to time limitations- to only use documents and interviews. In the terms of the veiligheidsregio's, information has only been collected from the cold phase, i.e., when there is no disaster or crisis. To get a complete picture, research should also be carried out during the hot phase with all 25 veiligheidsregio's. For example, by doing fieldwork during disasters and crises. Then it can also be examined whether certain characteristics of high reliability outweigh others. In addition, in such a follow-up study, it would be useful to interview more than one person per veiligheidsregio so that information saturation can be achieved.

Second, as also mentioned earlier in the discussion, it would be advised if a follow-up study had a second researcher. So, it is possible to perform an inter-coding check, which increases the trustworthiness of the study. Furthermore, a second researcher could also help to cross-check the data which is also a form of triangulating (Lincoln & Guba, 1986).

As indicated in the methods, iterative questioning was not used for all subjects during the interview, as there was only one hour available per interview. These questions on the same subject may help find out any 'lies' or, on the contrary, consistency from participants. Therefore, in a subsequent study, it would be beneficial if more time were available during the interviews so that iterative questions could be asked. This will increase the credibility of the study.

Fourthly, in order to improve the credibility of further studies, it is recommended to let the participants of the study read the transcripts (member checks) of the study and to discuss any inferences with them. In this way they can check the accuracy of the data.

Also, what emerged during this study is that the participants wanted to add nuance to the use of the word 'failure'. This was because a distinction could be made between unconscious, conscious and insurmountable failures caused by circumstances or missing equipment etc. It may be useful to include this nuance in a follow-up study. To see if there is a difference, for example, in what kinds of failures people are more likely to bring up.

Another way to do a follow-up study would be by running simulations or games with employees of the veiligheidsregio's (Kenis, Raab et al., 2017). These games or simulations can create situations, such as a cascading disaster, so that research can be conducted on veiligheidsregio's during the simulated hot phase. Studying this ex-ante assessments would improve our understanding of veiligheidsregio's as High Reliability Interorganizational Networks during cascading disasters.

### **Policy implications**

Based on this research, there are also some policy recommendations for the emergency management structure of the veiligheidsregio's and as well for the institutional structure.

The study found that all veiligheidsregio's consider the possible chain effects of a disaster and they are also aware that cascading disasters can occur. However, no specific plans for cascading disasters are present. For "single" disasters, it turned out that the veiligheidsregio's mainly use some kind of basic plans for disasters, improvising the rest while using their knowledge and skills. The advice would be to make such basic plans also for cascading disasters or at least to map the risks of cascading disasters.

It was also found that in general there is no culture in which it is possible for employees to address failures. Some regions (Limburg Noord and Noord-Holland Noord) are already working to change this culture by offering training sessions to learn how to report failures.

Another topic of attention is the way decisions are made. At the moment, the chair(wo)man of the veiligheidsregio's and the mayors are still the ones with the mandates. The advice would be to see if the organization of the veiligheidsregio's could be set up in such a way that the expertise can make decisions about their area of expertise instead of a chair(wo)man or mayor. This not only concerns 'small' decisions that are taken by the emergency services workers on the street, but also the strategic decisions. However, this requires a change in the hierarchical organizational structure. What would help here is that the teams consist of employees with opposing views and expectations, so that there is no oversimplification in the decisions that will be taken by the expertise.

Furthermore, the participants mentioned several times during the interviews that they are struggling with staff shortages and that this will most likely be also the case during cascading disasters. Therefore, more money should be made available from the government to train more people to be emergency workers or crisis managers. This is something that the veiligheidsregio's are probably already doing themselves.

With the help of this study and the policy recommendations, the veiligheidsregio's should be able to develop even further as High Reliability Interorganizational Networks. So that, hopefully, they will be able to respond more effectively and resiliently to cascading disasters in the future.

## Literature

- AIVD (n.d.) Dreiging voor Nederland. Retrieved December 3, 2021 from <https://www.aivd.nl/onderwerpen/terrorisme/dreiging#:~:text=De%20terroristische%20dreiging%20in%20Nederland,Nederland%20een%20aanslag%20te%20plegen.>
- Aktison, P. A. & Coffey, A. (1997). Analysing documentary realities. In D. Silverman (Ed.), *Qualitative research: Theory, method and practice*, London. Sage, 45-62.
- Aldrich, D. P., & Meyer, M. A. (2015). Social capital and community resilience. *American behavioral scientist*, 59(2), 254-269.
- Alexander, D., (2013). 'Volcanic ash in the atmosphere and risks for civil aviation: A study in European crisis management', *International Journal of Disaster Risk Science*, 4(1), 9–19.
- Ansell, C., Boin, A., & Keller, A. (2010). Managing transboundary crises: identifying the building blocks of an effective response system. *J. Contingencies Crisis Manage*, 18 (4), 195–207.
- ATLAS.ti [computer software] (2021). ATLAS.ti version 9.1.3 (2089) for Mac.
- Bharosa, N., Lee, J., & Janssen, M. (2010). Challenges and obstacles in sharing and coordinating information during multi-agency disaster response: propositions from field exercises. *Inform. Syst. Front*, 12 (1), 49–65.
- Berthod, O., Grothe-Hammer, M., Müller-Seitz, G., Raab, J., & Sydow, J. (2017). From High-Reliability Organizations to High-Reliability Networks: The Dynamics of Network Governance in the Face of Emergency, *Journal of Public Administration Research and Theory* 352–371. <https://doi.org/10.1093/jopart/muw050>
- Borgatti, S. P., & Foster, P. C., (2003). The network paradigm in organization research: A review and typology. *Journal of Management* 29, 991–1013.
- Bowen, G.A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), 27-40. <https://doi.org/10.3316/QRJ0902027>
- Brass, D. J., Galaskiewicz, J., Greve, H. J., & Tsai, W., (2004). Taking stock of networks and organizations: A multi-level perspective. *Academy of Management Journal* 47, 795–817.
- Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 57–71). American Psychological Association. <https://doi.org/10.1037/13620-004>

- Braun, V., & Clarke, V. (2021). Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. *Counselling and Psychotherapy Research*, 21(1), 37-47.
- CBS News, 2010, 'Volcanic ash puts organ transplants in peril', 19 April, <https://www.cbsnews.com/news/volcanic-ash-puts-organtransplants-in-peril/>.
- Choi, S. O.K., & Brower, R. S. (2006). When practice matters more than government plans. A network analysis of local emergency management. *Admin. Soc.* 37 (6), 651–678.
- Clifford, N., French, S. & Valentine, G. (2010). Getting started in Geographical research: How this book can help. In Clifford, N., French, S. & Valentine, G. (Eds.), *Key methods in geography*. Second edition. London: Sage Publications Ltd.
- Clingendael (2016). National Risk Profile 2016. An all-hazard overview of potential disasters and threats in the Netherlands. Retrieved from <https://www.clingendael.org/publication/national-risk-profile-2016>
- Coaffee, J. (2019). *Future proof: how to build resilience in an uncertain world*. Yale University Press. <https://doi.org/10.12987/9780300244953>
- Comfort, L. K., & Haase, T. W. (2006). Communication, coherence, and collective action. The impact of hurricane katrina on communications infrastructure. *Pub. Works Manage. Policy*, 10 (4), 328–343.
- Comfort, L. K. (2007). Crisis management in hindsight: cognition, communication, coordination, and control. *Pub. Admin. Rev.* 67 (1), 189–197.
- Comfort, L.K., Kapucu, N. (2006). Inter-organizational coordination in extreme events: The World Trade Center Attacks, September 11, 2001. *Nat. Hazards* 39 (2), 309–327.
- Cools, F., Van Duin, M., & Wijkhuis, V. (2017). *GRIP en de flexibele toepassing ervan*. Instituut Fysieke Veiligheid. Retrieved December 9, 2021 from <https://www.ifv.nl/kennisplein/crises-en-crisisbeheersing/publicaties/kennispublicatie-grip-en-de-flexibele-toepassing-ervan>
- Corbin, J. & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks, CA: Sage
- Cutter, S. L. (2018). Compound, cascading, or complex disasters: what's in a name? *Environment: Science and Policy for Sustainable Development*, 60(6), 16–25. <https://doi.org/10.1080/00139157.2018.1517518>
- Davis, G. L., & Robbin, A. (2015). Network disaster response effectiveness: the case of ICTs and Hurricane Katrina. *Homeland Secur. Emergency Manage*, 12 (3),



- High Reliability Interorganizational Networks for Cascading Disasters in the Netherlands* B. M. Bevers  
437–467.
- De Almeida Marques, J. O. (2005). The paths of providence: Voltaire and Rousseau on the Lisbon earthquake. *Cad. Hist. Fil. Ci., Campinas, Série, 3*, 33-57.
- Eisner, E. W. (1991). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. Toronto: Collier Macmillan Canada
- Eurocontrol, (2010). Ash-cloud of April and May 2010: Impact on air traffic, Brussels. Retrieved From <https://www.eurocontrol.int/sites/default/files/article/attachments/201004-ash-impact-on-traffic.pdf>.
- Fereday, J. & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, 5(1), 80-92. Retrieved 12 January 2009, from [http://www.ualberta.ca/~iiqm/backissues/5\\_1/pdf/fereday.pdf](http://www.ualberta.ca/~iiqm/backissues/5_1/pdf/fereday.pdf)
- Frederickson, H., & LaPorte, T. (2002). Airport security, high reliability, and the problem of rationality. *Public Administration Review*, 62(1), 33–43.
- Hennink, M.M., Hutter, I. and Bailey, A. (2011). *Qualitative Research Methods*. London: Sage Publications.
- Instituut Fysieke Veiligheid (n.d.). De crisisorganisatie. Retrieved December 9, 2021 from <https://elo.brandweer.nl/Pages/ViewItem.aspx?cp=%2FCMS%2FIFV%20-%20Crisis%20Management%20Academie%2FAlgemene%20Crisisbeheersing%2FE-learning%20Basiskennis%20Crisisbeheersing%2F3.%20De%20crisisorganisatie>
- Intergovernmental Panel on Climate Change (2014). Annex II Glossary, *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. New York and Cambridge: Cambridge University Press. [http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-AnnexII\\_FINAL.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-AnnexII_FINAL.pdf)
- Kapucu, N. (2006). Public-nonprofit partnerships for collective action in dynamic contexts of emergencies. *Public Administration*, 84, 205-220.
- Kenis, P. N., Raab, J., Kraaij – Dirkwager, M., & Timen, A. (2017). How prepared are we? The organizational network responses in two infectious disease outbreak scenarios in the Netherlands. In *How prepared are we? The organizational network responses in two infectious disease outbreak scenarios in the Netherlands*
- Koliba, C. J., Mills, R. M., Zia, A. (2011). Accountability in governance networks: an assessment of public, private, and nonprofit emergency management practices following Hurricane Katrina. *Pub. Admin. Rev.*, 71 (2), 210–220.
- Klijn, E., Koppenjan, J.F.M., & Termeer, K. (1995). *Managing networks*

- in the public sector: a theoretical study of management strategies in policy networks. *Pub. Admin*, 73 (3), 437–454.
- LaPorte, T. R., & Consolini, P., M. (1991). Working in practice but not in theory: Theoretical challenges of “high-reliability organizations”. *Journal of Public Administration Research & Theory* 1, 19–48.
- Lincoln, Y. S., & Guba, E. G. (1986). But is it rigorous? trustworthiness and authenticity in naturalistic evaluation. *New Directions for Program Evaluation*, 1986(30), 73–84. <https://doi.org/10.1002/ev.1427>
- Luckerhof, C. (2021, August 7). ‘Wij zijn in België niet goed georganiseerd om grote crises het hoofd te bieden’. *De Volkskrant*. Retrieved from <https://www.volkskrant.nl/nieuws-achtergrond/wij-zijn-in-belgie-niet-goed-georganiseerd-om-grote-crisis-het-hoofd-te-bieden~bf30ac7/>
- March, J. G., & Herbert, A. S. (1958). *Organizations*. Oxford: Wiley.
- McEvily, B., Perrone, V., & Zaheer, A. (2003). Trust as an organizing principle. *Organization Science* 14, 91–103.
- Moynihan, D. P. (2009). The network governance of crisis response: case studies of incident command systems. *J. Pub. Admin. Res. Theor.* 19 (4), 895–915.
- Nohrstedt, D. (2016). Explaining mobilization and performance of collaborations in routine emergency management. *Admin. Soc.* 48 (2), 135–162.
- Nohrstedt, D., Bynander, F., Parker, C., & Hart, P. (2018). Managing crises collaboratively: Prospects and problems - A systematic literature review. *Perspectives on public management and governance*, 1(4), 257–271. <https://doi.org/10.1093/ppmgov/gvx018>
- Oh, N. (2012). Strategic uses of lessons for building collaborative emergency management system: comparative analysis of hurricane Katrina and hurricane Gustav response systems. *J. Homel. Secur. Emerg. Manage*, 9 (1).
- Pescaroli, G., & Alexander, D. (2015). A definition of cascading disasters and cascading effects: Going beyond the “toppling dominos” metaphor. *Planet@ risk*, 3(1), 58-67.
- Provan, K. G., & Kenis, P. (2007). Modes of network governance: Structure, management, and effectiveness. *Journal of public administration research and theory*, 18(2), 229-252.
- Provan, K. G., & Kenis, P. (2008). Modes of network governance: structure, management, and effectiveness. *J. Pub. Admin. Res. Theor.* 18 (2), 229–252.
- Raab, J., & Kenis, P. N. (2009). Heading toward a society of net-works empirical developments and theoretical challenges. *Journal of Management Inquiry* 18 (3): 198–210.
- Raab, J., & Kenis, P. N. (2020). Back to the Future: Using organization design theory for

- effective organizational networks. *Perspectives on public management and governance*, 3 (2), 109–123. <https://doi.org/10.1093/ppmgov/gvaa005>
- O'Toole, Laurence J. (1997). Treating networks seriously: Practical and research-based agendas in public administration. *Public Administration Review* 57, 45–52.
- Petursdottir, G., Reichardt, U., Bird, D., Donovan, A., Gísladóttir, G. Hauksdottir A., Johannesdottir, G., Sigmundsson, F., Thordardottir, E.B., & Ulfarsson, G.F. (2020) 'Eyjafjallajökull eruption in 2010'. Science for Disaster Risk Management 2020: acting today, protecting tomorrow. Publications Office of the European Union, Luxembourg. doi:10.2760/438998, JRC114026.
- Resodihardjo, S. L., Van Genugten, M., & Ruiter, M. N. (2018). A theoretical exploration of resilience and effectiveness requirements' compatibility in formal and permanent emergency networks. *Safety science*, 101, 164-172.
- Rijksoverheid (2016). Staat van de rampenbestrijding 2016 landelijk beeld. Retrieved April 29, 2021 from <https://www.rijksoverheid.nl/documenten/rapporten/2016/12/07/tk-bijlage-rapport-staat-van-de-rampenbestrijding-2016-landelijk-beeld>
- Rijksoverheid (2016). Staat van de rampenbestrijding 2016 landelijk beeld. Retrieved April 29, 2021 from <https://www.rijksoverheid.nl/documenten/rapporten/2016/12/07/tk-bijlage-rapport-staat-van-de-rampenbestrijding-2016-landelijk-beeld>
- Rijksoverheid (n.d.). Veiligheidsregio's. Veiligheidsregio's en crisisbeheersing. Retrieved April 29 2021, from <https://www.rijksoverheid.nl/onderwerpen/veiligheidsregios-en-crisisbeheersing/veiligheidsregios>
- Roberts, K. H. (1990). Some characteristics of one type of high reliability organization. *Organization Science*, 1, 160–76.
- Robins, G. (2015). *Doing social network research: Network-based research design for social scientists*. Sage.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63-75. <https://doi.org/10.3233/efi-2004-22201>
- Sutcliffe, K. (2012). De kenmerken van high reliability organizations (HRO's). *Justitiële verkenningen*, 38(4), 66-83.
- Turrini, A., Cristofoli, D., Frosini, F., & Nasi, G. (2010). Networking literature about determinants of network effectiveness. *Pub. Admin*, 88 (2), 528–550.
- UNISDR (2009): UNISDR terminology on disaster risk reduction. United Nations

- international strategy for disaster reduction, Geneva, Switzerland.  
[http://www.unisdr.org/files/7817\\_UNISDRTerminologyEnglish.pdf](http://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf).
- UNISDR (2017). Cross-sectoral and multi-risk approach to cascading disasters. Retrieved from  
<https://www.undrr.org/publication/cross-sectoral-and-multi-risk-approach-cascading-disasters>
- UNDHA (1992). Internationally agreed glossary of basic terms related to disaster management. United Nations Department of Humanitarian Affairs, Geneva, Switzerland.  
Retrieved from  
<http://reliefweb.int/sites/reliefweb.int/files/resources/004DFD3E15B69A67C1256C4C006225C2-dha-glossary-1992.pdf>.
- Veiligheidsregio Amsterdam-Amstelland (2016). Regionaal crisisplan 2016-2020 up to date crisisaanpak.  
Retrieved June 7, 2021 from <https://veiligheidsregioaa.nl/regio/organisatie/>
- Veiligheidsregio Amsterdam-Amstelland (2021). Concept Beleidsplan 2021-2024 Buitengewoon veilig.  
Retrieved July 13, 2021 from personal communication via email
- Veiligheidsregio Amsterdam-Amstelland (2021). Amsterdam-Amstelland Regionaal Risicoprofiel 2021-2024. Retrieved December 16, 2021 from  
<https://veiligheidsregioaa.nl/regio/organisatie/>
- Veiligheidsregio Groningen (2019). Veiligheidsplan Veiligheidsregio Groningen 2020-2024.  
Retrieved August 24, 2021 from <https://veiligheidsregiogroningen.nl/wie-bestuurt-de-vrg/veiligheidsplan/>
- Veiligheidsregio Groningen (n.d.). GRIP opschalingsniveaus. Retrieved December 9, 2021 from  
<https://veiligheidsregiogroningen.nl/wat-wij-doen/zo-bereiden-wij-ons-voor/grip-opshalingsniveaus/>
- Veiligheidsregio Limburg Noord (2018). Regionaal crisisplan. Retrieved January 31, 2022 from  
<https://www.vrln.nl/over/beleid>
- Veiligheidsregio Limburg Noord (2020). Beleidsplan 2020-2023. Retrieved January 31, 2022 from  
<https://www.vrln.nl/over/beleid>
- Veiligheidsregio Noord-Holland Noord (2020). Samen hulpvaardig Beleidsplan veiligheidsregio Noord-Holland Noord 2020-2023. Retrieved May 31, 2021 from <https://www.vrnhn.nl/actueel/2019-12-17-bekijk-ons-beleidsplan-2020-2023-en-nieuw-regionaal-risicoprofiel>
- Veiligheidsregio Noord-Holland Noord (2021). Regionaal crisisplan Noord-Holland Noord 2021.  
Retrieved August 17, 2021 from  
<https://www.vrnhn.nl/veiligheidsregio-noord-holland-noord/risico-en-crisisbeheersing>
- Veiligheidsregio Zuid-Limburg & Veiligheidsregio Limburg-Noord (2019). Provinciaal

- risicoprofiel Zuid-Limburg en Limburg-Noord (2019). Retrieved December 16 2021 from [https://vrzl.nl/application/files/7415/6032/7879/Provinciaal\\_Risicoprofiel\\_Limburg\\_2019\\_VRZL-VRLN.pdf](https://vrzl.nl/application/files/7415/6032/7879/Provinciaal_Risicoprofiel_Limburg_2019_VRZL-VRLN.pdf)
- Veiligheidsregio Zuid-Limburg (2020). Samen Veilig - Meerjarenbeleidsplan 2020-2023. Retrieved December 22, 2021 from <https://vrzl.nl/wie-zijn-wij/beleid-en-publicaties>
- Veiligheidsregio Zuid-Limburg (2020). Regionaal crisisplan 2020-2023. Retrieved December 22, 2021 from <https://vrzl.nl/wie-zijn-wij/beleid-en-publicaties>
- Veiligheidsregio Zeeland (2016). Samen sterk voor een veilig Zeeland, Meerjarig beleidsplan Veiligheidsregio Zeeland. Retrieved May 27, 2021 from <https://www.veiligheidsregiozeeland.nl/documentatie>
- Veiligheidsregio Zeeland (2017). Regionaal crisisplan 2018-2021. Retrieved May 28, 2021 from <https://www.veiligheidsregiozeeland.nl/documentatie>
- Waugh Jr., W. L., & Streib, G. (2006). Collaboration and leadership for effective emergency management. *Pub. Admin. Rev.* 66 (1), 131–140.
- Weick, K.E., Sutcliffe, K. M., & Obstfeld, D. (1999). Organizing for high-reliability: process of collective mindfulness. *Research in organizational behavior*, 21, 81-123.
- Weick, K. E., & Sutcliffe, K. M. (2007). *Managing the Unexpected: Resilient Performance in an Age of Uncertainty*, 2nd ed. San Francisco, CA: Jossey-Bass.
- Wet Veiligheidsregio's (2020, February 1). Retrieved April 22, 2021 from <https://wetten.overheid.nl/BWBR0027466/2021-01-01>

## Appendix I - Codebooks

### First round

The codebook for the first round is included to show the progress from the first codebook to the second, thematic codebook. The coding in the first round for the policy documents was also mainly a learning process. Deductive Codes are made according to the theory in the study. In the first round, this codebook was used. Afterwards, it became clear that some codes were not or hardly used. It also turned out that it is too detailed, which is why the coding in the second round was coarser. Since the codes from the first round were already there anyway, some codes were included in the analysis on theme level to support the analysis of the themes.

Code Group	Code	Type	Example from the data	Clues for coder	Notes
Cascading disasters	Awareness	Deductive	<i>''Earthquakes and the consequences of gas production are cross-linked with health and environmental consequences (see section 7.1.3). In addition to possible victims of a more powerful earthquake, the consequences of gas production have already resulted in sick people. A more powerful earthquake could also cause disruption to the energy supply (power failure) and vital infrastructure (collapse of bridges, for instance) (see Section 7.1.4). A possible consequence may be large-scale public order problems (see Section 7.1.5).'' (Veiligheidsplan Veiligheidsregio Groningen, 2019)</i>	Aware of the possibility of a cascading disaster	
	Preparedness	Deductive	Code not used	Anticipation on cascading disasters e.g., have emergency plans available for cascading disasters	Code not used
	Critical Infrastructure	Deductive	<i>''Vital processes are processes that, in the event of a failure, may lead to casualties, major economic damage or social disruption. With the disruption of vital infrastructure, a distinction is made between the independent failure or disruption of a vital process or as a result of another event, such as the failure of the electricity supply due to high water or the disruption of the drinking water supply due to bacterial contamination, a so-called chain effect. For the Groningen region, the following facilities play an important role: - Energy supply - Drinking water supply</i>	Aware that critical infrastructure is vulnerable for cascading disasters.	

			- ICT and telecommunications'' (Veiligheidsplan Veiligheidsregio Groningen, 2019).		
Modes of governance	Efficiency in collective operations	Deductive	''By working in an information-driven way, we gain more insight into the risks and into the effectiveness of our activities. In this way, we can act more adequately in both prevention and incident response and make more effective choices about the deployment of capacity and resources.'' (Beleidsplan Veiligheidsregio Noord-Holland Noord, 2020).	Efficiency is more important than inclusiveness in decision making	
	Inclusiveness in decision making	Deductive	''There is, however, the condition that the chairman of the veiligheidsregio must consult with the mayors involved in the RBT with regard to the decisions he may take on the basis of the aforementioned articles, unless the required urgency opposes this. If a mayor believes that a proposed decision will disproportionately harm the interests of his municipality, he can have his objection recorded in writing.'' (Crisisplan Zuid-Limburg, 2020)	Inclusiveness in decision making is more important than efficiency	Only coded once
	The need for internal legitimacy	Deductive	Code not used	Internal legitimacy is favored above external legitimacy	Code not used
	External legitimacy	Deductive	''On the basis of this current information, the authorities are better able to, in the event of (large-scale) incidents or acute threat, explaining to representative bodies (including the city council), the media and the population about what the government has done in consultation with companies and institutions to counteract the risks.'' (Veiligheidsplan Zeeland, 2016)	''the necessity for a network to build a legitimate appeal to potential participants'' (Berthod et al., 2017).	review whether this should be used. What exactly do they mean by it?
	Quest for flexibility	Deductive	''An organizational structure that matches what the crisis in question demands of the organization. This from a basis that is prepared and flexibly filled in/adapted based on the actual situation that arises.'' and ''An eye for the extraordinary is necessary in order not to allow the situation to deteriorate into routine handling that does not suit the situation at the time. This also requires confidence in professional judgements and professional action at the operational level.'' (Crisisplan Amsterdam-Amstelland, 2016).	Flexibility is favoured above stability. Allow participants in their network to deviate from the plans when needed. Room for improvisation.	

	Quest for stability	Deductive	<i>“The crisis organization and the accompanying operational and administrative coordination mechanisms (CoPI, ROT and administrative teams) are mainly focused on classic disasters such as flash disasters and long-term crises (such as power failure or flooding). The starting point of this crisis plan is that the crisis organization is generically applicable to the physical incidents, disasters and crises that may occur in the veiligheidsregio’s service area. The main structure of the crisis organization established by law, with the accompanying standard staffing and turnout times, forms the basis of this crisis plan” (Zeeland crisisplan, 2017).</i>	Stability is favored above flexibility.	
	Trust between key actors within HRNs	Deductive	<i>“Cooperation with vital crisis partners is guaranteed in covenants and planning. The veiligheidsregio considers it important that officials know each other. Because conscious choices are made about what is needed when more and more scaling-up takes place, network moments become even more important. At these moments, we learn about each other’s crisis management, working methods and interests. Our ambition is to secure these networks more firmly by working together on added value, structurally exchanging safety information and contributing to more network meetings at various levels.” (Zeeland Beleidsplan, 2016).</i>	De veiligheidsregio is trying to foster trust among employees and/or external partners.	
Tightly coupled units		Deductive	Code not used	Failure of one participant may thwart the reliability of the collective performance	Code not used.
High Reliability	Anticipation	Deductive	<i>“In both scaled-up and non-scaled-up situations, the overall image is managed by the VINN and there is a continuous safety image. Together with partners in the general and functional chain, the veiligheidsregio works in the ‘3-North’ region on an up-to-date and continuous safety picture. The cold organization monitors dynamic risks for the continuous safety case so that the warm organization can take timely measures. In addition, a periodic analysis of safety scenarios is carried out to serve as input for keeping the risk profile up to date.” (Veiligheidsplan Groningen, 2019).</i>	Anticipate on possible disasters.	
	Containment	Deductive	<i>“If a disaster or crisis takes too long to resolve with its own staff, the neighboring veiligheidsregio Limburg-North (VRLN) or another veiligheidsregio for assistance. Vice versa, the VRLN can also make this</i>	Containment of incidents.	



			<i>request to the Veiligheidsregio Zuid-Limburg.’ (Crisisplan Zuid-Limburg, 2020).</i>		
Effectiveness	Size and composition	Deductive	<i>“Outside the core meeting, smaller crisis teams are sufficient and more effective for some risks or in a certain phase of a disaster or crisis. Separately composed teams (such as scenario teams) can also be deployed if long-term monitoring is required for a situation that may develop into a crisis. These scenario teams have a short line to the operational or administrative core consultation.” (Crisisplan Zuid-Limburg, 2020).</i>	The network limits its members and carefully selects members.	
	Integration and coordination	Deductive	<i>“For flash disasters, GRIP is the starting point. GRIP stands for Coordinated Regional Incident Response Procedure. GRIP regulates the multidisciplinary scaling up and coordination of the crisis management processes when combating unexpected and acute incidents.” (Crisisplan Amsterdam-Amstelland, 2016).</i>	Integration and coordination are contributed by training, joint preparation and planning. It helps the organizations in the veiligheidsregio to collaborate during a disaster (Nohrstedt, 2016). Coordination is fostered by a centralization of command, get-togethers, formalization and decision-making procedures (Moynihan, 2009; Nohrstedt, 2016; Klijn et al., 1995; Ansell et al., 2010; Resodihardjo et al., 2018).	
	Share information and communicate effectively	Deductive	<i>“We have more and more information, which is available in more and more different places at an ever increasing rate. By means of information-driven safety, the veiligheidsregio ensures that the relevant information is available to the right parties at the right time; in the cold, warm, and 'after' phases. At the right time, the relevant information is available to the right parties via information-driven safety. and the aftermath of an incident or crisis. It helps in taking (crisis) decisions, in cooperating with partners and in providing information to citizens. We see that cooperation is crucial for information-driven safety and that this is also expressed in the evaluation of the veiligheidsregio Act. Each party has a part of the information, and when put together it acquires value. The country is investing in Safety Nodes (Veiligheids Informatie</i>	Shared language and meaning and adequate information technology and communication systems.	

			<i>Knooppunten VIK; where information comes together and where an up-to-date safety picture is created that is as complete as possible. All security partners can then determine from their own perspective what is going on and what that means for them and for joint action.’’ (Beleidsplan Amsterdam-Amstelland, 2021).</i>		
	Accountability	Deductive	<i>‘[...] We recently finished our regional risk profile, at least in draft form. And there you can see something, a smaller development, but there really are some developments, because citizens and the direct chain organizations around us look at possible incidents differently than a number of years ago. And partly, in my opinion, this is also due to the influence of public opinion. So where does the essence lie? I think if we look at terrorism around 2010, 2015, yes, that is in the public mind. And so something else comes back to it and now it's the pandemic story. So, you see different choices being made in the region, but also within the country. And that, of course, is interesting.’ (Interview Veiligheidsregio Noord-Holland Noord).</i>	It can help employees of the Veiligheidsregio to have expectations from external stakeholders to attain the expected results (Turrini et al., 2010; Resodihardjo et al., 2018). Moreover, it also helps the veiligheidsregio if there are supervisory measures, for example from the government, to have effective crisis management (Davis and Robbin, 2015; Resodihardjo et al., 2018).	
HRO principles (to achieve resilience)	Preoccupation with failure	Deductive	<i>‘‘Learning and accountability start from the knowledge and acceptance that there is no such thing as ‘without failure’. We want to be open and transparent about achievements and points for improvement. At the same time, learning also requires a somewhat protected learning environment. Without acceptance of mistakes and protection of the learning environment, fear of reputational damage (personal and for the organization) sets the tone for the learning process. That is counterproductive.’’ (Beleidsplan Zuid-Limburg, 2020).</i>	Focus on failures because they are aware of the fact that one small failure can cause big problems. Extremely focused to find any deviation or occurrence of a failure. Encourage employees to report any failure, even if the person itself made the mistake. Frequent communication about which failures need to be avoided. Not satisfied with their own successes. They remain alert to errors (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).	
	Sensitivity to operations	Deductive	<i>‘‘Generic: In the event of an observable incident, initial crisis diagnostics is the task of the first units on site / CoPI. In a dormant situation, an accumulation of (mutually reinforcing) negative factors makes crisis diagnosis necessary. An initial diagnosis is made together with the notifier and, as far as possible, with other key parties on the basis of an estimate of</i>	Aware of their operations so they can spot any deviations, which may cause failures. To ensure mistakes are revealed, they make sure there is room to admit mistakes and also encourage their	

			<p><i>the Nature, People Involved and Context. The task here is to assess what the specific special characteristics are and which parties need to be activated.” (Crisisplan Amsterdam-Amstelland, 2016).</i></p>	<p>employees to admit their mistakes. Sensitivity to operations also includes being aware why people do things in a certain way. They do this, because High Reliable Organizations do not want to work on an auto-pilot. To notice deviations and people working on auto-pilot, High Reliable Organizations communicate frequently within their teams and also with people outside the team. They also try to detect near misses, because this may be a signal of a failing system (Resodihardjo et al., 2018; Weick &amp; Sutcliffe, 2007)</p>	
	Reluctance to simplify	Deductive	<p><i>“As described in the introduction to chapter two, the national method of developing a risk profile no longer meets the needs of society. The dynamics of trends and developments and the interrelatedness of risks mean that risks cannot be captured in just one category of the above classification. For example, if we look at the risk of 'gas production and earthquakes', we classify this risk under the threat theme of 'natural disasters'. However, the risk of 'gas production and earthquakes' in Groningen is much broader than the risk of seismicity and its consequences (physical damage). For instance, gas production and earthquakes have health effects and consequences for social safety and social unrest that are directly related to gas production. The risk of gas production and earthquakes can therefore not only be categorised under the theme of natural disasters, but also under the theme of threats to health and the environment. Moreover, more and more risks not only have a direct effect on, for instance, a disruption of the vital infrastructure, but also a more indirect effect on social unrest as a result of another risk.</i></p> <p><i>In order to demonstrate that the existing method according to the national guideline is no longer sufficient and that risks cannot be considered in isolation, we indicate cross-references between risks in</i></p>	<p>Making use of teams with opposing views and expectations and by making teams which consist of people with a wide range of experience. They are critical of categories by making use of subcategories and they are also aware of the fact that categories might be incorrect (Resodihardjo et al., 2018; Weick &amp; Sutcliffe, 2007).</p>	

			<i>this annex.” (Veiligheidsplan Groningen, 2019).</i>		
	Commitment to resilience	Deductive	<p><i>“EXPERIMENTING WITH DIFFERENT INITIATIVES</i>  <i>Of course, such a change in thinking and working methods does not happen all of a sudden. That is why we work towards these goals in manageable steps. By carrying out various experiments on a project basis, we can discover which innovations have potential. Is an experiment successful? Then we will develop it further. We have already started various experiments, such as the firefighter's assistant, the neighborhood firefighter's wife and the dual professional, which we hope to make a structural part of the firefighting organization during the next policy period.</i></p> <p><i>organization in the coming policy period. But we also continue to look ahead to new initiatives. For example, we are exploring the possibility of a Risk Factory within our region, where children and seniors can learn how best to react to various risks by experiencing interactive scenarios.”</i> (Beleidsplan Noord-Holland Noord, 2020).</p>	<p>“(1) training, (2) hiring people with a wide variety of experience, (3) stimulate creative thinking when faced with adversity; (4) learning from adversity; and (5) allowing conceptual slack.” (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018)</p>	
	Deference to expertise	Deductive	<p><i>“Placing responsibilities low in the organization requires a different way of working from employees and managers. Employees are facilitated by the organization to make this possible. They are given the right tools to be able to perform their tasks, both for the warm and the cold organization.”</i> (Veiligheidsplan Zeeland, 2016).</p>	<p>During emergencies, decision-making migrates to the frontline worker(s) with the expertise to act.</p>	<p>It is important to note that it is not always one single individual of the frontline who makes the decision, but instead by a group who has expertise. It is about expertise (group) and not about an expert (one individual) (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018).</p>
Hot ‘n cold phase	Cold phase	Deductive	<p><i>“Top risks in the VrAA</i>  <i>The risk profile of our region shows five priority risks for the coming years. In addition, we see "social unrest" as an increasing risk in society. Together these are the following risks:</i>  <i>&gt; Large and complex fires</i></p>	<p>“when there is no crisis and actions are geared towards creating contingency plans, training, and learning from previous crises in order to improve their</p>	

			<p>&gt; Failure of vital services                  &gt; Flooding and extreme weather                  &gt; Public unrest                  &gt; Pandemic                  &gt; Terrorist attack</p> <p>The social, economic and societal consequences of these risks are considerable. We must continue to prepare for them. We do this by further developing crisis management and our risk-oriented working method. And by professionalizing and expanding the cooperation with our partners, such as in the field of information-driven safety. Should a risk nevertheless occur, we will, together with our assistance partners, save people and animals. For example with our new Quick Response Team.” (Beleidsplan Amsterdam-Amstelland, 2021).</p>	<p>performance”                  (Resodihardjo et al., 2018).</p>	
	Hot phase	Deductive	<p>“In an acute situation, the crisis organization must act immediately under time pressure, and a previously described upscaling model is used: the GRIP model.” (Crisisplan Noord-Holland Noord, 2021).</p>	<p>“when a crisis actually happens and actions are geared towards minimizing and ending the crisis” (Resodihardjo et al., 2018).</p>	
<b>Inductive codes</b>					
	External crisis partners	Inductive	<p>“In addition, we have an extensive network of parties with whom we cooperate, such as the Dutch Red Cross, Essent, Enexis, Brightlands, ProRail, the other southern veiligheidsregio's (South-6) and, of course, the various relief organizations in the Euregional border area.” (Beleidsplan Zuid-Limburg, 2020).</p>	<p>External crisis partners (neighboring countries, companies etc.)</p>	
	GRIP	Inductive	<p>“The crisis organization scales up flexibly. The GRIP describes the structure for multidisciplinary management and coordination and is independent of the number of units and/or materials deployed. The GRIP includes the powers to scale up and down. It also indicates for each situation which parts of the crisis organization are active, who is in charge of the operational management and who has authority.” (Crisisplan Zeeland, 2017).</p>	<p>Depending on the degree of severity, there is local crisis management, but it is also possible for several veiligheidsregio's to work together. In order to indicate this, the veiligheidsregio's use the so-called GRIP structure (Coordinated Regional Incident Management). This structure consists of five levels: local (1 to 3), regional (4) and interregional (5). Which level is used depends on the situation (Instituut Fysieke Veiligheid, n.d.).</p>	

	Resilience	Inductive	<i>"we must therefore go to the citizens. here lies a role for the mayor who, as an ambassador of the concept of resilient Zeeland, enters into a dialogue with local politicians, interest groups, associations et cetera" (Veiligheidsplan Zeeland, 2016).</i>	Stimulating of resilience	
	Self-resilient citizen	Inductive	<i>"It is important that citizens know how they can prepare themselves for a possible crisis in the cold phase, but also how they know how to act during a crisis. This concerns the extent to which people provide for their own safety, but also for that of people who are unable to do so themselves (e.g., the less self-reliant). Due to the individualization of society, however, we see that it is increasingly "every man for himself" and that caring for others is not self-evident." (Beleidsplan Zuid-Limburg, 2020).</i>	Veiligheidsregio focuses on the resilience of the citizens themselves.	
	Situational awareness	Inductive		Aware of their surroundings	Unnecessary coding, deleted it.

### Codebook Thematic level

The theme codebook consists of themes that frequently appeared in the documents (and later the interviews) with the theory in mind. The codebook also includes some codes from the first codebook. The theme codebook can actually be seen as a focus on the important topics, while at the same time not coding too small.

Codes (thematic level)	Type	Example from the data	Clues for coder	Notes
Accountability to external stakeholders	Deductive	<i>We recently finished our regional risk profile, at least in draft form. And there you can see something, a smaller development, but there really are some developments, because citizens and the direct chain organisations around us look at possible incidents differently than a number of years ago. And partly, in my opinion, this is also due to the influence of public opinion. So where does the essence lie? I think if we look at terrorism around 2010, 2015, yes, that is in the public mind. And so something else comes back to it and now it's the pandemic story. So, you see different choices being made in the region, but also within the country. And</i>	It can help employees of the veiligheidsregio to have expectations from external stakeholders to attain the expected results (Turrini et al., 2010; Resodihardjo et al., 2018). Moreover, it also helps the veiligheidsregio if there are supervisory measures, for example from the government, to have effective crisis management (Davis and Robbin, 2015; Resodihardjo et al., 2018).	

		<i>that, of course, is interesting.'</i> (Interview Veiligheidsregio Noord-Holland Noord).		
Awareness and/or anticipation on cascading disasters	Deductive	<i>'A world without data and internet and a world without GPS positioning is almost unimaginable. Failure of one or more of these systems can therefore have a potentially serious effect on society. The consequences are not always clear. It is not known to what extent (chemical) industries, hospitals and other companies depend on these services and to what extent the failure can lead to consequential damage such as emissions of hazardous substances or the inability to provide care.'</i> (Veiligheidsplan Groningen, 2019, p. 50) And <i>'I think every incident is a cascading disaster. I think there is always something that has an effect on other things. And whether you have a collision of a car with a tree that temporarily closes the road, that also has an effect on your mobility, or whether it is as big as ionised radiation in a cloud, which also happened after Chernobyl. I think most causes of incidents are always a confluence of several circumstances, yes.'</i> (Interview Veiligheidsregio Zuid-Limburg).	Aware of the possibility of a cascading disaster. Anticipation on cascading disasters e.g. have emergency plans available for cascading disasters. Aware that critical infrastructure is vulnerable for cascading disasters.	
Coordination during disasters	Inductive	-	Describes how the veiligheidsregio's coordinate during a disaster.	Merged with integration and coordination
Cold Phase	Deductive	<i>'I: nou dan nu een stukje over vertrouwen. In de wetenschappelijke literatuur wordt vertrouwen gezien als een belangrijk element voor een succesvolle samenwerking. Dit is echter wel moeilijk op te bouwen en te onderhouden. In hoeverre speelt vertrouwen een rol in de samenwerkingen binnen de veiligheidsregio?</i> <i>P: Ja ik denk dat je vertrouwen van iemand opbouwt vooral in je koude fase en niet in je crisis. Dus op het moment dat je heel veel investeert in tijdens die koude fase als de crisis er niet in. In de ban van in samen op, van waar kan je wat voor elkaar betekenen, werkt dat uiteindelijk uit. En ja mocht er wel een crisis zijn, je kent elkaar, je weet hoe de huizen lopen. En je kent soms ook letterlijk gezichten. Dus dat draagt aan alle kanten bij aan een</i>	<i>“when there is no crisis and actions are geared towards creating contingency plans, training, and learning from previous crises in order to improve their performance”</i> (Resodihardjo et al., 2018).	

		<i>positief effect.</i> (interview Noord-Holland Noord)		
Different Types of Disasters	Inductive	Theme not used in analysis	The different types of disasters	
Striving for efficiency and effectivity	Deductive	Theme not used in analysis	Describes the focus on efficiency in the veiligheidsregio.	
External crisis partners	Inductive	<i>'In recent years, we have invested extensively in the network by maintaining good contacts, having coffee with each other, what is the situation with you? Are there still issues? How are things going with information management? And you see that large companies, those external partners, Tennet, Enexus, Pro-Rail, Waterboard, Rijkswaterstaat, the list is endless. So how do I set up a high-quality, effective crisis management and disaster response organisation when it matters most? And how do I keep that manageable and train, practice and keep people competent when they need to be trained? [...]. That is also relative, how often does something happen? And because we have invested in that network, you see that people know each other, get to know each other in the cold phase, as we call it. And that helps during the hot phase, because then I run into the same colleague and I've already spoken to him once and then I call and they say 'oh that's no problem, coming right up'. Instead of 'ooh, I have to ask if I can share that first'. So I think the investment we have made in maintaining our networks is paying off in the hot situation.'</i> (Interview Veiligheidsregio Zuid-Limburg).	External crisis partners who are not in the permanent network (e.g. neighboring countries, companies etc.)	
Flexibility of the VR	Deductive	<i>'We practice, we train, but we also know that it is always different from what you have just practiced and trained for. And what you say about cascading disasters requires even more coordination. Perhaps people need to be deployed for a long time. Which is where it gets exciting, I think, which is an important point. Imagine that you need three parallel teams, I'm just making something up. That also means something for your regular work. The police see that now in [place name refugee shelter]. They have to be there a lot, with more people, because it is restless and threatens to be unsafe</i>	Flexibility is favored above stability. Allow participants in their network to deviate from the plans when needed. Room for improvisation.	



		<i>there. That means that the regular work of the police is under pressure. So, they really are. But you can't say, oh we're going to add another bunch of people in response to the exceptions, the incidents and possible crises.'</i> (Interview Veiligheidsregio Groningen).		
Goal of the VR/Functions/Tasks	Inductive	Theme not used in analysis.	Describes the goals, tasks and functions of the veiligheidsregio.	
Governance of the VR	Deductive	<i>'Look, it's about what kind of decision you are asking for. If it's a small decision, the shop floor can do it just fine. Just to give you an idea: The most important decisions are made by the emergency services workers on the street. That's where life and death are at stake and where the decisions are made in the first five minutes. Only after half an hour are the officers there. So that's the slightly higher layer, who again have the authority to give operational direction and make decisions for the incident location. And another half an hour later the ROT meets. The regional operational team. It is about scenario thinking, preparing the administrative decision-making, that kind of thing. And they mainly prepare, they don't have that much mandate to actually take decisions. What are administrative decisions, then that goes through to the P(B?)T or to the mayor, and then the mayor takes a decision. He has the final responsibility. So small decisions are of course taken as low down in the organisation as possible.'</i> (Interview Veiligheidsregio Amsterdam-Amstelland).	Describes the governance in the veiligheidsregio. Who is authorized to do what?	In the analysis merged with deference to expertise
High Reliability	Deductive	<i>P: Yes, again I would not make the distinction. Of course, we take scenario thinking into account with regard to different themes or objects. For example, you know that if you have low water in the [river] due to drought, which we saw last year, we had quite low water and drought, or the year before that I don't know. Then we know, for example, that [chemical company] has problems with water intake for their cooling and steam installations. So you do include that in your planning. So your planning is based on the principal factor, and you then start thinking about cascading</i>	anticipation on disasters and containment of activities during disaster(s).	Combination of 'anticipation' and 'containment' from the first code round/book. Eventually not used in the analysis, since it was more seen as an outcome variable

		<i>effects. What does water problems mean, high or low? So drought or extreme high water levels for this, this, this, this. And to what extent do you then want to prepare for that to inform. And that also stops once. The same goes for gas, the same goes for electricity, well and all the forms of planning we have. So, I don't think I make a distinction. (interview Zuid-Limburg)</i>		
Hot Phase	Deductive	<i>I: Yes. And what if there is no standard available, for example? A disaster, I can't think of it right now, but that something has never been made for that? P: Well then you improvise. On the basis of the methods you have. So about the organization, about the structure of your meeting, for example. They are more or less the same for any type of disaster. The subsequent approach is tailor-made. You don't have to, you can't describe it in advance. That is also [unintelligible] planning is nice have the main line and those are more points of interest that you have to think about when you have an incident. Not the line of how you should handle it exactly. Because that doesn't work. ' (Interview Amsterdam-Amstelland).</i>	“when a crisis actually happens and actions are geared towards minimizing and ending the crisis” (Resodihardjo et al., 2018).	
Information and Communication	Deductive	<i>'[...] That means active imaging at the source location and in the effect area. Information is collected, filtered, interpreted and entered into the system, so that in a cycle, which they also call 'netcentric', you share it constantly, but at intervals of fifteen minutes, ten minutes, an hour, or whenever it is necessary. You get a new picture of the situation. So how do we do that? Well through the information management method. And the people in the team who are responsible for that. But that picture is collected from all members. So in fact everyone is there, contributing to it.' (Interview Veiligheidsregio Zuid-Limburg)</i>	Shared language and meaning and adequate information technology and communication systems.	
Pro-active attitude of the VR	Inductive	-	Describes the pro-active attitude of the veiligheidsregio.	Code not used in analysis
Dealing with failures (made)	Deductive	<i>'[...] But we are in an official world and it is not. Let me say, the culture is not like that. It is an element of culture. So, you can have all sorts of nice</i>	Focus on failures because they are aware of the fact that one small failure can cause big problems.	

		<i>procedures and all sorts of protections and protocols. It's a bit like the whistleblower story. You can do everything, but whether it is actually done is another question. That's another matter.'</i> (Interview Veiligheidsregio Zeeland).	Extremely focused to find any deviation or occurrence of a failure. Encourage employees to report any failure, even if the person itself made the mistake. Frequent communication about which failures need to be avoided. Not satisfied with their own successes. They remain alert to errors (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).	
VR is sensitive to operations	Deductive	<i>'[...] So, we do look, like... We learn from Fort Oranje. What worked there? But at the same time, you also have to see that there is a substantial difference with what is happening here now. So, in that sense you take your experiences with you, you also have to be very alert to that. That's what the literature says, of course. And psychology. You also have a certain prejudice. Like, oh, we did it that way then, so it would be appropriate to do it again now.'</i> (Interview Veiligheidsregio Groningen).	Aware of their operations so they can spot any deviations, which may cause failures. To ensure mistakes are revealed, they make sure there is room to admit mistakes and also encourage their employees to admit their mistakes. Sensitivity to operations also includes being aware why people do things in a certain way. They do this, because High Reliable Organizations do not want to work on an auto-pilot. To notice deviations and people working on auto-pilot, High Reliable Organizations communicate frequently within their teams and also with people outside the team. They also try to detect near misses, because this may be a signal of a failing system (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007)	
Situational Awareness	Inductive	-	Awareness of the current situation.	Code not used
Size and composition of the team(s)	Deductive	<i>Well, that's according to the structure we have and it works. Look what we have seen in the covid now, and we are moving more and more towards that. We are now very much stuck with: operational team consists of. And then there's a whole list of officers. What we're moving towards is: there is an operational team. There's someone on it and he's in charge, coordinating that team. Support staff there to keep that team going. But who is in that team depends on what is going on [...] Well, I think that's where we need to go. And</i>	The network limits its members and carefully selects members.	

		<i>I don't think that's the case now, because we still have a list of: the fire service commander is on it, and well, everyone's on it. Yes, but if there is no fire. With all due respect, that doesn't help me. [...] before you know it, you have 80 people in a room [laughter] and we don't want that either. So, we are actually looking for much more flexibility when it comes to the composition of those levels.'</i> (Interview Veiligheidsregio Zeeland).		
Skilled and Professional Employees	Deductive	-	The employees are skilled and professional.	Code not used in analysis
Trust among employees in the VR/external partners	Deductive	<i>'And because we have invested in that network, you see that people know each other, get to know each other in the cold phase as we call it. And that helps during the hot phase, because then I run into the same colleague and I've already spoken to him once and then I call and it's 'oh that's no problem, coming right up'. Instead of 'ooh, I have to ask if I can share that first'.</i>	De veiligheidsregio is trying to foster trust among employees and/or external partners.	
Reluctance to Simplify	Deductive	<i>'Because it is very nice to write a lot of plans, thick books. You don't read these thick books during an incident, because you don't have the time for that. [...] and the prepared scenario is always different, or the reality is always different from the prepared scenario. [...] so you really can only do it in outline format.'</i> (Interview Veiligheidsregio Amsterdam-Amstelland).	Making use of teams with opposing views and expectations and by making teams which consist of people with a wide range of experience. They are critical of categories by making use of subcategories and they are also aware of the fact that categories might be incorrect (Resodihardjo et al., 2018; Weick & Sutcliffe, 2007).	
Striving for resilience	Deductive	<i>You work as a team, the moment you see things that are different or of which you say it's strange, you make a statement about it. Years ago, the veiligheidsregio started this, in the form of team resource management, where actually every member of the organization must be able to say at any time during such a crisis: hey, I see a bottleneck here, I see something that surprises me, we need to look at it. In particular, yes, there is a kind of hierarchy, who is whose? But on the other hand, we have very clearly said and trained each other that if there is something that you say is strange and odd, then we have to draw each other's attention to it.'</i> (Interview	Stimulating of resilience. ‘‘ (1) training, (2) hiring people with a wide variety of experience, (3) stimulate creative thinking when faced with adversity; (4) learning from adversity; and (5) allowing conceptual slack.’’ (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018)	

		Veiligheidsregio Noord-Holland Noord).		
Deference to expertise	Deductive	<p>‘‘Look, it’s about what kind of decision you are asking for. If it’s a small decision, the shop floor can do it just fine. Just to give you an idea: The most important decisions are made by the emergency services workers on the street. That’s where life and death are at stake and where the decisions are made in the first five minutes. Only after half an hour are the officers there. So that’s the slightly higher layer, who again have the authority to give operational direction and make decisions for the incident location. And another half an hour later the ROT meets. The regional operational team. It is about scenario thinking, preparing the administrative decision-making, that kind of thing. And they mainly prepare, they don’t have that much mandate to actually take decisions. What are administrative decisions, then that goes through to the PBT or to the mayor, and then the mayor takes a decision. He has the final responsibility. So small decisions are of course taken as low down in the organization as possible.’ (Interview Veiligheidsregio Amsterdam-Amstelland).</p>	During emergencies, decision-making migrates to the frontline worker(s) with the expertise to act.	It is important to note that it is not always one single individual of the frontline who makes the decision, but instead by a group who has expertise. It is about expertise (group) and not about an expert (one individual) (Weick and Sutcliffe, 2007; Resodihardjo et al., 2018)
Quest for stability	Deductive	-	Stability is favored above flexibility.	Code not used in analysis
Integration and coordination	Deductive	<p>‘So, we try for all incident types, we try multi-information maps. We call them MIKs. We try to make an MIK for all the different disasters or crises that provides a certain basic knowledge of the incident type. So, then you are talking about responsibilities, leadership and coordination. And that is actually the fixed five crisis themes: leadership and coordination, information management, crisis communication, reporting and alerting and scaling up. That is actually the fixed, what do you call it, the basis during crisis management and that is where I try to give the crisis official as good a sort of flying start as possible, more of a certain basic information level about that type of incident. So yes, we have plans and protocols, but the further up the scale you go, the less they are used. But more use is made of</p>	Integration and coordination are contributed by training, joint preparation and planning. It helps the organizations in the veiligheidsregio to collaborate during a disaster (Nohrstedt, 2016). Coordination is fostered by a centralization of command, get-togethers, formalization and decision-making procedures (Moynihan, 2009; Nohrstedt, 2016; Klijn et al., 1995; Ansell et al., 2010; Resodihardjo et al., 2018).	

		<i>information cards and basic knowledge. Knowledge about the source incident.' (Interview Veiligheidsregio Limburg Noord)</i>		
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## **Appendix II - Invitation e-mail for participation interview**

Beste heer/mevrouw,

Mijn naam is Bibian Bevers en ik ben een masterstudente sociologie van de Rijksuniversiteit Groningen. Ik doe - onder leiding van Dr. Francesca Giardini - onderzoek naar de rampenmanagement van de veiligheidsregio's. Hierbij richt ik mij specifiek op zogenaamde 'cascading disasters' (vrij vertaald naar keten/domino rampen). Hierbij gaat het om een ramp welke een ander voorval met grote impact teweegbrengt. In de praktijk zou het bijvoorbeeld kunnen voorkomen dat een overstroming of aardbeving zorgt voor uitval van de energievoorzieningen.

Voor dit onderzoek ben ik op zoek naar een veiligheidsregio medewerker die geïnterviewd wilt worden over de rampenmanagement van de veiligheidsregio. Deze medewerker heeft het liefst ervaring met het maken van beleid omtrent crises en rampen, maar ook ervaring met het veldwerk tijdens een ramp. Veiligheidsregio Groningen raadde mij medewerkers met een piket-functie aan, maar wellicht weet u een functie welke beter geschikt zou zijn.

In de bijgevoegde flyer staat een uitgebreidere omschrijving van het onderzoek en het interview. U kan ook deelnemen aan dit onderzoek als uw veiligheidsregio géén plannen of protocollen heeft voor keten/domino rampen.

Zou u mij in contact willen brengen met een geschikte persoon? Of zou u mijn mail **inclusief de flyer als bijlage** willen doorsturen naar deze persoon?

Alvast bedankt voor de moeite!

Hartelijke groeten,

Bibian Bevers

*Department Sociology / University of Groningen*

*06 13650310*

*b.m.bevers@student.rug.nl*

## Appendix III - Flyer



rijksuniversiteit  
 groningen

faculteit gedrags- en  
 maatschappijwetenschappen

### Flyer onderzoek naar rampenmanagement van de veiligheidsregio

Beste Veiligheidsregio-medewerker,

Bij dezen nodig ik u uit om deel te nemen aan een sociologisch onderzoek naar domino/keten rampen. Het doel van deze kwalitatieve studie is om de waargenomen betrouwbaarheid van de organisaties in de veiligheidsregio's te onderzoeken, d.w.z. of werknemers zichzelf in staat achten om te blijven functioneren in geval van domino/keten rampen. Ik zal u ook enkele vragen stellen over de werkwijze in de veiligheidsregio.

**Wie ben ik?** Ik ben Bibian Bevers, een master studente Sociologie aan de Rijksuniversiteit Groningen met als specialisatie sociale netwerken, dit gaat niet over sociale media, maar over relaties tussen mensen, organisaties etc. Voor mijn masterscriptie doe ik onderzoek naar rampenmanagement van de veiligheidsregio's in Nederland. Dit onderzoek wordt uitgevoerd onder begeleiding van Dr. Francesca Giardini.

**Waarvoor heb ik u nodig?** Ik ben geïnteresseerd in de interorganisationele samenwerking tussen de verschillende organisaties welke onderdeel zijn van de Veiligheidsregio. Hierbij wordt gefocust op de voorbereidheid op domino/keten rampen (cascading disasters). *Ik ben benieuwd in hoeverre medewerkers zoals u denken dat de veiligheidsregio in staat is om te gaan met deze domino/keten rampen. Uw antwoorden zullen een aanvulling zijn op de analyses die ik heb uitgevoerd op de beleidsplannen van de veiligheidsregio's.* Ik denk dat u als medewerker een waardevolle bijdrage kan leveren aan het onderzoek door deel te nemen aan het interview. Het is belangrijk om te melden dat dit geen kennistest is, of een functioneringstest o.i.d. Er zijn geen foute of goede antwoorden. **U kan ook deelnemen aan dit onderzoek als uw veiligheidsregio géén plannen of protocollen heeft voor keten/domino rampen.**

**Waarom nu?** Eén van de grootste en meest ingrijpende onderwerpen van dit moment zijn rampen zoals Covid19 en de watersnoodramp in de zomer van 2021. In de toekomst zullen natuurrampen, epidemieën en ook nieuwe rampen zoals cyber-aanvallen vaker voorkomen. Niet alleen de frequentie zal toenemen, maar ook de impact. Dit kan komen door zogenaamde keten/domino rampen. Hierbij gaat het om een ramp welke een ander voorval met grote impact teweegbrengt. In de praktijk zou het bijvoorbeeld kunnen voorkomen dat een overstroming of aardbeving zorgt voor uitval van de energievoorzieningen.



**Wat heb ik van u nodig?** Ik nodig u graag uit voor een interview van ongeveer één uur. Samen kunnen we een geschikte (online) locatie en datum bepalen.

**Wat gebeurt er dan met uw antwoorden?** Ik zal het interview opnemen (alleen audio) en daarna zo snel mogelijk transcriberen, waarbij ik persoonlijke identificeerbare informatie verwijder zodat het interview geanonimiseerd is. De anonieme opnames zullen op een beschermde schijf op de universiteit worden bewaard (max 10 jaar) waar alleen mijn begeleiders Dr. Francesca Giardini, Dr. Marieke van Gerner-Haan en ik bij kunnen. Uw anonieme inzichten zullen worden gebruikt voor wetenschappelijke doeleinden.

**Wat heeft u hieraan?** U draagt bij aan maatschappelijk relevant wetenschappelijk onderzoek. Het afgeronde onderzoek kan, mocht u dat willen, met u gedeeld worden. Ik hoop enorm dat u me kunt helpen om dit onderzoek te voltooien! Indien u aan ons onderzoek wilt meedoen, kunt u mij bereiken via [b.m.bevers@student.rug.nl](mailto:b.m.bevers@student.rug.nl) of via +31 6 13 65 03 10. Indien u vragen heeft, mag u altijd contact opnemen.

Met vriendelijke groeten, ook  
namens Dr. Francesca Giardini

Bibian Bevers

Rijksuniversiteit Groningen

Faculteit van Gedrags- en Maatschappijwetenschappen / Sociologie.

Grote Rozenstraat 31  
9712 TG Groningen

## Appendix IV - Informed consent form

### GEÏNFORMEERDE TOESTEMMING

*“HIGH-RELIABILITY NETWORKS FOR CASCADING DISASTERS IN THE NETHERLANDS: AN EXPLORATION OF FIVE VEILIGHEIDSREGIO’S AND THEIR POLICIES.”*

- Ik heb de informatie over het onderzoek gelezen. Ik heb genoeg gelegenheid gehad om er vragen over te stellen.
- Ik begrijp waar het onderzoek over gaat, wat er van me gevraagd wordt, welke gevolgen deelname kan hebben, hoe er met mijn gegevens wordt omgegaan, en wat mijn rechten als deelnemer zijn.
- Ik begrijp dat deelname aan het onderzoek vrijwillig is. Ik kies er zelf voor om mee te doen. Ik kan op elk moment stoppen met meedoen. Als ik stop, hoef ik niet uit te leggen waarom. Stoppen zal geen negatieve gevolgen voor mij hebben.
- Ik geef hieronder aan waar ik toestemming voor geef.

Toestemming voor deelname aan het onderzoek:

Ja, ik geef toestemming voor deelname

Nee, ik geef geen toestemming voor deelname

Toestemming voor het maken van audio/video-opnames tijdens het onderzoek:

Ja, ik geef toestemming voor het maken van audio van mij als deelnemer.

Nee, ik geef geen toestemming voor het maken van audio van mij.

Toestemming voor de verwerking van mijn persoonsgegevens:

Ja, ik geef toestemming voor de verwerking van mijn persoonsgegevens zoals vermeld in de onderzoeksinformatie flyer. Ik weet dat ik tot één week na ondertekening kan vragen om mijn gegevens te laten verwijderen. Ook als ik besluit om te stoppen met deelname, kan ik hierom vragen. Na die datum zullen de gegevens worden gebruikt voor het onderzoek omdat het voor de onderzoeker niet mogelijk zal zijn om de persoon te identificeren en te verwijderen uit de volledig geanonimiseerde dataset.

Nee, ik geef geen toestemming voor de verwerking van mijn persoonsgegevens.

Volledige naam deelnemer:	Handtekening deelnemer:	Datum:
Volledige naam aanwezige onderzoeker:	Handtekening onderzoeker:	Datum:

De aanwezige onderzoeker verklaart dat de deelnemer uitvoerig over het onderzoek is geïnformeerd. *U heeft recht op een kopie van dit toestemmingsformulier.*

## **Appendix V - Interview guide**

**Datum en tijd:**

**Veiligheidsregio nummer:**

**Locatie/omgeving:**

### **Interviewgids**

#### *Introductie*

Allereerst wil ik u bedanken voor het meedoen aan dit interview. Ik heb waarschijnlijk ongeveer één uur nodig om met u te spreken over de organisatie en werkwijze binnen de veiligheidsregio tijdens rampen en cascading disasters (in het Nederlands betekent dit zoiets als domino-/ketenrampen). De onderzoeksliteratuur wordt voornamelijk in het Engels geschreven en is soms moeilijk correct te vertalen, vandaar dat ik vanaf nu ‘cascading disasters’ zal zeggen. Hierbij gaat het om een ramp welke een ander voorval met grote impact teweegbrengt. De eerste ramp hoeft zelf niet extreem te zijn, maar kan een extreme impact hebben door de cascading effecten.

Voordat we beginnen, is het denk ik leuk als u ook weet wie ik ben.

Ik ben Bibian Bevers een master studente sociologie aan de Rijksuniversiteit Groningen. Momenteel ben ik met de laatste fase van mijn studie bezig, hiervoor moet ik mijn master scriptie schrijven. In mijn onderzoek wordt er onderzocht of en op welke manier veiligheidsregio's zullen werken volgens een bepaalde organisatietheorie tijdens rampen of cascading disasters.

Alles wat mij wordt verteld binnen dit onderzoek blijft anoniem. De data zal worden geanonimiseerd zodat dit niet herleidbaar is naar u. Dit wordt bijvoorbeeld gedaan door uw naam niet te gebruiken. Ik zal dus ook niet met uw collega's binnen de veiligheidsregio of met andere partijen delen dat u hebt meegedaan aan dit onderzoek. Mijn begeleiders en ik zullen volgens de AVG-richtlijnen werken. De anonieme opnames zullen maximaal 10 jaar op een veilige schijf staan op de universiteit, waarna deze opnames worden vernietigd. Alleen mijn begeleiders en ik kunnen bij deze beveiligde schijf.

Aan u de vraag of u het toestaat dat er een geluidsopname wordt gemaakt met een audiorecorder van de universiteit, zodat er geen door u vertelde informatie verloren gaat.

Het is van belang dat u weet dat meedoen aan dit interview op vrijwillige basis is en dat u dus op elk moment met het interview kan stoppen. Wilt u nog steeds meedoen aan het onderzoek? Zo ja, heeft u nog vragen voordat we beginnen?

## 1. **Dagelijkse werkzaamheden**

### a. Functie

- Wat is uw officiële functie?
  - Heeft u nog een andere functie gehad?
- Hoe ziet een gemiddelde werkdag eruit?

Onderwerpen interview:

- Werkwijze veiligheidsregio organisatie
- Cascading disasters
- Netwerk van de VR

Ik ga u nu wat vragen stellen over hoe jullie werken als veiligheidsregio organisatie. Bij sommige vragen maak ik gebruik van voorbeelden welke zijn gevonden in de literatuur of in rapporten van andere organisaties uit andere delen van de wereld.

### a. [commitment to resilience]

Graag zou ik het met u willen hebben over het begrip ‘veerkracht’. Als u weet wat het begrip ‘veerkracht’ - of in het Engels ‘resilience’- betekent, zou u mij dan dat begrip willen uitleggen?

-Zo nee, uitleggen: ‘veerkracht is het vermogen om door te zetten in onverwachte noodsituaties, deze op te vangen en er weer bovenop te komen.’

- In de literatuur wordt de term veerkracht veel gebruikt als het over rampen gaat. Is het ook iets waar u in uw dagelijkse praktijk tegenkomt? Is dat een duidelijk doel dat u en de organisaties nastreven?  
Probe: veerkracht van de organisatie(s)

### b. [deference to expertise]

De veiligheidsregio bestaat, zoals u weet, uit een netwerk van verschillende verbonden organisaties welke hun eigen specifieke taken hebben betreft de hulpverlening.

- Mijn vraag aan u is wie of welke organisatie de beslissingen maakt tijdens rampen?
  - In hoeverre speelt expertise van deze persoon of organisatie(s) een rol?
  - Zit er ook een verschil in de grote en kleine beslissingen die gemaakt kunnen worden door mensen met expertise?

- c. [sensitivity to operations operationeel bewustzijn] [Reluctance to simplify]
- Stel er doet zich een ramp voor; Hoe zorgen jullie voor een situationeel overzicht?
  - Stel er doet zich een ramp voor; Hoe houden jullie in de gaten of de hulpverlening goed verloopt tijdens een ramp?
  - Stel er doet zich een ramp voor; Hoe gaan jullie om met complexe situaties tijdens rampen? [reluctance to simplify]
    - Maken jullie hierbij gebruik van checklists, scripts, protocollen, subcategorieën?
    - In hoeverre volgen jullie deze?

d. [preoccupation with failure]

Ik zal nu wat vragen gaan stellen over het voorkomen en het omgaan met fouten. Het gaat hierbij om kleine en grote fouten. Ik wil hier benadrukken dat ik met deze vraag niet wil oordelen over jullie functioneren als veiligheidsregio. Ik stel deze vraag omdat mensen altijd fouten kunnen maken, waar dan ook. Ik zal eerst een voorbeeld geven uit een andere organisatie:

Op vliegdekschepen van de marine moeten vliegtuigen landen. Puin en andere losse voorwerpen op het vliegdek kunnen erg gevaarlijk zijn, omdat dit in de vliegtuigmotor gezogen kunnen worden. Daardoor kan het vliegtuig niet meer vliegen. Om die reden lopen alle medewerkers, ongeacht hun rang, elke dag in een rij naar voren om losse voorwerpen te zoeken.

- Hoe proberen jullie te voorkomen dat er fouten gemaakt worden tijdens de hulpverlening?
  - Hoe gaan jullie om met fouten, wanneer deze gemaakt zijn?

Probe: rapporteren/melden, ruimte om aan te geven?

## 2. Cascading disasters. Keten/domino rampen

Eén van de grootste en ingrijpende onderwerpen van dit moment zijn rampen zoals Covid-19 en de watersnoodramp in de zomer van 2021. In de toekomst zullen natuurrampen, epidemieën en ook nieuwe rampen zoals cyber aanvallen vaker voorkomen. Niet alleen de frequentie zal toenemen, maar ook de impact. Dit kan komen door zogenaamde cascading disasters. Hierbij gaat het om een ramp welke een ander voorval met grote impact teweegbrengt. De eerste ramp hoeft zelf niet extreem te zijn, maar kan een extreme impact hebben door de cascading effecten. Een bekende ramp met cascading effecten is de ramp in Fukushima. Waarbij een Tsunami een kernreactor vernielde, waardoor er radioactieve straling vrijkwam.

Ik ben geïnteresseerd in hoeverre de veiligheidsregio iets doet met cascading disasters in de praktijk.

- In hoeverre ziet u een vergelijking tussen een enkele, grote ramp en cascading disasters?  
Probe: wordt een CD zelfde behandeld als een grote ramp? CoPI teams etc
- Heeft u zelf ervaring/de veiligheidsregio met cascading disasters? Zo ja; zou u hierover kunnen vertellen?
  - Met welke cascading disasters bent u wel/nog verder bekend?
- Worden er oefeningen met cascading disasters gedaan?
  - Zo ja; hoe zien deze oefeningen er dan uit?
  - Voor welke cascading disasters wordt er getraind?
  - Zo nee; waarom wordt dit niet gedaan?

Afgelopen zomer hebben er veel overstromingen plaatsgevonden in Nederland, Duitsland en België - zoals u weet. De hulpverlening liep in België niet helemaal goed, niet omdat ze niet kundig waren, maar omdat de *coördinatie* tussen de hulpdiensten moeizaam verliep. Als gevolg daarvan kregen bijvoorbeeld de zwaarst getroffen mensen soms geen hulp. Het ging hier om een enkele ramp, maar bij een cascading disaster is er nog meer coördinatie nodig tussen de verschillende hulpdiensten, dan bij een enkele ramp. Dit is nodig omdat de rampen elkaar opvolgen en verschillend van aard zijn.

- Hoe denkt u dat de samenwerking zal verlopen tijdens een cascading disaster in uw veiligheidsregio?

### **3. Network effectiveness**

Bij cascading disasters is het volgens de wetenschappelijke literatuur belangrijk om samen te werken. Er zullen bijvoorbeeld taken verdeeld moeten worden en er zullen prioriteiten gesteld moeten worden. Daarom ga ik u wat vragen stellen over het netwerk van de veiligheidsregio's. Dit gaat dan over de mensen/organisaties met wie jullie samenwerken.

Eerst zal ik u wat vragen stellen over jullie samenwerkingspartners.

#### **a. [netwerk zelf]**

In jullie beleidsdocumenten hebben jullie het over externe partners - zoals waterbedrijven, energiemaatschappijen, Politie, Defensie etc.-, maar jullie hebben het ook over interne partners zoals de brandweer en de GHOR.

- Wat is uw ervaring betreft de samenwerking met de interne organisaties? Neem hiervoor de meest acute fase van de Coronacrisis in gedachten.  
Probe: frequentie, soepel
- Wat is uw ervaring betreft de samenwerking met de externe organisaties? Neem ook hiervoor de meest acute fase van de Coronacrisis in gedachten?  
Probe: frequentie, soepel

b. [trust]

In de wetenschappelijke literatuur wordt vertrouwen gezien als een belangrijk element voor een succesvolle samenwerking. Dit is echter wel moeilijk op te bouwen en te onderhouden.

- In hoeverre speelt vertrouwen een rol in de samenwerkingen binnen de veiligheidsregio?

Probe: totstandkoming van vertrouwen, wat levert het op?

c. [Information/communication]

- Tijdens een ramp moet er onderling tussen de hulpverleners en eventuele externe partners gecommuniceerd worden. Ik vraag mij af hoe jullie zorgen dat er gecommuniceerd wordt of informatie gedeeld kan worden?

Probe: LCMS

Wat gebruiken jullie als LCMS uitvalt?

d. [integratie en coördinatie]

- Hoe worden er beslissingen genomen tijdens een ramp? (centralization of command 'coördinatie')

Probe: door 1 iemand, hiërarchie, vergaderingen, beslisprocessen

a. [flexibility]

- Een ramp kan ook onvoorspelbaar zijn, waardoor een voorbereiding of training niet overeenkomt met de werkelijke situatie. Hoe gaat de veiligheidsregio om met zo'n situatie?

Probe: flexibel, voorbeeld laten geven

**Afsluitende vraag**

In uw perceptie, waarom denk u dat de veiligheidsregio wel of niet kan omgaan met een onverwachte cascading disaster wanneer deze morgen zal plaatsvinden?

**Open einde**

Hebt u het idee dat ik, in het hele gesprek iets ben vergeten te bespreken, waarvan u denkt dat dat wel relevant is? Of heeft u nog andere dingen die u wilt meegeven?

Als u nog op enig moment iets wilt toevoegen of meegeven aan dit onderzoek kan dit binnen een week, U kunt mij dan bereiken via [b.m.bevers@student.rug.nl](mailto:b.m.bevers@student.rug.nl) (dit staat natuurlijk ook in de e-mail).

**Heel erg bedankt voor uw tijd!**

