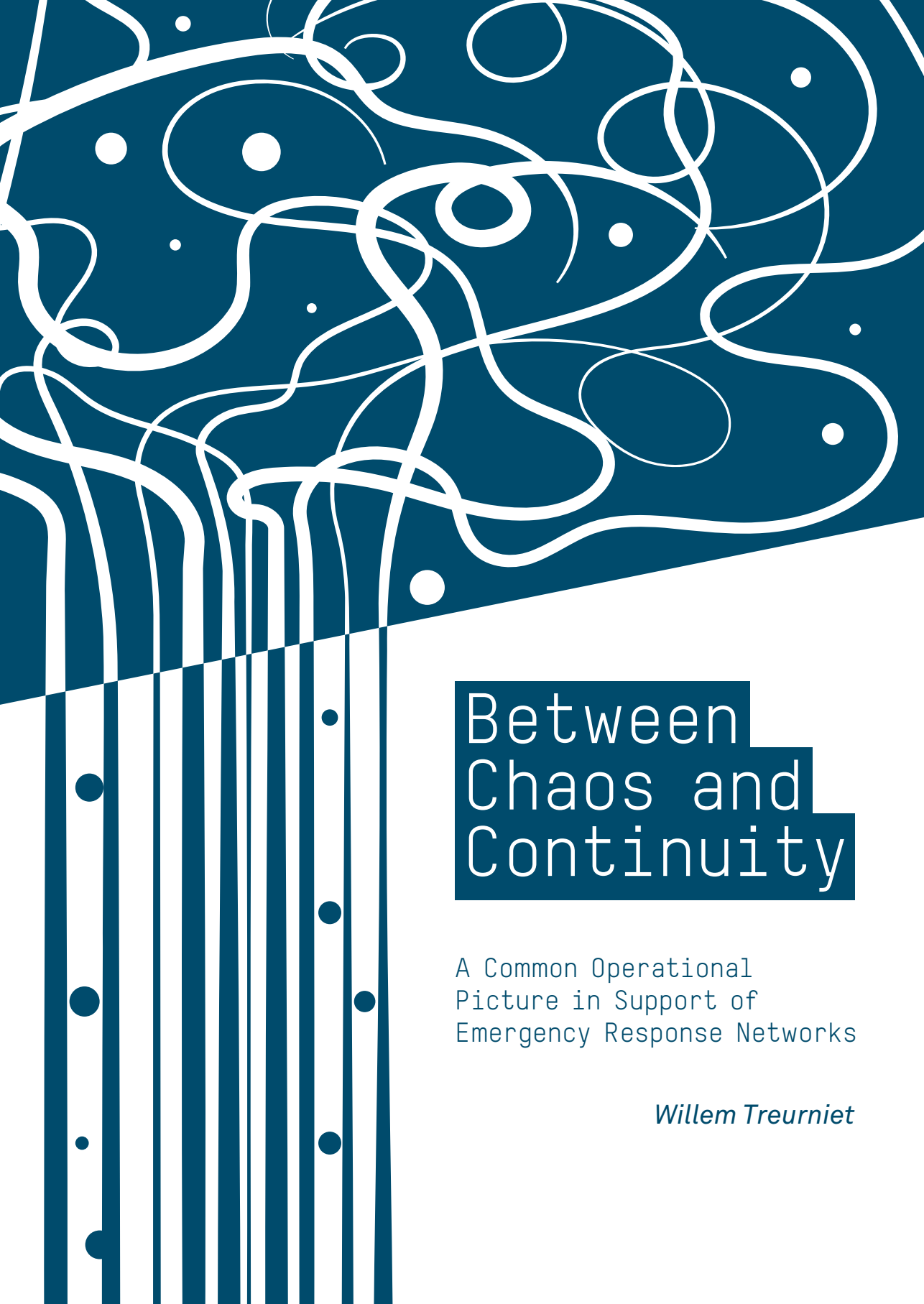
Between chaos and continuity

Treurniet, Willem

2022

document version
Publisher's PDF, also known as Version of record



Between Chaos and Continuity

A Common Operational Picture in Support of Emergency Response Networks

Willem Treurniet

Between Chaos and Continuity

A Common Operational Picture in Support of Emergency Response Networks

Cover design and layout: Delta3, the Netherlands

Printed by: MediaCenter Rotterdam, the Netherlands

ISBN: 978-90-9036240-3

VRIJE UNIVERSITEIT

Between Chaos and Continuity

A Common Operational Picture in Support of Emergency Response Networks

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan
de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus
prof.dr. J.J.G. Geurts,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de Faculteit der Sociale Wetenschappen
op woensdag 7 september 2022 om 11.45 uur
in een bijeenkomst van de universiteit,
De Boelelaan 1105

door
Willem Treurniet
geboren te Berkel en Rodenrijs

promotoren:	prof.dr.ir. F.K. Boersma prof.dr. P. Groenewegen
promotiecommissie:	prof.dr. A.H. van Marrewijk prof.dr. A. Bergmans prof.dr. M.T.I.B. Bollen prof.dr. J.F.M. Koppenjan dr. M.J. van Duin

Table of Contents

List of Figures

List of Tables

1 Introduction[1]

Particularly in modern Western communities, the effects of large-scale safety and security emergencies such as floods and severe power outages quickly cascade through various closely connected parts of the community. Because of the multifaceted nature of such events, the response to them requires a coordinated effort by multiple organisations. Even a relatively small emergency often requires collaboration between twenty or more organisations (Treurniet, Van Buul-Besseling, & Wolbers, 2012). In addition to organisations that can provide relevant information, knowledge or capabilities, other organisations are involved in the response because of their responsibilities for property or community services that are either affected or under threat.

There are a number of difficulties in organising the response to emergencies. The first derives from the fact that the response collective is occasional in nature. Because each emergency is unique, each emergency response collective is *occasional* in the sense that its composition and structure are tailored to the specific nature and extent of the emergency it is responding to. The occasional nature of the collective implies that the organisations and individuals may not have collaborated previously or may not even be familiar with each other, which may complicate the collaboration greatly (J.M. Berlin & Carlström, 2011; Comfort & Kapucu, 2006). Despite this, to contain the situation and prevent it from becoming worse as far as possible, the collective must be able to work effectively and coherently right from the start and able to react swiftly to the changing dynamics of the emergency.

The second difficulty has to do with the governance of the response effort. The governance of the emergency response collective is typically arranged differently in each country. A common denominator in such arrangements is that there is no strict hierarchy throughout the collective as a whole while at the same time the collaboration involves certain obligations (Abbasi & Kapucu, 2012; Kapucu & Garayev, 2013). Since the emergency response collective is occasional in nature, those working within it remain part of their own organisation, which therefore has some say in what they are permitted to do, and this may place certain limitations on what they can do. On the other hand, for the emergency response collective to be able to act decisively, the organisational actors involved are required to demonstrate a certain level of commitment. Such collective, which is linked by a limited number of more or less common goals, can be termed an *organisational network*.

1 Partly based on Treurniet, W. (2014), Shaping Comprehensive Emergency Response Networks. In T. J. Grant, R. H. P. Janssen & H. Monsuur (Eds.), *Network Topology in Command and Control: Organization, Operation, and Evolution* (pp. 26–48). Hershey, USA: IGI Global.

The third difficulty arises because of the nested nature of the response effort. Generally, a number of interrelated decision cycles can be distinguished in organisational emergency response networks. Consider, for example, the operational, tactical and strategic governance levels. Each of these levels has its own dynamics and its own required speed of decision-making (Rimstad & Sollid, 2015). The most urgent issues typically have to be dealt with at the operational level, while the issues handled at the strategic level, although less urgent, are broader in scope and more complex, and the timescales may be longer. Nevertheless, the same emergency has to be dealt with in these different decision cycles and the cycles therefore have to be mutually coherent and coordinated.

The fourth difficulty has to do with the availability of information (Turner, 1976). Organisations involved in the emergency response network have access to a large amount of information and data relating to the emergency. The possibilities in this area have increased even further in recent decades because more information became available via the internet and because of the growth of social media. Not all organisations have the same information, and it is necessary but difficult to combine data and information gathered from different sources and for different purposes into a meaningful, unified whole. At the same time, deep uncertainties about specific aspects are often inherent to emergencies. This may be uncertainty about the situation itself (Are there any casualties? How stable is the construction of this damaged building? Is it an accident or has it been caused intentionally?), or about future developments (Will the levee hold? Will the wind change direction? Will the social unrest increase and become uncontrollable?). It can also be uncertainty about what effects interventions may have.

The emergency response is complicated further by the fact that it is very visible. Emergencies and the response to them attract a lot of public attention, not only from those involved but also from the broader community. This visibility may put additional pressure on the responding organisations, since decisions – especially those that may appear in hindsight to be wrong – are likely to be subject to scrutiny.

In this introductory chapter I will first draw an outline of the world of emergency response whereby I specifically zoom in on the Dutch context in which I conducted my research into the role of the common operational picture in support of emergency response networks. This description ends in a focus on safety regions in the Dutch system. I subsequently state the specific problems that form the starting point of the research. This problem stating section ends in the research questions to be addressed. The chapter concludes with a discussion of the research approach and a description of the structure of the research and the thesis.

1.1 Contextualising background

1.1.1 Emergency response in the Netherlands

I conducted the research underlying this thesis by studying several emergencies that took place in the Netherlands. As I will elaborate later in this chapter, the Dutch context is a particularly interesting one, given the focus of my research, as since the early 2010s emergency response networks in the Netherlands have been organised in a netcentric way (Boersma, Wagenaar, & Wolbers, 2012), which means that the coordination of collaborative work is based primarily on a common operational picture maintained throughout the organisation network.

Let us take a closer look at how the response to emergencies is organised in the Netherlands. In the Dutch system an emergency does not in principle affect the regular allocation of responsibilities; normal organisational responsibilities will still apply in an emergency. More than fifty *community sectors* have been distinguished by the Dutch government, each of which plays a specific role during an emergency (Brainich von Brainich Felth, 2012). By far the majority of these community sectors are formed by *functional networks*, responsible for a specific functional domain such as electricity, social security, financial flows or food safety. Most of these functional networks contain a mix of public and private organisations. There is one specific community sector that is focused not on a specific functional domain but on managing public safety and public order. In this sector there is a *safety network* which is made up largely of government institutions and government agencies from national to municipal levels. At the regional level, there are legally regulated partnerships of clusters of adjacent municipalities called *safety regions*, which are important organisational bodies in the safety network. The Netherlands is divided in 25 such safety regions, which are legally regulated through the Safety Regions Act (Ministry of the Interior and Kingdom Relations, 2010b). These safety regions are in charge of identifying the risk of fire, disasters and crises, advising the authorities on how to deal with such risks, preparing for firefighting, and organising disaster relief and crisis management. They are also in charge of establishing and maintaining a fire brigade, coordinating emergency health care, providing an emergency control room function, and purchasing and managing joint equipment. In addition, they are responsible for establishing and maintaining an information infrastructure to support collaboration within the safety region and between the safety region organisations, organisations in the rest of the safety network, and those in functional networks.

The safety network has two main duties, as do the safety regions. The first is to protect the population, and the second is to ensure proper coordination between the organisations involved in preparing for or responding to safety and security incidents. As *subsidiarity* is an essential principle in the Netherlands, implying that a matter ought to be handled by the least centralised authority capable of addressing it effectively, decision-making takes place in the functional networks as much as possible (Brainich von Brainich Felth, 2007, p. 9). Given its responsibility for protecting the population, the safety network has the final say in cases where public safety is at issue. In most emergencies, organisations from a number of different community sectors will be involved in the response, and together they constitute an occasional organisational network, tailored to the specific needs of the emergency. Coordination within this occasional network can take place at three different levels. When public safety is affected and normal provisions are no longer adequate, the supreme command resides with the mayor. The mayor may decide to appoint an operational leader to take charge of the tactical and operational command and control of the responding organisations and agencies. In the case of supra-local safety and security incidents, the supreme command resides with the chairman of the safety region. In that case, an operational leader will *always* be appointed. In the case of supra-regional safety and security incidents, coordination is taken through interministerial alignment at the national level, because the ultimate authority for a functional network lies with one of the ministries[2].

How should this work in practice at the regional level? Consider, for example, a massive electricity outage. The primary responsibility for coping with such an event resides with the functional network managing the power supply. If vital interests of the community are threatened or even affected, the safety network comes into play. This safety network coordinates with the functional network managing the electricity supply without taking over responsibility for the supply. Legal regulations prohibit this functional network from distinguishing between individual electricity customers. So, electricity providers are not allowed to provide emergency generators selectively to individual customers. If the safety network decides – from the perspective of the care of the general public – that emergency power should be provided to a nursing home, for example, only this network has the legal mandate to order the functional network managing the supply to do so.

1.1.2 The role of the safety region in coordinating the response network

Safety regions are responsible for establishing the main organisational structure for disaster relief and crisis management for their own region. The central purpose of this structure is to coordinate the collaborative response effort, and it consists of an emergency control room organisation, one or more on-scene command teams, one or more population care teams, a tactical command team and a strategic command team. As a minimum, the command teams at the various levels include representatives from the fire services, the emergency health care services, the police and the population care services.

2 More detailed information about public order and safety in the Netherlands and the role of mayors, safety regions, and the provincial and the national levels can be found in Muller, Brainich von Brainich Felth, Brouwer, and Schilder (2017).

They can be supplemented with representatives from other organisations involved in the response to a particular incident. In a Safety Region Ministerial Order, many requirements are stated with respect to safety regions, including requirements regarding how often disaster relief and crisis management exercises are to be held as a minimum in each safety region (Ministry of the Interior and Kingdom Relations, 2010a). Consequently, the four different services represented in the command teams for any particular incident are relatively familiar with each other and each other's work. Occasionally, depending on the scenario, other potential crisis partners are involved in exercises as well. It is important to bear in mind that exercises have to be planned carefully and all the various teams and individuals involved in an exercise have to allocate the requisite time in their agenda for the briefing, the exercise itself, and the debriefing. If during the exercise the emergency response organisation decides that a specific organisation should be involved in the response, this is not possible to do realistically within the exercise. In most exercises the role of this external organisation is played by a response cell but this role-playing is often far from realistic and is not a full substitute for real involvement by the external organisation. Because for many crisis partners realistic involvement in exercises occurs only sporadically and because the number of potential crisis partners is very large – it should be recalled that there are about fifty different functional networks, each made up of different potential crisis partners – the organisations in the safety region are less familiar with the crisis partners from outside the safety region. As a consequence, there is stronger cohesion between the organisations within the emergency response subnetwork for which the safety region is responsible than between this subnetwork and other more occasional crisis partners.

This is one of the reasons why, in practice, a safety region's responsibility for establishing the coordinating core of the response network often appears to be problematic. I stated earlier that the two main duties of the safety network, and therefore of the safety region, are taking care of the safety of the population and ensuring there is proper coordination between the organisations involved in responding to a safety incident. On several occasions I noticed that the safety region's coordinating role was given too little attention. In such cases, the organisations for which the safety region was responsible – such as the fire services – were themselves inclined to react quickly to the incident instead of focusing on coordination of the response and on ensuring that the other organisations with responsibilities fulfilled their responsibilities. A similar observation was made in a recent evaluation of the Safety Regions Act (Muller et al., 2020). One of the recommendations with respect to the safety regions was: "Crisis management must be structured more on the basis of network cooperation, whereby all crisis partners contribute to crisis management as much as possible from their own responsibilities and authorisations. The nature and scale of the specific threat or crisis should be leading in the composition of the network." (Muller et al., 2020, p. 9).

An example of this tendency to focus on action rather than coordination can be found in the response to a gas failure in Velsen-North in the Netherlands (Inspectorate of Safety and Justice, 2016). On 15 January 2015 a gas main in Velsen-North was accidentally damaged by workmen, resulting in 1,227 households being without gas until 21 January. In line with its responsibilities, the gas supplier immediately started dealing with the broken gas main and communicating with the households affected. Simultaneously, the safety region set up an emergency response team which identified several response measures for the emergency response workers, including turning off the gas supply and checking each house's connection to the gas network. The evaluation report for the emergency response stated that the response could have been more efficient. It took longer for the gas company to start the repair work because the organisations brought into action by the safety region did not stick to their allotted role and meddled in activities that were part of the gas company's responsibility (Inspectorate of Safety and Justice, 2016). This example shows that the actors for whom the safety region is responsible cannot always restrain themselves from taking action and do not always leave certain parts of the operation to other organisations which should be carrying them out. If the safety region actors are inclined to consider involving other crisis partners anyway, they often make that judgement themselves. These external partners – provided they are well informed – are generally much more able to determine what the situation means what they have responsibility for. This limited focus on the broader organisational network tends to be more and more problematic because in a society in which the systems and processes are becoming ever more complex and interdependent, I see a likelihood that the emergencies we will face will require more extensive and more complex response networks.

So far, I have only discussed how public and private organisations respond to safety and security incidents, but the response network is often more complicated. In addition to public and private professional response organisations, the affected community can itself be an essential source of information and capabilities (Dupont, 2004; Dynes, 1994; Helsloot & Ruitenberg, 2004; Lindell, Perry, Prater, & Nicholson, 2006; Nakagawa & Shaw, 2004; Quarantelli & Dynes, 1985). One example of large-scale community response in the Netherlands is a citizen initiative that took place in May 2013. Two young brothers – Ruben and Julian – had been missing since 6 May 2013. That day, they had been driving with their father through the south-eastern part of the country. The father was found dead on 7 May. He had committed suicide. There was no clear clue as to where to look for the two boys. With so little to go on, police forces, reinforced with defence units, conducted systematic searches of several forests and rural areas.

On 9 May a citizen initiative was launched to carry out additional searches. Ten days later a passer-by reported something suspicious to the police and the two boys were found in a ditch. Investigations showed that the boys had died shortly after they went missing. From 9 to 19 May search activities were conducted by several citizen groups, and these were coordinated via social

media and a dedicated website (JulianRubenNL, 2013). Through the use of these media, the citizen search activities were deliberately kept separate from the search activities of the professional forces. There was a separate section on the website with questions from the police to the public which arose from the police investigations. The following statement was also prominent on the website: "We kindly ask you to keep the coordination in the hands of one person and not to initiate your own activities. If you want to search, please contact us, and will put you in contact with the person who has contacts with the Mayors and the Police. [...] Duplication of work would be a waste of effort. There are maps and we have a script that we can share."

In this particular case, the professional response organisation coordinated with the citizen search initiatives. Some basic guidance on search techniques was provided, and areas were explicitly assigned as "released for citizen search activities". One particular person was assigned as the point of contact[3] and was given the role of mediating between local people involved in the search and the professional response organisation. In this way, the citizen initiative was contained and made manageable for the professional response organisation. It is questionable whether this containment of the citizen initiative was the most effective way of involving the broader community in this search operation. In a later missing person incident – that of Anne Faber, which took place in September and October 2017 – the collaboration between the police and a citizen search initiative was more intense. A report setting out the lessons learned stated that, *because of [its] self-organising capacity, the family not only played an active role in the collaboration, but also showed itself as a reliable partner for the police* (Lam & Kop, 2020, p. 53). There are more examples I could mention where involving the broader community in the response to emergencies had mixed success. These examples indicate that professional response organisations often find it difficult to know how best to relate to the broader community and to response initiatives started by that community. The interests and values of the professional response organisations differ from those of the broader community. The professional response organisations do not have a personal interest in the outcome of the response. Their interests are in seeing that justice is done to all the parties involved and in ensuring their safety and security. The citizens involved have a personal interest of some kind. Some of them take action to express their compassion or their social involvement. Others do so because they themselves or their relatives and acquaintances have been personally affected – as in the examples above. As shown in the literature (Herranz, 2008), and as will be elaborated in Section 2.4, these differences in interests and values make it more difficult to put effective coordination arrangements in place.

3 A point of contact mediating between the crisis management organisation and a specific stakeholder group is what Acquier, Gand, and Szpirglas (2008) call an *anchorage point*.

To summarise this section, more often than not safety and security threats or breaches need a response from organisational bodies other than just the emergency services. Responses are needed from a broad range of public and private organisations, and more and more often emergencies elicit a response from groups of citizens, whether self-organised or not. Practice shows that in many cases, the organisations at the core of the safety network, despite being responsible for coordination, have difficulty in delegating responsibilities to the broader range of network players.

1.2 Statement of the problem

In the previous section I discussed the occasional organisational networks formed to respond to incidents that pose a threat to public safety or security. A great deal of research has already been conducted on collaborative networks and more specifically also on occasional collaborative networks, and much is already known about them. Occasional collaborative networks are indeed considered the most effective form of response to safety and security incidents: there is no one single organisation that is qualified to solve the problem but interaction between several organisations is needed to make sense of the situation and to respond adequately to it. Kapucu, Arslan, and Collins (2010, p. 19) put it as follows: large and complex problems *are best approached from a cooperative effort combining resources and preventing duplication*. The word *complex* denotes the notion of *emergence* in the sense that the dynamics of the events arise from the interaction between the entities involved and the occurring phenomena instead of being implicit in those entities and phenomena themselves (Standish, 2008). However, Kapucu et al. (2010) go on to say that *organising the cooperative effort is almost as difficult as the problems they are created to address.* Organising this cooperative effort is difficult for several reasons, one being that – as noted above – the collaborative network is typically an occasional one, tailored to respond to a specific event. This implies that the representatives from the collaborating organisations may not be familiar with each other, but those in the collaborative network are still expected to take action quickly and decisively. Another complicating factor is that the collaborative network often is a network that spans several sectoral and functional boundaries, which implies that complicated transboundary collaboration will be required (Ansell, Boin, & Keller, 2010). The broader community, or the response initiatives initiated by it, can in a sense be viewed as part of this collaboration network. Transboundary collaboration implies that there may be differences in organisational interests, cultures and strategic values that will need to be dealt with. Another complicating factor is the uncertainty and the issues regarding the level of information available. Sometimes – for example in the first hectic period after a sudden-onset incident such as an explosion or a shooting – *limited availability* of information leads to uncertainty. In other instances it may be the *abundance* and *equivocality* of data that is the problem, and the fact that information is acquired from many sources and provided by many different organisations; this makes it difficult to come to an adequate understanding of what is going on. Cooperation is also difficult because – particularly in modern Western communities – the collaborative network is an open network in the sense that

communities of interest, pressure groups and citizens in general look over the shoulder of the responding organisations via traditional and social media.

For this thesis I have specifically chosen to study three challenges that are fundamental to the organisation of cooperative emergency response efforts: the composition of the organisational network making the cooperative effort, the interaction between that network and the broader community, and the coordination within the network. In the following three subsections, all three areas will be explored in more detail to identify where the knowledge gaps are in each case. In the last subsection three corresponding research questions will be formulated.

1.2.1 Composition of the response network

The first challenge I will address is the gap in our understanding of who to involve in the cooperative effort. Each safety and security incident requires a response that is tailored to its particular nature and scale. Particularly with crises that unfold rapidly, it is difficult initially to gauge their likely impact, especially over the longer term. In the chaos and uncertainty, first responders often tend to under-estimate the scale of an incident. They quickly move to collaborating with organisations that they are used to working with (Kapucu & Hu, 2016), and in consequence the less obvious and longer-term safety and security issues receive too little attention too late. The longer-term impact of the emergency takes the response organisation by surprise. The existence of this knowledge gap is confirmed by Nohrstedt, Bynander, Parker, and 't Hart (2018, p. 267), who conclude that examining "emergent ad hoc collaborative arrangements to draw lessons and insights about ways to speed up processes of network formation and collective action" is one of the avenues for future research that could advance our understanding of collaborative crisis management.

Consider, as an example, the chemical fire incident that occurred in the port area of Moerdijk in the Netherlands on 5 and 6 January 2011 and was subsequently evaluated comprehensively (Inspectorate of Public Order and Safety, 2011a). A mix of chemical substances caught fire in an industrial zone next to the port area. The dense plumes of smoke and the pollution from water used to put out the fire had many environmental and societal consequences. It became unclear to citizens whether they could safely continue with their daily routine. Instead of responding empathically to the perceptions of health risks emerging within local community, the organisation involved in the emergency response network tried to control those perceptions by emphasising their own more technical view of the emergency (Messemaker, Wolbers, Treurniet, & Boersma, 2013). They repeatedly stressed that no hazardous substances had been found at a level that would endanger public health. In view of the plume of thick, black smoke, this communication was at odds with the gut feelings of the public and, as a result, the social unrest in fact increased rather than decreased. Another emergency in the same period where the wider effects were not considered early enough occurred near the Ouwerkerk Creek (in the Dutch province of Zeeland). In late July 2012 a dog died, showing symptoms of an infection from blue-green algae. The dog had been swimming in a creek. Further investigation revealed that there were toxic algae in the dog's stomach as well as in the eastern part of the creek, and a comprehensive emergency response organisation was set up. The committee evaluating this incident stated that, in the initial phase, the organisations involved in responding to this incident were focused primarily on "... finding technical solutions to a technical problem, without having an eye for the possible social impact of the incident" (Bos & Verberne, 2012, p. 7). In the week immediately following the detection of the algae, the responding organisations had been focusing primarily on developing an approach to control these toxic algae. They did not pay enough attention to the social unrest that arose in response to by media headlines such as "Great alarm after discovery of algae in creek". In these two examples the broader and longer-term impact on the community received insufficient attention, and as a consequence this impact grew uncontrollably.

In contrast to these two examples, there are also emergencies where the consequences and risks have been overstated, leading to unnecessary social unrest and additional costs. A Dutch example was when asbestos was discovered during the renovation of an apartment building in the Kanaleneiland district of Utrecht on Sunday 22 July 2012. In response, the residents of several apartment buildings were evacuated, parts of the district were closed, and a comprehensive emergency response organisation was set up. The incident attracted media attention and caused much anxiety among residents. The first conclusion of the evaluation committee reads: "The measures taken following the discovery of asbestos in Kanaleneiland were disproportionate in hindsight" (Jansen, Fernandes Mendes, Rook, Stordiau-van Egmond, & Van Zanten, 2012).

What these examples indicate is that it is difficult to shape a proportional emergency response network in a way that ensures the composition of the network is tailored to the emergency and its impact on the community. The response network should be equipped to handle not only the initial cause of the emergency but also its impact on the community, which can be very complicated and diverse. The initial cause of the emergency can have a *direct* impact on the community; the impact can also be *indirect*, in the sense that it is the result of cascading ripple effects from the emergency, and it can even be the result of the response itself. The impact on the community can also be caused by actions taken in response, either as an intended effect or as a side effect of measures with a different purpose. Even the mere fact that an extensive response network has been set up can have an impact on the community. If certain organisations are not included in the response network, this may imply that that some of the consequences of the emergency are not being attended to, or at least that the response to it is not being coordinated with other responsive actions. If, on the other hand, many organisations are involved in the response, the responsive actions themselves, and even the mere existence of the large response organisation, may increase the impact on the community. So, the challenge is to shape a proportional emergency response network and to strike

a balance between involving the relevant organisations in the response on the one hand, and, on the other, not needlessly increasing the impact on the community through the response itself.

1.2.2 Interaction with the broader community

The second challenge in responding cooperatively to emergencies that I will address is how to strike a balance between focusing on the cooperative effort and taking time to interact with and pay attention to the broader community. Emergency response networks can easily fall into an *elite panic* (Solnit, 2010) in the sense that they try grimly and vigorously to contain the chaos and restore order and societal continuity. In so doing they often overlook the needs and potential of the broader community. They focus too much – sometimes even frenetically – on getting things done and on resolving uncertainty. This may be very frustrating in terms of the needs of the broader community, and by doing this the emergency response organisations may engage in activities that fall outside their particular area of expertise and capability or outside their remit. The possibilities of the professional part of the emergency response network may not be sufficient to restore a situation that has got out of hand, or at least may not be able to do so reasonably efficiently.

In Section 1.1.2 I mentioned some examples of the involvement of citizen groups in responding to an emergency. Another example of the practical value of spontaneous deployment of community capacity can be found in the response to a café fire in Volendam in the Netherlands in 2001. Shortly after midnight on 1 January, there was a fierce fire in the café 't Hemeltje. Fourteen young people died and more than 200 were seriously injured. The first responders were faced with a very difficult challenge because of the huge number of wounded people, the nature of their injuries and the low temperature outside. Fortunately, there was an active First Aid Association in Volendam. Although this association was not a formal part of the emergency services, its members played an active role that night. Through telephone calls, around 70 of them came to the emergency site to help with the emergency response.

An example of spontaneous help from the broader community can also be found in the aftermath of a fire that broke out on 19 November 2011 in the rail traffic control centre in Utrecht. It was a Friday afternoon, and rail services around the city could no longer run because of the fire. There was a lot of mutual citizen support in the evacuation of passengers from stranded trains. Elderly and other less self-reliant people were looked after by fellow passengers. That evening, thousands of people were stuck at Utrecht Central Station and had to find alternative means of transport or somewhere to sleep. Camp beds were set up in an adjacent trade fair centre but none of these beds were actually used. Via Twitter and other social media, every stranded person was able to find another way of getting to his or her destination or was given a place to spend the night.

A further illustration of the role of the affected community in an emergency is provided by a fragment of a hitherto unpublished interview with a Dutch first responding officer:

How an incident affects the community can be illustrated by the lightning strike during a funeral in the village of Vorden on the 25 August 2006. A former member of the local marching band was being buried. During the ceremony, there was a performance by the marching band. Immediately after the funeral, a tree on the cemetery was unexpectedly struck by lightning and two members of the marching band lost their lives. This incident had a serious impact on the local community. In responding to this incident it was crucial to think from the perspective of the community right from the start. As an example, it was very important to take into account that the local community had many social ties with the victims and with the other members of the marching band, including family, neighbourhood and church membership ties. As a consequence, very soon – informally – the identity of the victims was generally known. It is very important to take this reality into account in responding to the incident; in the approach, in the allocation of tasks, in the organisations to be involved in the response and also in the crisis communication.

The interviewee concluded by saying: *In the heat of the moment it often happens that responders are very much focused on their own core tasks and activities and forget to think from the perspective of the affected community. As said, in the long term, incidents will not be judged on the progress in dealing with the cause of the incident. Instead they will primarily be judged on the effect the incident has on the community. The longer-term image of the incident the community has is closely related to activities such as crisis communication, the settling of claims and psycho-social aftercare. Crisis communication and interaction with distinct target groups should be taken into account right from the start, as an integral part of approaching an incident. As an example, I once deliberately chose to organise a guided tour with journalists and photographers to give them a closer look at the process and progress of fighting a wildfire.*

This conclusion perfectly captures the nub of the second challenge. While in practice – as illustrated in several examples – the initiatives and actions of citizens and citizen groups are shown to be very valuable in emergency response (Schmidt, 2019; Schmidt, Wolbers, Ferguson, & Boersma, 2018), it appears to be difficult for the professional responders to determine the best way of informing and involving the *broader* community. In examining this second challenge I do not focus primarily on the active involvement or participation of citizens and citizen groups in emergency response. The examples of this type of participation are given mainly to illustrate its potential. Against this background, and also in recognition of that the community is (albeit unwillingly) already involved in any crises that strike it, I see it as important for the communication with the broader communication to be as transparent and open as possible.

The challenge is how to strike an appropriate balance between the actual response to the emergency situation itself and the interaction with the broader community.

1.2.3 Interaction within the emergency response network

The third issue in responding cooperatively to emergencies that I will address is what can be expected from a common operational picture as a means of supporting collaborative decision-making within the emergency response network. The common operational picture is generally regarded as an important enabler of collaboration and coordination in an organisational network. By the term common operational picture, I mean the synthesised information relating to the incident that is gathered by all the various parties involved in dealing with it (Wolbers & Boersma, 2013). The common operational picture can serve as a mechanism for coordination throughout the collaboration network (Okhuysen & Bechky, 2009). It does so by representing and sharing the different perspectives on the situation, thereby helping to build a shared understanding across the different organisations in the collaboration network.

If in a specific case a large amount of information is available from different organisations, the common operational picture provides a means of making those multiple pieces of information more manageable by aggregating, structuring and interrelating them. On the other hand, if there is only limited information available, the common operational picture helps in combining and distributing this information effectively in order to allow as many organisations as possible to benefit from it and to reduce uncertainty. The shared understanding that the common operational picture helps to generate enables the collaborating organisations and teams to coordinate their work and to respond to the emergency in a coherent manner. In line with Comfort (2007), I see a common operational picture – maintained throughout the emergency response network – as a means of achieving a sufficient level of shared understanding among the different organisations and jurisdictions taking part in emergency response operations in different locations, so that all the actors readily understand the constraints on each other and the possible combinations of support and collaboration between them under a given set of conditions. Note that the common operational picture is typically dynamic, since the processes of information gathering and synthesis are continuous ones, aimed at resolving uncertainties and filling the gaps in the response organisations' understanding of what is going on.

Although the common operational picture *helps* in building a shared understanding, in this thesis the terms common operational picture and shared understanding stand for two different phenomena. While I use the term common operational picture to mean synthesised *information*, the term shared understanding – i.e., "the degree to which people concur on the value of properties, the interpretation of concepts, and the mental models of cause and effect with respect to an object of understanding" (Bittner & Leimeister, 2014, p. 115) – focuses on the *mental effect* of that information. It is also important to note that the term *picture* in common operational picture is used metaphorically and does not denote the actual *visualisation* of the synthesised information.

In the Dutch emergency response practice, operational information management is the process by which the common operational picture is maintained. This process has become an integral part of the emergency response network. Since the early 2010s the coordination of emergency response networks in the Netherlands has been organised in a netcentric way (Boersma et al., 2012). This means that each team involved in the response network is responsible for maintaining an up-to-date representation of the situation, reflecting the team's professional perspective with respect to it (Van de Ven, Van Rijk, Essens, & Frinking, 2008). As depicted in Figure 1, the common operational picture can be thought of as stored information, and separate information domains can be distinguished for each of the collaborating organisations. As indicated by the different colours of the five small barrels, the structure and content of each information domain is specific to the particular organisation to which it belongs. The fire services have a different perspective on an emergency from the police, and regard different characteristics as relevant. To support this information-sharing mechanism, a nationwide crisis management information system (LCMS) has been established in the Netherlands. The LCMS enables each team to maintain its own perspective on the situation. Geographical information can be maintained in a geographical module of the LCMS. An LCMS text module can be used for non-geographical information. The LCMS enables all organisations and teams, even those not directly involved in the response, to access and visualise the geographical and non-geographical information maintained by other teams and organisations. An operational information management process has been implemented to provide structural support for the collaboration between the organisations and teams in the network. For this operational information management process, a new role has been introduced into the crisis management structure: operational information managers. The operational information manager of each team is typically charged with maintaining the information domain that represents the perspective of that team. These various representations then form a common operational picture that is shared among the teams involved in the emergency response. The information manager of the team in charge of the tactical lead directs the process of maintaining the common operational picture. This directing role entails seeing that all the teams involved contribute to the common operational picture, identifying any inconsistencies or gaps, and taking action to address them. He is also responsible for ensuring there is coherence between the various representations of the situation as well as between the operational, tactical, and strategic command levels.

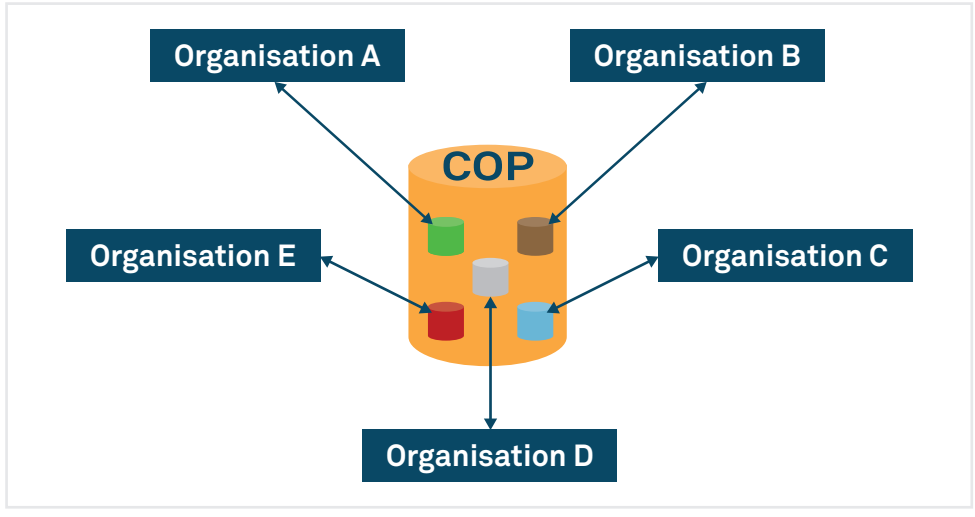


Figure 1 – A common operational picture shared among the teams and organisations involved in emergency response

The conceptualisation of the common operational picture will be discussed in more detail in Chapter 2, where extended versions of Figure 1 will be provided.

A number of potential benefits of collaborating on the basis of a common operational picture are mentioned in professional emergency response documents (Treurniet & Korpel, 2015). Some of these have already been touched upon in the previous subsections. The common operational picture may serve as a basis for shaping the emergency response network and also for informing the broader community. Emergency response professionals also expect working on the basis of a common operational picture to have a number of other benefits. First, the decision cycle is expected to be faster, because the process of gathering information and compiling a picture takes less time during emergency response coordination meetings. When the common operation picture is used, less of the precious meeting time needs to be devoted to deliberative assessment of the situation and coordinated decision-making. Second, proactive information sharing is expected result in a richer and more comprehensive situational picture, because other members of the network are invited to enrich, supplement and correct the information if necessary. Errors, ambiguities, misunderstandings, uncertainties and information lacunae can be dealt with quickly, because other actors in the network can easily respond to what has been shared. Third, a common operational picture is expected to enable the organisational network to anticipate the dynamics of a developing situation. In particular, if actors share their prognoses, intentions and plans, other organisations and teams in the collaborative network can take these into account when making decisions. Finally, collaboration on the basis of a common operational picture is expected to lead to better substantiated and better coordinated decisions.

Although in practice there is broad consensus that a common operational picture makes a valuable contribution to the functioning of an organisational network responding to safety and security incidents, scientifically much is still unknown about the precise nature of its contribution from a network point of view. The contribution of a common operational picture to the functioning of response network can be problematic in several respects. The information that has been stored may not reflect the reality of the situation itself. Moving from reality to stored information and subsequent sharing of that information requires several transformations, and each step in that process may lead to distortion and filtering (Mulder, Ferguson, Groenewegen, Boersma, & Wolbers, 2016). It may not always be possible to convey the essence of the situation in informational form, and even if this can be done, doing so in a timely fashion may be problematic. If information about the situation is available, organisations may not always willing to be transparent and to share their perspective on the situation with other organisations. If they do, the information they share may not always be understandable to other organisations that do not have the requisite background or specialist knowledge.

Since I have been working as professional in the field of crisis management and response, I was able to link my research with observations in the field of crisis management. This enabled me to reflect on examples I came across during training sessions and actual crisis operations. I came across examples of both overstating and underrating the value of a common operational picture. How can the value of a common operational picture be overstated? In the early 2010s, after having moved to a netcentric way of working, the leader of a tactical-level coordination team once said: “Finally I can lead without a blindfold!” Indeed, that is how it is supposed to be: collaboration on the basis of a topical, coherent, complete, clear and concise common operational picture, helping the response organisation to know what it does know and what it does not. If the common operational picture prevents people from realising that the crisis is taking place in the real world, it can easily become a new form of blindfold. The common operational picture should not become a new reality that masks what is actually going on: that – for example – a father is desperately searching for his missing daughter, or that an 83-year-old woman, with no access to social media, is becoming very concerned about what to do when a cloud of smoke begins to filter into her apartment. The common operational picture should be structured in such a way that it helps determine what needs to be done, who can best do it, and how the work should be coordinated. In this way, the common operational picture should provide a way of enabling the response organisation to stand with both feet planted firmly on the ground and with eyes wide open in the community.

However, I also came across examples where the value of the common operational picture was being underrated. These included emergency response exercises or operations in which, even though the information manager of a coordination team tried very hard to maintain an up-to-date common operational picture that captured the essence of the situation as well as possible, it

was not actually used in the decision-making process. Instead, each team meeting started with a virtually blank sheet, with each team member being allowed to give a summary of his or her perspective on the current situation. When this happened, precious meeting time was spent on recapitulating the situation, leaving less time for making a joint assessment of the situation and of how the emergency response was progressing and for making joint decisions. Looking more closely at exercises or operations in which I have seen this to be happening, it is often attributable to the fact that not all members of the occasional coordination team were used to netcentric collaboration and to the key role played in this by the common operational picture.

In addition to the challenges described in the previous two subsections, and going beyond the abovementioned potential benefits, I seek to explore empirically what role the common operational picture can and cannot play in the coordination of the organisations and teams that make up the emergency response network.

1.2.4 Research questions

I would expect that a common operational picture could be of value not only for dealing with the third challenge – the interaction within the response network – but also, through the contribution it makes to shared situational understanding, for dealing with the first two, namely the composition of the occasional response network and the interaction with the broader community. So, the overarching question in this thesis is: *what is the role of a common operational picture maintained throughout an organisational emergency response network in finding an appropriate composition for the occasional response network and for supporting interaction with the broader community as well as interaction within the response network itself?* With this overarching question in mind, I address three sub-questions that correspond to the three challenges in organising collaborative emergency response efforts that are central to this thesis.

The first sub-question is: *what patterns of involvement can be discerned in organisational networks that respond to emergencies?* In addressing this question I seek to advance our understanding of how to set up an emergency response network that is fit for purpose. The answer to this sub-question provides insight into how the composition of the organisational network can be driven by the common operational picture, which depicts the nature and the impact of the emergency that is being responded to.

The second sub-question is: *how can the communication strategy of a collaboration of emergency response organisations make a difference to an emergency's overall impact on the community?* The answer to this sub-question provides insight into how a common operational picture can be used to support the way in which a group of response organisations communicates with the broader community.

The third sub-question is: *how does maintaining a common operational picture during an emergency response contribute to collaborative sensemaking between the front line and the remote parts of the response network?*

1.3 Research approach

1.3.1 Prologue

In the 1990s, building on my technical background in informatics, I was involved in a research programme on command and control, studying the feasibility of substantial reduction of frigate-level command teams. This involved an applied research study that took place years before I started my PhD research, and in retrospect that research can be viewed as part of the prologue to my PhD study. In the context of the naval command and control research programme I did several studies on the structure and process of maintaining a common operation picture in a naval setting. I worked on technical solutions for fusing and transforming sensor observations to more abstracted common operational pictures (Paradis, Roy, & Treurniet, 1998). I also worked on how to structure a common operational picture in order to make it meaningful for naval command teams and to enable it to contribute to understanding the tactical situation (Treurniet, van Delft, & Paradis, 1999). This study resulted in a five-layer meta-model of a naval situation, which consisted the following layers: physical form, physical function, generalised function, abstract function and functional purpose (Rasmussen, Pejtersen, & Goodstein, 1994).

The rather technical focus of my research and consultancy work gradually shifted to a non-technical focus. I found out that in general the technical aspects of problems and solutions were the least complex. In most cases the human, cultural, organisational and process aspects are the most interesting because they are more determinative yet less pliable. My research interest gradually shifted to the command and control processes and the organisational aspects associated with it. My contribution to Essens, Spaans, and Treurniet (2007) illustrates this shift. In this publication I and my research colleagues argue that the interrelationship between four different networks – cause-and-effect networks, social networks, information networks and ICT networks – is determinative for contemporary networked command and control in military operations. The flexible interaction between these four types of network helps to provide the agility needed for command and control in today's military operations.

In line with the shift of my work focus to process and organisational aspects, I advised many organisations, including various Dutch safety regions, water boards, the Rijkswaterstaat (the executive agency of the Ministry of Infrastructure and Water Management) and drinking water companies, on the implementation of netcentric collaboration. In an observation and evaluation role, I have been involved in dozens of emergency management exercises carried out by safety

regions and their crisis partners. I was also involved in evaluations and sessions focusing on the lessons learned from real-life incidents[4].

1.3.2 Genesis and divergence

The initial focus of my PhD research was to look at what makes an emergency response network a reliable network that is prepared to respond adequately to the emergency it has been set up to respond to. A network being trustworthy means that it does what is needed to respond to the emergency and its effects. I conducted exploratory research on several different aspects of emergency management networks, which resulted in several work-in-progress publications. The first piece of work was a publication with colleagues about the need for collaboration awareness in addition to situation awareness (Treurniet et al., 2012). This publication forms the basis of Chapter 6 in this thesis. In this chapter I and my research colleagues argue that several incidents show that situation awareness is not sufficient for reaching effective collaboration between organisations involved in the response to crises. Another key element is collaboration awareness, which we define as having knowledge about the formal and informal structures and the ways in which organisations do their work and achieve their goals (Oomes, 2004; Van Aart & Oomes, 2008).

A second publication was about the consequences of the multi-sector nature of safety and security networks (Treurniet, Logtenberg, & Groenewegen, 2014). More specifically it discussed how to prevent, overcome and cope with the tensions resulting from this multi-sector nature. The preliminarily findings of that exploration were that an active network governance approach helps to make a response organisation more decisive and more purposeful. The flexibility and decisiveness of the networked organisation can be enhanced if informal network governance measures are also applied. Moreover, a purposeful information infrastructure, directed towards a limited number of clear priority issues, is a key factor in enabling the network to function effectively.

A third publication was about what types of archetypal organisational network governance structures can be identified (Treurniet & Van Buul-Besseling, 2015). In an organisational network a balance has to be achieved between the internal dynamics of the various member organisations that make up the network on the one hand, and the emerging dynamics of the network collaboration itself on the other. The precise nature of this balance will depend on the context, and to help those making decisions on how to achieve that balance, I and my research colleague have developed a framework describing four archetypal networked organisations: fragmented, deconflicted, coordinated, and collaborative and agile. These four archetypes serve two purposes. First, they can be used to guide networked organisations as they adapt to changing administrative and societal contexts. Second, they can be used to express the dynamics of the development of a response organisation in a particular emergency situation.

The exploratory work on networked collaboration showed us that there are many factors that help to ensure that collaborative networks are reliable. Ensuring a sufficient level of collaboration awareness is one of them. Another factor that needs to be considered is the various strategic orientations of the organisations involved in the networked collaboration. The governance structure of the network, which can range from fragmented to collaborative and agile, is a third factor but there are also many other relevant factors. So, the explorations taught us that the question of what makes an emergency response network trustworthy is so broad that more focus was needed in the research programme.

1.3.3 Convergence and elaboration

I brought more focus to the research by approaching the initial question at three different levels. First I considered the response network as a part of the broader community and studied the interaction between the network and the community. Second I looked more closely at the response network itself and studied its composition. What pattern can be discerned in terms of which organisational nodes make up the response network? The third and final level was the level of the interaction between the organisational nodes. In this last step I focused more specifically on what role the common operational picture plays in this interaction.

In combining these three sub-studies in one thesis I used a thread that runs through each of them: the common operational picture. The common operational picture obviously plays a key role in the last study but if you look more closely to the other two, it does so in these studies as well. It plays an essential role in ensuring coherence in the interaction between the response network and the broader community and in deciding which organisations to involve or not to involve in the response. So, although each of the three sub-studies is somewhat broader in scope than just the role of the common operational picture, this nevertheless became the common thread running through the thesis.

What type of contribution do I intend to make to the scientific debate? Considering that my professional work is close to practice, there is a temptation to conduct rather *pragmatic* research aimed at separating out and showing more clearly the effects of different potential interventions on how emergency response is organised or at finding the causes of identified problems in emergency response (Abbott, 2004). After all, the results of this type of research have the greatest chance of being directly applicable to emergency response. I chose to dig somewhat deeper and focused on making a more *conceptual* contribution to the scientific debate (Booth, Colomb, & Williams, 2003).

4 A more detailed description of my professional career can be found in the section *About the Author* at the end of this thesis.

Although I foresee that the research will also provide insights that can be applied to practice, my ambition is to go beyond what works and what does not and to further our conceptual understanding of emergency response.

Two complementary approaches are often distinguished in conceptual social science research: syntactic and semantic (Abbott, 2004). *Syntactic* research explains the world by *modelling* particular actions and interrelationships to greater levels of abstraction. The formal models that this type of research aims to create are meant to mimic the world as closely as possible. Examples include multi-agent systems models of crisis management organisations (Garcia-Magarino & Gutiérrez, 2013), game-theoretical models of crisis decision-making (Bennett, 1995) and crisis management domain ontologies (Lauras, Truptil, & Bénaben, 2015). *Semantic* research explains the world by assimilating it to general *patterns*, searching for regularities across time or (social) space. Social network analyses are good examples of semantic research (Romascanu et al., 2020; Topper & Carley, 1999).

The nature of the research questions and the fact that I have easy access to the rich semantics of the emergency response field led me to choose *semantic* research. More specifically, I deliberately chose to take a qualitative-interpretative approach because I needed to retain as much of the semantic richness of the research material and its context as possible (Corbin & Strauss, 2008; Schwartz-Shea & Yanow, 2013; Yanow, 2015). The cases I have used for the research were selected to gain a better understanding of how emergency response works and – more specifically – what role a common operational picture plays in this. The cases have not been selected to prove the occurrence of certain phenomena, but to gain more insight into how they work. For this reason, Chapters 3, 4, and 5 are based on a limited number of cases. In-depth analysis of semantically rich research material provided more insight in the details of the collaborative decision-making processes than a shallower analysis of a larger number of cases would have done.

I would like to stress that I did not choose a semantic and qualitative-interpretative research approach because I think it to be superior in overall terms to other approaches. In the end, we need a combination of the many different methods to advance in the scientific field. As stated by Abbott (2004, pp. 61-62), *our methods set up a methodological Rock-Paper-Scissors game. Put any two studies using slightly different methods together, and one will seem to have a more effective method. We will then find that this method can be improved further by moving toward yet a third method. And that third method may in turn be improved by moving towards the first!* I will come back to this in Chapter 7 where I reflect on how the research contributes to the scientific debates and where I provide recommendations for further research.

My personal intensive involvement in emergency response practice has important implications for my research role and gives my research some of the characteristics of reflection-in-practice (Schön, 2017). The benefit of this involvement is that it is relatively easy to consider the objects and topics being studied in a rich practical and historical context which I have even helped to shape. Of course, this also has a scientific risk. My intensive involvement in the emergency response domain, and the fact that I was directly involved in decisions on how emergency response should be conducted in a netcentric way in the Netherlands, makes it challenging for me to maintain the necessary objectivity and scientific distance. To mitigate this risk I deliberately chose to conduct all the empirical parts of the research with other researchers, the focus of whose work lies more in the academic domain and whose role gives them greater professional distance from practice.

1.4 Structure of the research

The overall structure of the thesis is shown in Figure 2. Chapter 2 describes the conceptual context by addressing the notion that emergency response builds on the potential of the affected community. The emergency response network is thus deliberately regarded as *part of* the community and not as an external entity. After all, the options for emergency response organisations to control all aspects of how an emergency may affect the community are rather limited. Chapter 2 zooms in on the key concepts used throughout this thesis. The concepts of community, crisis, emergency, and organisational network are all discussed, and this is followed by an elaboration of the nature of emergency response networks and the common operational picture that supports collaboration within them. The chapter concludes by revisiting the research questions, relating them to the concepts discussed.

Chapter 2 is derived in part from:

Treurniet, W. (2014). Shaping Comprehensive Emergency Response Networks. In T. J. Grant, R. H. P. Janssen & H. Monsuur (Eds.), *Network Topology in Command and Control: Organization, Operation, and Evolution* (pp. 26–48). Hershey, USA: IGI Global.

Parts and aspects of Chapter 2 have been presented at several annual Information Systems for Crisis Response and Management (ISCRAM) conferences:

Treurniet, W., Logtenberg, R. A., & Groenewegen, P. (2014). *Governance of occasional multi-sector networks.* Paper presented at the 11th International ISCRAM Conference, University Park, Pennsylvania, USA.

Treurniet, W., & van Buul, K. (2015). *Four archetypal networked organisations.* Paper presented at the 12th International ISCRAM Conference, Kristiansand, Norway.

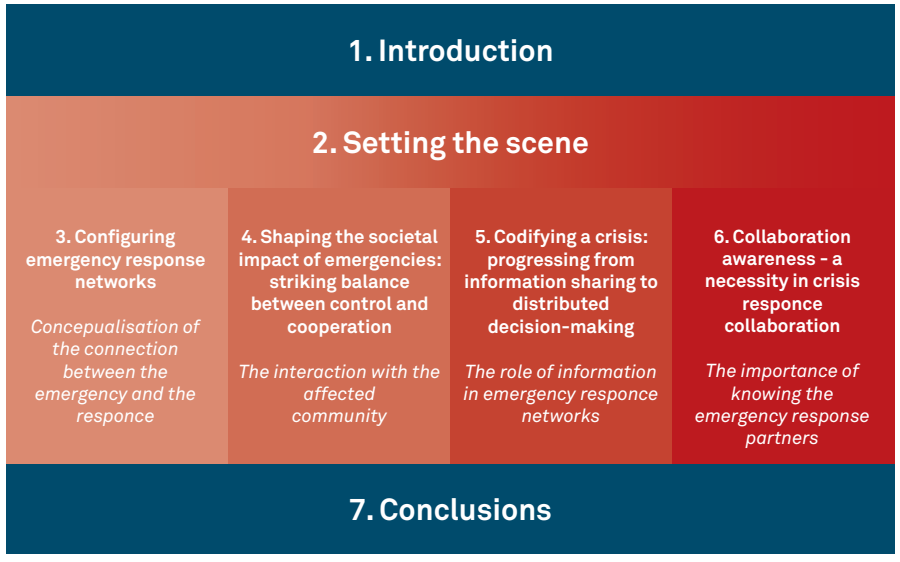


Figure 2 – Thesis structure

Chapter 3 addresses the first sub-question concerning what patterns of involvement can be discerned in organisational networks that respond to emergencies. It provides a conceptualisation of the essence of an emergency and of an emergency response and the connection between these two phenomena. This chapter looks at what happens when an emergency occurs within a community, and focuses on discernible patterns of involvement in the emergency response. It addresses the question of how the nature of an emergency is related to how the response organisation is structured. I and my research colleagues found that the emergency situation and the emergency response network mutually shape each other and are a reflection of each other. Failing to detect or ignoring ripple effects shapes the scope of the emergency and the response to it differently. How the insights gained in Chapter 3 subsequently also provided insights into the role of the common operational picture in providing a coherent view on both the emergency situation and the emergency response network is discussed in the concluding Chapter 7.

Chapter 3 has previously been published as:

Treurniet, W., Boersma, F. K., & Groenewegen, P. (2019), Configuring emergency response networks, *International Journal of Emergency Management, 15*(4), 316–332.

In preparation for writing this publication I conducted a preliminary study. I did a qualitative analysis of the response to twenty safety and security incidents, for which I primarily used secondary data (Van Duin, Wijkhuijs, & Jong, 2013). After this preliminary study I did an in-depth reconstruction of the response to three incidents based on primary data extracted from the nation-wide crisis management system used in the Netherlands. I subsequently conducted a qualitative-interpretative analysis of this data because this approach is best suited to gaining more insight into how the emergency situation and the emergency response network relate and to searching for patterns suggested by the research question (Abbott, 2004). The major of the publication was written by me. The contribution of the two co-authors consisted of a few small passages of text and several rounds of review.

Chapter 4 focuses on how the emergency response network interacts with the broader community. As emergency response builds on the potential of the affected community, this interaction is very important. We argue that crisis communication must strike a balance between a directive approach of chaos, command and control and a more empathic approach of continuity, coordination and cooperation. We also show how these two approaches are reflected in the planning processes throughout the emergency response network.

Chapter 4 has previously been published as:

Treurniet, W., Messemaker, M., Wolbers, J. J., & Boersma, F. K. (2015). Shaping the societal impact of emergencies: striking a balance between control and cooperation. *International Journal of Emergency Services, 4*(1), 129–151. doi: 10.1108/IJES-06-2014-0007.

The study was based on press releases from the organisations involved and articles from several mainstream newspapers, which were qualitatively analysed. The actual work of acquiring the data and conducting the analysis was done in cooperation with a master's student. The student's contribution to this work was part of his final-year assignment that I supervised. I subsequently strengthened the theoretical framework and related the gained insights to the scientific debate on public relations. The research provided insights into how the emergency response network should communicate with the broader community. In so doing it helped to address the second sub-question of how a common operational picture can be used to support the way in which a group of response organisations communicate with the broader community, and how it can thereby make a difference to an emergency's overall impact on the community. The role of the common operational picture in this matter is not discussed in Chapter 4 itself. However, how the insights from this chapter also threw light on the role of the common operational picture in providing transparent and coherent communication is discussed in the concluding Chapter 7.

Our early work on shaping the societal impact of emergencies was presented at the 2013 ISCRAM conference:

Messemaker, M., Wolbers, J. J., Treurniet, W., & Boersma, F. K. (2013). *Shaping societal impact: between control and cooperation.* Paper presented at the 10th International ISCRAM Conference, Baden-Baden.

Chapters 3 and 4 stress the key importance of maintaining a common operational picture throughout the emergency response network. Chapter 3 shows how the common operational picture can contribute to deciding what organisations to involve in the response. Chapter 4 shows how the common operational picture, including the uncertainties and the information lacunae, can contribute to determining how to interact with the broader community.

Chapter 5 addresses the third sub-question concerning how maintaining a common operational picture during emergency management can contribute to collaborative decision-making between the front line and the remote parts of the response network. It zooms in on the role of the common operational picture in the collaborative decision-making process. It focuses on information and knowledge sharing as a condition for enabling a coherent and decisive emergency response. While it is generally accepted that information sharing is essential for smooth collaboration within an emergency response network, what particular roles this shared information may play in the decision-making process has not been studied extensively. This chapter helps to fill this gap by focusing on the interaction between the front line and the remote part of the response network. I and my research colleague found that it is important to bear in mind the need to exchange not only factual information but also interpretations and perspectives on the potential consequences of the crisis and of particular actions that might be taken. We also found that it is important to be aware that not all information that is relevant to share can be codified adequately in the common operational picture.

Chapter 5 has previously been published as:

Treurniet, W., & Wolbers, J. J. (2021). Codifying a crisis: Progressing from information sharing to distributed decision-making. *Journal of Contingencies and Crisis Management, 29*(1), 23-35.

The study was based on my own reconstructions of the development of two common operational pictures, each of which was used to support the response to an incident. For these reconstructions I used primary data extracted from the Dutch nationwide crisis management system. In a first phase, I undertook qualitative-interpretative analysis of the reconstructions and reflected upon them in three in-depth interviews with officers who had mainly been involved in remote parts of the emergency response. In a second phase I complemented the insights gained from this first phase by coding and analysing three additional interviews with frontline officers. I did the major part of the writing work. The introduction, theoretical framework and discussion are the result of a number of joint discussions and iterative rounds of rewriting.

As reflected in the title of this thesis, one common, central theme in dealing with the challenges in networked emergency response is that there is a pendulum swing between chaos and continuity. How does this pendulum swing relate to the three challenges and the three sub-questions described earlier in this section? The first challenge is how to establish an orderly response to the *chaos* of the emergency and how to shape and organise the response so that it will pave the way for the eventual *continuation* of the regular community structures. The second challenge is how to *involve the broader community* in the response as soon as the *chaotic* and often unsafe emergency situation permits. The third challenge is how to bridge the gap between the *chaotic* frontline processes and the more *deliberate* processes in the remote part of the emergency response network.

The emergency response should strike a balance between dealing with the chaos caused by the emergency and preserving and contributing to societal continuity. We show that sharing information by means of a common operational picture maintained throughout the emergency response network and between the emergency response network and the broader community is crucial in striking this balance. We also show that although maintaining a common operational picture can add value by helping to drive collaboration within an emergency response network, there are limits to how far it can do this.

Chapter 6 focuses on one of the consequences of the occasional and dynamic nature of emergency response networks. These characteristics imply that it is not easy for the organisations involved in the emergency response to keep track of the composition of the emergency response network and of the role, relationships and status of each node of the network. So, it is important to strive not only for situation awareness – i.e., awareness of the emergency itself – but also for collaboration awareness, which entails having knowledge of the formal structures and the informal ways in which organisations work and achieve their goals (Van Aart & Oomes, 2008). Being aware of the needs, goals, expectations, culture, capabilities and procedures of the emergency response partners makes collaboration more effective. I and my research colleagues identify what organisations need to know about each other in order to collaborate effectively and we also describe the possible measures that can be taken to increase collaboration awareness.

Chapter 6 provides details of some exploratory steps in researching collaboration awareness. It is based on several workshops and interviews with practitioners rather than on extensive empirical research. I argue that situation awareness alone is not sufficient to ensure effective collaboration but that collaboration awareness is also important. I also explore how collaboration awareness can be fostered and supported. Chapter 6 builds on:

Treurniet, W., van Buul-Besseling, K., & Wolbers, J. J. (2012). *Collaboration awareness – a necessity in crisis response coordination*. Paper presented at the 9th International ISCRAM Conference, Vancouver, Canada.

Chapter 7 concludes the thesis. It gives a summary of the main findings and discusses the scientific and practical implications for how the common operational picture supports emergency response. I argue that emergency management is network management in the sense that an emergency itself is a network phenomenon but also in the sense that the emergency response organisation is an organisational network that must be managed. The common operational picture provides a view on both the emergency and the emergency response organisation and as such it is a valuable catalyst for shaping both. I argue that the common operational picture needs to be multi-faceted as well as multi-level to be effective. The different perspectives of the organisations involved in the response must be part of the common operational picture and it is important that it is not only used to share facts but also the interpretations and consequences thereof. I discuss how the common operational picture provides a valuable basis for command and control within an emergency response network. It supports command and control by providing a view on the emergency and on the response to it from a process angle as well as from a content angle. It also facilitates command and control to shape the organisational emergency response network proportionally. I conclude Chapter 7 with some suggestions for follow-on research.

2 Conceptual framework[5]

Abstract

To set the scene for this thesis, this chapter discusses some of the key theoretical concepts. This discussion has two focal points. The first is the role of the affected community in the case of an emergency. We conceptualise a community as a network of networks and a crisis as a failure rippling through those networks. Looking at the networked nature of a community, we look at two sides of a coin: vulnerability and resilience. The dependencies in a community cause it to be vulnerable in the sense that failures can easily ripple through its fabric. On the other hand, there is much empirical evidence to suggest that a community is typically very resilient in that it often has the ability to deal with failures and to bounce back in the event of crises. The second focal point is the emergency response network, which is a high-reliability mixed-sector network. This means that coordination is needed between organisations and collectives with differing strategic orientations. It also means that a common operational picture is typically maintained throughout the network, and this forms the basis for a cyclical process of collaborative sensemaking.

2.1 Introduction

This thesis zooms in on three emergency response issues: how the composition of the emergency response organisation relates to the emergency situation, how it interacts and communicates with the broader community, and how different parts of the organisation interact with one another and make decisions together. In studying these issues, I address particularly the role that a common operational picture plays in dealing with these emergency response issues. To pave the way for the main chapters, this chapter sets the scene for this thesis by laying out an analytical framework. We first define and connect the most important terms and concepts: community, crisis, emergency, and organisational network. Subsequently, I elaborate on the nature of emergency response networks. I do so by drawing on the theory of high-reliability networks and by zooming in on the role of a common operational picture in the collaborative sensemaking process in such networks. We conclude by revisiting the problem statement in the light of the concepts discussed. We start from the concepts depicted in Figure 3. This figure builds on Figure 1 (see Chapter 1), as it presents the idea that some organisations form an organisational network to respond to a crisis and they share information through a common operational picture (COP). Each of the collaborating organisations has its own particular information domain, as represented by the three coloured barrels in Figure 3. Throughout this chapter, these concepts and the interrelationships between them will be elaborated, and Figure 3 will be expanded along the way in illustration.

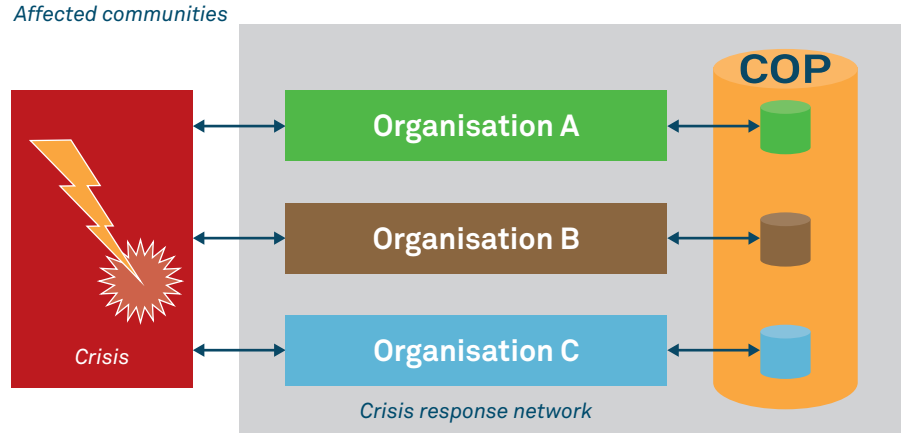


Figure 3 – Concepts to be discussed and interrelated in this chapter

5 Based on Treurniet, W. (2014). Shaping Comprehensive Emergency Response Networks. In T. J. Grant, R. H. P. Janssen & H. Monsuur (Eds.), *Network Topology in Command and Control: Organization, Operation, and Evolution* (pp. 26–48). Hershey, USA: IGI Global.

2.2 Communities, crises and emergencies

In our daily life we have certain basic needs such as food, drinking water, shelter, safety and security. Our access to food and water is dependent on a variety of factors, including production capability and distribution logistics. For shelter we depend on the construction sector, and for our safety and security we depend on various systems and organisations. All of these various facilities are in themselves dependent on other factors, including transport infrastructures, facilities for energy supply and telecommunications, and financial systems.

We conceptualise communities as tightly woven webs of interdependent institutions, social networks, physical entities and critical infrastructures (Boin, 2009; Castells, 2004; Hoffman & Oliver-Smith, 2002; Lindell et al., 2006; Quarantelli & Dynes, 1985; Raab & Kenis, 2009). This way of looking at communities is reflected in the following definition of community: *The combination of social units and systems which perform the major social functions of production-distribution-consumption, socialisation, social control, social participation, and mutual support, having locality reference*[6]. This definition is adopted from Quarantelli and Dynes (1985) and is also in line with Warren (1972).

In this thesis, a *crisis* is defined as an event in which safety or security are at stake because one or more vital community interests are affected while the regular structures and resources are not sufficient to maintain stability. The wording of this definition is derived from the one used by the Dutch government (Ministry of Security and Justice, 2013). Substantively, this definition is in line with those used by Boin, 't Hart, Stern, and Sundelius (2005) and Stern (2003), although their formulations are more geared to national and international politics.

By definition, a crisis has a societal impact in the sense that it affects or threatens one or more vital societal interests. In the Netherlands, six national vital interests have been distinguished: territorial security, physical safety, economic security, ecological safety, and social and political stability (NCTV, 2019). Cultural inheritance is often mentioned as the sixth vital interest. As such, these six vital interests correspond to six societal domains that a crisis can have an impact on. The extent of the community impact and the nature of a particular crisis can be very diverse and complex. A crisis has a concrete impact if, for example, ecological or physical safety are at stake, as in cases of environmental pollution or large-scale power outages.

6 Note that the adjunct "locality reference" – present in the definition of Quarantelli and Dynes (1985) but also in the work of Lindell et al. (2006) – may not be that important any more, at least not in the traditional sense of the word 'locality'. Over the last few decades cyberspace has added a new dimension to this term.

Its impact is more abstract or psychological if there is a threat to economic security or social/political stability – as in a financial crisis, for example.

The impact of a crisis can be *direct* in the sense that one or more vital interests are threatened or harmed because of the original crisis event. The impact can also be *indirect* in the sense that ripples from the original crisis event can run through the fabric of the community before indirectly affecting one or more vital interests. Critical infrastructures and facilities such as transportation modes, telecommunication facilities, energy supply networks and drinking water facilities (Luiijf & Klaver, 2006) typically play a considerable role in second-order crisis impacts. As the definitions of the concept of community indicate, the functioning of a community depends heavily on critical infrastructure facilities, even more so because these facilities are interdependent (Luiijf, Nieuwenhuijs, Klaver, Van Eeten, & Cruz, 2008). Crises can also have a big impact because the role of information within the community has changed, and the widespread use of social media often has a strong influence on community perceptions of an incident. An incident which may be relatively small-scale in its effect can easily evoke strong feelings and lead to social unrest.

Figure 4 depicts a crisis as a network of community networks affected by a disturbance in one of the networks. We point out that, compared to Figure 3, additional details have been added only to the crisis part. The disturbance – indicated by the lightning bolt – ripples through the network of networks and by so doing hampers the functioning of these other networks. The disturbance may even lead to new connections between the networks, as indicated by the dotted edges of the network. High water levels may, for example, lead to power outages because the water network and the electricity network interact in ways that are different from normal.

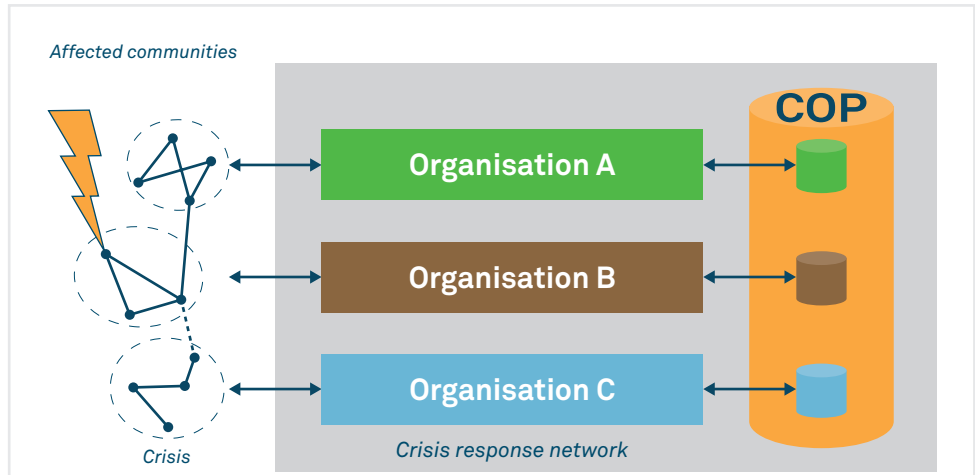


Figure 4 – A crisis as a network of community networks with a disturbance rippling through it

As an example, let us consider the direct impact that the flooding of a river can have on vital societal interests. Territorial security can be directly threatened as the flooded area cannot be used for a time for its intended purpose. Physical safety can be threatened as the flooding may cause fatalities, serious injuries and disruption to the provision of basic needs such as shelter. Economic security can be threatened because of the costs of relief, recovery and reconstruction or because of loss of income, and also because economic activity is disrupted. Ecological safety can be threatened because of structural disruption to ecologically sensitive areas. Social and political stability can be threatened because of the disruption to daily living and the socio-psychological impact. Finally, cultural inheritance, such as ancient buildings or art, can be severely damaged or destroyed by a river flooding. Hence, a river flooding can have a direct impact on any of the vital interests of the community.

A crisis such as a flood can also have a number of second-order effects. Depending on the duration, the extent and the nature of the exposure to the water, the flooding may damage or disrupt objects that are vital to critical products or services. One such example is an electricity generating station, which will obviously fail in the event of serious flooding. As a consequence, critical products or services – e.g., the electricity supply – may fail or may be reduced in capacity, resulting in second-order societal effects[7].

In this thesis I zoom in primarily on *emergencies*, which I view as a specific category of crisis. A framework for differentiating between various types of crises can be derived from Boin et al. (2005, pp. 16, 94, 95), who make a distinction between crises based on the rise rate and the recovery rate. The rise rate denotes the speed at which a crisis unfolds, and the recovery rate denotes the speed at which a crisis is resolved. Table 1 outlines this framework, showing the four different types of crisis that result from differing combinations of rise and recovery rates.

This thesis focuses on crises with a fast rise rate, which I also refer to as *emergencies*. More specifically, the cases I study are relatively small incidents that require the scaling-up of a response organisation but are still reasonably manageable.

7 Surprisingly enough, third-order effects caused by interdependencies among critical infrastructures appear to be quite rare. While interdependencies exist everywhere, they rarely appear to be strong enough to trigger a serious cascading outage of critical infrastructure. Most of these breakdowns in infrastructure are caused by interdependencies between the energy and telecom sectors (Luiijf et al., 2008).

Table 1 – Crisis classification framework; after Boin et al. (2005)

	Recovery rate	
Rise rate	**Fast**	**Slow**
Fast	Fast-burning crisis (e.g., a large fire)	Long-shadow crisis (e.g., an earthquake or tsunami)
Slow	Cathartic crisis (e.g., tracing and dismantling a threatening terrorist organisation, gradually escalating international tension followed by a sudden resolution)	Slow-burning crisis (e.g., climate change, population ageing)

In Chapter 3 I will elaborate on that, but the main reason for this is that the frequent occurrence of such relatively small incidents makes my research findings more broadly applicable. Meanwhile, many of the disaster characteristics are also applicable to smaller incidents when one considers their direct and indirect impact on society and the vulnerability and resilience of the citizens affected. Later in this chapter I will give some examples of the societal impact of relatively small-scale incidents and how citizens responded to them.

We have argued that communities are vulnerable and can be affected in a number of ways. One might say that the more developed a community is, the more ways there are in which it can be affected by a crisis. The functioning of a developed community is highly dependent on a number of organisational structures and infrastructures, i.e., the more visible and tangible parts of the community structure (Little & Krannich, 1988, p. 30). Fortunately, this is not the whole story. Communities are inherently *resilient* as well, in that they often exhibit the capability to cope with unanticipated dangers, and to learn to 'bounce back' or adapt (Lorenz, 2013; Rosenthal, Boin, & Comfort, 2001; Van Trijp, Boersma, & Groenewegen, 2018; Weick & Sutcliffe, 2007).

Empirical research (Dynes, 1994; Helsloot & Ruitenberg, 2004; Nakagawa & Shaw, 2004; Quarantelli & Dynes, 1985) shows that, while some of the more concrete parts of the community fabric may severely be damaged and disrupted during an emergency, the 'softer' parts appear to be very resilient and some of the social ties will even be strengthened through the process of coping with the emergency. Quarantelli and Dynes (1985), for example, discuss how the five major social functions they distinguish – production-distribution-consumption, socialisation, social control, social participation and mutual support – are affected by a crisis. As shown above, several types of crisis can dramatically change the *production-distribution-consumption* function. As a consequence, the focus then shifts from seeking to satisfy higher-level needs to dealing with more basic needs and emergency response equipment. *Socialisation activities*, usually associated with

the higher regions of the hierarchy of Maslow (1943) such as education and development, will be reduced and will be replaced by activities such as providing shelter and food. *Social control* is normally based on adhering to regular formal norms such as speed limits or parking restrictions. These formal norms are set aside, and social control will be based instead on more informal norms such as willingness to help and to share. *Social participation* and *mutual support* show a dramatic increase in times of emergency. Quarantelli and Dynes (1985, p. 164) conclude that:

A notable aspect of all these activities is that they seldom involve conflict, disagreement, or dispute; they are clearly matters of high community consensus. (They may become points of controversy after the emergency is over, but that, in itself, is a sign that the community situation is returning to normal.)
This view is supported by many other scholars, including Nakagawa and Shaw (2004), Boin, Brown, and Richardson (2019), and Helsloot and Ruitenberg (2004). Helsloot and Ruitenberg (2004), for example, disprove three myths with respect to citizen responses to disasters:

1. *Citizens panic in a disaster.* It is argued that panic reactions are actually very rare, though they do occur in very specific circumstances where there is immediate and serious danger, a high level of uncertainty, and few perceived means of escape.
2. *Citizens are helpless and dependent.* It is argued that, instead of being helpless and dependent, citizens tend to roll up their sleeves and start to act. When they need help or shelter, most victims go to relatives and friends on their own initiative.
3. *Looting occurs during and after a disaster.* It is argued that, in western cultures at least, looting rarely occurs during and after a disaster – at least not on a large scale.

This view is also supported by Solnit (2010), who gives a vivid account of how communities have responded to a number of very large-scale disasters. In a way, it is also supported by Acquier et al. (2008), who conducted an in-depth qualitative case study of an emergency experienced by a French public transportation company. They argue that, in the situation they were studying, because the emergency response organisation took a *stakeholders' perspective* on the emergency situation rather than *a technical and legal perspective*, this had a significant positive effect on the relationship between the emergency response organisation and the community groups affected. Focusing attention on those parts of the community that were affected or involved, rather than on the safety or security event itself, contributed to a smooth recovery from the emergency.

In summary, I have conceptualised a community as a network of networks and a crisis as a failure that ripples through these networks. Looking at the networked nature of a community, I have looked at both the resilience and the vulnerability of networked communities.

The dependencies in the community render it vulnerable in the sense that failures can easily ripple through its fabric. On the other hand there is much empirical evidence to suggest that many communities can be very resilient in that they often have the ability to deal with failures and to bounce back after a crisis.

2.3 Organising emergency response

Having conceptualised community and emergency, I now shift the focus to organising the response to emergencies. A crisis, including an emergency, can be characterised as a complex and wicked problem (Head, 2008; Rittel & Webber, 1974; Standish, 2008). Head (2008) argues that wicked problems are those that score highly on a number of dimensions, specifically the complexity of elements and interdependencies, uncertainty, and divergence in viewpoints and interests. A crisis will typically score highly on all of these dimensions. Firstly, a crisis is complex because its dynamics arise from the interaction between the community networks involved instead of being implicit in some individual entities and phenomena. Secondly, a crisis always involves uncertainty. This may be uncertainty over exactly what is going on or what effect the measures taken will have. Thirdly, a crisis involves divergence in viewpoints and interests because several interdependent community networks are affected. Measures adopted in one network can have negative consequences for another. Likewise, measures that are urgently needed in the short term can have negative effects in the longer term.

Because of the complex and wicked nature of crises, the response requires coordinated effort by multiple organisations (Head, 2019; Klijn & Koppenjan, 2016). There is a broad consensus that *organisational networks* are particularly suitable arrangements for formulating an adequate response to wicked problems such as crises (Brooks, Bodeau, & Fedorowicz, 2013; Danielsen & Førde, 2018; Kapucu & Garayev, 2013; Provan & Lemaire, 2012). Or, as Ganor (2009) put it, with regard to dealing with terrorist networks: "It takes a network to beat a network." Let us have a closer look at what is meant by organisational networks.

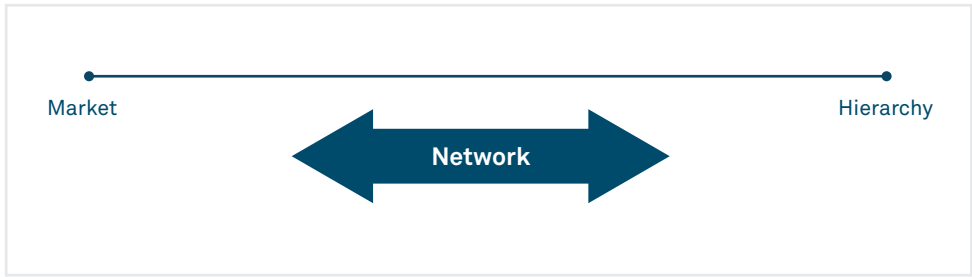


Figure 5 – Continuum between market and hierarchy

There is no generally agreed definition of what an organisational network is. An early view was that an organisational network was a collective anywhere on a continuum between a market and a hierarchy (Coase, 1937; Williamson, 1975). This way of approaching the concept of organisational networks (Figure 5) fits with how Whelan (2012) approaches them: organisational networks strike a balance between being hierarchical organisations, controlled by administrative or bureaucratic means, and market forms of organising that involve no organisational structure. Whelan (2012, p. 4) states that network forms of collaboration

... involve repetitive exchanges between a set of autonomous but interdependent organisations in order to achieve individual and shared objectives. Network organisations are controlled not through administrative means or the law but through relationships based on reciprocity and trust. Networks are understood to balance the 'reliability' of hierarchies with the 'flexibility' of markets, providing them with a number of advantages as forms of organisation.

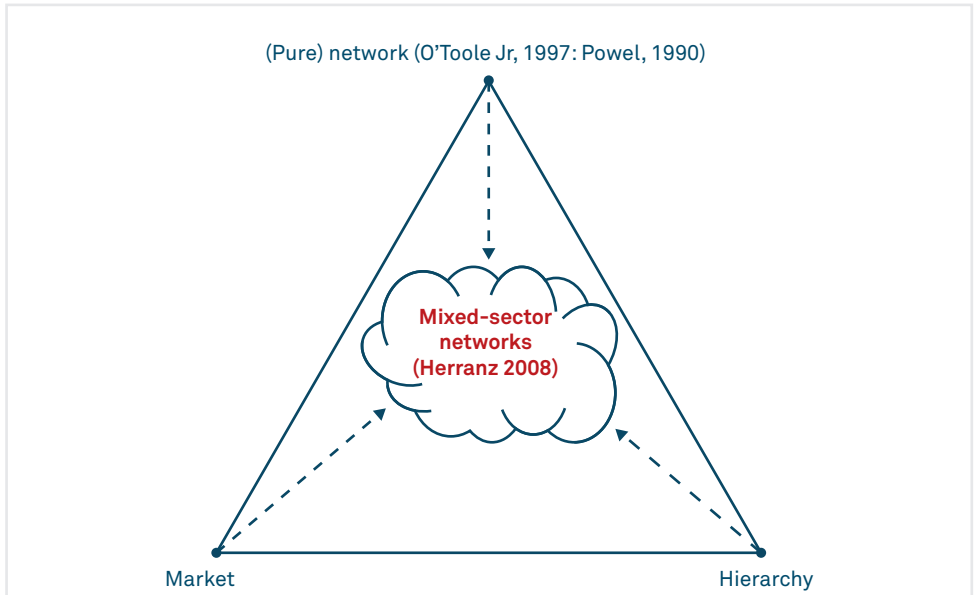


Figure 6 – Network as a separate organisational archetype

O'Toole Jr (1997) and Powell (1990) defined an organisational network as a separate interorganisational archetype from market and hierarchy, and describe them as being characterised by common goals and reciprocal relationships (Figure 6). Referring to Stark (2001), Herranz (2008) argues that most organisational networks cannot be distinguished as separate from hierarchical and market forms of coordination. Many organisational networks are made up of organisations with fundamentally incompatible attitudes.

Herranz (2008) uses the term *strategic orientation* to express this. He distinguishes three archetypical strategic orientations of a (networked) organisation: *bureaucratic*, *entrepreneurial* and *community*. Governmental networks and public agencies are examples of organisational networks that are predominantly bureaucratic in orientation. Networks of private companies are primarily entrepreneurial. Volunteer organisations or neighbourhood associations are predominantly community-oriented. Table 2 shows the characteristics of these three archetypical strategic orientations.

Table 2 – Characterisation of archetypical strategic orientations; after Herranz (2008, p. 10)

Strategic orientation Values dimension	Bureaucratic	Entrepreneurial	Community
Ideology	Legislated order (e.g., state-focused), fairness	Market focus, individualism, innovation, efficiency	Civil society focus, humanitarian, compassionate
Goals, preferences	Stability, accountability, equitable treatment	Value maximisation	Social balance, equitable outcomes
Power and control	Very centralised, with more reliance on rules	Semi-centralised, with reliance on teams	Less centralised, with interest groups
Implicit structure	Hierarchical, departmental	Semi-autonomous units (often hierarchically structured)	Loosely coupled units
Decision process	Procedural, rational, top-down	Technical, opportunistic, middle-out	Situational, participatory, bottom-up
Decisions	Follow from programmes and routines	Follow from value-maximising choice	Result from socially negotiated solutions to problems
Information requirements	Reduced by use of rules and procedures	Extensive and systematic	Ad hoc

Note that *bureaucratic*, *entrepreneurial* and *community* are meant as archetypical characterisations. In a real-world situation the contrast between network types may not be as sharp as suggested here. Referring to the incidents discussed earlier, an emergency response network typically exhibits all three types of strategic orientation. In Chapter 3 I explore the composition of emergency response networks and I argue that these networks typically consist of various types of organisations and sub-networks, including bureaucratic, entrepreneurial and community ones. The organisational

network of the first responders, municipalities and government agencies has a predominantly bureaucratic orientation. Legal order, fairness, stability, accountability and equitable treatment are important values in this part of the organisational network. Entrepreneurially oriented private organisations are often responsible for many of the critical products and services or may be involved as providers of capacity and expertise. In this part of the organisational network market focus, market share and business continuity are important values. Citizens, volunteer organisations and also non-governmental collectives have a community nature and orientation. This part of the organisational network has a compassionate focus on civil society, on humanitarian aspects, and on equitable outcomes for every individual affected. Differences in strategic orientation and values often cause tensions in the network collaboration.

In line with the heterarchic (i.e., interdependent as opposed to hierarchical) network approach of Herranz (2008), Kapucu, Hu, and Khosa (2017) conclude that most definitions of networks in public administration highlight the importance of collective action, common goals, and relationships between organisations. Provan, Fish, and Sydow (2007) define networks somewhat more narrowly as constellations of organisations that come together through the establishment of social contracts or agreements rather than through legally binding contracts. See also Figure 7.

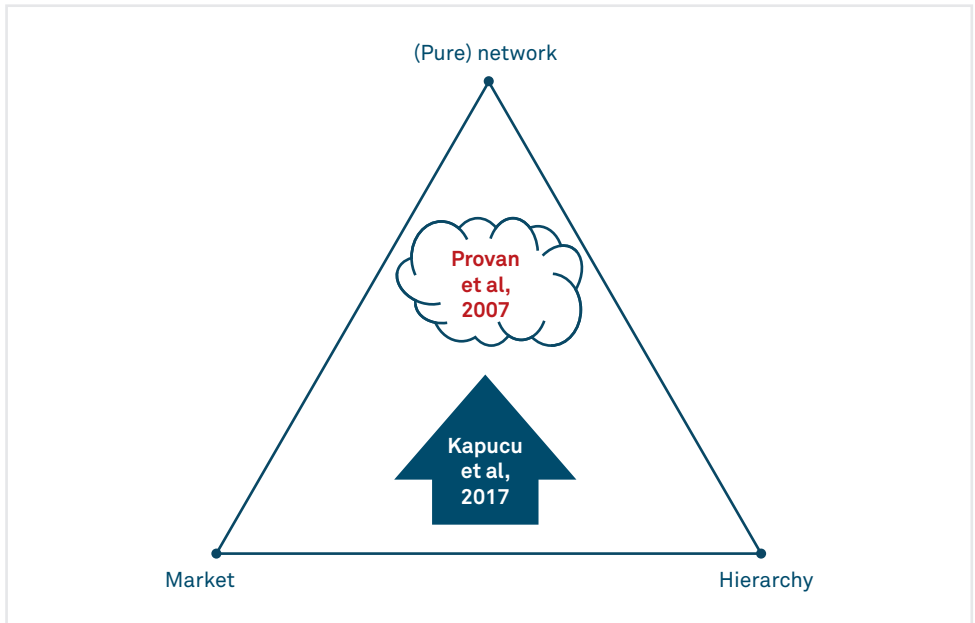


Figure 7 – Networks as heterarchic structures

Where does the discussion in this section lead us? In this thesis a rather broad definition of organisational network suffices. Such a definition should at least accommodate the elements suggested by Kapucu et al. (2017), namely interdependence, collective action and commonality of goals. Bardach (2017) would call such organisations *primarily network-like*. In line with the definition of governance network used by Klijn and Koppenjan (2016), I define an organisational network as being based on more or less stable patterns of social relations between mutually dependent organisations, which cluster around a common problem, common goals and/or a set of resources.

2.4 Moving collaboratively from chaos to continuity

The breadth and multidisciplinary nature of emergency response networks imply that most are mixed-sector networks. As I argued in Chapter 1 and in the previous sections, and as I will elaborate in Chapter 3, both the public and the private sector are involved in the response (Busch & Givens, 2013), and in many cases citizens and citizen collectives also play a role (Schmidt, 2019; Waldman, Yumagulova, Mackwani, Benson, & Stone, 2018).

From their empirical research Kapucu et al. (2010) call for a greater focus on local-level capacity development in response to disasters. An emergency situation does not fundamentally change the responsibilities and capacities of community sectors, including the private ones, per se. In many countries the role of the public sector in emergency response has become too large. Dupont (2004, p. 77) argues that

... the monopoly attributed to the state over the provision of security is more a historical distortion – or at least a temporary anomaly – than a durable condition.

Since the affected community may be an important source of information and capabilities, making use of those capabilities can be very valuable, as there are limits to how far the responding organisation can directly influence the emergency's impact on the community. After all, a defining characteristic of crises and emergencies is that regular structures and resources are not adequate to cope with them. In contrast, there is ample evidence that emergencies do not significantly reduce either the capacities of individuals or social structures (Groenewegen-ter Morsche & Oberijé, 2010; Quarantelli & Dynes, 1985; Solnit, 2010). Instead, there are many indications that communities are generally able to cope with emergencies decisively and resiliently; they may even exhibit more decisiveness and resilience than they appear to do in day-to-day life (Quarantelli & Dynes, 1985; Solnit, 2010).

Examples of citizens' involvement in emergency response

The response to the levee breach in the Dutch village of Wilnis that occurred in the early hours of Tuesday 26 August 2003 is a good example of the involvement of citizens in emergency response. At 1.30 am, a peat levee failed along the ring canal near the centre of the village (Van Baars, 2005). A 60-metre section of the levee shifted about 10 metres outwards, leaving breaches at both ends of the shifted section. Despite swift action to close the breaches, several hundred houses were under half a metre of water and a number of residents had to be evacuated. Citizens and local companies played an important role in responding to the emergency (Groenewegen-ter Morsche & Oberijé, 2010). They assisted in regulating traffic and guarding property and also in organising and manning information points and emergency shelter. One of the professional emergency workers in the Wilnis case said: "Citizens are more capable than is generally assumed by the emergency services." Of course this individual example does not prove that communities always play a substantial and constructive role in responding to emergencies. It is merely yet another illustration of how it can sometimes work in practice. In Chapter 1 I also described how the community contributed to the search for the two missing children, Ruben and Julian and to the search for Anne Faber. I also mentioned the involvement of first-aid workers in the response to the café fire in Volendam, the help that was spontaneously offered after the power outage near Utrecht Central Station, and the involvement of the local community of Vorden after two members of a marching band were struck by lightning. These examples can be added to the many others that can be found in the literature.

More fundamentally, above all an emergency is an event that impacts *the community,* and consequently the community as a whole ultimately has to deal with it. Of course, I recognise that different individuals and different subsections of the community may be impacted differently and that some of those who are struck are not able to deal with it without help from others.

The ultimate aim of any emergency response is to ensure that the community affected can be restored and reconstructed. In the initial phase of responding to an emergency, however, the desired end-state will typically be far from concrete and specific. As time progresses, the desired end-state will become clearer and it is valuable to develop it in concert with the affected community itself. As Nakagawa and Shaw (2004, p. 12) put it: "Disaster recovery is not only about building houses but the reconstruction of the whole community as a safer place." A good example of aiming to "build back better" (Kennedy, Ashmore, Babister, & Kelman, 2008) is the recovery after the 2011 earthquake in Christchurch, New Zealand. Through interaction with the affected community, and based on more than 100,000 suggestions submitted by local people, a vision for the future of central Christchurch was developed (Christchurch Central Development Unit, 2013), consisting of six key themes: green city; stronger built identity; compact core; live, work, play, learn and visit; accessible city; and embrace cultural values.

Taking advantage of community resilience in responding to an emergency and giving members of the community an active role has consequences in terms of selecting an appropriate approach to emergency response planning (Dynes, 1994). A good example of a planning approach conceived with this in mind is that of *continuity*, *coordination* and *cooperation*. This approach is based on the assumption that emergencies do not significantly reduce the capacity of existing community structures to cope (Helsloot & Ruitenberg, 2004). In line with this assumption, it is a good thing in emergency response to respect the existing structures as much as is reasonably possible and to strive for cooperation and coordination. This is also reflected in a policy study by the United Nations Office for the Coordination of Humanitarian Affairs (2013, p. 2). This study *imagines how a world of increasingly informed, connected and self-reliant communities will affect the delivery of humanitarian aid. Its conclusions suggest a fundamental shift in power from capitals and headquarters to the people aid agencies aim to assist.*

There is a very close interplay between the emergency response network and the whole community. This is in line with how Karl Weick approaches *organisations* and *organising* when he argues that an organisation and its environment are tightly linked together:

Investigators who study organizations often separate environments from organizations and argue that things happen between these distinct entities. This way of carving up the problem of organizational analysis effectively rules out certain kinds of questions. Talk about bounded environments and organizations, for example, compels the investigator to ask questions such as "How does an organization discover the underlying structure in the environment?" Having separated the "two" entities and given them independent existence, investigators have to make elaborate speculations concerning the ways in which one entity becomes disclosed to and known by the other. But the firm partitioning of the world into the environment and the organization excludes the possibility that people invent rather than discover part of what they think they see. (Weick, 1979, p. 166)

This line of thinking has been brought a step closer to the crisis management domain by the plea made by Grisogono (2006), Grisogono and Radenovic (2007) and Spaans, Spoelstra, Douze, Pieneman, and Grisogono (2009) for crisis management organisations to adopt an *adaptive stance*. This adaptive stance starts from the notion that in crisis situations the regular structures fail to maintain stability while the response organisation also has limited powers to contain or even influence the impact of a crisis on the community. The fact that there is considerable uncertainty makes the situation even more complex. In such situations, a reliable way for the responding organisation to achieve success is to make use of the potential and the dynamics inherent to the community. By mindfully initiating actions and sensing how the community reacts, the responding organisation seeks to separate out combinations of activities which are sensible, reasonable and helpful from those which are not. The most effective actions taken by the responding organisations are those that strike the right chord with the community.

The *continuity, coordination and cooperation* planning approach is contrasted by Dynes (1994) with a more directive planning approach of *chaos*, *command* and *control*. This approach is based on the assumption that an emergency situation typically causes chaos in a community, which leads to existing structures being unable to cope with the situation. So, an emergency response organisation is needed to restore order in a directive manner.

These two planning approaches are archetypes: in practice, neither is applicable in its purest form. Any emergency leads to a certain amount of chaos, insecurity and lack of safety and, as a consequence, some degree of directive command and control is necessary to restore stability. At the same time it makes sense to make use of the potential available in the community and recognise the fact that in the end the community has to be able to deal with the emergency. So, an emergency response organisation has to strike a balance between the two irreconcilable planning approaches.

In summary, it is valuable to view emergency response networks not primarily as government networks but as organisational networks in which – depending on the nature and extent of the event – all relevant sectors of the community are involved. Organisations outside the government can play an important role, given their capacity and responsibility. However, it is also important to involve the community because, once the crisis is over, members of society will have to pick up the threads. The final point is that, especially with a complex event such as a crisis, it is fundamentally wrong to make a strict divide between the crisis event and the response to it.

2.5 Emergency response networks as high-reliability networks

In the previous two sections I focused primarily on the whole-networks level of the organisational emergency response network and not so much on the nodes within the network, that is, the individual organisations participating in the emergency response. In this section I open the network box and examine more closely how those organisations collaborate coherently. In order for these organisations to interact adequately with each other, it is important for them to have *collaborative capacity*. Four different elements are required for an organisation to have collaborative capacity (L. Y. H. Allen, 2011): purpose, structure, communication and resources. *Purpose* means that they are open to and focused on collaboration with other organisations. *Structure* means that they have procedures, infrastructures and systems in place to control and oversee collaboration (Davis & Robbin, 2015). *Communication* means they have the ability to exchange information with other organisations in the network. *Resources* refers to the expertise and financial means they need in order to develop and sustain collaboration. Given the focus of this thesis, when looking at the interaction between the organisational network nodes I focus primarily on their communication or information exchange capacity. In this, I take as my starting point the fact that it is very important for emergency response networks to be reliable. The stakes in containing emergencies are high, and it is crucial that the chances of the response being effective should be as high as possible.

Berthod, Grothe-Hammer, Müller-Seitz, Raab, and Sydow (2017) translated the five well-known principles of high-reliability organisations (Weick & Sutcliffe, 2007) to high-reliability *networks*. The first principle is *preoccupation with failure*. As an emergency can be seen as a failure whose effects ripple through the fabric of the community, this principle is very important for emergency response networks. For an emergency response network to come to grips with the situation, it is crucial to find out what went wrong and how this impacts the community. Furthermore, it is important to monitor closely whether or not the responses are being effective. In an emergency response network this translates into a strong focus on information gathering and information sharing. As I argued in Chapter 1, a multidisciplinary and up-to-date integrated common operational picture, combined with a collaborative culture of openness and transparency, is generally accepted an enabler for this principle of preoccupation with failure in an emergency response network (Comfort, 2007; Wolbers & Boersma, 2013).

The second principle is *reluctance to simplify*. One of the implications of this principle for an emergency response network is that the network should be as comprehensive as the emergency itself. Most emergency situations are multifaceted in that they affect in some way several parts of the tightly woven web of institutions, social networks, physical entities and critical infrastructures that communities essentially are (Raab & Kenis, 2009). It is important to draw on all relevant expertise in the response in order to assess the nature and extent of the emergency situation and

to ensure that the response is effective. If you think *for* another organisation, instead of really *involving* it, there is a risk that the emergency situation and its impact on the community will be dangerously oversimplified, that the response will not be as effective as it could have been, or that unwanted side effects of responsive measures are overlooked or underplayed.

The third principle is *sensitivity to operations*. Especially in the fog, chaos and turbulence of emergency situations it is very important to stay in close contact with those at the operational level. Sensitivity to operations is an important precondition for the sensemaking process, being an important challenge in responding to an emergency. We use the term sensemaking to denote *a diagnostic process directed at constructing plausible interpretations of ambiguous cues that are sufficient to sustain action* (Weick, 2012, pp. 55-56). Weick (1979) conceptualises the sensemaking process as a cyclical process of *enactment*, *selection* and *retention* (Figure 8).

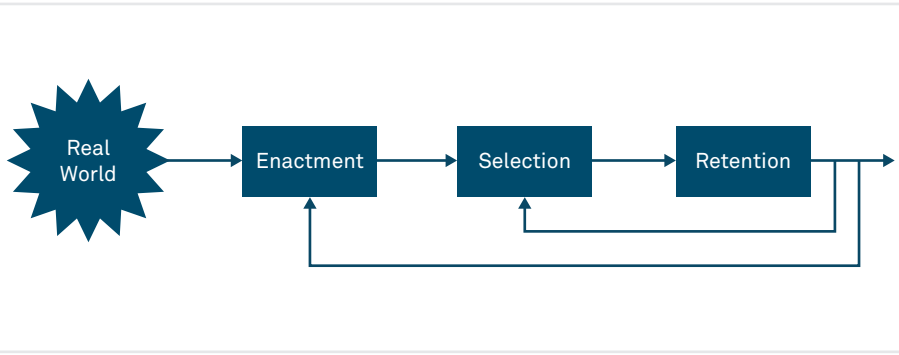


Figure 8 – The sensemaking process (adapted from Weick (1979))

Of these three subprocesses, *enactment* is the only one in which the (emergency-stricken) external "environment" is directly engaged. Enactment includes taking action and subsequently observing how the situation responds. It also includes straightforward observation of the situation. The enactment subprocess results in raw and often equivocal observations of the external environment. In the *selection* subprocess one or more structures are imposed on to the raw observations, in an attempt to reduce the equivocality. These 'structures' are based on past experiences and other knowledge of how things are interrelated in the real world. This knowledge includes the skills and attitudes of those involved in the response (Weggeman, 1997). In the subsequent *retention* process helpful depictions of reality are retained and stored, and these then form the background against which the next stage in the enactment process takes place. For each of the organisations involved in the emergency response, this helpful representation of reality is "a punctuated and connected summary of a previously equivocal display" (Weick, 1979, p. 131) of the emergency situation.

By applying the cyclical sensemaking process it is possible to separate sensible and helpful responses from those which are not. Sensemaking entails cyclical interconnections between *meaning* and *action*, and one could even argue that sensemaking is not just an important challenge in responding to an emergency – as I stated above – but that, in emergency response, it *is* organising the response (Glynn & Watkiss, 2020).

How does this work at the aggregated or network level of the emergency response? The high-reliability networks principle of *sensitivity to operations* stresses the need to share an up-to-date common operational picture throughout all levels of the response network, including the tactical and strategic levels. I conceptualise the common operational picture as the synthesis of the results of the retention processes of each of the individual organisations involved in the emergency response. This is illustrated in Figure 9, which is a further elaboration of Figure 4. Through a cyclical sensemaking process of enactment (E), selection (S) and retention (R), each organisational entity in the emergency response network contributes to the common operational picture by maintaining its own information domain and by helping to ensure the coherence and the synthesis of the common operational picture as a whole. Examples of the organisational entities may include institutions, agencies and companies but also coordination teams at the strategic, tactical or operational level.

It is important to note that the loops feeding back into the enactment and selection sub-processes of the individual organisations in Figure 9 originate from the common operational picture as a whole and not only from the information domain of the organisation itself. This reflects the way in which the common operational picture supports the coordination throughout the emergency response network (Okhuysen & Bechky, 2009). When interacting with and intervening in the emergency situation (enactment), and also when structuring and interpreting raw observations (selection), individual organisations do not just take their own perspective into account, they also consider the common operational picture as a whole, including the perspectives of other organisations in the network. It should be recalled that I conceptualised the common operational picture as a synthesis of the results of the retention processes of each of the individual organisations in the emergency response network. It is important that coordination of this synthesis is assigned unambiguously to one of the participating organisations. This coordinating role includes ensuring that all organisations continue to contribute to the common operational picture and also to identifying any ambiguities and inconsistencies within it. For the sake of clarity and to avoid overcomplicating the figure, this coordinating role is not depicted in Figure 9.

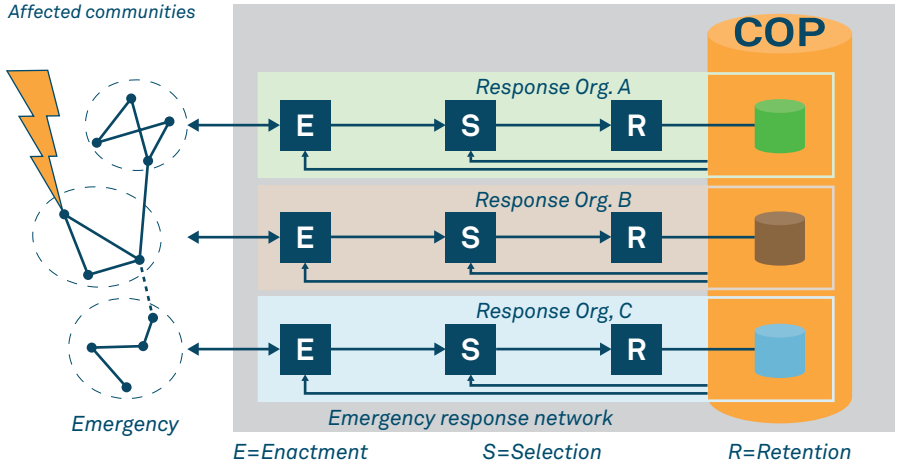


Figure 9 – Organisations involved in the emergency response continually update their own part of the common operational picture.

The fourth principle of high-reliability networks is *commitment to resilience*. Resilience is the ability to absorb strain, to bounce back and recover, and to learn from past experiences (Weick & Sutcliffe, 2007). This fourth principle can be applied to emergency response in several ways. The constituent organisations must be able to absorb strain in their own area of responsibility. The stability of the organisational emergency response network as a whole can be strengthened by establishing a decisive main structure for the network (Douglas, Berthod, Groenleer, & Nederhand, 2020). The ability to bounce back can be considered at two levels. In the short term, in addition to being an inherent property of a network structure, this ability can be enhanced by reliable communication facilities, including backup and fallback measures. In the longer term the community's ability to bounce back can be fostered during the response by paying attention at the right time to continuity and sustainability. The ability to learn from past experiences is something that must be organised in an overarching way by establishing an effective process of capturing lessons learned. One of the challenges here is to let this cycle transcend the individual organisations.

The fifth principle is *deference to expertise*. This principle implies multidisciplinary collaboration throughout the emergency response network at all levels. Relevant organisations and expertise should really be involved in the response and organisations should be restrained from thinking for others. Care should be taken not to use data originating from other organisations without bringing in the expertise needed to interpret this data. This fifth principle also implies that those involved have some level of mutual acquaintance with each other's working processes.

The high-reliability nature of emergency response networks has the following implications. The network is a broad network that draws on all relevant expertise. As I will elaborate in Chapter 4, this brings into effect the continuity principle advocated by Dynes (1994), which I mentioned in the previous section. There is a culture of openness and transparency within the network. Rather than establishing only dyadic information exchange mechanisms (Steelman, Nowell, Bayoumi, & McCaffrey, 2014), the network members maintain and share a common operational picture across the network; it has a rather broad scope, it is up to date and serves as a basis for collaborative sensemaking and decision-making. In Chapter 5 I explore this in more depth. The common operational picture consists of a number of information domains. Each domain is associated with a particular organisational entity, and is maintained through a closed process loop in which the organisation makes more and more sense of the emergency through enactment, selection and retention. In this way, the organisations within the emergency response network continually and iteratively frame, elaborate, question and reframe the situation (Klein, Wiggins, & Dominguez, 2010). To ensure there is convergence and coherence in the collaborative sensemaking process, coordination of this process is unambiguously assigned to one of the organisational entities in the emergency response network. This coordinating role includes coordination of the collaborative development of the common operational picture and also of the decision-making and actions taken throughout the network. The network has a decisive main structure (Nohrstedt, 2018) and the constituent organisations have an adequate level of collaboration awareness, i.e., an awareness of the formal organisational structures and the informal ways in which organisations work together and achieve their goals (see also Chapter 6). This characterisation is in line with that of Nowell, Steelman, Velez, and Yang (2018), who argue that the typical structure of high-performing emergency response networks is a core-periphery structure, in which a balance is struck between being emergently coordinated and being coordinated through more centralised network structures.

2.6 Revisiting the problem statement

In Chapter 1 I stated that this thesis focuses on three challenging areas in organising cooperative emergency response efforts: the composition of the organisational network making the cooperative effort, the network's interaction with the broader community, and the interactions within the network. More specifically, I focus on the role of the common operational picture in dealing with these challenges. If I revisit the problem statement and relate it to the three challenges to the concepts described in this chapter, it becomes clear that I am seeking to address three *transboundary issues* (Ansell et al., 2010). Against this background, I briefly discuss the three challenges and visualise them in Figure 10, which is an extended and annotated version of Figure 9. The first of these challenges (1 in Figure 10) is the main topic in Chapter 3, where I look at the transboundary connection between the emergency and the response to it. In Section 2.3 I argued that there is a broad consensus that organisational networks are particularly suitable arrangements for formulating an adequate response to wicked problems such as crises. In the

study that forms the basis of Chapter 3, I and my research colleagues explore the links between the network nature of the community and the crises striking it on the one hand and the network nature of crises and emergencies on the other hand. We show how the extent of the degradation of the community networks relates to the emergency response network. We argue that the emergency and the response to it mutually shape each other and that the common operational picture plays a pivotal role in this shaping process.

The second challenge (2 in Figure 10) is the main topic in Chapter 4, where I look at the transboundary connection between the emergency response and the community. In this part of the thesis I expand on the typical role citizens play in responding to emergencies and on the characteristics of organisational emergency response networks. In Sections 2.2 and 2.4 I discussed this role of citizens and I argued that there is much empirical evidence to suggest that communities can be very resilient in that they have the ability to deal with failures and to bounce back after a crisis. In Chapter 4 I analyse how the role of citizens is reflected in the dominant logic of the planning processes throughout the emergency response network and also in how this network communicates with the broader community.

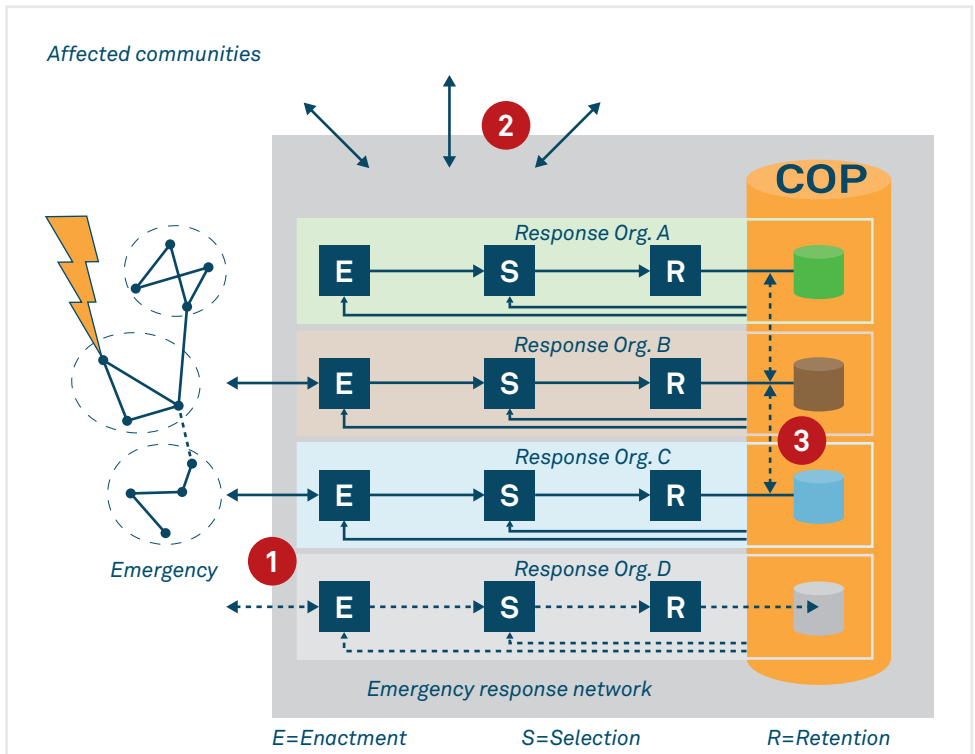


Figure 10 – Visualisation of the three research issues

The third challenge (3 in Figure 10) is the central focus of Chapter 5, where I examine the transboundary connection between the front line and the more remote parts of the organisational response network. I do this by zooming in empirically on the role of the common operational picture in this connection. More specifically, I expand on how I conceptualised the common operational picture in Section 2.5 as a basis for collaborative sensemaking and decision-making.

3 Configuring emergency response networks[8]

Abstract

If an emergency strikes a community, a response effort involving multiple organisations is initiated. In the fog and chaos it seems difficult to determine which organisations and agencies to involve in the response in order to ensure that the organisational network is fit for purpose. In this chapter we study three recent emergencies in the Netherlands in order to find out what patterns are detectable in the network of the organisations responding to the emergency. Based on qualitative analysis we develop insights about how the composition of the organisational network and the development of this composition over time relate to the nature of the emergencies, the way in which they develop, and the impact they have on the community. While emergency management scholars often focus on large disasters that can have devastating effects, we have deliberately selected a number of smaller incidents. We find the community to be an intertwined network of networks. A failure in this constellation of networks may result in an emergency situation. The failure itself and any collateral effects from emergency response actions ripple through the constellation of networks and may therefore have a multifaceted impact on society. We found that the emergency situation and the emergency response network mutually shape each other and are a reflection of each other. Failing to consider possible ripple effects, or ignoring them when they occur, *shapes the scope of the emergency and the response to it differently.*

8 Published as Treurniet, W., Boersma, F. K., & Groenewegen, P. (2019). Configuring emergency response networks. *International Journal of Emergency Management, 15*(4), 316-332.

3.1 Introduction

If an emergency strikes a community, response efforts may be initiated by multiple organisations that interact with each other and the authorities. Consequently, ad hoc networks of organisations emerge and take action to respond to whatever they consider to have gone out of control. The actors in such networks should work together to prevent or mitigate acute and adverse impacts on the community and to help it recover from the emergency and restore stability. However, in the fog and chaos of responding to an emergency it is difficult to decide which organisations and agencies should ideally be included in the response network to ensure that the resulting network is fit for purpose and able to remain so. In many countries, the rules and regulations for emergency management provide guidance – implicit or explicit – on the formal composition of response networks (Kapucu & Garayev, 2013; Moynihan, 2009). However, in many cases, the formal arrangements agreed in advance fall short of what is needed in a specific emergency. In particular, it appears to be challenging to respond *proportionately* to an emergency and to choose the right combination of actors that will enable an appropriate response. The authorities responsible often tend to either over- or underestimate the reach and impact of an emergency. Establishing too wide a network can quickly lead to an unwanted or an unnecessarily increased impact on the community, because of subsequent social unrest or additional costs, for example.

To give an example: on 22 July 2012 the discovery of asbestos in an apartment building in the Dutch city of Utrecht eventually led to a decision to evacuate the area affected. Although the detection of asbestos was the initial trigger for the response, the highly visible reaction of the emergency services, and the dynamics of the interaction between the emergency services, the housing corporation and the citizens affected were more determinative for the extent of the emergency than the way the asbestos hazard was handled. In this case confusing networked dynamics across a broad range of organisations led to social unrest and to subsequent distrust of the authorities. The evaluation committee concluded that: “The measures taken [...] were disproportionate in hindsight” (Jansen et al., 2012, p. 65). In other words, the emergency was not *contained* but rather *worsened* by adding actors to the response network.

In contrast, if the reach and impact of an emergency are underestimated, failing to take proportionate action may mean that some of the emergency’s potential effects on the community are overlooked. This is illustrated by the case of an outbreak of toxic algae in Ouwerkerk Creek (the Netherlands) in summer 2012, where there was also a risk that the contamination could spread to other parts of the water system. The incident was dealt with by the organisations responsible,

in particular, the Rijkswaterstaat[9] and the local water board[10]. A subsequent investigation found that the response network had zoomed in on "... finding technical solutions to a technical problem, without having an eye to the possible societal impact of the incident" (Bos & Verberne, 2012, p. 7). Consequently, partners that were essential for addressing the broader societal impact in this case were left out of the ad hoc organisational response network.

Most scientific research on emergency response simply assumes that an organisational response network exists, and focuses on its general structure and development over time (Wolbers, Groenewegen, Mollee, & Bím, 2013) or on coordination across the network (Topper & Carley, 1999). Acquier et al. (2008) conducted a qualitative case study of an emergency experienced by a French public transport company. The authors argue that the situation was settled conclusively by taking a proactive approach and involving a broad range of stakeholders affected by the emergency, rather than focusing primarily on the technical and legal aspects. Although their analysis furthers our understanding of which organisations to involve in order to ensure the response is effective, they conclude by arguing the need for further research on how the composition of the organisational response network is linked to the dynamics of the emergency situation. The question of which organisations to involve in the emergency response does not seem to have been given sufficient attention. With this chapter, we intend to help fill this gap. Through qualitative analysis of three incidents we seek to address the question of what patterns of involvement can be discerned in organisational networks that respond to emergencies in the Netherlands. By addressing this question we seek to advance our understanding of how to set up an emergency response network that is fit for purpose, and how the composition of the organisational network relates to the nature of the emergencies and their impact on the community.

3.2 Theoretical framework

In this chapter our working definition of a *crisis* is an event in which safety or security are at stake because one or more vital community interests are affected while the regular structures and resources are not sufficient to maintain stability. In this definition, the actual content of the crisis is regarded as a *black box*, and the focus is on the extent of its impact on the community. An alternative is to look at a crisis from a *white-box* or internal perspective, approaching it in much the same way as Perrow (2011) approaches the concept of an accident – namely as a failure in a subsystem, or in a system as a whole, that damages more than one unit and in so doing disrupts the ongoing or future output of the system. For *system* and *subsystem,* we substitute *network* and *subnetwork*, as our focus is on crises at the societal level. If we look at a crisis in this way, we can see that it still has an impact on the community, because the output of the network is disrupted, but more attention is paid to the often unpredictable connections between parts of the overall network in which the disruption occurs. The networks and subnetworks in which failures may lead to an emergency situation can be very diverse (Lindell et al., 2006; Quarantelli & Dynes, 1985). Examples include social networks of various types, such as community, city or regional networks (Castells, 2004; Hoffman & Oliver-Smith, 2002), and also physical networks such as gas and electricity networks, drinking water and sewage networks, and road networks.

We see an *emergency* as a crisis that escalates very fast (Boin et al., 2005; Treurniet, 2014). It can then be described as a rapidly escalating failure of a network or constellation of networks (see also Dörner, 1996), which can lead to violation or threat to one or more vital community interests. In this chapter, this failing network or constellation of networks is also referred to as a *disrupted network*.

Might the way the initial cause of the emergency is classified provide some important clues as to how to set up an emergency response network that will be appropriate for dealing with the disrupted network? In the Netherlands, for example, seven societal themes are used for classification: natural environment, built environment, technological environment, critical infrastructures and facilities, traffic and transportation, health, and socio-cultural environment (Houdijk, 2009; Treurniet, 2014). Turner and Pidgeon (1997, p. 158) argue that *the usefulness of [...] a classification is limited [...] because the multiple forms of energy commonly released in many accidents and disasters complicate the pattern*. Although the initial cause of an emergency can be linked to one specific societal domain, the cascading effects seen in emergencies connect to more than one. Using a generic typology of to classify emergencies based on their initial cause is therefore not very helpful for setting up an emergency response network to fit the disrupted network. The initial cause may not always be the main determining factor.

The first implication of this is that our analysis should focus on the *composite societal impact* of the events rather than on their *initial cause*. The second implication is that each stakeholder may perceive the societal impact of an emergency differently, because each has its own perspective on the disruption of the community network. Each stakeholder has access to a slightly different information, while the amount of information that can be combined and processed with the resources available is less than the amount needed to capture the full complexity of the situation Turner (1976). Even if all the different stakeholders had a shared picture of the facts, they would each still assess the situation based on their own perspectives, responsibilities, roles and expertise. To borrow what Estes (1983) said in relation to social security crises: an emergency may be said to exist to the extent that it is perceived to exist.

9 Rijkswaterstaat is responsible for the smooth and safe flow of traffic, for the maintenance and improvement of the waterway system, and for flood defences.

10 Water boards are responsible for the quality of regional watercourses and for ensuring the embankments are in good repair.

Turning now to the *response* to emergency situations, this has been a subject of study for many scholars, but Drabek (1983) was one of the first to look at which agencies make up the emergency response networks responding to post-disaster search and rescue demands. From his analysis of a series of disasters of different sizes he concluded that every single incident – big or small – is initially responded to by one particular emergency organisation, which sets in motion an emergent multi-organisational network (Johan M Berlin & Carlström, 2008). He found that, in practice, responses are determined first by those who are first on the scene and then by the particular demands of the situation, the capacities of the emergency response organisation itself, the idiosyncrasies of the local situation and the potential helpers (Drabek, 1983), rather than by a holistic view of what is needed to resolve the situation.

Other scholars by and large see these networks as centralised, with one authority driving how they are shaped and developed. They also seem to take the view that the public sector plays a pivotal role in this centralised authority (Comfort & Kapucu, 2006; Kapucu et al., 2010; Moynihan, 2009; Robinson, Eller, Gall, & Gerber, 2013; Topper & Carley, 1999). In the response to an emergency, two areas of focus are often distinguished: first, intervening in the disrupted network and managing the effects (i.e., failure management), and second, dealing with the effects of the emergency on community interests (i.e., consequence management). See, for example, the distinction between crisis management and consequence management made by Comfort and Kapucu (2006) in their analysis of the 9/11 terrorist attacks. They define crisis management as the effort to identify and hunt down the perpetrators of the attacks, and consequence management as the immediate mobilisation of search and rescue operations to save the lives of people at the scene, as well as the provision of disaster assistance to those who had suffered losses as a result, and the recovery and reconstruction of the damaged communities. Imagine the emergency as a tap which has been accidentally turned on, leading to a room being flooded: the first concern is how to turn off the tap, and the second is how to dry out the room. Comfort and Kapucu (2006) analysis of the 9/11 attacks focused specifically on the process of drying out, the *consequence management*, which they see as a quintessential function of government and of public managers at all levels of government.

While each of these studies assumes the existence of a network of emergency response organisations, and the development of this network is studied over time, none of them consider the *composition* of the network in the sense of asking which organisations should be involved in the emergency response. Kapucu et al. (2010) write in terms of 'necessary elements'. Topper and Carley (1999) refer to the emergence of a network of 'stakeholder organisations' in general, Comfort and Kapucu (2006) mention 'the public sector' as being responsible for consequence management, and Moynihan (2009) stresses the diverse nature of the network partners. Robinson, Berrett, and Stone (2006) study the dyadic collaboration relationships between network partners, and Kapucu and Hu (2016) show the value of already established relationships between network partners.

However, none of these contributions offer much specific advice in terms of how to determine which organisations to involve in the emergency response.

Moreover, most of the contributions referred to – like many other publications on crisis and emergency management – focus on disastrous incidents characterised by large-scale devastation and social disruption (Comfort, Birkland, Cigler, & Nance, 2010; Dynes, 1994; Garnett & Kouzmin, 2007; Kapucu et al., 2010; Kapucu & Van Wart, 2006; Kapucu, Yuldashev, & Feldheim, 2016; Kusumasari, 2012; Lindell et al., 2006; Lindell & Prater, 2003; Mendonca & Wallace, 2004; Nakagawa & Shaw, 2004; Quarantelli, 1988; Quarantelli & Dynes, 1985; Siciliano & Wukich, 2016; Solnit, 2010; Tierney, Bevc, & Kuligowski, 2006). While Abbasi and Kapucu (2012) and Kapucu and Garayev (2013) do look at somewhat smaller and thus less chaotic cases, they focus primarily on network *structure* and not so much on network *composition*.

So, the question of which organisations to involve in the emergency response network, and the related question of how the development of an emergency is affected by which organisations are involved, seems to be addressed in the literature in quite general terms only. Our research seeks to provide more insight into how the composition of the emergency response network relates to the nature of the emergency.

3.3 Method

For our analysis we decided to take a small-N approach, thereby striking a balance between retaining some of the richness of the cases and being able to draw some conclusions (Abbott, 2004). We selected three emergencies that occurred in the Netherlands as the basis for the analysis. Two of them occurred in 2011 and one in 2015. The case selection is a stratified sample (Flyvbjerg, 2006) in two respects. First, we have deliberately chosen to look at relatively small incidents, which Van Duin et al. (2013) term *mini-crises*. A mini-crisis denotes an event of a short duration that causes a certain level of disquiet, agitation, or even turmoil within the local community and attracts a lot of media attention, but then fades away again relatively quickly (Van Duin et al., 2013, pp. 9, 10). In our modern society, such mini-crises are common, because even small-scale incidents often induce social anxiety or moral panic (U. Beck, 1992; Ungar, 2001) and in so doing have significant societal impact. We believe that such mini-crises will provide research material which is more relevant for answering our research question. Large-scale disasters often lead to a response network that is difficult to chart (Kapucu & Van Wart, 2006; Moynihan, 2009). Furthermore, smaller-scale incidents occur more often, which means that more empirical cases are available and that scientific insights from research may be easier to apply. Finally, we believe that smaller-scale incidents may provide a less complex setting in which decisions on the make-up of the response organisation can be given careful thought.

In major disasters normal processes of sense-making often fall short (Sellnow, Seeger, & Ulmer, 2002), and this is therefore less than ideal for deciding what would constitute a consciously created, fit-for-purpose, response organisation.

Within this group of cases, we selected three cases based on rather pragmatic considerations such as availability of time and access to rich material (Seawright & Gerring, 2008). In particular, having access to rich material – particularly all the details of the common operational picture at any moment – is often a critical factor in case-based research into emergency management. An additional reason for selecting these three cases is that they are generally considered by practitioners to be cases that matter. They are exemplary in the sense that they are often referred to in the professional emergency management discourse.

The first case is a liquid fire incident that has been well documented by the Inspectorate of Public Order and Safety (2011a). The second is a shooting in a shopping mall, also well documented by the Inspectorate of Public Order and Safety (2011b). We had already been using both cases in a comparative case study on how crisis communication reflects the incident response approach (Treurniet et al., 2015), so were already quite familiar with the research material. The third case concerns the aftermath of the collapse of two heavy cranes in 2015. For the mall shooting and the crane incident, there were two additional information sources: the emergency centre registration for each incident and data exported from the LCMS, a crisis management system used in all the safety regions[11] in the Netherlands. The emergency centre registrations are basically tables in which each row contains one entry extracted from the emergency centre information system. Such entries are composed of a date/time group, the name of the dispatcher, and a text message. The LCMS system is used to maintain a common operational picture throughout the crisis organisation. This common operational picture consists of a dedicated view on the situation for each of the participating teams. Each view contains one or more text fields indicating the current status of a specific aspect of the situation – such as *victim overview*. The LCMS data used as a source for the qualitative analysis is a chronological list of field mutations. Each field mutation indicates who modified which field of which view, when the modification was done, and what the modifications were.

We argued above that an emergency stems from the failure of a community network or a constellation of community networks, and leads to a breach of, or threat to, one or more vital community interests. In our three cases we were looking for patterns in how the composition of the responding organisational network relates to the characteristics of the emergency. For each case we investigated systematically what particular community networks were damaged, and what ripple effects that had. We also investigated what the community impact was. We applied a grounded theory approach, treating the empirical material along the lines described by Gioia, Corley, and Hamilton (2013). We reconstructed the causal network of each of the cases as well as the response and the composition of the organisational response network. The theory emerges via "recursive cycling among the case data, emerging theory, and later, extant literature" (Eisenhardt & Graebner, 2007, p. 25). Note that, to a certain extent, our reconstructed causal networks suffer inherently from the same subjectivity as discussed above in the theoretical framework. Cascading effects and causal relations may be said to exist to the extent they are perceived to exist, and this undoubtedly also affects our analysis.

11 The Netherlands is divided into 25 safety regions. Each safety region is a partnership of municipalities in which a number of safety-related tasks are combined, including fire service, emergency health care, disaster management and crisis coordination.

3.4 Findings

For each of the three cases we provide a short narrative addressing five related aspects: the potential impact on the community which the emergency response organisations needed to consider; the stakeholders threatened or impacted by the emergency; the interventions initiated by the emergency response organisations; the collateral effects of these interventions; and the stakeholders who needed to be involved because of these collateral effects. These narratives represent the results of our systematic analyses of how the three cases developed over time. They reflect the key considerations for the emergency response organisations over the course of the emergency response.

3.4.1 Liquid fire in Moerdijk

On 5 January 2011, in an industrial area in the Dutch municipality of Moerdijk, a small fire breaks out at a chemical depot and proves difficult to extinguish. Figure 11 provides a causal diagram of the event, showing the consequences and the response measures taken by the emergency management network.

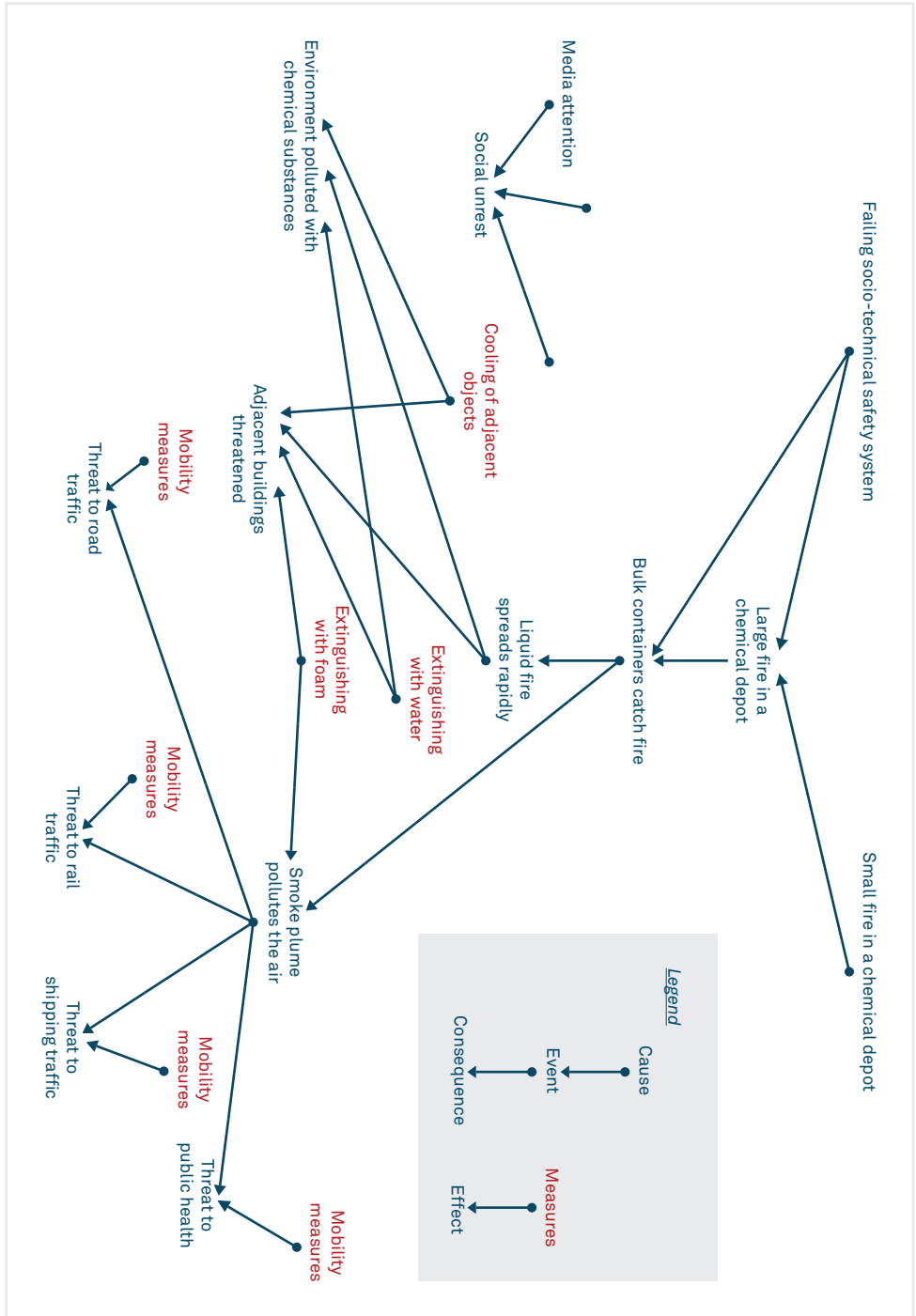


Figure 11 – Causal diagram of the liquid fire in Moerdijk, including the consequences and the response measures.

The chemical depot's failing socio-technical safety system is seen as the initial trigger of the *network disruption*. This safety system fails in the sense that a fire breaks out and is able to spread quickly. The situation escalates as more and more intermediate bulk containers of flammable liquids catch fire. The resulting liquid fire spreads rapidly across the area outside the chemical depot. The fire threatens adjacent buildings and the smoke plume pollutes the air. Ideally, a liquid fire should be put out with foam. The amount of foam available on site is not sufficient, however, to put out the fire. In fighting the fire, a balance has to be struck between several competing objectives – including, for example, needing to use water to cool flammable substances and vulnerable objects, increasing the height of the smoke plume by allowing the fire to burn as hot as possible, shortening the duration of the fire by actively extinguishing it, and limiting the level to which chemical substances pollute the environment. A collateral effect of the firefighting is that the water used to extinguish the fire and to cool the adjacent objects and buildings in order to prevent the fire from spreading leads to a rapid overflow of toxic liquids and thus causes environmental pollution. This pollution makes it necessary to involve the local water board, Brabantse Delta, in the response, as it is the body responsible for water quality. Another collateral effect of the firefighting is that the smoke plume spreads at a lower altitude. This exacerbates the situation for those downwind of the incident. The nature of the threat posed by the smoke plume is very unclear. Any smoke is noxious, but the composition of this particular smoke plume is unknown, and the weather forecasts are also uncertain. The decision to start extinguishing the fire necessitates coordination with organisations that are responsible for the safety of downwind municipalities (i.e., adjacent safety regions) and transport infrastructures (i.e., Rijkswaterstaat for the road and shipping traffic and ProRail for the rail traffic). Subsequent cascade effects of stopping the shipping and rail traffic and closing down highways are not actively coordinated by the emergency response organisation.

Failure management and consequence management are tightly interwoven in this case. The initial failure directly threatens the local community in several ways. The side effects of managing these consequences leads to failures in several community networks, which must in turn also be managed.

3.4.2 Mall shooting at De Ridderhof

One Saturday in April 2011 a shooting takes place at the De Ridderhof, a shopping mall in Alphen aan den Rijn in the Netherlands. The shooting lasts only a few minutes, and comes to an end when the perpetrator shoots himself. Figure 12 provides a causal diagram of the event, showing the consequences and the response measures taken by the emergency management network.

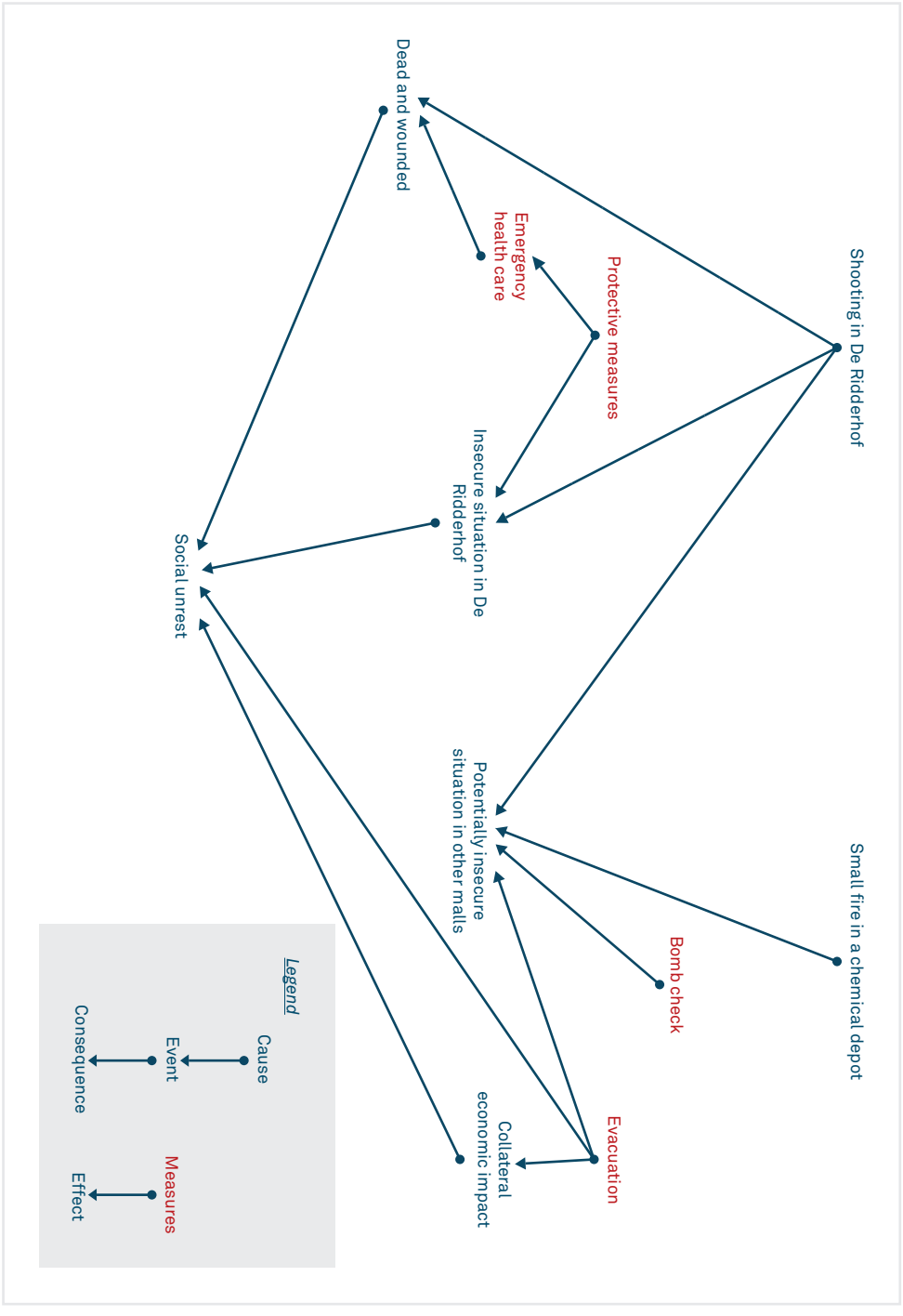


Figure 12 – Causal diagram of the mall shooting at De Ridderhof, including the consequences and the response measures.

In this event the *network disruption* originates from the psycho-social history and background of the perpetrator and his access to weapons. Police forces and emergency health care units are immediately involved in the response. Fire services provide support and the municipality is responsible for arranging emergency accommodation and registering the victims.

The questioning required for the investigation and the measures taken to protect the public have the collateral effect of hindering the provision of emergency health care to the wounded. A car is found near the mall with an envelope on the passenger seat addressed to the police. After the vehicle is carefully opened by a bomb squad, the envelope is found to contain a letter in which a bomb threat is issued against three other shopping malls in Alphen aan den Rijn. Given the violent and horrible actions of the perpetrator, the letter is taken seriously. The decision to evacuate the three malls requires coordination with the mall owners and shopkeepers, because of the impact of that decision on their work and responsibilities. The three malls are evacuated and checked for explosives, but none are found. Evacuating the three malls leads to social unrest and also has an economic impact. In the meantime those who have been shot dead in De Ridderhof are identified and taken away for further forensic investigation.

As in the previous case, it can sometimes be difficult to separate out failure management from consequence management. For example, the evacuation of the three shopping malls can be seen as part of consequence management, but managing the impact that these evacuations have on daily life can be seen as part of failure management.

3.4.3 Collapse of cranes on building project

In this incident the *network disruption* occurred when a new bridge deck was being installed across the river Oude Rijn – as in the previous case, this was in the municipality of Alphen aan den Rijn. On 3 August 2015, two heavy cranes are being used to install the bridge deck. The cranes are positioned on pontoons. At a critical point in the hoist operation, both the cranes and the pontoons appear to be unstable. The cranes and the bridge deck that is suspended on them topple over, destroying two shops and two houses. Several other buildings are also damaged. The operational leader recounted in an interview that he considered the start of the emergency to be the point at which the cranes and the bridge deck had already toppled over. By disregarding the causal network leading to the disruption, he excludes from the emergency response any discussion of what has caused the instability in the first place. The one thing he does in this regard is to acknowledge that the emergency response needs to leave room for the activities of an investigating team and that care should be taken to avoid destroying evidence. A causal diagram of the event, showing the consequences and the response measures taken by the emergency management network, is provided in in Figure 13.

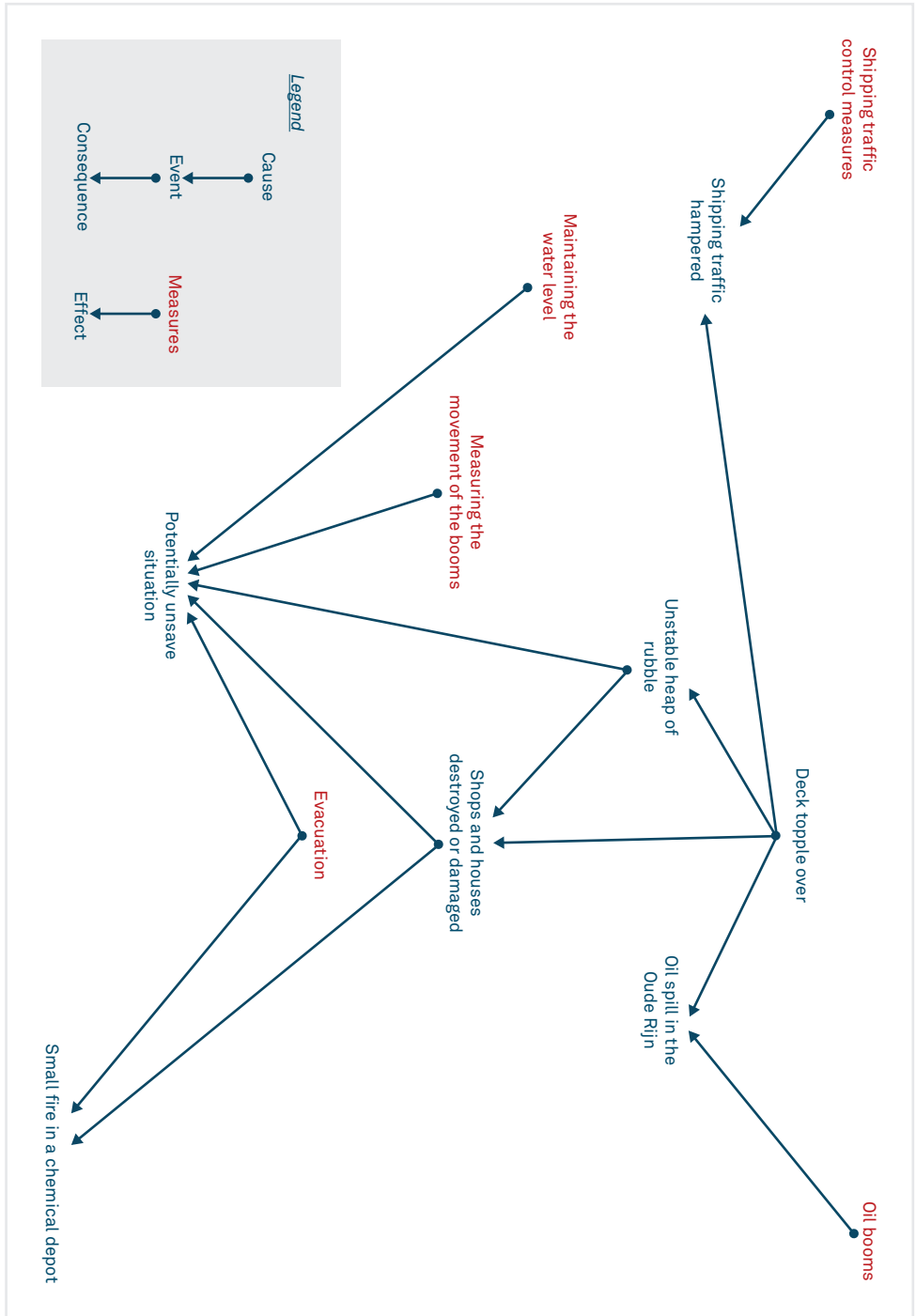


Figure 13 – Causal diagram of the collapse of cranes, including the consequences and the response measures.

Given the enormous havoc, it is initially thought that there could be up to twenty victims. Miraculously, however, the only victim appears to be a dog. While the search and rescue process is underway, a number of nearby shops and houses are evacuated. The collateral effect of the evacuation is to intensify and prolong the disruption to normal daily life. It is decided to prevent the oil spill from spreading further and to stop the shipping traffic. These decisions mean involving the water board (responsible for the water quality in the area) and the Rijkswaterstaat (responsible for controlling the shipping traffic in the Oude Rijn. The measures taken for this purpose have an economic impact and create additional disruption to daily life. The next morning the pontoons and the booms of the cranes appear to be moving slowly. This means that the response team is faced with new issues in that the damaged buildings could collapse further. It is decided to extend the evacuation period, enlarge the area to be evacuated, and start measuring precisely, on an hourly basis, the degree to which the pontoons and the booms are moving. Over the course of the day the response team gains a clearer indication of the stability. Through consultation with experts, the team is able to gain a better picture of whether further collapses are likely and what the consequences may be. The situation is deemed stable enough to withdraw the emergency response organisation and to hand over coordination to a project organisation led by the municipality. This project organisation is tasked with processing claims, sorting out legal matters, removing debris, and normalising the situation.

Meanwhile, the water board (which is also responsible for water *quantity* in the area) is instructed to keep the water in the Oude Rijn at a constant level. The Oude Rijn is an important river for draining off superfluous surface water from the area, but before receiving this instruction, the water board had not been involved in considering what the consequences of maintaining a constant water level might be. After the incident, the officer responsible at tactical level stated: “What has been less visible were the consequences of this accident for water management in the region. In the period of the accident, the water board had already been scaled up [...] due to the drought in that period. The Oude Rijn, as a freshwater river, played an important role in controlling the consequences of the drought. However, due to the accident, the water level in the river had to be kept constant in order to minimise the chance of movements in the heap of rubble. A second problem that arose later was related to the risk of extreme amounts of precipitation during the autumn. The pontoons in the Oude Rijn [...] halved the flow capacity and were expected to remain there for a couple of weeks. This could cause problems when extreme amounts of precipitation would have to be removed via the Oude Rijn. If that were not possible, this could cause flooding in the hinterland.” (Van Duin & Wijkhuijs, 2016, p. 168).

As in the previous case, here there is also a subtle difference between failure management and consequence management. Once the cranes had collapsed, the immediate priority was to stop the shipping traffic as quickly as possible and to deal with the oil spill in the Oude Rijn. As soon as

the clear and present danger had been alleviated, activities were handed back to the organisations normally responsible for shipping traffic and water quality, namely the Rijkswaterstaat and the water board.

3.4.4 Analysis

In each of the three cases the following general pattern can be discerned in the relationship between the development of the emergency and the configuration of the response network. The initial events, and the responses to them, lead to several forms of irregular impact on other community networks – *irregular* in the sense that the impact differs from the way in which, or the extent to which, community networks normally interact. These irregular impacts can be either cascading effects that are an inherent part of how the incident unfolds (e.g., a liquid fire in a chemical depot threatens adjacent buildings) or collateral effects that stem from deliberate interventions by the response organisations (e.g., precautionary evacuation of malls leads to collateral economic impact).

Each irregular effect, whether cascading or collateral, may affect additional community networks and may therefore imply that other organisations need to become involved in the emergency response. This applies particularly to organisations whose interests are affected or threatened by the cascading or collateral effect. There are also other organisations that are involved because of the capacities they can provide that will help in carrying out the interventions.

The scope and nature of an emergency – and sometimes even whether there is an emergency at all – is not an established fact but rather a construct that is in the eye of the beholder. In the three cases we analysed, a complex combination of factors led to the initial failure. The initial cause of the network disruption is often not altogether clear or people may fundamentally disagree about it. This can complicate the emergency greatly, or can even turn out to be the essence of the emergency. All three of the cases we studied show signs of this. In each case, there was clearly public debate over licences that were issued or not, and over who was to blame, and views on this were also expressed in social media. In all three cases the emergency response organisation decided to deal with these debates and feelings only to a limited extent.

What is even less obvious is where the ultimate *end* of the causal chain lies. Just as when a drop of water falls into a pool, the ripple effects can be very far-reaching. Consider, for example, the cascade effects of stopping the shipping and rail traffic and closing down highways in the liquid fire case. We can also see more generally how reactions to emergencies often evolve or are even intensified through the use of traditional and social media (Wijngaert, Dijk, & Tije, 2014). Which cascading effects to deal with as part of emergency response, and which to exclude, is ultimately the choice of the responding organisational network. In hindsight, the tactical officer in the collapsed cranes case realised that it would have been better to involve the water board in the decision to maintain the water level for a longer period of time. The consequences of such a decision relating to the water system can best be assessed by the organisation responsible for it.

Analysis shows that *initially*, in all three cases, our two key areas of attention – failure management and consequence management – can be clearly distinguished. On the one hand, there is a network in which a failure occurs, and this failure may ripple through a network of community networks. On the other hand, the failure has an impact on the community. Both the failing networks and the impact on the community must be dealt with. As the response progresses, the distinction between failure management and consequence management is often not that clear any more.

In the area of failure management, organisations that were responsible for failing networks before the emergency are still responsible for those networks in the emergency response phase. In the liquid fire case, for example, the water board was responsible for maintaining the water quality. In the abnormal circumstances of an emergency these regular organisations often call in extra capacity or need protection against physical threats or unwelcome attention from disaster tourists. This protection and extra capacity can be provided by the emergency services, the military, other private organisations or voluntary organisations, but this support does not affect the responsibility which the organisations have for the failing networks.

Consequence management, namely the process of curbing or dealing with a breach of any of the vital interests, comprises two aspects. The first is to identify, consider, and counter any threats posed to the vital interests. Alongside actual breaches, this also includes any clear and present danger posed to vital interests or to the response organisation itself. All three cases show that the judgement as to whether a danger is “clear and present” is often subjective and prone to uncertainty. Just as mopping a room does not make sense if one does not also take steps to stop the influx of water, the second key aspect of consequence management is to ensure that the organisations responsible for failing systems and networks take their responsibilities seriously. Since new developments may trigger hitherto unaffected community functions or networks, this aspect of consequence management requires constant monitoring of the evolving situation. More importantly, emergency interventions often have collateral effects on community functions or networks, and therefore require coordination with organisations responsible for those functions or networks (i.e., failure management).

Hence, consequence management is more complex than simply limiting the impact of an emergency on the community and may in itself trigger additional needs for failure management. Our analysis of the three cases shows that, to a considerable extent, the (negative) effects on the community are influenced, or even caused or enacted (Weick, 1979), by the response itself.

A good example is the deliberate reduction of freedom of movement in both the mall shooting case and the collapsing cranes case, which was done to protect citizens from (assumed) danger and to prevent the response effort from being hampered by disaster tourists. So, although initially failure management and consequence management can be clearly distinguished, the two often become more and more intertwined as the response progresses.

3.5 Discussion

In line with the findings of Acquier et al. (2008), we found that the emergency situation and the emergency response network are a *reflection* of each other; neglecting or ignoring ripple effects shapes the scope of the emergency and the response to it differently. The scope of the emergency can be derived either *deliberately* or *implicitly* from the whole of the affected community networks. The scope can be derived *deliberately* by charting the disrupted network of networks, by identifying the part of the network that is considered to be within the scope of the emergency, and by subsequently involving the organisations responsible in the emergency response. More often, the scope of the emergency is derived *implicitly* by letting it be shaped by the composition of the emerging response organisation. In this case, the extent of the emergency is determined implicitly by which organisations are involved in the emergency response network. This involvement is based only to a very small degree on a holistic perception of what is needed to resolve the situation (Drabek, 1983). The societal impact of an emergency situation is generally multifaceted, while the perception of the situation is fluid and subjective and often involves a great deal of uncertainty.

Organisations that were responsible for failing networks before the emergency are still responsible for those networks in the emergency response phase. By involving these organisations in the emergency response, the emergency response organisation builds upon organisational structures that already exist in the community. This puts into practice the *continuity* principle advocated by Dynes (1994) as part of an emergency response planning model, provided "that the resources from the pre-emergency community are relevant and sufficient" (Dynes, 1994, p. 156).

In general, emergency response organisations, including the public authorities, are responsible for dealing with consequence management. Notably they often interact intensively with the community, stimulating and supporting its potential, and they call in extra capacity if needed. On many occasions it is even the other way round, in the sense that the authorities do not take the lead but rather choose to support community-driven initiatives. In the mall shooting case, for example, spontaneous community-led initiatives to organise emergency shelter facilities were actively supported by the emergency workers, and the groups leading these initiatives were even included as part of the response organisation.

We found that failure management and consequence management are closely interlinked processes. Cascading effects and responsive actions often lead to new failures that have to be managed. Hence, there is a need for intensive coordination between those responsible for failure management and those responsible for consequence management. Although the two processes can theoretically be distinguished, they are often such intertwined that they cannot be analysed as two separate domains. One avenue for future research would be to find out what patterns may be discernible in the coordination of the organisational network responding to the emergency, and to look particularly at the interaction between failure management and consequence management. More specifically, we would like to substantiate the presumption that maintaining a common operational picture throughout the whole emergency response network helps to drive active coordination throughout the network.

We deliberately studied a number of *smaller* incidents, which might be regarded as relatively low-key. Although the regular organisational structures have failed in some way in all three cases, the situation does not become uncontrollable chaos and the composition and configuration of the emergency response organisation can be given careful thought. Such scenarios are also relatively common in the sense that incidents of similar magnitude typically occur once or twice a year in the Netherlands. Generalising the findings should nevertheless be done with care, and on a case-by-case basis (Firestone, 1993). The findings are based on a limited number of cases, all of which are from the Dutch context. Future research could advance the debate in at least two directions (Abbott, 2004). The insights we have presented here could be validated *syntactically* and enriched by further in-depth analysis of historic cases. The insights also have a more *pragmatic* – i.e., concrete and directly practical – application, as this clearer understanding of the logic of configuring a fit-for-purpose emergency response could be beneficial in practical operational circumstances.

3.6 Conclusions and practical implications

We studied three recent emergencies in the Netherlands because we wanted to find out what patterns might be discernible in the composition of the organisational network responding to the emergency, and whether there were patterns in that composition changed over time. In the organisational emergency response network, we distinguished two closely interdependent components: failure management and consequence management. To return to our earlier analogy, failure management can be thought of as *turning off the tap*, while consequence management can be thought of as *drying out the room*.

Our main finding is that the emergency situation and the emergency response network mutually shape each other and as such are a *reflection* of each other. This finding advances our understanding of how to put together an emergency response network that is fit for purpose, and therefore contributes to the scientific debate on emergency response organisations.

Some practical implications for emergency response also begin to emerge. The first is that demarcating the disrupted network determines the initial composition of the failure management part of the emergency response network. Or, to put it the other way round, the initial composition of the emergency response network may reveal an implicit assumption with respect to the disrupted network. Whether it does so explicitly or implicitly, it is the emergency response network that decides the scope of the failing network considered as part of the emergency. In this respect, the emergency is not something that just happens to the emergency response organisation but actually involves choices by the response organisation itself. This choice is a major factor in determining which organisations should be part of the emergency organisation.

Indeed, from the very beginning, the scaling-up of an emergency response network should involve the organisations responsible for the failing networks. Scaling-up routines or procedures should encourage the involvement of organisations responsible for all kinds of community networks. It should thereby be acknowledged that in many cases this responsibility does not reside solely with professional organisations. Think, for example, of situations in which social networks are disrupted. Especially if amplified by social media, the dynamics of social networks can be intense nowadays and can easily lead to emergencies. There is no professional organisation that can be held responsible for the dynamics of such social networks. Of course, if any criminal offences are committed, the police will need to be brought in. As long as there are no such offences, however, the scope for intervention is limited, and care needs to be taken to avoid restricting freedom of expression.

Although in the case of an emergency it is possible in theory, like Comfort and Kapucu (2006) did, to make a *distinction* between the disrupted network and the failure management process on the one hand, and community effect and the consequence management process on the other, in reality it may be impossible to separate out these two processes, as they are often very closely intertwined. Expectations with respect to the effectiveness of the failure management process are crucial in determining which potential scenarios are considered in the consequence management process. Similarly, those involved in consequence management may feel the need to set priorities for the failure management process so that extra attention will be paid to specific parts of the failing network. The interventions considered or initiated during the consequence management process may also have collateral effects on hitherto unaffected areas of the community, and new failure management processes may therefore be needed. In the liquid fire case, for example, the firefighting tactics affected the intensity and height of the smoke plume. This in turn determined which citizen groups, infrastructures and facilities were put at risk.

As a consequence, there is a need for failure management processes and consequence management processes to be coordinated. Expectations as to what failure management can achieve are relevant for the planning of consequence management. Likewise, consequence management measures may either facilitate or adversely affect the failure management process.

Annex – Additional insight into the data used

In this annex we provide more insight into the data used. We analysed three incidents: a liquid fire, a mall shooting and a collapse of cranes. The first two incidents have been well documented by the Inspectorate of Public Order and Safety (2011a, 2011b). For the second and third incident, there were two primary information sources: the emergency centre registration for each incident and data exported from the LCMS, the crisis management system used in all the safety regions in the Netherlands. The data from the emergency centre registration and the LCMS data cannot be made publicly available. For each of the three incidents we provide more insight into the data used by showing some intermediary steps in the analysis.

Tables 3, 4 and 5 provide overviews of the organisations involved in the responses to the liquid fire, the mall shooting, and the collapse of cranes, respectively. An indication of each organisation's role is given, and of whether this role can be characterised as consequence management or as failure management; the responsive measures taken by the organisation are also listed. The emphasis is on those organisations that were involved because of their responsibility for a community network. For the sake of completeness, the tables begin with an overview of the most important organisations involved because of their capacity and expertise.

Table 3 – Organisations involved in the regional-level response to the liquid fire, including their roles and responsive measures

Organisation	Role	CM, FM or E&C[12]	Responsive measures
Fire services	Responsible for fighting fires and hazardous substances	CM	Extinguishing fires, preventing the fire from spreading, advising on hazardous materials, ensuring the safety of emergency workers, coordinating the fire service operations
Regional police services	Responsible for maintaining public order and safety	CM	Closing the shipping traffic on the Hollands Diep, setting up road blocks and mobility measures, criminal investigation
National police services	Responsible for maintaining public order and safety	CM	Closing shipping traffic, stopping rail services, closing highways
Rijkwaterstaat	Responsible for fairway management of national waters	FM	Closing shipping traffic on the Hollands Diep, advising on buffering of (or on dealing with) polluted water used to fight fires, advising on and carrying out highway closures
Brabantse Delta Water Board	Responsible for the quality of surface water and for sewage treatment	FM	Advising on and dealing with polluted water used to fight fires, ensuring the continuity of the sewage treatment system
National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu; RIVM)	Conducting research and applying knowledge relating to public health and environmental safety	E&C	Sampling and analysing (polluted) water
Safety regions of Rotterdam-Rijnmond, Zuid-Holland Zuid, and Midden- en West-Brabant	Responsible for coordinating the emergency response at the regional level	Coordination of both CM and FM	Coordinating large-scale safety operations
Military organisation	Providing assistance in responding to crises and disasters	E&C	Providing fire-extinguishing capacity (crash tenders)
Corporate fire services (ATM and Shell)	Fire service capacity at the company level	E&C	Extinguishing fires, preventing the fire from spreading
Regional Medical Emergency Services Organisation (GHOR)	Coordinating medical assistance, including advising other authorities and organisations	CM	Providing safety advice to emergency workers, employees of surrounding businesses, and citizens
Municipality of Moerdijk	Care of the general public	CM	Crisis communication, administrative coordination
ProRail	Responsible for the Dutch railway network	FM	Advising on and carrying out railroad closures
Public prosecution	Detecting and prosecuting criminal offences	FM	Criminal investigation

12 Consequence management, failure management or (provider of) expertise and capabilities.

Table 4 – Organisations involved in the regional-level response to the mall shooting, including their roles and responsive measures

Organisation	Role	CM, FM or E&C[12]	Responsive measures
Police services	Responsible for maintaining public order and safety	CM	Initiating the criminal investigation, safety measures, ensuring explosives are made safe, identifying those who have died
Water Board (Hoogheemraadschap Rijnland)	Responsible for the quality of surface water and for sewage treatment	Informed, but not involved	Not applicable
Emergency call centre	Responsible for taking emergency calls and for dispatching emergency units	CM	Dealing with emergency calls, dispatching emergency units
Various medical teams, including ambulance teams and a mobile medical team	Providing medical care	CM	Providing emergency health care, transporting the wounded, registering victims
Regional Medical Emergency Services Organisation (GHOR)	Coordinating medical assistance, including advising other authorities and organisations	CM	Coordinating medical services, including the ambulance services, psychosocial health care, and identifying the wounded
Fire services	Responsible for fighting fires and dealing with hazardous substances	CM	Providing logistics support and taking precautionary measures
Municipality, including the Central Registration and Information Office, and the Shelter and Care and the Information departments	Care of the general public	CM	Registering victims Organising shelter and care for victims and witnesses Providing information to specific target groups and to the general public
Emergency accommodation	Providing emergency shelter for victims and bystanders	E&C	Providing emergency shelter for victims and bystanders
Hospitals	Providing medical care	E&C	Providing medical care
Health service combination	Group of professional and voluntary workers, including their assets, that can be used when the regular medical care is inadequate in a disaster or major accident	E&C	Providing medical care
Victim support	Providing assistance after crimes, traffic accidents and disasters. Providing emotional support and support in criminal trials, and helping victims to get compensation for damages.	E&C	Providing victims with legal, practical or emotional support
National Institute for Public Health and the Environment (RIVM)	Conducting research and applying knowledge relating to public health and environmental safety	E&C	Advising the crisis organisation on public health
ARQ psychotrauma expert group	Providing expertise in shocking events and psychotraumatology for individuals, organisations and society	E&C	Providing psycho-traumatic support
Bomb Squad	Identifying and clearing explosives	E&C	Searching for, defusing and clearing explosives
Royal Military Police (KMAR)	Providing assistance to the police	E&C	Surveillance and protection

Table 5 – Organisations involved in the regional-level response to the collapse of cranes, including their roles and responsive measures

Organisation	Role	CM, FM or E&C[12]	Responsive measures
Bus transport, crane operator, USAR, hotels, emergency shelter, veterinarian, hospitals, military organisation, rescue brigade, psychosocial assistance, animal ambulance, salvage	Provider of capacity and expertise of various kinds	E&C	
Gas and electricity provider (Liander)	Responsible for gas and electricity supply	FM	Shutting off electricity and gas
Rijkswaterstaat	Responsible for fairway management of national waters	FM	Redirecting shipping traffic
Province of South-Holland	Responsible for fairway management of regional waters	FM	Shutting down shipping traffic
Municipality of Alphen aan den Rijn	Care of the general public	CM	Cordoning off or clearing areas, providing emergency shelter
Water board (Hoogheemraadschap Rijnland)	Responsible for the quality and quantity of water in the Oude Rijn	CM (control of water quality); FM (control of water quantity)	Containing oil leakage, maintaining water levels in the Oude Rijn
Labour Inspectorate	Enforcement of civil law	FM	Conducting the labour law investigation
Forensic Inspectorate	Enforcement of public law	FM	Conducting the public law investigation

4 Shaping the societal impact of emergencies: striking a balance between control and cooperation[13]

Abstract

In our modern society, safety and security incidents can have a very considerable and wide-ranging impact. Yet the extent to which this impact on society can be directly affected by the responding organisations is limited. At best, the actions they take can reduce the immediate damage to some degree and help to accelerate the recovery process. Proper crisis communication can make the biggest difference with respect to overall societal impact. We argue that crisis communication must strike a balance between a directive approach of chaos, command and control and a more empathic approach of continuity, coordination and cooperation. Using two cases of real-life emergencies we analyse how crisis communication reflects the incident response approach and how societal impact is affected.

13 Published as Treurniet, W., Messemaker, M., Wolbers, J.J., & Boersma, F.K. (2015). Shaping the societal impact of emergencies: striking a balance between control and cooperation. *International Journal of Emergency Services, 4*(1). doi: 10.1108/IJES-06-2014-0007

4.1 Introduction

In 2011 a fire at a chemical storage facility in Moerdijk, in the Netherlands, had a big impact on Dutch society and caused a lot of public disquiet. An official investigation by the authorities revealed a failing communication, poor information management and a lack of interaction between the emergency response organisations and the affected community (Inspectorate of Public Order and Safety, 2011a). A few months later, a shooting in a shopping mall in Alphen aan den Rijn, again in the Netherlands, also had a big public impact as this kind of shooting was unprecedented in the Netherlands. However, the incident caused limited disquiet within the local community, and an official independent investigation by the authorities revealed that communication to citizens had been given considerable priority and that the emergency response organisations had communicated in a way that was open empathic and very professional (Inspectorate of Public Order and Safety, 2011b). These two cases illustrate that the effect of communication by response organisations can differ dramatically between crises.

As the examples above illustrate, an emergency has an inherently significant societal impact in the sense that it affects various critical sectors (Treurniet, 2014). In the Moerdijk case, the smoke plume and the water used to extinguish the fire, which then became polluted, affected several transportation arteries and threatened the natural environment. In the Alphen aan den Rijn case, the shooting and the response to it severely affected everyday life as a number of shopping malls were closed and feelings of insecurity developed among large numbers of citizens. In this chapter, we use the term emergency to denote a crisis that escalates rapidly. By 'crisis' we refer to an event in which safety or security are at risk because one or more vital interests are at stake and regular structures and resources are not sufficient to maintain stability (Boin et al., 2005; Treurniet, 2014). Hence, the extent to which societal impact of a crisis can be influenced by a responding organisation is limited. After all, a distinguishing characteristic of a crisis is that the regular structures and resources are insufficient to deal with the situation. At best, the actions taken in response to the crisis can help to reduce the direct damage and to accelerate the process of recovery (Garnett & Kouzmin, 2007; Treurniet, 2014).

Above all, a crisis impacts *the community,* and therefore the community has to – and to a great extent can – deal with it. A crisis situation does not fundamentally change the responsibilities and capacities of various sectors of society, including the private sector, *per se*. As such, Kapucu et al. (2010) argue in favour of local-level capacity development in response to disasters. Increasingly, community response paradigms that centre on attention to community capacity-building (K. M. Allen, 2006; Mathbor, 2007) recognise this and build on this notion (Ahmed et al., 2012). Consequently, emergency response organisations are increasingly being confronted by demands from the public for more immediate and clear-cut communication about the emergency response operations and their effects (Reynolds & Seeger, 2005).

However, in the crisis communication literature the capacity of communities is not yet sufficiently recognised. If an emergency response organisation is truly to build on the community capacity, then crisis communication needs to be regarded as genuinely *two-way* – i.e. communication in the real sense of the word (Veil, Bühner, & Palenchar, 2011). This two-way process – whether or not it is regarded in that way – causes a societal dynamic where the emergency response organisation and the affected community interactively influence the societal impact of an emergency. Our contribution will be an analysis of how crisis communication can make a difference in terms of the overall impact of an emergency on society.

Therefore, we pose the following question:

> How can the communication strategy of a collaboration of emergency response organisations make a difference in terms of the overall impact of an emergency on society.

We will look for an answer to this question by undertaking a comparative case study of the two Dutch emergencies we mentioned earlier: a large fire at a chemical storage facility in Moerdijk and a mall shooting in Alphen aan den Rijn. Both emergencies occurred in 2011. We aim to contribute to theory building by developing inferences from these cases and connect these to the literature on both crisis communication and emergency management. This builds on the idea that in both debates there is a lack of a common vocabulary that stresses the relationship between the community and the emergency response processes (Manoj & Baker, 2007).

4.2 Theoretical approach

The attitude of the response organisations with respect to communities is reflected in the planning model they adopt (Dynes, 1994). The traditional logic used in emergency management is based upon the 3-C model in which it is assumed that a disaster causes *Chaos* that needs to be put under *Control* by means of a *Command* structure (Quarantelli & Dynes, 1985). These ideas are rooted in military doctrines that a command and control structure of this kind is most effective in dealing with threats. Since many emergency response organisations have evolved from the military domain, these assumptions still prevail as the underlying rationale during emergency response operations, and also dictate their information and communication strategies (Steinberg & Shields, 2008, p. 22).

In the 3-C model the underlying assumptions are extended towards the role to the public in responding to disasters. Citizens are typically perceived as 'inconvenient bystanders' who are passive and cannot take care of themselves. Their spontaneous actions are seen as irrelevant or even disruptive to the command and control structure (Helsloot & Ruitenberg, 2004). In this view, these citizens need to be taken care of (or controlled) and to be informed by means of official statements from government authorities.

A response organisation tends to see information-sharing and communication as a one-way provision of information: from the professionals to the citizens.

The original 3-C model has been shown by Dynes (1994) to be inadequate; he argues that we need to move towards a different 'C3' model, one that is based upon the concepts of *Continuity*, *Coordination* and *Cooperation*. It is assumed that during disasters society does not necessarily spiral into chaos (Helsloot & Ruitenberg, 2004), but that social and institutional structures in fact remain intact to a large extent. Emergencies do not eliminate the full capacity of individuals or social structures, although these structures are put under pressure and there is a certain amount of disquiet. This disquiet cannot be brought under control, but must be *coordinated* by emergency response agencies in *cooperation* with existing organisations and groups that have expertise in the affected social or infrastructural domains. Using existing social structures and the expertise within them is considered the most effective way to solve problems relating to emergencies. The creation of artificial structures to control the situation in a more directive manner is not possible, and even if it were, it would be unlikely to be effective (Dynes, 1994).

We realise that the both 3-C and C3 approach are ideal types. In practical circumstances, neither approach is necessarily applicable in its purest form. Each emergency leads to a certain amount of chaos and, as a consequence, some degree of directive command and control is necessary to restore stability decisively. At the same time it makes sense to make use of the potential available in the community and to keep in mind that, in the end, the community itself has to be able to deal with the emergency. This does not only apply for situations that are less severe and relatively comprehendible. Sellnow et al. (2002) describe an extreme disaster wherein all existing forms of sense-making fall short. Such disasters exhibit large-scale complex interactions, unfamiliar sequences, or unplanned and unexpected sequences, that are either not visible or not immediately comprehensible (Perrow, 2011, p. 78). Obviously, in such extreme cases, application of the directive 3-C model and excluding the role of the broader community would be yet another example of overrating the potential of the response organisation. So, in practical circumstances an emergency response organisation has to strike a balance between both irreconcilable approaches.

We assume that the 3-C and C3 approaches each exhibit a different kind of logic and may therefore also have a distinct *communication style* to accompany it. A good example of this can be found in Carter, Drury, Rubin, Williams, and Amlôt (2013), although their chapter focuses on a specific type of crisis communication, namely with victims in large-scale chemical, biological, radiological and nuclear (CBRN) emergencies, specifically around mass decontamination activities. In one of the sources studied by Carter et al. (2013), the communication style is directly connected to the intended effect. It lists a number of values to be considered when communicating with the public in order to encourage trust and credibility: "competency/professionalism, care, empathy, compassion,

respect, understanding, organisation, commitment, knowledge, encouragement of involvement, and honesty" (Abeel, 2006, p. 42; Carter et al., 2013, p. 38). Similar findings were made by Menon and Goh (2005).

Interpretation of the emergency involves paying attention to how the society is affected and expressing compassion with affected citizens (Groenendaal, De Bas, & Helsloot, 2012; Helsloot & Ruitenberg, 2004; Helsloot, Scholtens, Groenendaal, & Stapels, 2012; Regtvoort & Siepel, 2007). Several strands of communication literature address reporting to the public in their own particular ways, such as risk communication and crisis communication. Risk communication has traditionally been associated primarily with health communication which warns the public about environmental hazards and the risks associated with particular behaviours. Availability of information allows lay people to make informed choices about risk, so the communication facilitates decision-making and risk-awareness (Ferrante, 2010; Menon & Goh, 2005; Reynolds & Seeger, 2005; Seeger, 2006). On the other hand, crisis communication is often associated with damage control and the need to re-establish reputations (Reynolds & Seeger, 2005; Seeger, 2006). While important lessons are drawn, academics claim that the crisis communication literature is dominated by non-theoretical case studies and guidelines, and there is consequently a lack of systematic knowledge and theoretical grounding (Falkheimer & Heide, 2006). We extend their message to the field of emergency management literature, and argue that communication theories need to be more expressly related to the dominant attitude of the response organisations towards communities. Relating these two fields can be valuable in helping crisis communication to be used more effectively to intensify and enrich the interaction between an emergency response organisation and the affected community.

In a section on *Directions for Future Research* Sellnow et al. (2002, p. 290) zoom in on a specific aspect of this interaction. They state that "the question of appropriate levels of equivocality in crisis messages remains largely unanswered. [...] Communication researchers should focus on clarifying how equivocality functions in crisis messages and developing guidelines for crisis managers." Our work focuses on the crisis communication style in general and as such provides a more generalised contribution to answering this question.

The domain of communication between organisations and the broader public – denoted by the term public relations – has generated a body of literature that is very relevant for our debate on the interaction between the emergency response organisation and the affected community. From a survey of professional resources, Van Ruler (2004) developed a framework of ideal types of PR communication strategies. She (2004, p. 138) stresses that in communication, the potential receivers must always be borne in mind and the effects should be evaluated. Having said that, she distinguishes four ideal types of PR practice, in two dimensions. The first dimension refers to meaning-making. In the *denotative meaning* of a phenomenon its objective signification is stressed, while in the *connotative meaning* the emphasis is on personal feelings and subjective associations with the phenomenon. As an example, the denotative meaning of smoke is "a cloud of fine particles". Examples of connotative meanings of smoke are: "toxic", "polluting" and "smelly". The second dimension refers to where the control of the communication resides. In the *controlled one-way* variant, only one communication partner has the means to influence the communication, while in the *two-way* variant the communication is really an interactive process.

Controlled one-way

Focus on denotative meaning		Focus on connotative meaning
	Information Focus on transfer of information to target groups	**Persuasion** Focus on influencing perceptions, sentiments and connotations in target groups
	Consensus-building Focus on creating a bond between both sides of the communication chain	**Dialogue** Focus on diachronic co-creation of meanings with target groups

Two-way

Table 6 – Four ideal types of public relations (after Van Ruler (2004))

We will use these ideal types to discuss the communication between the emergency response organisation and the target groups among the general public. We would expect a *Continuity*, *Coordination* and *Cooperation* approach to be associated with communication at the level of connotative meaning, as it requires reference to and recognition of the mental impact that an emergency will have. We do not expect a strong link between a *Chaos*, *Command* and *Control* approach and a specific type of public relations communication, as communication does not play a key role in this attitude. If we had to indicate a tendency, we would expect that the type of communication would tend towards the controlled one-way side, with a focus on the denotative meaning. Moreover, we would expect that two-way communication best matches the desirable interaction between the emergency response organisation and the affected community.

4.3 Method

In order to analyse what role both the 3-C and C3 models play in the dynamics of communications, we selected two cases in the Netherlands for a comparative case analysis: a fire at Chemie-Pack in Moerdijk and a mall shooting at *De Ridderhof* in Alphen aan den Rijn. Our case selection was done on theoretical grounds, based on the characteristics of both the 3-C and C3 approach, in

order to provide examples of extreme situations or contrasting types. Given the limited number of cases we studied, it made sense to choose extreme situations in which the process of interest was "transparently observable" (Eisenhardt, 1989). Based on independent investigations the two cases we briefly described in the introductory section were chosen as suitable material with which to analyse the interaction between the emergency response organisation and the affected community, including the role of different aspects of communication herein.

We also considered the comparability of the two cases. As they differ in nature, this comparability is not immediately obvious. Slovic (1987) argues that incident-related public disquiet is connected to two factors, *dread risk* and *unknown risk*. Dread risk is defined by perceived lack of control, catastrophic potential, fatal consequences and the inequitable distribution of consequences and benefits. Unknown risk is defined by hazards judged to be unobservable, new and unknown, and whose effects only manifest themselves after some delay (Slovic, 1987, p. 283).

The dread risk nature of the mall-shooting incident is self-evident, and given the association of the fire incident with chemicals, both incidents seem to be comparable in terms of dread risk. In terms of unknown risk, the comparability is less straightforward because in both cases there are equivocal elements. A chemical threat – as in the first case – can be very insidious and there is some delay before the harm becomes apparent. The smoke plume, on the other hand, was very visible. In the second case hand-held weapons posed a very explicit threat but the brutality of the shooting, on the other hand, was unprecedented in the Netherlands. Although the two cases differ in nature, we believe that they are nevertheless comparable to a considerable extent.

We used newspaper articles from the four largest Dutch national newspapers – NRC Handelsblad, de Volkskrant, Algemeen Dagblad and De Telegraaf – to analyse the societal impact of the emergencies, covering the mainstream daily print media. Joint press releases were used to analyse the crisis communication from the emergency response organisations.

For the Moerdijk fire, we retrieved newspaper articles from 5 January 2011 to 1 April from the LexisNexis database, using the search string "Chemie-Pack OR Moerdijk". Additional analysis showed that news reports on the actual emergency response appeared until 26 January, so we took that as our cut-off point. We used joint press releases from the two most affected safety regions to analyse the crisis communication from the emergency response organisation. These were retrieved from the website of safety region Zuid-Holland Zuid and the websites of the municipalities of Moerdijk, Dordrecht and Breda. Topics included uncertainty about toxic substances, exposure to toxic substances, and also different perspectives for action that the emergency response organisation communicated with the public.

For the Alphen aan den Rijn mall shooting, we retrieved newspaper articles for the period from 9 April to 9 May 2011 from the LexisNexis database, using the search string "alphen OR tristan OR ridderhof". "Tristan" is the first name of the perpetrator. The emergency was short-lived, and additional analysis showed that news reports on the actual response and communication from the authorities were very limited. We took Friday 15 April, one week after the emergency, as the cut-off point. We used joint statements to the press by the mayor of Alphen aan den Rijn, the chief of police and the public prosecutor to analyse the crisis communication from the emergency organisation. These were retrieved as videos from the website of national news agency NOS[14] and YouTube[15], and transcribed for analysis. Topics in the newspapers articles and the statements to the press included deployment of the emergency organisation, reactions to the emergency and activities of the media.

We did not undertake a systematic meta-analysis of social media data for this article, for two reasons. First, we could build upon in-depth studies by van Van Duin, Tops, Wijkhuijs, Adang, and Kop (2012) for Alphen aan den Rijn, and by De Bas (2012) for both Moerdijk and Alphen aan den Rijn in which the authors analysed the role of Twitter during both emergencies. Their studies made clear that traditional media continued to be the main medium during both crises. The authors showed that a lot of information was recycled on Twitter; news from traditional media in particular is frequently retweeted. Therefore, in the second place, we chose not to redo this analysis but to incorporate it to enrich our findings.

We followed the logic of grounded theory (Corbin & Strauss, 2008) and assigned codes to the data; this resulted in the emergence of different themes and topics that reflected categorisation of the symbolic representations (Strauss, 1993) used by both the emergency response organisations and the media. Building theory based on case studies is a highly iterative process, and tightly linked to the data. A strength is that the likelihood of ending up with valid theory is high because the theory-building process is intimately tied to evidence-making, and it is likely that the resultant theory will be consistent with empirical observation (Eisenhardt, 1989). A content analysis was carried out to analyse message contents and media responses to the crisis communication with the help of the MaxQDA tool. In this process 'paragraphs' were used as the unit of analysis. The codes were used as a guide to systematically map out and assess the communication style. We strived for inter-coder reliability by discussing the nature of the categorisations in collaborative meetings and going back and forth between the data and the theoretical concepts. We searched for relationships between these codes, which allowed us to group them into categories.

14 www.nos.nl. Accessed January 30, 2013.

15 www.youtube.com. Accessed January 30, 2013.

We kept iterating and working together until a consensus was reached on the structuring of codes and categories and the meaning of the codes.

For each of the cases a specific structure of codes and categories was derived, tightly linked to the data and reflecting the specifics of the incident. Several recurring themes emerged from the categorisations, reflecting the communication aspects (Reynolds & Seeger, 2005) of both cases. We use these aspects throughout this article to structure the findings. The communication aspects include the *type of language* used in the communication to the public – expressing the main perspective voiced with respect to the emergency, the *reading* of the emergency organisation as they made sense of the emergency – expressing the connotation and interpretation of the emergency, the *disclosure of information* when communicating new developments – expressing the dynamics of the amount of information revealed over time, the *connectedness* of the response organisation in relation to society and the *direction* of the response organisation as they engaged with society in shaping the consequences of the emergency. We used these aspects as stepping stones to identify the different levels of interaction that we came across in our study.

The structures of codes and categories derived from both cases are listed in Annex I to this chapter and illustrated with a quotation from one of the sources analysed. In line with the grounded theory approach applied, these structures formed the basis for the further analysis documented in the subsequent section.

4.4 Findings

4.4.1. Case one: Moerdijk fire

4.4.1.1 Description

On Wednesday 5 January 2011 a fire starts at Chemie-Pack, a company in Moerdijk, the Netherlands which processes and stores a variety of chemical products. The Moerdijk municipality is part of the safety region Midden- en West-Brabant. A big plume of black smoke rises above the fire and drifts over residential areas. The emergency is covered on national television and in news reports nationwide. During and after the fire public disquiet increases, because it is not known what kind of chemical substances are involved and what chemical contamination the soot particles may have caused. The immediate challenge faced by the emergency response organisations and the civil authorities is to communicate the level of threat posed by the fire while measurements of the risk are still taking place. In the first stages of the emergency, the emphasis is on communications about the response to the fire, informing the public about what action they should take and reporting on ongoing developments as the emergency unfolds. Due to the uncertainty that arises about possible chemical contamination, public disquiet increases and the authorities soon face a second challenge: measuring the possible contamination and communicating with the public about these results in order to calculate the risks and reduce disquiet.

In the Dutch emergency response structure, responsibility for crisis communication is divided between the specialised emergency services and the mayor's office. Depending on whether it is necessary to scale up the response, responsibilities shift towards the regional government authorities (e.g. see: Van de Ven et al. (2008)). In the initial phase of this emergency the mayor of the municipality of Moerdijk was responsible for crisis communication. In later phases this responsibility shifted to the coordinating mayors of the safety regions affected.

4.4.1.2 Findings

In the Moerdijk case, the emergency organisation tended to take a command and control approach in their communication to the public, expressing a view of the emergency based on self-reliance and from a dominantly unilinear perspective without taking into consideration the role of the society. In the three weeks of press conferences, the focus of the emergency response organisation with regard to the possible contamination was on providing facts and validations (denotative). They spent time gathering information before releasing any of it to the public, giving room for speculation and more public disquiet.

4.4.1.2.1 Type of Language

In communications with the public, technical and formal language was used, apparently giving mixed signals and increasing the level of disquiet. Although the underlying messages from the emergency response organisation might be technically (i.e. denotatively) correct, the general language with respect to the contamination did not take into consideration how the impact of the situation (i.e. the connotative meaning) might be seen by the public. While an investigation into the soot particles from the smoke cloud was ongoing and there was still uncertainty about the specific substances involved, press conferences were organised collectively by all involved response organisations involved to explain that the "damage to the health of the citizens remains limited" and that "there are no hazardous substances measured *to the extent* that they endanger public health" (emphasis by authors) (Press release by the Mayor of Breda, 6 January 2011; Press release by the Mayor of Moerdijk, 6 January 2011). Four hours after the fire, strange odours and respiratory problems were reported on Twitter, and the reassuring message from the emergency organisation was greeted with disbelief by Twitter users (De Bas, 2012; Stronkman, 2011). Alarmed residents nearby had just witnessed black smoke clouds being emitted from a company that handled chemical products; the ongoing investigations and the rather technical reference to the risk measurements added a contradictory element to the communication, made worse once the media simplified it to "no hazardous substances were released" (Algemeen Dagblad, 6 January 2011). Possible soot contamination was described in a technical fashion, as it was acknowledged

that soot was dangerous in general but here measurements were needed to assess the possible risks involved. “Soot is always dangerous, but the RIVM looks specifically whether there are health risks in the released soot.” (Press release, Zuid-Holland Zuid, 7 January 2011). In public debates and newspaper articles, scepticism was expressed about the information released by the emergency response organisation and about the notion that such a large fire at a chemical storage facility would have no harmful effects on health (De Telegraaf January 6; Algemeen Dagblad 6 January; De Telegraaf 7 January; Algemeen Dagblad 8 January). Two days after the fire a leaked third-party report surfaced in the media, stating that ditches around the emergency area were contaminated with carcinogens. This fuelled mistrust within society and in the media, and led to questioning of the reassuring messages from the authorities. Progress reports about the possible contamination at the emergency area and surroundings were formal in tone and made no attempt to address the disquiet within society and the impact caused by the growing uncertainty. Increased levels of metals measured in grasslands were said to be irrelevant in terms of people’s possible exposure to them, as it was stated that “the authorities indicated from the outset that people should avoid contact with soot [...]” (Press release by the Mayor of Breda, 12 January 2011).

4.4.1.2.2 Reading

Throughout its dealings with the press, the emergency organisations emphasised facts and validations. Even though insights were given into the activities carried out at the emergency site and at a contaminated neighbouring harbour, the facts and validation-based reading with regard to the soot contamination recurred throughout the press releases as “the presidents of the safety regions [...] attach great importance to careful, complete and detailed communication on the results of the RIVM study on the public health consequences [...]” (Press release, Midden- en West-Brabant and Zuid-Holland Zuid, 10 January 2011). In another statement, it was said that “we need to know exactly what area the particles of the plume may come down and what its composition is and what that means.” (Press release by the Mayor of Breda, 11 January 2011). From the start of the emergency, the emergency response organisations emphasised the notion that no public health issues had been discovered. Disquiet within society could be eliminated when “clear and accurate information about the measurement results” were available (Press release, safety region Midden-en West-Brabant, 14 January 2011).

Although factual and denotative information is essential for the emergency response organisations to cope with the situation, especially considering the environmental and health risks of possible contamination within an urban area, communicating without regard for the connotative perspective of the citizens affected seems to have had worsened the societal impact. A tension emerged between the view outlined by the emergency response organisations on the one hand, and the ones which were circulating among members of the public on the other. The media and citizens had an opportunity to develop their own more disturbing view of the emergency, as uncertainty about the chemical substances and dozens of health complaints from workers and residents emerged in the newspapers. Some experts warned in the media of far greater risk, talking of a cocktail of dangerous substances and a totally unpredictable toxic mix (Algemeen Dagblad, 8 January 2011; Algemeen Dagblad, 10 January 2011).

4.4.1.2.3 Disclosure of Information

Even though the emergency response organisation stated that openness to those involved was very important (Press release, safety region Midden- en West-Brabant, 11 January 2011), the list of substances stored at the site of the emergency was not made public until three days afterwards, and turned out not to correspond to the previous soothing words from the authorities. The response organisation disclosed information about the possible contamination after storing it up and accumulating it for some time. “At the moment analyses are still being performed on the beaten-down soot and on the presence of potentially harmful substances in crops. The same applies to analyses in relation to contaminated surface water. This will take several days to complete.” (Press release, safety region Midden- en West-Brabant, 9 January 2011). Complete and accurate measurements were thought to be the key to dampening public disquiet, and measurement results for specific areas were released only once the full data had been gathered. Seven days after the emergency, during which public disquiet increased, the results of the first thorough measurements were released.

4.4.1.2.4 Connectedness

During the aftermath of the Chemie-Pack fire, the focus of the emergency response organisation was on providing denotative information about technical progress and solutions to the public health risks, a fact-based approach requiring complete validation. At the same time, however, citizens expected to be informed in a timely fashion and in a way that took account of how the emergency had affected them and the disquiet it had caused. Instead of trying to respond to the perceptions of risk that emerged from within society, the emergency organisation relied on its own judgment and resources, trying to control the perceptions of risk by emphasising their own rather different view of the emergency.

4.4.1.2.5 Direction

While citizens became increasingly distrustful in the weeks after the emergency, the emergency response organisation maintained its unilinear approach, communicating information on a one-way basis without noticeable regard to the developments taking place within society. The perceived risk to the public was relative, and complete and accurate measurements were thought to be the key to dampening public disquiet. Within the context of empowered citizens and a diversified (social) media landscape, the slow and generally contradictory messages which ignored the perceptions of the general public contributed to more disquiet within the community and greater distrust of the

authorities. Relying solely on a command and control approach increased the discrepancy between the perspectives of the citizens and the emergency organisation.

Table 7 summarises the communication aspects of the Moerdijk fire.

Table 7 – Communication aspects of the Moerdijk fire

Communication Aspects	Chaos, Command & Control
Type of language	Technical and formal
Reading	Facts and validation
Disclosure of information	Accumulative and lingering
Connectedness	Self-reliant
Direction	Unilinear

In terms of Table 6, the crisis communication in the Moerdijk case was predominantly of the *Information* type. The main focus was on transfer of information. To a certain extent it may even be defendable to characterise the crisis communication as being of the *Town crier* type (Van Ruler, 2004, p. 130). This type is not included in Van Ruler's communication strategies schematic because it does not take the potential receivers of the message into consideration and can as such be characterised as *emission* rather than as *communication*.

4.4.2 Case two: Alphen aan den Rijn mall shooting

4.4.2.1 Description

On Saturday 9 April 2011 at 12.08 pm a 24-year old man arrives at shopping mall *De Ridderhof* in Alphen aan den Rijn. He opens fire in the parking lot, killing his first victim, and continues his route through the indoor mall. During a three-minute killing spree, he causes six fatalities, wounds 16 others and finally commits suicide inside the mall. The first police unit arrives on the scene at 12.15 pm. Once inside the mall they discover that the gunman is dead and the immediate danger has passed (Inspectorate of Public Order and Safety, 2011b). The moment the emergency response is initiated, the shooting is already over. Consequently, crisis communication is the primary response measure.

Immediately after the shooting the authorities face several challenges. Victims require medical attention, eyewitnesses need to be taken care of, and an assessment has to be made as to whether the gunman acted alone and whether there is any remaining danger. A note from the perpetrator is discovered during the early hours of the investigation; specific bomb threats expressed in the note lead the authorities to close three other shopping malls in Alphen aan den Rijn and to evacuate nearby residents. At about midnight the evacuees return to their homes, as no explosives have been found in the shopping malls during the sweep. After a thorough forensic investigation the last body is removed from the crime scene at *De Ridderhof* and transported to the mortuary on 10 April at 3.00 am. On the evening of Sunday 10 April a commemoration is held inside the city of Alphen aan den Rijn.

4.4.2.2 Findings

In the Alphen aan den Rijn case, the emergency response organisation tended to show an empathic approach in their communication to the public, reflecting an awareness of the mutual relationship between the response organisation on the one hand, and the general public on the other. In the two successive days of press conferences, the focus of the emergency response organisation was on disclosing information openly and incrementally, and giving insights into what measures had been taken and why.

4.4.2.2.1 Type of Language

The communications to the public showed an empathic and considerate use of language which took account of the connotative meaning of the emergency. Concern for those involved was a central theme throughout the weekend: "we want to wish [those involved] the best and give them all our compassion and we can assume that we are all ready here in Alphen aan den Rijn and beyond to support [those involved]". It is "[...] a shock to all of us and we will do everything to mitigate all consequences from this as much as possible" (First press conference, 9 April). Throughout the press conferences compassion was shown for the citizens affected, the survivors and the bereaved as well as for other residents affected by the actions taken by the emergency response organisation. This created an image of the response organisation as identifying with those affected by the emergency, and taking time to express the connotative meaning and the human dimension of the emergency.

4.4.2.2.2 Reading

The emergency response organisation read the situation as being one which required them to focus on providing insights into what was going on and reasons for their actions. When questions were raised about a possible SWAT team entering the house of the main suspect, the justification for this action was given as "[...] that is done to first ensure that the home is safe to enter by police so the tactical investigation can take place." (Third press conference, 9 April). In response to questions on social media, information was given about the deployment of the police and what had unfolded at the scene, starting from the first emergency call, as well as a prognosis of the likely short-term deployment and scheduled future actions: "at present there is a large-scale deployment consisting of 70 detectives who are currently involved in four major issues.

[Explanation of the four areas follows]" (Second press conference, 9 April). This resulted in the local community being involved in the ongoing efforts in response to the emergency.

4.4.2.2.3 Disclosure of Information

During the aftermath of the emergency, the emergency response organisation was committed to open and incremental disclosure of information. The importance of this was repeatedly and explicitly stated, and the public was continually reassured that all available information would be given as soon as possible, "because we believe that everyone has a right to know what exactly is going on [...]" (Second press conference, 9 April). This approach was reflected across the board, as information about the victims, the criminal investigation and the deployment of first responders was regularly updated during the weekend. At the same time realistic limits were set in regard to the forensic investigation: "it won't be possible to give all information on all accounts. This has to do with the fact that the forensic investigation is ongoing, and that we should not interfere." (Third press conference, 9 April). Even though the emergency organisation withheld certain information that might compromise the investigation, at the same time it also showed an openness regarding new developments and details.

With the investigation still ongoing, basic information about a possible related shooting earlier in the week, information about the perpetrator, his firearms licence and background, and the fact that he was already known to the police was shared and updated with the media during the aftermath of the emergency. By sharing this information incrementally, the media and the general public could quickly form a better picture based on facts instead of rumours. Nevertheless, several rumours still circulated within the (social) media (Volkskrant ,11 April; Volkskrant,12 April) – for example, about the perpetrator's alleged military background, different family members being among the victims and a ten-year-old girl allegedly being shot in the head. From the messages from the municipality of Alphen aan den Rijn, it is clear that the authorities paid attention to the feeling expressed within the (social) media (De Bas, 2012). Rumours were actively dispelled during the press conferences and on Twitter – for example, "I refute the rumours that his family was wounded or killed by the offender. [...] The rumour that he was an ex-soldier, I can refute. That is not the case" (Third press conference, 9 April; Van Duin et al. (2012)). When the media requested the name of the perpetrator, this was confirmed on the spot, acknowledging the fact that his name was already circulating on social media anyway. When it became evident that on social media, on Twitter in particular, the general public were tagging their messages with #shooting in relation to this emergency, the municipality discarded their own previous #shootingincident tag and replaced this with the tag now being used by the wider community (Van Duin et al., 2012).

4.4.2.2.4 Connectedness

Instead of suggesting that it possessed all the relevant information, the emergency response organisation confirmed gaps in its knowledge during the investigation. Some questions simply could not be answered because the specific information was still unavailable: "I honestly have no more information" and "I cannot honestly say" (Public prosecutor, second press conference, 9 April; public prosecutor, third press conference, 9 April). Efforts were focused on support for the victims, eyewitnesses and bystanders: it was stated that the organisation wanted "[...] to help the affected people as good as possible" and the "[...] concern is now mainly on the safety of the citizens here in Alphen, the care of the victims, which must be settled first." (First press conference, 9 April; second press conference, 9 April). The emergency response organisation was aware of the impact of its actions and stated explicitly during the evacuation with regard to bomb threats that "[the evacuation] has an enormous impact. The public disquiet that arose is very understandable" (Second press conference, 9 April). This indicated that the issue at hand was a communal problem, and could not be viewed in isolation from society.

4.4.2.2.5 Direction

Throughout the emergency, the communications reflected a flexible attitude on the part of the emergency response organisation, and a readiness to disclose new information as well as to keep the connotations and the perceived feelings of the public in mind. This indicates that there was an awareness of being embedded in and operating within a broader society, and that the "truth" was not something that could be controlled. Instead, the emphasis was on working with society and on coordinating the information already circulating within society, reflecting an awareness of the mutual relationship between the emergency organisation and the society.

In the wake of the emergency, newspaper articles focused on various topics, including eyewitness accounts, the background of the perpetrator and gun control issues, and the emphasis was on the emotional impact of the emergency. General consensus in the coverage confirmed a positive experience of the way the emergency response organisation had informed the public. On Twitter the sentiments shifted from expressions of disbelief and confusion to a request for validated information from the traditional media, and eventually people express their personal emotions with respect to the horror (Van Duin et al., 2012).

Table 8 summarises the communication aspects of the Alphen aan den Rijn shooting.

Table 8 – Communication aspects of the Alphen aan den Rijn shooting

Communication Aspects	Continuity, Coordination & Cooperation
Type of language	Empathic and considerate
Reading	Insights and motives
Disclosure of information	Open and incremental
Connectedness	Communality
Direction	Balanced

In terms of Table 6, the crisis communication in the Alphen aan den Rijn case was predominantly of the Persuasion type. The crisis organisation was more empathic and more responsive to the connotative aspects and the perceived feelings of the public.

4.5 Discussion

To study the communication characteristics and the interaction between the emergency response organisation and the affected community, we undertook a comparative case analysis of two Dutch emergencies. Our content analysis revealed different communication styles used by the emergency response organisation in its communication to the public.

Table 9 contrasts the communication aspects which emerged from our analysis; in the following paragraphs we will briefly compare the findings from both cases.

Table 9 – Communication aspects combined

Communication Aspects	Chaos, Command & Control	Continuity, Coordination & Cooperation
Type of language	Technical and formal	Empathic and considerate
Reading	Facts and validation	Insights and motives
Disclosure of information	Accumulative and lingering	Open and incremental
Connectedness	Self-reliant	Communality
Direction	Unilinear	Balanced

In terms of the four ideal types of communication strategy mentioned in Table 6, in both cases the crisis communication can be characterised as *controlled one-way* as it is predominantly controlled by the crisis organisation. Both cases differ specifically along the focus axis. The crisis communication in the Moerdijk case focused primarily on *denotative* meaning-making while the crisis communication in the Alphen aan den Rijn case focused primarily on *connotative* meaning-making.

As Dynes (1994) argues, the traditionally dominant approach – characterised by the notion that command and control are the means to reduce chaos – is inappropriate. This approach assumes that citizens need to be informed because they are not capable of collecting correct information. Improvisation and spontaneous actions are seen as irrelevant or disruptive, and the regular civil institutions are not able to cope adequately due to the ineffectiveness of their command structures. As shown in the Moerdijk fire and the Alphen aan den Rijn shooting, citizens draw their information from multiple sources, including official communication as well as multiple (social) media channels. The idea that the emergency response organisation has a monopoly on taking charge in an emergency, and can influence what happens because it has full control over the information flow within society as events unfold, is not in line with reality. Experts and other individuals or institutions will take part in these evolving situations and may present different views or even cause rumours, possibly false ones. In the Moerdijk case, the emergency response organisation amplified the discrepancy between the authorities and society by tending towards command and control principles. In the Alphen aan den Rijn case, the emergency response organisation was able to absorb the emerging views and rumours, and dampen their effects by applying continuity, coordination and cooperation in their communication to the public. In practice, there is no clear top-down vertical relationship between the emergency response organisation, society and other actors when it comes to the societal impact of an emergency. As we have seen in our study, an interplay emerges and the emergency response organisation is one of many actors embedded in this social interaction. Any organisation that limits itself to a more rigid and closed command and control approach, in which it is simply a transmitter of denotative information, fails to take fully into account the dynamics of modern society. Whatever blend of 3-C and C3 strategy is used, the emergency response organisations need to make clear to the public what they do and do not know in a particular situation. This enables citizens to act more self-reliantly. If it is not possible to communicate an unequivocal picture of the situation the response organisation should not try to do so. "... unequivocal statements during a crisis might be less valuable than probabilistic statements, reflecting more realistically the lack of precise predictability in many crisis situations and allowing stakeholders to make their own qualitative assessments." (Sellnow et al., 2002, p. 288)

Crisis communication focuses mainly on managing or framing public perceptions in order to reduce harm for both the organisation and its stakeholders (Reynolds & Seeger, 2005).

When we look at communication theory in relation to the dominant attitude of the response organisations, the managing or framing of public perception becomes apparent as the dominant planning logic. It is important to apply crisis communication to a broader spectrum, in which the response paradigms of the emergency response organisation are better reflected. As Seeger (2006) argues, effective communication must be an integrated and ongoing process, emphasising the developmental features of crises and the various communication needs of the public while these situations unfold. In our study we see that crisis communication based on an attitude of continuity, coordination and cooperation contributes to connecting risk communication and crisis communication, and as such contributes to the integration Seeger pleads for.

In terms of the ideal types distinguished by Van Ruler (2004), the focus of communications should shift to the more connotative side. A challenge in this shift is to incorporate and act upon feelings and perceptions in the community, particularly if the communication is of the *controlled one-way* type. By being embedded within society, the emergency response organisation must be seen as an integral part of a two-way communication process. Consequently, the response organisation will have to act on new developments instead of falling back on transmitting the same message with less (or no) regard for the recipients. Thus a 'dialogue' emerges in which many actors, including citizens, victims, eyewitnesses, journalists and authorities, participate.

Community capacity-building is important, as the affected community and society in general play an important role in returning things to a normal pre-crisis state. Society appears to be sufficiently resilient not to spiral into chaos and the emergency response organisation and affected communities *mutually shape* each other, together influencing the (perceived) impact of the emergency. Consequently, communities need to be integrated into the emergency response paradigm, not as inconvenient bystanders but as capable resources and full partners in shaping the emergency situation and its consequences. In using the term *mutual shaping*, we refer to the debate on the social shaping of technology (Bijker & Law, 1992; MacKenzie & Wajcman, 1999; Williams & Edge, 1996). Bijker and Law (1992, p. 3) argue that technological innovation never happens in isolation: "*Technologies do not [...] evolve under the impetus of some necessary inner technological or scientific logic. They are not possessed of an inherent momentum.*" Technological innovation can never be fully dictated by a project, a team or a restricted network of organisations. It is rather a product of continuous interaction with the society on a number of aspects.

Likewise, societal impact is a product of continuous interaction between the emergency response organisation and the affected community. The scientific debate on social shaping of technology might contain valuable elements for better understanding the mutual shaping of emergency response organisations and affected communities. If the safety and security issues permit, this idea of mutual shaping may even be stretched to co-constructing a course of action with the community. In many countries the term *citizen participation* is used to stress the role of citizens in striving for safety and security. Indeed, in a recent major criminal investigation in the Netherlands, the efforts of the community played such an important role that the public prosecutor coined the term *police participation* to express the notion that the police had essentially tailored their own response to that of the community so as to make use of the far greater capability that was available within society at large.

Social media offer valuable means of really shifting communication towards the *two-way* side; i.e. the two bottom quadrants of Table 6. A point of special interest is, however, that social media support communication with specific target groups only: people communicating via social media. Working with *anchorage points* can be a way of avoiding this bias. The idea of using anchorage points was introduced by Acquier et al. (2008). They use the term for specific actors involved in the community before the crisis who were already in contact with key stakeholders as part of their day-to-day activities. Anchorage points who have contextual knowledge and can improve the understanding of the situation can become key to facilitating the dialogue between the community and the emergency response organisation. Likewise Franco, Ahmed, Kuziemsky, Biedrzycki, and Kissack (2013) argue in favour of investing in relationships with the community that are mediated through trusted actors.

4.6 Conclusion

Crises have a significant societal impact because safety and security are at stake. Crises do not occur in isolation from the broader social environment, but are embedded within it. The way in which people within society interpret the information from the authorities – both denotatively and connotatively – is important for the emergency response organisation in order that it can adapt to ongoing developments and match its communication more effectively to the affected communities. As emergency response organisations and communities interact with each other, together influencing the societal impact of a crisis, the logic underlying the response actions becomes important. Is the main focus on directive control or on cooperation with the affected communities?

In the Moerdijk case, the emergency response organisation tended towards the chaos, command and control approach: a top-down approach in which the response organisation tried to control the developments within society. In the weeks following the emergency this approach seems to have contributed to an increasing disquiet within society and an unnecessary level of uncertainty among the population. The command and control approach and the communication which accompanied it seem to have amplified the societal impact of the emergency. In the Alphen aan den Rijn case, the emergency management organisation favoured the continuity, coordination and cooperation approach. With this approach, the role of the communication in mutual shaping becomes an integral part of the messages, coordinating the developments emerging from within society. By

keeping up with the latest developments and communicating openly and in an empathic manner, with an eye to connotative meaning-making, it seems that members of society had less reason to become troubled by the actions of the emergency response organisation and by the uncertainty inherent in the situation. The mutual shaping and active dispelling of rumours seem to have kept in check possible contributors of societal impact.

Given the complexity of a real-life emergency, the communication profiles will never be as clear cut and distinguishable as the ideal types presented in our article. During a emergency, the emergency response organisation is confronted with diverse challenges, such as combatting the cause and direct effects of the emergency, restoring the affected vital interests of the community, communicating to the affected citizens and the general public, all the while being scrutinised by, and embedded in, society. In the actual response to an emergency, both short-term and long-term, a directive approach might be the most effective in addressing the cause of an emergency. So when the situation does not allow for planning, a chaos, command and control approach can help both the speed and clarity with which an organisation copes with the situation. At the same time, crises are embedded in society, and the direct short- or long-term actions affect this complex context. When major crises occur, a more hybrid approach that includes continuity, coordination and cooperation might be more effective. However, due to the complexity of crises and the increased role of citizens, it is not always clear which approach will be the most appropriate. Using a mixture of these approaches might provide the best balance in terms of mutual shaping of the emergency response and the citizen experience during crises. The connection we made with the public relations debate may offer the emergency response organisation insights into a more extensive repertoire of communication means, enabling them to strike this balance.

Based on our study we argue that, in crisis communication, more attention should be paid to the way in which a response organisation approaches the situation, and to the dynamics of the interaction with the affected community. The attitude of the emergency response organisations and the interaction with the community shape the societal impact of an emergency. We need to move beyond the traditional underlying assumptions, and re-examine the needs of an increasingly complex society in which citizens always play a role in the complex dynamics between the authorities, communities and society at large while an emergency unfolds. More attention should be paid to the fact that emergency response and the affected community mutually shape each other; large-scale operations need to be moved out of their exclusivity and integrated into society. Or, to express it in terms of a variation on the conclusion of Slovic (1987, p. 285) with respect to risk communication and risk management: crisis communication and crisis management efforts are destined to fail unless they are structured as a two-way process. Each side – expert and public – has something valid to contribute. Each side must respect the insights and intelligence of the other.

The conclusions of this research confirm the well-established premise that collaboration and communication between the response organisation and the affected community have an added value. In this respect this work does not provide completely new insights. While the value of this form of collaboration may be well established in theory, it still seems to be often neglected in practice. The main contribution of this chapter is that we have connected the debate on the communication between the response organisation and the community to the debate on the two ideal-typical planning approaches, 3-C and C3. This connection has enabled us to demonstrate what consequences the chosen planning approach can have for crisis communication. Our research revealed five key aspects of crisis communication, with correspondingly different types of communication resulting from the two planning approaches. Using these five aspects can be helpful in matching a planning approach to an appropriate style of crisis communication.

The five aspects itself are considered to be applicable to a broad range of cases as the they are closely connected to several existing debates. The findings on how a crisis communication approach works in practice are based on a very limited number of cases. Even though the underlying themes emerged from the empirical data and provided us with tangible results relating to specific aspects of communication, these findings can only be generalised on a case-by-case basis (Firestone, 1993). To enable this generalisation, a rich and detailed description of the cases and the analysis has been included in the chapter. When seeking to apply these findings to other scenarios, it is important to take into account the cultural, social and administrative contexts of the cases in this study, both of which focus on incidents that took place in rural areas in the Netherlands in 2011.

4.7 Limitations

First of all, in our study we used newspaper articles to analyse the societal impact of both emergencies. While newspapers articles can give a good indication of the impact and developments within society, the data might be less detailed and rich than other research data (e.g. (semi-) structured interviews with affected citizens), and might not give a full or accurate reflection of the impact on society. Moreover, the coverage of news in newspaper articles is the result of the work of journalists and editors and as a consequence subject to subconscious and deliberate forms of framing. Secondly, measuring the impact of specific emergency response communication in a causal relationship in a real-world setting is virtually impossible. At best, we can find possible correlations between the communication aspects and societal impact. Thus it cannot always be clear how some of the developments influenced each other and how these relationships evolved over time.

Annex – Structure of codes and categories for both cases

Table 10 and 11 list the codes and categories, translated in English, that were derived from the Moerdijk case and the Alphen aan den Rijn case respectively. Each category is illustrated with a quotation, again in translation, from one of the sources analysed. In practice, however, the structure of codes and categories was arrived at in the opposite order: first the codes were derived from textual sources, then the categories were obtained from code groupings.

Table 10 – Main codes derived from the Moerdijk case

Categories	Derived codes	Illustrative quotation
Action perspective	Action perspective of crisis organisation; action perspective of emergency workers; action perspective of employees of the industrial zone; action perspective of people living in the neighbourhood; health-related symptoms; precautionary measures.	"The advice remains to avoid contact with the soot. Also watch children who are playing and do not consume vegetables from your own garden."
Aftercare	Actions of organisations and stakeholders; informing citizens; lifting restrictions.	"Today and tomorrow the police and fire service are organising meetings for all emergency workers [...] who were involved in the firefighting and the aftermath."
Cause of the incident	-	"Employees testified that the fire had started outside the premises. Fluids flowed into the building, causing the rest of the depot to catch fire."
Comparison with other disasters	Communication about the actions of the crisis organisation; health investigation; extent of the incident; potential consequences.	"In 1986, the emissions from the burning reactor at Chernobyl settled down in a similarly erratic pattern."
Deployment crisis organisation	Compliments for the crisis organisation; actions taken; consequences; collaboration within the crisis organisation; firefighting; evaluation; health of emergency workers; precautionary measures; informing the public on the deployment of crisis organisation; deployment and availability of resources; signals from government.	"The firefighting in the Chemie-Pack incident has been conducted competently, but it is an unforgivable mistake that firefighters and policemen had to work without respiratory protection."
Health risks	Presence of hazardous substances; exposure to hazardous substances; conclusions with respect to exposure; physical symptoms; uncertainty with respect to toxic substances; contamination of water; health risk prevention measures; lifting restrictions; potential contamination of grown crops; nourishment.	"The medical aid organisation in the region is aware of symptoms of irritated eyes, respiratory problems and headaches."
History of Chemie-Pack	-	"Since 1974 the company has been packaging chemicals."
Inspections	Issuing of the operating license; observed offences.	"Their actual practice did not comply adequately with general procedural guidelines."
Policy	Emergency deployment; inspection/ permit policy; safety and security policy.	"He believes that the permits do not fit the companies, which have been restructured and grown over the years."
Reactions from citizens	Health risks; reactions from citizens on informing the public; ignoring instructions; role of the government; precautionary measures; mistrusting information.	"Residents of Moerdijk are not against industry, but are often disappointed by government, politics and business."
Resignation of Denie[16]	-	"This decision was not taken looking backwards but looking into the future."
Societal impact	Economic; informing the public on societal impact; inconvenience.	"Presumably the harvest on the fields underneath the smoke plume has to be given up for lost."

16 Denie is the name of the mayor of the municipality of Moerdijk. Shortly after the Chemie-Pack incident, he decided to resign because he considered himself incapable – in a mental and a physical sense – of leading the recovery process.

Table 11 – Codes and categories derived from the Alphen aan den Rijn case

Categories	Derived codes	Illustrative quotation
Actions of crisis organisation	Informing the public on actions of the crisis organisation; preventive actions of the crisis organisation; investigation (firearms licence, actions of the crisis organisation, facts); reactions to the incident; role of the national authorities; role of the mayor; social media.	"Specialist detectives have come from various police forces throughout the country to deal with the forensics."
Background of perpetrator	Prevention of violent behaviour; relatives; licence/possession of weapons; motive; behaviour; shooting club; mental factors.	"If you saw him walking by, you saw a quiet boy, not someone whom you would expect to do something like this."
Comparison with other incidents	-	"Two massacres in Kerkrade in 1999 and 2003 gave rise to stricter rules."
Connections/ dialogue	Connecting information to the media; societal impact/context of the incident; refuting of rumours/distortions; questions in social media; questions from the general public.	"The perpetrator lived with his father. I can refute the rumour that it concerns an ex-military; this is not the case."
Coping	Resuming the thread (shopkeepers); aftercare; commemoration.	"For shopkeepers and employees of De Ridderhof in Alphen aan den Rijn last Saturday was a horrible day."
Deployment crisis organisation	Aftercare relatives; the crisis organisation's way of acting; prognosis duration; specific actions of the crisis organisation.	"And I have already indicated we are trying to have the names available as soon as possible in order to deal with any questions from relatives."
Empathy	Relevance of informing the public; expressions of gratitude; awareness of public disquiet/social effects; expressions of sympathy.	"We all find it terribly annoying that it takes that long. It is really necessary. It is really necessary."
General reconstruction	-	"In less than fifteen minutes, 24-year-old Tristan van der Vlis shot his machine gun empty."
Incident causes	Drugs; games; investigation; possession of weapons; media; comparison with other incidents.	"It seems that he has done in reality what he used to play at home."
Information relating to the incident	Information unknown; specific incident information; information about the perpetrator; information about victims (secrecy, privacy).	"Regarding some aspects it will not be possible to give all the information."
Media action	Crisis organisation; media role.	"Even the government gave in to the baying hordes by holding a press conference every other minute."
Reactions	Royal Netherlands Shooting Association; relatives (of victims); authorities; citizens; shooting club; reactions on emergency relief; eye witnesses; local residents.	"They let him go to the mall for an ice cream and since then nothing has been heard of him."
Victims	Hospitalisation; background.	"After the rescuers stopped the worst bleeding, the 10-year-old was rushed to hospital in Gouda."
Weapons act	Comparison with other countries; politics.	"For an automatic weapon such as the famous M16, no licence can be granted in the Netherlands."

5 Codifying a crisis: progressing from information sharing to distributed decision-making [17]

Abstract

A key challenge in crisis management is maintaining an adequate information position to support coherent decision-making between a range of actors. Such distributed decision-making is often supported by a common operational picture that not only conveys factual information but also attempts to codify a dynamic and vibrant crisis management process. In this chapter we explain why it is so difficult to move from information sharing towards support for distributed decision-making. We argue that two key processes need to be considered: supporting both the translation of meaning and the transformation of interests between those on the front line and those in the remote response network. Our analysis compares the information-sharing processes in three emergency response operations in the Netherlands. Results indicate that on several occasions the collaborative decision-making process was hampered because actors limited themselves to factual information exchange. The decision-making process only succeeds when actors take steps to resolve their varying interpretations and interests. This insight offers important lessons for improving information management doctrines and for supporting distributed decision-making processes.

17 Published as Treurniet, W., & Wolbers, J.J. (2021). Codifying a crisis: progressing from information sharing to distributed decision-making. *Journal of Contingencies and Crisis Management, 29*(1), 23–35.

5.1 Introduction

A recurring challenge in crisis management is how to develop an adequate information position (Boin et al., 2005). Gathering and sharing up-to-date information about the crisis is needed to develop and maintain shared awareness of the situation (Klein et al., 2010). It also ensures that those involved stay informed about how the response organisation is progressing (Deverell, Alvinius, & Hede, 2019; Treurniet et al., 2012), and enables them to develop options regarding how to intervene (Pfaff et al., 2013). Developing an adequate and shared information position requires a collaborative effort by multiple response organisations. Response organisations need to address operational, tactical, and strategic issues simultaneously in a rapidly changing environment (Owen, Brooks, Bearman, & Curnin, 2016), which often leads to ambiguity and discontinuity (Wolbers, Boersma, & Groenewegen, 2018).

In the language of crisis managers, this means using a common operational picture to tackle the perceived ambiguity and enable a shared overview of the crisis and the progress of the response operation to be developed (Comfort, Dunn, Johnson, Skertich, & Zagorecki, 2004; Copeland, 2008; Endsley, 1995). Many technological solutions have been suggested for how to create and maintain a common operational picture, often stressing the importance of collecting and fusing data (Looney, 2001) or of synchronising and distributing information (Copeland, 2008; DeMarco, 2016). Although there are exceptions (Uhr, 2009), these technical solutions are generally considered to improve the speed and quality of the collaborative decision-making process (Comfort, 2007). Accordingly, information management has predominantly been approached from a warehousing logic, which reveals the assumption that it is possible to collect and store all the relevant information, develop a complete overview of events, and specify what actions need to be taken and by whom (Copeland, 2008; DeMarco, 2016; FEMA, 2014; Leedom, 2003). Current studies seriously question this assumption (Wolbers & Boersma, 2013), as it prevents any substantial progress being made on developing a more nuanced information-sharing doctrine (Tatham, Spens, & Kovacs, 2017; Wolbers & Boersma, 2019).

Attempts to compile a complete factual overview during a crisis generally fail because of an important trade-off in information gathering, which is conceptualised as the ‘variable disjunction of information’ (Turner, 1976). By this expression Turner (1976) means that each actor has access to a slightly different set of information, while the amount of information that can be combined and processed with available resources is less than the amount of information needed to capture the complexity of the situation. This classic trade-off implies that during a crisis no actor is able to attain a perfect information position, because the cost of obtaining a new piece of information has to be balanced against the cost of obtaining an alternative piece. Paradoxically, this means that, in a rapidly changing crisis situation, putting too much effort in constructing a complete overview will eventually result in the information position becoming outdated, because the situation will have

already changed significantly by the time the overview is complete. Also, since all the actors collect information to support their own decision-making process at the operational, tactical, or strategic level, different perspectives of the crisis situation are likely to develop.

While the promise of many information-sharing doctrines is to support the decision-making processes on the front line, the tactical, and the strategic level, decision-making processes at each of these levels have a quite different logic, and thus different information requirements. Years of research into frontline command highlight that commanders rely on recognition-primed decision-making to connect cues and information to well-known scripts that they have developed from previous experience (Barton & Sutcliffe, 2009; Klein, Calderwood, & Clinton-Cirocco, 1986). This allows them to make quick decisions in environments that involve a high level of risk and complexity. In contrast, strategic-level decision-makers use information to support sensemaking processes over a longer time period, engage in meaning-making to frame societal impact, and use information to claim or redirect accountability (Boin et al., 2005). These differences mean that it is highly challenging for a single information-sharing platform to seamlessly connect the front line and the remote response network. The on-scene dynamics and the uncertainties involved render it virtually impossible to convey an up-to-date situational picture that addresses all the aspects that are relevant to those operating remotely at the tactical and strategic levels of the response organisation (Bosomworth, Owen, & Curnin, 2017). Likewise, it is very difficult to express broader tactical and strategic perspectives on the situation in a way that is meaningful and manageable at the operational level (Bye et al., 2019; Curnin & Owen, 2013).

Accordingly, we need more insight into how information is translated and transformed as it moves between the front line and the remote response network at the tactical and strategic level. Against this background we ask the research question: *how does information sharing in a crisis management operation contribute to collaborative decision-making between the front line and the remote response network?* To answer this question, we studied the information-sharing and collaborative decision-making processes during three emergency response operations that took place in the same region in the Netherlands.

5.2 Theoretical framework

It is well known that a crisis management operation consists of different collaborative decision-making processes taking place at the operational, tactical, and strategic level (Boin et al., 2005; Curnin & Owen, 2013; Owen et al., 2016). Chen, Sharman, Rao, and Upadhyaya (2008) argue that collaborative decision-making processes in response operations can be conceptualised as a number of nested decision-making cycles, which we refer to as the *front line* and *remote response network*. A range of studies describe a tension between the front line and the tactical/strategic level (Bosomworth et al., 2017; Curnin & Owen, 2013; Owen et al., 2016). Frontline cycles of coordination that support fire-fighting, acute medical care, or police operations involve actions that need an immediate reaction and do not allow for lengthy deliberation. Rimstad and Sollid (2015) use the 2011 Norway terrorist attack to show that frontline operations are characterised by rapid critical decisions, made primarily on the basis of pattern recognition (Cohen-Hatton, Butler, & Honey, 2015; Groenendaal & Helsloot, 2018; Klein, 1993; Meso, Troutt, & Rudnicka, 2002). These frontline processes can be highly chaotic and unpredictable, and may sometimes even be incomprehensible to actors operating at a distance (Barton, Sutcliffe, Vogus, & DeWitt, 2015; Boehm, 2018; Curnin, Brooks, & Owen, 2020; Njå & Rake, 2009).

The remote response network typically seeks to address the broader, long-term impact of the crisis by focusing on the implications for various stakeholders, resource allocation, and community expectations (Curnin, Owen, Paton, & Brooks, 2015). Those at the strategic level – generally as part of the remote response network – focus on meaning-making, which entails offering the broader community a frame through which the crisis situation can be understood (Boin et al., 2005; You & Ju, 2019). Boin et al. (2019) show that in the response to Hurricane Katrina different organisations and officials communicated different frames, but most of these frames had hardly any connection to how the situation was experienced by those at the front line.

As such, the front line and the remote response network can be two 'worlds in themselves' (Njå & Rake, 2008). While frontline processes are driven by 'knowledge by acquaintance', the remote response network is driven by 'knowledge by description' (Baron & Misovich, 1999). This is an important difference, and means that it is difficult for the organisation as a whole to be sensitive to the lived experience and concrete situational details to which those at the front line have access (Barton et al., 2015). Only as time goes on, and more room becomes available for longer deliberation and for the facts to be validated, can those at the tactical and strategic level use their more overarching risk assessments to provide more active guidance to the frontline operations (Rimstad & Sollid, 2015; Scholtens, 2008). However, actively steering frontline operations too soon generally results in the strategic-level decision-makers being accused on engaging in micromanagement.

Collaborative decision-making in emergency response is thus a multifaceted and nested phenomenon. It is multifaceted in the sense that it requires knowledge-intensive transboundary collaboration between organisations with differing knowledge bases and expertise. It is nested in the sense that it typically consists of a number of interconnected decision-making cycles, differing in their level of abstraction and the time pressure involved. The multifaceted and nested nature of the collaborative decision-making processes feeds into the state of variable disjunction of information among the organisations contributing to the response (Turner, 1976).

The common operational picture, as an information-sharing platform, plays a key role in connecting the perspectives of the different teams across organisational boundaries (Ansell et al., 2010), providing an up-to-date representation of the status of the emergency situation and the actions taken in response. Underlying the discussion of the common operational picture as an information-sharing platform is the notion of developing a shared situational awareness (O'Brien, Read, & Salmon, 2020). The debate on this subject flourished in the 1990s and early 2000s, with a range of studies being conducted in aviation and in the naval and military domain (Endsley, 1995; Hutchins, 1995; Salmon et al., 2008; Sarter & Woods, 1991; Taylor & Selcon, 1990). These studies describe situational awareness as being acquired through cognitive processes that integrate knowledge derived from recurrent situation assessment (Salmon et al., 2008). The debate cumulated in a range of cognitive process models that describe how information is processed and evaluated to support decision-making (Bedny & Meister, 1999; Endsley, 1995; Smith & Hancock, 1995).

While the debate on shared situational awareness offered a predominantly cognitive approach to information sharing, later studies showed that information management should be broadened out into a cyclic and collaborative sensemaking process that feeds into the development of shared situational awareness (Klein et al., 2010). During the process of information sharing it is important to leave room for different sensemaking accounts (Wolbers & Boersma, 2013). For different teams and different organisations different aspects of the situation are relevant. The common operational picture should be able to reflect these differences, and a continuous process of collaborative framing, questioning and reframing should help to reconcile the differing perspectives to arrive at a more consistent, less equivocal view of the situation (Klein et al., 2010). This combination of collaborative sensemaking and shared situational awareness makes collaboration on the basis of a common operational picture both complex and effective.

As the common operational picture is intended to support the transboundary collaboration between the front line and remote response network (Comfort et al., 2004), its supporting role is more problematic than is often suggested in the literature. The information-sharing dilemmas that are experienced in response operations are often more complex and nuanced than can be captured in factual terminology. As such, crisis information management also involves more reflective, knowledge-intensive processes, such as meaning-making, prioritisation, future scenario development, and considerations of the rationale of the response. However, we know relatively little about the processes of sharing these more abstract levels of information that play a part in supporting collaborative decision-making (Wolbers & Boersma, 2013).

Carlile (2002, 2004) conducted relevant research on information-sharing in distributed organisations. He distinguishes three levels on which information can be shared: the syntactic level of *factual information*, the semantic level of *interpretations*, and the pragmatic level of *implications* that interpreted facts may have for the interests of other actors involved. Likewise, crisis management scholars have pointed out that *translation* of the inherent meaning of terms is generally needed, because meanings and implications of the information transferred must be exchanged and coordinated as well (Kalkman, Kerstholt, & Roelofs, 2018; Luokkala, Nikander, Korpi, Virrantaus, & Torkki, 2017; Merkus et al., 2017; Van de Walle, Brugghemans, & Comes, 2016; Wolbers & Boersma, 2013). Others have argued that interests have to be negotiated between collaboration partners (Ansell et al., 2010; Wimelius & Engberg, 2015), which means that the contextual meaning of information must be *transformed*. In this chapter, we take a closer look at information sharing by analysing how using these various levels of information sharing contributes to collaborative decision-making by the front line and the remote response network.

5.3 Method

We conducted a detailed qualitative analysis of how information sharing supports collaborative decision-making by differentiating between different levels of information sharing. We analysed three real-life emergency management operations: a gas explosion in an apartment building in 2010, a shooting in a shopping mall in 2011, and the collapse of two cranes being used to hoist a bridge deck in 2015. For each operation, we examined how the information provided in a common operational picture was used to address key collaborative decision-making challenges. The analysis was complemented by semi-structured interviews with operational officers involved in one or more of the operations. All three cases were sudden-onset crises, the tactical lead resided with the same commander, and they took place in the same municipality: Alphen aan den Rijn in the Dutch safety region of Hollands-Midden. Evaluation reports and media accounts show that the response to all three incidents was successful in several senses (McConnell, 2011). First, it followed pre-anticipated and appropriate processes and the decisions taken had the effect of minimising damage and loss of life. Second, those decisions ensured that political goals were achieved without attracting any substantial opposition. Furthermore, the three incidents occurred during a period in which a specific information management doctrine, netcentric operations (Alberts, Garstka, & Stein, 1999), was being implemented in the Netherlands. In netcentric operations each participating team is responsible for maintaining an up-to-date representation of the situation, reflecting the professional perspective of that team, and for sharing this representation with other teams (Van de Ven et al., 2008). In addition, a new role was introduced into the crisis management structure: information managers watched over the coherence between the operational, tactical, and strategic command level.

The response to regional-level incidents, like the three we analysed, is coordinated as follows (Scholtens, 2008). The frontline operation is coordinated by an on-scene, multidisciplinary command team in which all the disciplines working directly at the incident location are represented. This on-scene command team is led by a field commander, who is supported by an information

manager. This information manager is responsible for maintaining an up-to-date operational picture and sharing it with the rest of the emergency response network. A tactical command team is also established, based well away from the incident location. This remote team is responsible for supporting the on-scene operation and for dealing with the broader effects of the incidents. These include both physical effects, such as the spread of smoke or toxic gases, and psycho-social effects, such as social unrest and turbulence in social media. This tactical command team is led by a tactical commander, who is supported by an information management section. The information manager leading this section is responsible for maintaining an up-to-date tactical picture and for the coherence of the common operational picture as a whole. If the incident involves issues that require substantial coordination at the municipal level, a strategic coordination team is established. This team, which also meets somewhere remote from the incident location, is led by the mayor of the municipality or by the chairman of the safety region, usually the mayor of the largest city in the safety region.

We collected our data from two different information-sharing platforms: the information system of the emergence response centre (GMS), and the nationwide crisis management system (LCMS). The GMS registrations are basically tables in which each row contains one entry extracted from the information system. An entry of this type includes a date, a time, the name of the dispatcher, and a text message. Data from the LCMS reflect a dedicated view for each of the teams operating at the different levels of command. Each view contains one or more textual fields. For our qualitative analysis, we used a chronological list of field mutations extracted from the LCMS. Each field mutation consists of an identifier for the view, an identifier for the field, a date/time group, an identifier for the person who has modified the field, and the contents of the field.

For each of the cases, the contents of the GMS registration and the registration exported from the LCMS were integrated into one table. In this process the text messages from the GMS registration were copied exactly. To incorporate the field modifications from the LCMS registration some manual processing was needed. The marked insertions and deletions had to be converted to a textual description capturing the essence of the modification.

We assessed the three cases from a process perspective (Langley, 1999). We applied a *narrative strategy* as a preliminary step to prepare a chronology for subsequent analysis. This strategy involves constructing a detailed story from the raw data. Subsequently, we aligned the data to the three levels of information sharing: *factual information*, *interpretations* of the factual information, and *implications* that the interpreted facts may have for the interests of other actors involved. At the interpretations level we broke the data down into a series of multidisciplinary decision-making themes that were discernible on the information-sharing platforms. At the implications level we examined the choices that needed to be made at the strategic level and those that involved deep uncertainty (Walker, Lempert, & Kwakkel, 2013), where conflicting interests needed to be weighed against each other. By taking this processual approach, which involves contextualisation of the decisions made, we account for possible hindsight bias, which can occur when causal reasoning alone is used to explain crisis decision-making (Schakel & Wolbers, 2019).

To reconstruct the information-sharing process over time in each of the three cases, we engaged in 'recursive cycling among the case data' (Eisenhardt & Graebner, 2007, p. 25). This entailed going back and forth between the empirical data, the templates we used for categorisation, and the logic of the narrative. Through this process we derived a coding structure, consisting of a number of themes with underlying concepts (Gioia et al., 2013). Each of the themes expresses a key collaborative decision-making topic that could be discerned as a thread running throughout the emergency management operation. This coding structure allowed us to visualise the processes used to reach different levels of information sharing and to relate them to key collaborative decision-making topics (see Annex).

We validated our initial analysis by conducting a member check (Schwartz-Shea & Yanow, 2009) using reflective interviews with six officers involved in one or more of the cases. One of them was the tactical leader of the emergency response in all three cases. Four of them were responsible at the operational level for a significant part of the decision-making in one or more of the three cases. One was involved as information manager in one of the cases. The interviews took place in 2016 and 2018 and lasted two to four hours. The visual reconstructions of the information-sharing process over time formed the main input for our conversations with the officers. This visual reconstruction helped them to bridge the gaps between the time when the incidents occurred and the point at which the reflective interviews took place. The officers reflected extensively upon the cases, and identified what they had experienced as the toughest episodes and collaborative decision-making issues. They also reviewed our reconstruction of how the information-sharing process unfolded and reflected on what role the different levels of information sharing had played in addressing the decision-making challenges. Whenever necessary, the underlying data was referred to during the sessions. We transcribed and analysed these interviews in order to build a richer picture of what had occurred and to deconstruct the key challenges in the collaborative decision-making processes that we had identified through our document analysis. This approach gave us a richer understanding of the collaborative decision-making process, which we will now describe in detail.

5.4 Findings

The three incidents featured as cases in our study occurred in the municipality of Alphen aan den Rijn, the Netherlands, on 6 December 2010, 9 April 2011, and 8 August 2015 respectively. On 6 December 2010 there was a gas explosion in an apartment building. As a result of the subsequent fire and the structural damage caused by the explosion, the apartment building had to be

evacuated. On 9 April 2011 there was a serious shooting incident in a mall. Seven people, including the perpetrator, lost their lives and seventeen were wounded. On 8 August 2015 two large cranes toppled over into a residential area while a new bridge deck was being hoisted into place. A number of houses and shops were damaged or destroyed.

For each of the cases, we provide a short description, and we then sketch out a particular collaborative decision-making issue faced by the crisis managers. We describe the collaborative decision-making dilemma from the perspective of the front line and the remote response network. We also describe how the level of information sharing throughout the emergence response organisation developed over time while this issue was being dealt with and how it was concluded.

5.4.1 Arranging emergency accommodation after a gas explosion in a residential flat

Monday 6 December 2010 was a mostly cloudy day in the Netherlands, with temperatures close to freezing. At 1.01 pm, the emergency room of the Hollands-Midden safety region received information about an explosion in a six-storey apartment building in Alphen aan den Rijn (*Explosion on the sixth floor. Windows have been blown out.*). After the explosion a fire broke out in a number of the apartments. As a result, and because the explosion had caused structural damage to the apartment building, the building was evacuated.

The key decision-making topics in this emergency response operation are listed in the Annex. One of the key topics in which information sharing played an essential role in supporting the distributed decision making was arranging temporary accommodation for the inhabitants of the apartments. In doing so they faced various difficulties to codify the emergent nature of this process. Figure 14 provides a reconstructed timeline of the accommodation process.

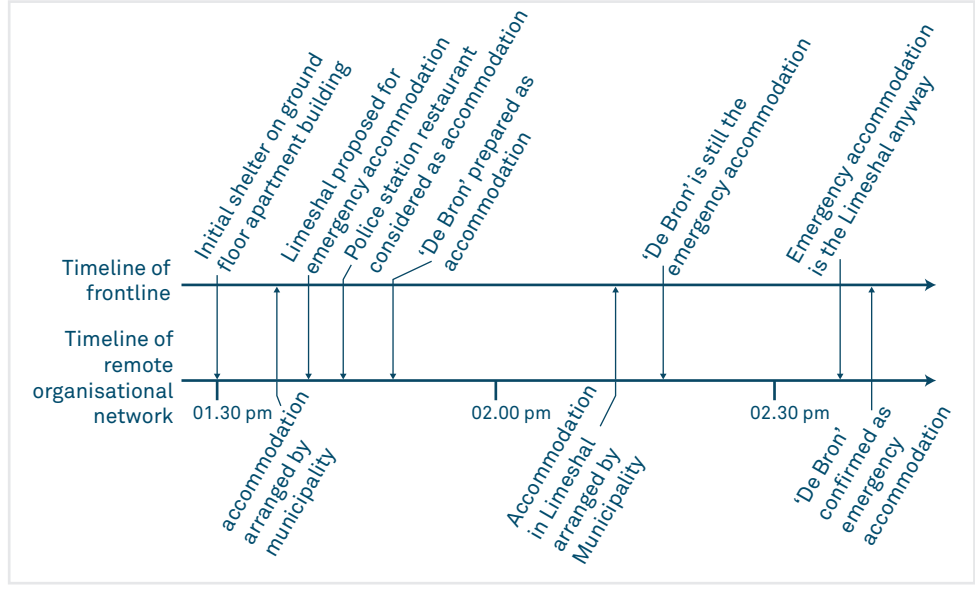


Figure 14 – Timeline of arranging accommodation.

Before the command teams were established, the units on the street realised that emergency accommodation would need to be arranged. So as to waste no time the staff in the emergency centre began arranging emergency accommodation 29 minutes after the initial emergency call was received. The on-scene commander said in the interview: *It is not really a very explicit intellectual process. It is more like a strategy of coincidental opportunities. If the first solution solves the problem, that is sufficient. We have other things to do.* The emergency centralists registered in their system details of the frontline initiatives being taken to arrange emergency accommodation. As it is ultimately the responsibility of the municipality to arrange accommodation, the municipality officials were alerted in parallel. Eight minutes later a separate process was initiated by the municipality, in accordance with its own pre-planned scripts. Another three minutes later, the police initiated a third process. Finally, five minutes after that, the "De Bron" church centre spontaneously opened its doors and started to welcome people who had been affected (*De Bron is already arranging care*).

Three different processes were started in parallel to arrange accommodation. Those involved in these three processes quickly shared factual information about their decisions, but even small delays in information sharing led to coordination problems due to the speed of the action trajectories. The confusion lasted for the next 70 minutes. By that time, the centralists in the emergency centre were clearly annoyed, as reflected in their use of capitals and exclamation marks: *EMERGENCY ACCOMMODATION DE BRON!!! SOURCE: REGIONAL OPERATIONAL TEAM* (Figure 15).

14:40:23 | OPVANGLOKATIE DE BRON

14:40:23 | !!! VAN HET ROT

Figure 15 – Irritation reflected in an extract from the emergency centre registration

The on-scene commander explained in the interview: *Initially, we had arranged accommodation. After scaling up to the tactical level, the tactical team did it all over again, with a different location. So, we decided to move the people to this new location. We thought: oh, did they come up with something else again, you know? Then the tactical team decided: well, all right, let them go back anyway. And the people went back again!*

This case shows that accommodation typically has to be arranged while the incident command structure is still being established. Thus it can often be the case that initiatives are started spontaneously by other groups within the local community, running in parallel with the activities of the emergency responders. While it is important that all the partners involved are informed quickly about initiatives, even short delays can easily lead to conflicting actions and agreements at the network level. Furthermore, in this particular case sharing factual information about the locations was not sufficient, as deliberation over choices and the implications of particular choices could not be easily codified in the common operational picture. Hence, having a common operational picture does not guarantee that that the implications of particular decisions will be considered by different actors in the response network.

5.4.2 Bomb threat after a mall shooting

On Saturday 9 April 2011, at 12.09 pm, the Hollands-Midden safety region received an emergency call: *Shooting in the De Ridderhof mall!* De Ridderhof is in the municipality of Alphen aan den Rijn. The call was soon followed by reports of injuries. Police units and paramedics rushed to the mall. After a few minutes the shooting was over. At 12.19 pm it was reported that the gunman had committed suicide. In the shooting, seven people, including the perpetrator, lost their lives and seventeen were seriously injured. At 2.10 pm it was confirmed that there had been only one perpetrator. Around the same time an on-site command team was established. This team took charge of operational coordination of response activities at the scene, including attending to the wounded, identifying those who had been killed, and undertaking forensic investigation.

The main decision-making topics the emergency response organisation had to deal with are listed in the Annex. As part of the safety and security challenge in this incident, a particular episode in the information sharing process played a key role in supporting collaborative decision making. The central issue in this episode was how to deal with and codify the bomb threat posed against the De Ridderhof mall?

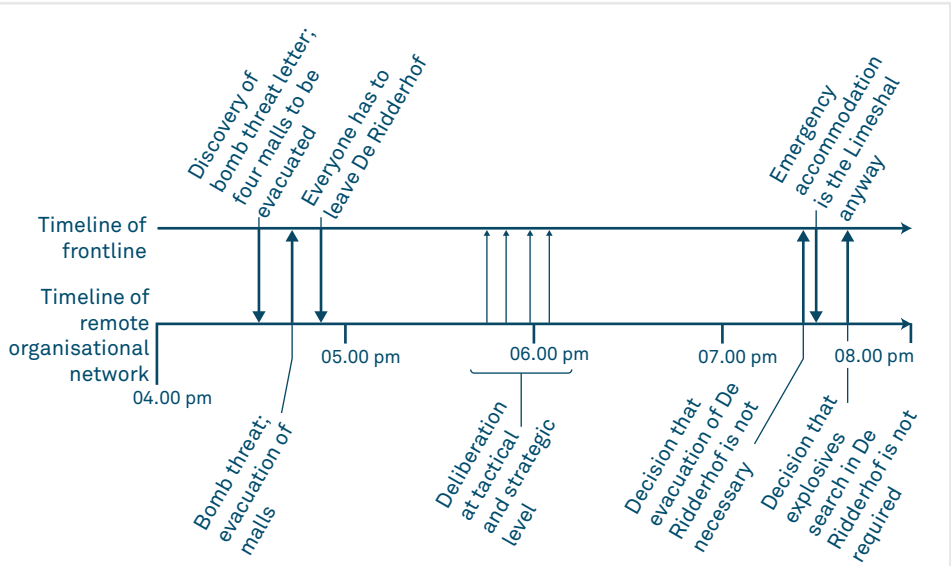


Figure 16 – Information exchange about whether or not to evacuate De Ridderhof

At 1.55 pm the gunman's car was found with an envelope on the passenger seat. After the car had been carefully opened by a bomb squad, the envelope was found to contain a bomb threat to a number of shopping malls in Alphen aan den Rijn. At that time, a forensic team had started its investigation inside De Ridderhof, although it was not immediately clear whether the bomb threat included De Ridderhof as well. As a precaution, the frontline commander immediately decided to stop the forensic investigation and evacuate De Ridderhof. Figure 16 depicts the information exchange between the frontline commander and the remote response network. The decision of the frontline commander to evacuate De Ridderhof was communicated via the common operational picture and is indicated in the figure by bold arrows (implications level). In the remote response network, several teams at the tactical and strategic level started a two-and-a-half-hour deliberation about which malls should be evacuated. Factual information about the progress of this deliberation was shared through the common operational picture. The outcome was that it was decided there was no bomb threat to De Ridderhof, so clearance was given to proceed with the forensic investigation.

The frontline commander at De Ridderhof reflected on this: *I asked the question: 'Are we safe here, yes or no?' This question was ultimately even dealt with in the strategic team. Finally they said: 'Yes, De Ridderhof is safe'. By that time, I was, like, what is happening on the street, what is happening in the tactical team, what is happening in the strategic team? We had been taking measures even before they talked about it and decided on it. [...] Now the strategic team decided De Ridderhof is not at risk. [...] This made the forensic investigation team ask: 'Why is it safe now? Who decides on that? Does the strategic team decide that it is safe?'* In other words, implications-level information from the remote response network did not convince the frontline commander and the teams operating there that it was safe to work in De Ridderhof.

The forensic investigators would not resume their work until an explosives scout had determined that there was no sign of an explosive device in De Ridderhof. While the frontline commander was saying that an explosives scout needed to confirm it was safe in order for work to resume, the remote response network was still stating that searching for explosives in De Ridderhof was *not* necessary (Figure 16). This stand-off tells us that even if information about the uncertainty over the bomb threat is shared, the lived experience of uncertainty is not addressed by simply sharing factual information. Safety issues and the urgent need to carry out risk assessments are very much dependent on the perspective of the beholder. In this case, the front line and the remote response networks seemed to be operating in two entirely different worlds.

5.4.3 Instability of pontoons

On Monday 8 August 2015, at 4.09 pm, the emergency centre servicing the area of the Hollands-Midden safety region received the following call: *a crane has fallen down on shops and houses*. The call came from a citizen in the municipality of Alphen aan den Rijn. Two heavy cranes were being used to install a new bridge deck across the river Oude Rijn. The cranes were positioned on pontoons in the Oude Rijn. At a critical moment in the hoist operation the combination of the cranes and the pontoons became unstable. Both the cranes and the bridge deck toppled over, destroying two shops and two houses on the eastern bank of the Oude Rijn. A number of other buildings were also damaged. Given the enormous havoc, it was expected that there could very well be up to twenty victims. Miraculously, the only casualty turned out to be a dog.

The key decision-making topics the emergency response organisation had to deal with are listed in the Annex. Whether or not the heap of rubble was sufficiently stable, despite of the apparent movement of the pontoons, was one of the key issues in codifying the information sharing process to support distributed decision making.

Figure 17 depicts the information exchange between the front line and the remote response network relating to evacuation and the release of addresses during the first 24 hours of the response operation. During the first few hours, the frontline commanders struggled to assess the stability of the heap of rubble. During that period the frontline commanders communicated factual information about the four addresses that had been directly hit by the fallen cranes, as well as the 35 other properties that were evacuated for safety reasons. In Figure 17 this factual information exchange is shown by thin arrows. The frontline commander recalled that he received a phone call around 10.00 pm from the tactical-level commander, who asked why it was not possible to declare some of the evacuated addresses safe. The frontline commander replied: *We just do not know. Have some confidence that we deploy people to investigate the situation, but we do not know yet and we cannot be faster than we are now.* This conversation between the frontline commander and the tactical commander – indicated in Figure 17 by the first bold arrow – can be characterised as an information exchange at the implications level: the frontline officer asked for attention to be paid to the safety of the people being evacuated and the tactical officer sought to minimise the disruption to daily life.

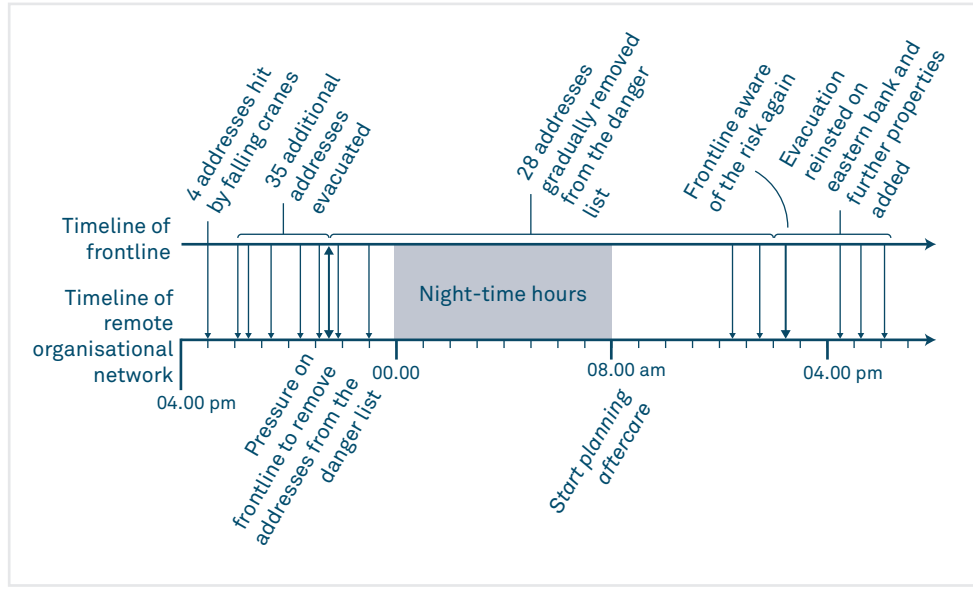


Figure 17 – Information exchange on the evacuation of addresses and the removal of addresses from the danger list

Later in the evening some of the addresses were declared safe and the residents were able to return to their homes. By noon the next day 28 of the properties initially evacuated had been declared safe. At that point, the frontline commander who had been working at the scene the previous evening was called back to the front line. He found a situation in which the uncertainty over the mechanical stability of the heap of rubble was actually no less than it had been the evening before, even though a substantial number of houses had been declared safe in the meantime. He immediately decided to

re-evacuate the inhabitants of those houses. In an interview he recalled: *... really, my basic thought was: how is that possible? That is not possible! It is still unstable! It is still moving! The stability has not been calculated at all... How could they do this?* Another frontline fire officer recounted in an interview *that the quay joist hung on just four screws – tiles [of the pavement] had come upwards.* The first re-evacuation was registered in the common operational picture as: *CHANGE: <address> is being evacuated because of instability of pontoon*. In Figure 17 this information exchange is indicated by the second bold arrow. The first part of the sentence provides factual information with respect to evacuation of an address. The second part of the sentence conveys implications-level information about the reason for the evacuation.

After the initial phase of hectic activity, the emergence response organisation was faced with the issue of how to deal with an apparently unstable heap of rubble. A delicate assessment had to be made as to whether to accept the risk of further collapse or whether to continue evacuating houses. The frontline commander reflected on this dilemma: *I don't argue that the administrative reality is a reality; it is very true! Weighing up whether an area has to be evacuated or not... I understand it very well! The thing is, perspectives have to be brought together. Sharing information in the LCMS, in information systems and in netcentric collaboration environments is not only about factual information. That is where netcentric collaboration fails. It is about common intention, common interests, however you want to look at it. [...] Here I was bothered by the tactical team because I had been saying, you know, don't ask me to speed up, don't push me to work harder and better, because I'm really doing as much as I can. Help me above all by asking where you can support me, what [our information] really means, and what interpretation can be attached to it!* This reflection underlines the differences in interpretations – in terms of implications – between those at the front line and those in the remote response network. The common operational picture did not provide sufficient support to those who had to decide between ensuring safety and minimising disruption to daily life. It seemed impossible to codify the complexity and uncertainty of the situation in the common operational picture, and thereby span the boundary between the front line and the remote response network.

5.5 Analysis

Our analysis indicates that information codified in the common operational picture is mostly *factual information* about the developing situation. By factual information we mean the characteristics of the incident and the actions taken by each of the various response organisations. In general, sharing factual information provides a solid basis for collaborative decision-making. However, in each of the cases we analysed crisis managers faced periods of confusion in which information sharing at the factual level was not sufficient to overcome the collaborative decision-making challenges. The on-scene commander in the collapsed cranes incident stated during the interview: *sharing factual information doesn't always help answer: hey, what does this mean? What does this mean in terms of time and in terms of how bad this is?* Collaborative decision-making often required information exchange at the level of interpretation and/or at the level of implications to provide direction and to bridge the semantic or pragmatic boundary between the front line and the remote response network. Only after that boundary had been bridged could information exchange at the factual level again support the collaborative decision-making process.

If we zoom in on the information exchange between the front line and the remote response network, we see that not all frontline information can be codified in time to be of use. On the front line, rapid decision-making takes place on the basis of pattern recognition, which is hard to convey. The on-scene commander in the gas explosion incident said during the interview: *the speed of decision-making at the operational level and at the tactical level is not always the same. At the tactical level it always takes more time to complete the decision-making, while at the operational level you often see the need to speed things up.* The quick decisions to evacuate immediately after the cranes had collapsed are examples of this. These decisions were based on an overall impression of the local situation, including the structure of the heap of rubble, the layout and nature of the built-up area, the apparent tension in the cables of the cranes, and the fact that they were attached to the quay. On several occasions the dynamics of the situation and the uncertainty made it difficult to codify the situation in real time. An example of this is the rapid decision to abort the forensic investigation immediately after it became known that a bomb threat might have been issued against De Ridderhof.

In all of our cases, we saw that task differentiation results in the variable disjunction of information, which leads to different sensemaking accounts (Turner, 1976). Even if teams find other ways to express and exchange their perspectives, and share their views on what implications their actions may have for their interests, differences in sensemaking emerge. In other words, if different actors or teams are taking different actions in different contexts (e.g., on-scene vs. remote), the perceived relevance and meaning of the facts may also differ (Barton et al., 2015). An example of this is the frontline decision not to resume the forensic investigation until after an explosives scout had established that there were no signs of any explosive devices, even though the remote response network had already deemed it to be safe. This also complicates the flow of information, codified in the common operational picture, from the remote response network to the front line. In principle, the perspectives of those at the tactical and strategic level of the emergency response organisation – who are typically remote from the location of the incident – provide relevant context for those at the front line. The on-scene commander in the gas explosion incident called this *bringing the outside world in*. If those in the remote response network do not have a rich and up-to-date view of the situation at the scene and of the dilemmas being faced at the front line, it is difficult for them to make appropriate decisions about what information about the broader context of the incident will be relevant to the frontline responders.

5.6 Discussion and conclusions

In this chapter we asked the question: *how does information sharing in a crisis management operation contribute to collaborative decision-making between the front line and the remote response network?* Our qualitative analysis of the collaborative decision-making processes during three large emergency response operations in the Netherlands has increased our understanding of different levels of information sharing during a crisis. We found that the information codified in a common operational picture to support distributed decision-making was predominantly factual. At the time when the three cases in our study took place, those involved were gaining experience of collaborating on the basis of a new information management doctrine. The tactical officer in charge of all three cases explained that their growing understanding of how to work with this netcentric operations doctrine helped to mitigate the variable disjunction of information and contributed directly to the coherence of the emergency response. In many academic discussions, however, the warehousing philosophy of information sharing, in which factual information is conveyed, has been presented too categorically as an enabler of transboundary decision-making (Cinque, Esposito, Fiorentino, Carrasco, & Matarese, 2015; Copeland, 2008; DeMarco, 2016). Our analysis shows that, in particular, the differences between the decision-making dynamic of the front line and the remote response network cannot be bridged completely by sharing factual information. The information acquired by the front line, as well as the uncertainty inherent in that information, cannot always be codified in time or in sufficient detail to provide the remote response network with input for tactical and strategic level decision-making (Barton et al., 2015). As a result, especially in dynamic and chaotic circumstances, the front line and the remote response network can easily be operating in two worlds (Rimstad & Sollid, 2015).

A practical implication of our findings is that both the frontline staff and those in the remote response network should be aware of the different levels of information sharing and should be hesitant about relying too quickly or too extensively on sharing factual information via a technical platform. In order to stimulate tactical and strategic sensemaking, it may take deliberate acts of sense-giving, sense-demanding and sense-breaking to advance understanding (Vlaar, Fenema, & Tiwari, 2008). Although information-sharing platforms certainly do play a role in reducing the variable disjunction of information at the level of factual information (Turner, 1976), richer forms of information sharing are needed to bridge semantic and pragmatic boundaries. Establishing direct radio links and telephone and video connections might be useful to provide a platform to share concerns that are more implicit, more complex, and that have hitherto been tacit. Indeed, Barton and Sutcliffe (2009) stress the importance of voicing concerns that may emerge in a collaborative effort in order to overcome dysfunctional momentum in the collaborative process.

Our findings complement the work of Wolbers and Boersma (2013), who argue that a common operational picture should be regarded as a trading zone rather than an information warehouse used in the exchange of factual information. While their study focused predominantly on the level of interpretations, we extend this discussion by adding the level of interest into the information-sharing process. Building on the conceptualisation of information exchange made by Carlile (2004), our study indicates that, in the trading zone, actors are not only having to negotiate regarding the different meanings but also need to negotiate regarding the different implications that a particular piece of information, and any collaborative decisions taken in response to it, may have for their own functioning or the functioning of others. Particularly in parts of the emergency response organisation where there is ample time to gather and transfer information and where careful thought can be given to how information is translated and transformed, the integrative framework proposed by Carlile (2004) for managing information can be readily applied.

A practical implication of this insight is that stagnation in the collaborative decision-making process may be overcome by deliberately shifting the focus to the interpretation or implications level of information exchange. The emergency response organisation should be very precise in terms of how it uses terminology. Lack of clarity over terms may be indicative of a misunderstanding between organisations, and time may be required to reach agreement on the interpretation. More complex negotiation of interests is needed at the implications level to develop creative and transboundary problem solving (Leonard-Barton, 1995). The development of multidisciplinary scenarios may be necessary in such cases to provide the insights needed. Overall, the information-sharing infrastructure provides sufficient support for sharing factual information and engaging in rule-based decision-making. However, to support more transboundary collaborative decision-making, which requires more extensive deliberation of dilemmas and insight into the perspectives of other actors, additional methods of information sharing are likely to be required to overcome the semantic and pragmatic boundaries that are in place.

Annex I – Coding structures

Table 12 provides the code structure for the gas explosion case. The GMS registration consisted of 205 entries. For technical reasons, in this particular case there were no LCMS data available for analysis, but the LCMS did not play a very significant role in the Hollands-Midden safety region by that time, either. The on-scene command team did not even have access to the system. The decision-making process was based mainly on spoken accounts from team members, and was captured in periodic meeting reports, and decision lists were a more important source of information. A seven-page decision list was available to complement the emergency centre registration. This decision list summarised the decisions taken by the team in charge of the tactical coordination.

Table 12 – Coding structure for the gas explosion case

Key decision-making topics	Codes
Access restriction	Crime scene; CS; access control; raising of the barrier
Asbestos	Asbestos
Emergency accommodation	De Bron; Troubadourweg; Limeshal; Kees Musterstraat [details of accommodation]
Activation of municipal crisis organisation	Municipality
Return of residents	House; release of building; apartment; utilities [energy, gas, electricity]
Victim list	1000 [code for deceased person]; victim; deceased; wounded
Stability of the apartment building	Stability; construction of building; structural condition; danger of collapse

Table 13 provides the coding structure for the mall shooting case. The GMS registration consisted of 39 pages and the registration exported from the LCMS consisted of 506 pages. The registrations contained 865 and 468 entries respectively.

Table 13 – Coding structure for the mall shooting case

Key decision-making topics	Codes
Public sentiments	Horror; bad news coverage; outrage; empathy; hearsay; rumours; sick minds; dismay; disrespect; understanding; speechless; compliment; amazement; disbelief; homage; criticism
Victim list	Number of casualties; victim overview; registration of casualties; triage category; identification/identity of casualties; information about hospitalised victims
Target groups	Victims; relatives; shopkeepers; neighbourhood residents; schools; general public
Harmonisation of crisis communication	Information number; calling
Emergency accommodation	Emergency accommodation; emergency care; De Bron; Limeshal; police station; 30 [code for police station]
Multidisciplinary organisation	Unit status; substitution; logistics; allocation of tasks and responsibilities; lines of command
Foreign affairs	Foreign countries; international; Syrian [the ethnic background of one of the victims]
Safety and security	Crime scene; safety and security of emergency workers; safety and security of bystanders and general public; precautionary measures
Transition to normalised situation	Prognosis; hand-over to project organisation; aftercare
Psychosocial support	Psychosocial support to emergency workers; psychosocial support to others involved; fire service mental support team
Disaster tourism	Disaster tourism
Looking after properties	Real estate; goods left behind in the rush to leave

Table 14 provides the coding structure for the collapsed cranes case. The GMS registration consisted of 24 pages and the registration exported from the LCMS consisted of 1,240 pages. The registrations contained 540 and 510 entries respectively.

Table 14 – Coding structure for the collapsed cranes case

Key decision-making topics	Codes
Status of the various addresses	Street names; address; house; shop; building; utilities [gas, electricity]
Movement of pontoons	Stable; stability; movement; buckling of the quay
Victim list	Victims; wounded; persons; victim information system
Emergency accommodation	Emergency accommodation; location indicators (Chinese restaurant; restaurant "De Meiden"; Tulip Inn; Avifauna; Goede Herderkerk [Good Shepherd Church]; Schiphol); persons
Communication	Communication; message; informing; meeting; press; media
Access restriction	Crime scene; emergency regulation; investigation; investigation agencies; access control; blocked
Transition to normalised situation	Aftercare; follow-up phase; project; scaling down

Annex II – Visualisations of the multidisciplinary themes of the three cases

In this annex we provide some more insight into the data used. We analysed three incidents: a gas explosion, a mall shooting and a collapse of cranes. One of the primary data sources for each of the cases was the emergency centre registration and data exported from the LCMS, the crisis management system used in all the safety regions in the Netherlands, which cannot be made publicly available. In order to provide some insight into this data as far as we could, we made a visualisation of it for each of the three cases. These visualisations are all translations of the visual reconstructions of the information-sharing process over time that we used as the main input for the reflective interviews.

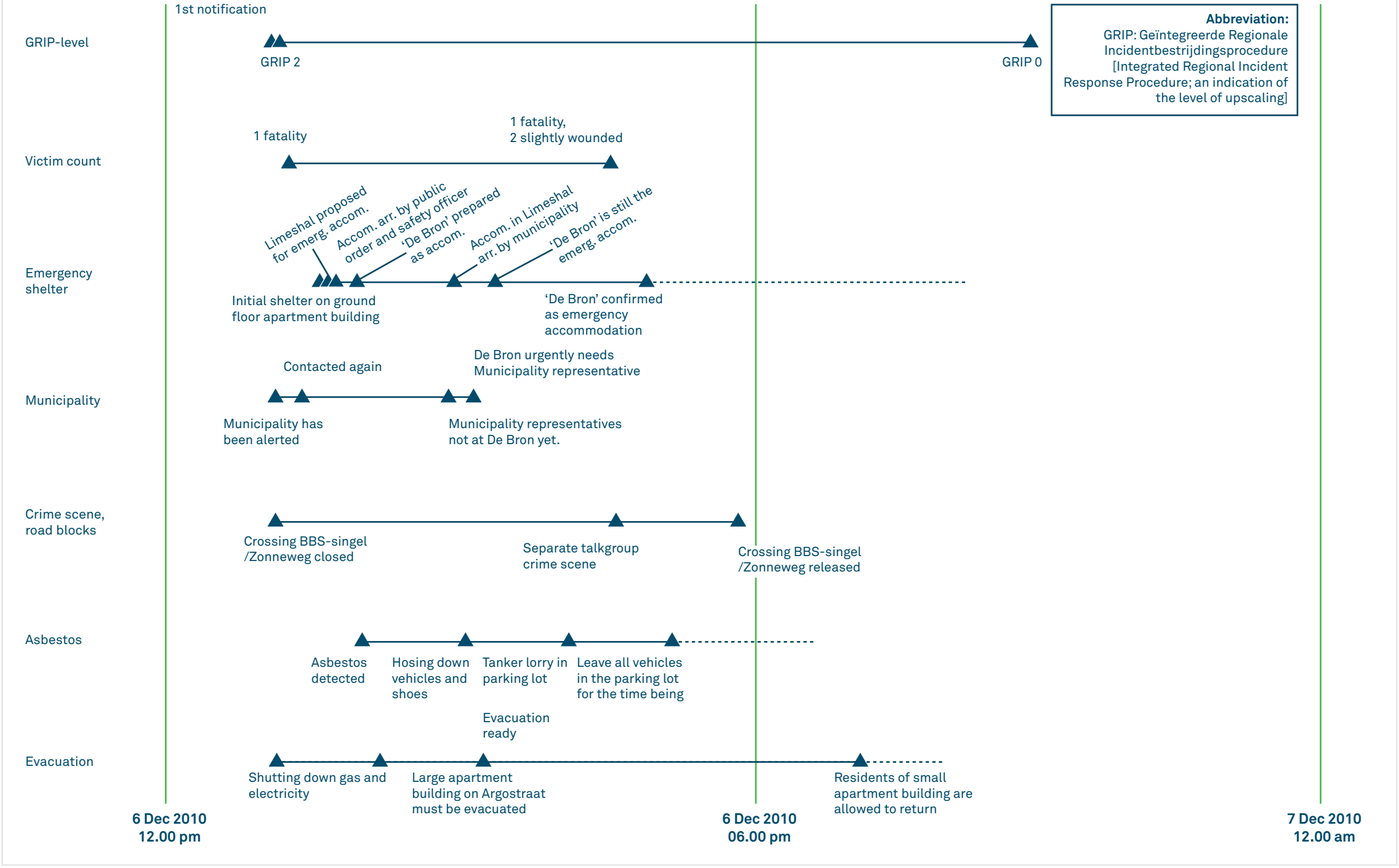


Figure 18 – Reconstruction of the information-sharing process for the gas explosion incident over time

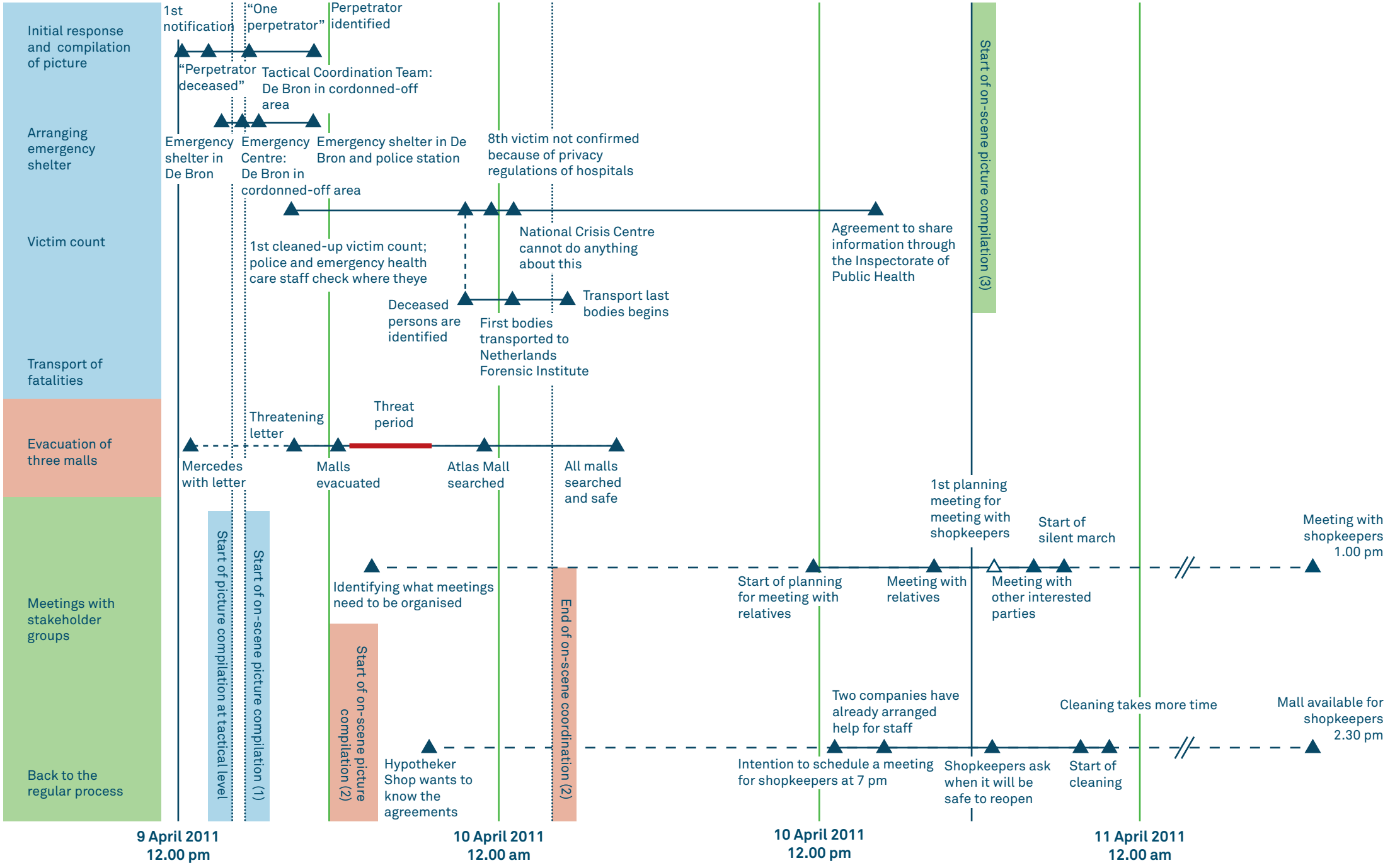


Figure 19 – Reconstruction of the information-sharing process for the mall shooting incident over time

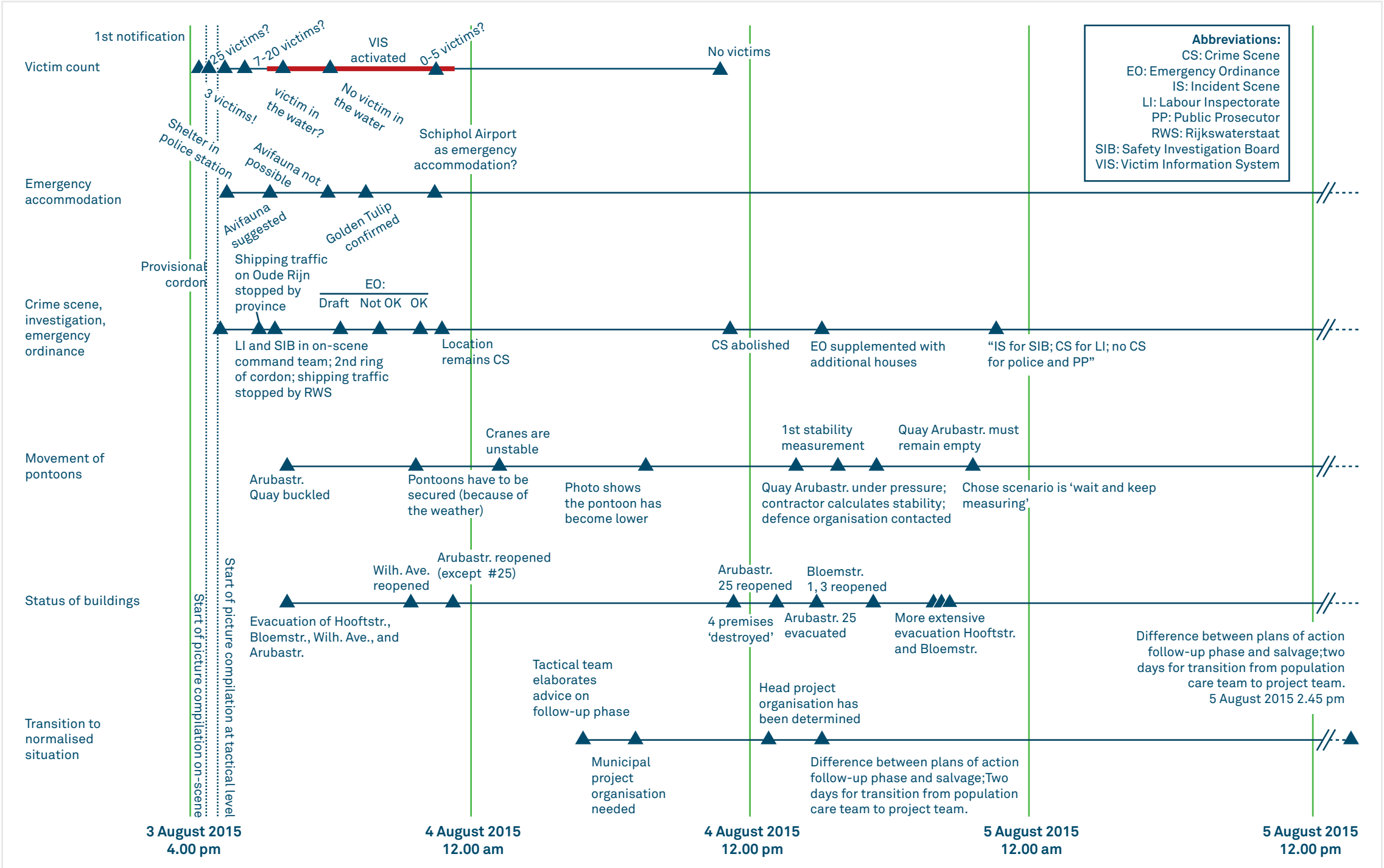


Figure 20 – Reconstruction of the information-sharing process for the collapsing cranes incident over time

6 Collaboration awareness – a necessity in crisis response collaboration[18]

Abstract

In crisis management involvement is required from a large number of organisations. Not only do the first responders need to take action, but so too do organisations and entities such as civil authorities, public utilities and crisis teams as well as the community as a whole. A key condition for effective collaboration is situation awareness. However, several incidents show that situation awareness alone is not sufficient to ensure there is effective collaboration between the organisations involved. Collaboration awareness is a second key element. Knowing the needs, goals, expectations, culture, capabilities and procedures of the other response partners allows organisations to collaborate more effectively. In this chapter we describe the results of our exploratory research focusing on what organisations need to know about each other in order for this to happen. We conclude by discussing various possible ways of increasing collaboration awareness.

18 Based on Treurniet, W., van Buul-Besseling, K., & Wolbers, J. J. (2012). *Collaboration awareness – a necessity in crisis response coordination*. Paper presented at the 9th International ISCRAM Conference, Vancouver, Canada.

6.1 Introduction

A lot of effort has already been invested and continues to be invested in achieving shared awareness and understanding of the situation between the many organisations often involved in collaboration in an emergency response network. In the previous chapters I added to this body of knowledge by focusing on the common operational picture as a means of sharing views on the situation throughout an organisational emergency response network. In Chapter 3 I argued that the common operational picture implicitly also provides a view on the emergency response network, because the emergency situation and the emergency response network are a reflection of each other. For emergency response collaboration to be effective, more explicit information exchange is needed about the organisations involved in the response. A common operational picture and the shared situation awareness it contributes to are *essential* but not *sufficient* for effective collaboration. In practice, problems can also be caused by a lack of *collaboration awareness*, which we define as having knowledge about the formal and informal structures and ways in which organisations collaboratively do their work and achieve their goals (Oomes, 2004; Van Aart & Oomes, 2008). This definition includes organisational interdependencies, which can be very determinative for the effectivity of a collaboration (Thompson, 2003).

In this chapter, I supplement the focus so far on shared situational awareness as the *raison d'être* of the common operational picture, with a focus on collaboration awareness. I expand and integrate our own exploratory work, published as Treurniet et al. (2012), with some other scientific insights, and the contribution this chapter provides is primarily a conceptual and theoretical one. I specifically strengthen our previous work with insights on the importance of trust in emergency response collaboration (Das & Teng, 1998, 2001; Hayes, 2007) and on how collaboration awareness helps to build trust in an occasional collaboration (T. E. Beck & Plowman, 2014; Meyerson, Weick, & Kramer, 1996; Quinn & Worline, 2008).

Let us first look at some examples in which lack of collaboration awareness came into play. In October 2005 there was a fire in a detention centre at Schiphol Airport in the Netherlands. Eleven people were killed and fifteen were injured. The subsequent evaluation (Dutch Safety Board, 2006) revealed that the coordination between the fire department and the detention centre had been inadequate. The emergency services of the detention centre were not aware of the fact that it was not possible for the fire services to be at the incident location and ready for deployment less than fifteen minutes after the initial alarm. Another example is given by Schakel and Wolbers (2019). They describe a police chase that took place in the Netherlands in 2016. Because the chase crosses several police regions, a number of different regional police organisations were involved, as the central police unit whose remit was national. At one point in the operation, an operator in the emergency room of one of the police regions concluded from the type of a police car he saw on camera images of the chase that the central police unit was directly involved. Until then the

operator had not been aware of this collaboration partner. In this case the lack of collaboration awareness fortunately did not lead to more serious problems than inadequacy of coordination[19].

In the next two sections I give a more in-depth exploration of the concept of collaboration awareness. I explore it from a theoretical perspective and I also draw on incident evaluation reports, and workshops and interviews with practitioners. Subsequently, I suggest various support measures that might enhance the level of collaboration awareness in a networked organisation. I conclude by making some suggestions for further research.

6.2 Collaboration awareness in theory

Why is it important for emergency response organisations to have a view on the rest of the emergency response network? In answering this question my starting point is that organisations engage in a networked collaboration because they are reciprocally dependent in their effort to tackle a common problem, pursue a common goal, or make joint use of resources (Klijn & Koppenjan, 2016; Thompson, 2003). Organisations depend on each other's expertise to coordinate tasks but have little authority and control over the actions of other organisations (Kapucu et al., 2010; Provan et al., 2007). The reciprocal interdependence of emergency response organisations places high demands on the coherence of the organisational network (Weick, 2005). Reciprocal interdependence is the most comprehensive and demanding type of interdependence as it includes the other two types traditionally distinguished: pooled interdependence and sequential interdependence Thompson (2003). This reciprocal dependence becomes even more important because the risks, stakes and interests involved in the collaboration are high, to the point of being often a matter of life and death. Trust, defined as *the degree to which the trustor holds a positive attitude toward the trustee's goodwill and reliability in a risky exchange situation* (Das & Teng, 1998, p. 494), and awareness of reciprocal dependence are important conditions for effective collaboration (Das & Teng, 1998, 2001; Hayes, 2007). It is important that the organisations collaborating in an emergency response network are able to have mutual trust in each other.

Unfortunately, in an occasional network, which an emergency response network is, trust is not always a given. It typically takes time to build, and the time-critical nature of a crisis often does not allow this. Various scholars have shown, however, that it is sometimes possible to build trust quickly in occasional networks (T. E. Beck & Plowman, 2014; Meyerson et al., 1996; Quinn & Worline, 2008). Meyerson et al. (1996) started to use the term *swift trust* to denote this means of managing the vulnerability, uncertainty and risk inherent in these occasional collaborative situations. Swift trust is not to be confused with blind trust. The *generic* notion that organisations are dependent on each other in all the vulnerabilities, uncertainties and risks inherent in an emergency speeds up the building of trust, but swift trust still relates to *concrete* and *specific* collaboration partners. Several scholars show that being aware of each other's roles, personnel, characteristics, capabilities, expertise, practices and procedures – in other words, having collaboration awareness – helps to build trust in an occasional collaboration and by so doing improves the collaboration (T. E. Beck & Plowman, 2014; Curnin, Owen, Paton, Trist, & Parsons, 2015; Hyllengren et al., 2011).

What options do we have for improving collaboration awareness? Van Aart and Oomes (2008) state that the concept of collaboration awareness encompasses everything that constitutes useful knowledge for enabling the synchronised joint actions within a networked organisation to run efficiently and effectively. This means not only monitoring the formal structure and procedures but also showing the informal communication and coordination patterns and allowing the individual members of the organisation to adapt their view on the collaboration to their own particular needs. In other words, collaboration awareness is a necessary condition for coordination, the process of interaction that integrates a collective set of interdependent tasks (Okhuysen & Bechky, 2009). According to Okhuysen and Bechky (2009), studies have identified three integrating conditions for successful coordination: accountability, predictability and common understanding. We use these conditions to further clarify the relationship between coordination and collaboration awareness.

Accountability is about who is responsible for specific elements of the collaborative response effort. When a power outage occurs, for example, the organisation responsible for management of electricity infrastructure is also responsible for managing a power failure. At a more detailed level, there can be parts of the organisation that have similar capabilities, such as two fire platoons. Different tasks can be assigned to each of the platoons. It is important to state the division of responsibilities explicitly to allow an efficient allocation of tasks. In Chapter 1 I mentioned a gas failure incident in Velsen-North in the Netherlands (Inspectorate of Safety and Justice, 2016). In response to this incident the safety region formed a crisis team without giving enough consideration to the responsibilities of the gas supplier or taking into account sufficiently the responsive actions that would immediately be initiated by this organisation. This is a practical example of insufficient collaboration awareness in terms of accountability.

Predictability, the second condition for successful coordination, is about the breakdown of work, the duration and interdependencies between different elements of the task, which enables the various organisations to anticipate on what others will contribute to the task. Predictability enables interdependent parties to anticipate subsequent task-related activity, because they know what the elements of the task are and when they should happen. In the previous section I mentioned the fire at a detention centre at Schiphol Airport. The emergency services at the centre significantly

19 Van Lakerveld and Wolbers (2020) give many more examples of situations in which lack of collaboration awareness caused problems, led to inefficiency or to uncoordinated action, or could easily have done so.

underestimated the time that the fire department would take to arrive, which led to unfortunate decisions and responsive actions. This is a practical example of insufficient collaboration awareness from the perspective of predictability.

Common understanding, the third condition for successful coordination, provides a shared perspective on the whole task and on how individuals' work fits within it. In a crisis response operation the common operational picture contributes to this but so do the interests and priorities of the organisations involved. Common understanding also includes the scoping of the crisis response organisation, given the size, nature and likely effects of the incident. Which of the vital interests are threatened and which are the organisations responsible? The incident of the collapsed cranes, which I used several times as a research case in the previous chapters, provides an example of insufficient collaboration awareness in terms of common understanding. The incident itself and the responsive measures taken by the organisations involved in the emergency response had a significant impact on water levels in the Oude Rijn and its hinterland. Although the water board was responsible for these water levels, it was not actively involved in the decision-making process with respect to the responsive measures and their duration. The organisations that were actually involved in decision-making appeared not to have had enough of an eye to the interests of those likely to be affected by changes to the water levels and did not consider the harmful effects that such changes could have.

6.3 Elaboration of the concept of collaboration awareness

In the previous section I asked what options we have to improve collaboration awareness and we looked for an answer in the scientific literature on coordination. In addition, we studied evaluations of safety incidents, and we conducted workshops and interviews with practitioners to further elaborate and make the scientific insights on collaboration awareness concrete with an indication of what we need to know about the organisations we are collaborating with and thus what information should be shared. Table 15 gives an indication of relevant aspects of collaboration awareness with respect to each of the three abovementioned conditions for successful coordination: accountability, predictability and common understanding.

Table 15 – Examples of information needs related to collaboration awareness

Elaboration of conditions		Examples of relevant aspects
Accountability		
›	**Roles**	tasks
›	**Responsibilities**	mandate, commitment, conditions (what is allowed and what not?)
Predictability		
›	**Organisational structure**	command structures, size, span of control
›	**Dependencies**	on whom and on what?
›	**Capabilities**	bottlenecks, personnel, material, network, sustainability
›	**Method**	coordination needs, decision-making processes, ways of working, procedures, tactics
›	**Planning**	ordering of activities, interdependencies of tasks
›	**Actual status**	activities, availability, location, operational information progress, workload
›	**Communication**	points of contact, communication means and modalities, semantics, coordination times, meeting times
Common understanding		
›	**Vision/mission**	ambitions, goals, success/failure factors
›	**Interests**	priorities, personal interests, hidden agendas
›	**Expectations**	with respect to collaboration and to progress of work
›	**Culture**	backgrounds, values, perceptions, jargon
›	**Social aspects**	willingness or motivation to collaborate, knowledge of each others, mutual trust, personalities

To gain more insight into when and how collaboration awareness can be improved we next add some more structure to the inventory provided in Table 15. We do this by mapping the items in that inventory on a two-dimensional plane. The first dimension of the plane is derived from the the distinction made in the coordination debate between planned and emergent action (Okhuysen & Bechky, 2009). Collaboration awareness can be improved by taking preparatory measures in the planning phase before the actual collaboration begins. Collaboration awareness can also be improved in situ, i.e., during the collaboration. Both categories of measures are needed and must be in balance with each other. Collaboration awareness in connection with *occasional* collaboration cannot be fully established up front because each collaboration is different in terms of the

organisations involved and the coordination structures needed. On the other hand, it is very difficult to establish an adequate level of collaboration awareness in situ if no preparatory measures have been taken at all.

The second dimension of the plane that is used to add more structure to the inventory of possible elements to consider in relation to collaboration awareness is derived from the distinction made in the coordination debate between explicit and implicit coordination (Espinosa, Lerch, & Kraut, 2004; Rico, Sánchez-Manzanares, Gil, & Gibson, 2008). Explicit coordination mechanisms are defined by Espinosa et al. (2004, p. 6) as *those mechanisms explicitly employed by a team for the purpose of managing task dependencies.* Examples of explicit coordination mechanisms are task organisation activities and team communication. Implicit coordination mechanisms are defined by Espinosa et al. (2004) as those based on shared situational awareness. If collaborating organisations have a sufficient level of shared situational awareness, the activities can be coordinated to a certain extent without dividing up the work explicitly and without explicit communication on how the work should be aligned. People working together on a task in the same location can, for example, see directly what others are doing and can if necessary adjust their own work without communicating explicitly regarding that realignment.

Both of these dimensions are depicted in Figure 21. The horizontal axis relates to whether coordination can be arranged up front or whether it is to be done in situ. The vertical axis relates to the awareness that the actors have of the coordination processes. Relating the concept of collaboration awareness and the elements listed in Table 15 to these coordination dimensions helps in identifying what kind of information is used and what might be necessary to increase the level of collaboration awareness.

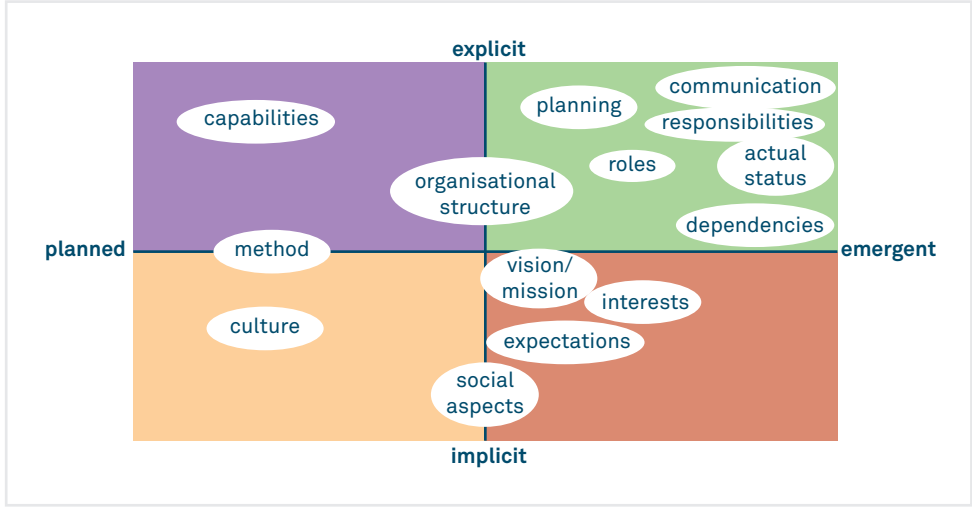


Figure 21 – Types of information needed collaboration awareness

6.4 Developing collaboration awareness support

To share information of the various kinds shown in the four quadrants, certain specific methods may be most appropriate (see Figure 22). The information needs in the upper-left quadrant can typically be supported with action plans set out in written documents. Examples include the administrative network maps that have been developed in the Netherlands for several types of crisis (Ten Dam, 2018). Each of these maps gives an overview of the formal relationships between administrative organisations and indicates which organisation is responsible for which domain and for taking what types of measures.

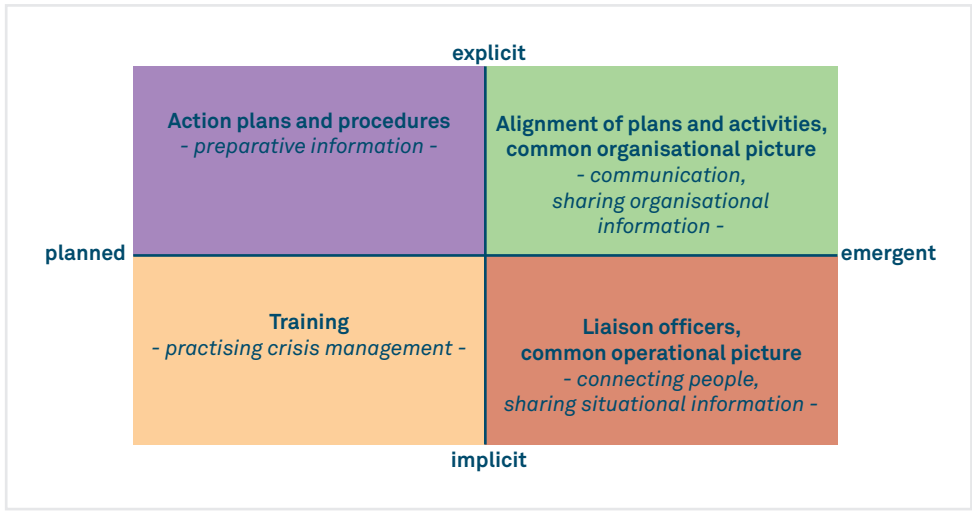


Figure 22 – Methods for enhancing collaboration awareness

In the upper-right quadrant, information systems can typically be used to share dynamic information on the organisations and teams involved in a collaborative operation. This may be information about actual or intended plans to enable the alignment of activities. It could also be a visual depiction of the overall response network, the availability and status of the organisations involved, contact details, the interrelationships between the organisations involved, the lines of command and the lines of communication (Oomes, 2004; Van Aart & Oomes, 2008).

In the lower-left quadrant, collaboration in a training setting is an invaluable way of maintaining the level of collaboration awareness. Training sessions can be used to help specific collaboration partners become familiar with one another and to help maintain that familiarity, but it can also be used to develop a willingness to collaborate and to make organisations and teams aware of the importance of swift trust (Meyerson et al., 1996) and how to establish it.

For the information needs featured in the lower-right quadrant there are several possible measures. Maintaining and sharing a common operational picture is one of them, as it is instrumental in developing shared situational awareness and also provides insight into involvement, plans and actions of other teams and organisations. Even if the involvement, plans and actions of the organisations and teams involved in the collaboration are not explicitly part of the common operational picture, some indications of these can often be inferred anyway from the information displayed about the situation and from the responsive measures taken. Another helpful measure is exchange of officers. Liaison officers are often exchanged between collaborating teams that are not based in the same location. They serve as boundary spanners, and because they are involved in the processes of the team to which they are assigned, the activities of this team can be aligned on the fly with the activities of a liaison officer's own organisation with a minimum of explicit inter-team communication and coordination (Curnin, Owen, Paton, & Brooks, 2015; Power, 2018).

6.5 Conclusion

This chapter emphasises and illustrates collaboration awareness as a necessary condition for effective and efficient coordination of emergency response. Real-life incident reports were used to illustrate the consequences of not having collaboration awareness. The concept of collaboration was also discussed in relation to three conditions for successful coordination (accountability, predictability and common understanding) to outline what organisations should know about each other as a minimum in order to collaborate effectively. Additionally some typical measures to enhance the level of collaboration awareness were suggested.

Our findings in this study were that collaboration awareness in organisational emergency response networks can ultimately only be brought to a sufficient level *during* the emergency response operation. The composition of the emergency response network is always specific in the sense that it is tailored to the nature and extent of the emergency. This implies that it is not feasible to be familiar with all the organisations or even all the individual representatives of organisations that one might have to work with at some point. It is therefore important for organisations with a role in emergency response to develop a willingness to collaborate that can be applied in any collaborative relationship it may face. During the emergency response collaboration, information sharing through the common operational picture provides a valuable means of developing swift trust. In addition, exchanging explicit information about the organisations involved in the emergency response has an even greater effect in terms of facilitating collaboration.

This chapter is based on some exploratory work and there is much room for follow-on research. A possible next step would be to focus in more detail on the concept of collaboration awareness. The factors we identified in relation to the three integrating conditions for successful coordination, as shown in Table 15, were based on analysis of a limited number of incident evaluations and a relatively small number of workshops and interviews with practitioners. This inventory needs to be validated, strengthened and broadened.

In addition to strengthening the theory-building on collaboration awareness, further work needs to be done to assess the effectiveness of the suggested support measures. This applies particularly to the explicit, in-situ collaboration awareness measures indicated in the upper-right quadrant of Figure 22. What information about the organisations and teams involved, including their plans and activities, might be most valuable in terms of supporting the collaboration and how should this information be disclosed and visualised?

7 Conclusions

This chapter starts with an overview of the main conclusions of our research. I then discuss what scientific and practical implications these findings have for how the common operational picture supports an organisational emergency response network. The chapter concludes with some suggestions for future research.

7.1 Summary of the research

The thread that runs through the thesis is how and to what extent a common operational picture can support an emergency response network in mitigating and coping with three challenges: the composition of the organisational network making the cooperative effort, the interaction between that network and the broader community, and the coordination between the front line and the remote parts of the response network. Making sense of the situation is an important condition for being able to tackle these three challenges. I conceptualised the common operational picture as an enabler of this sensemaking process and, more specifically, as the stored information that results from the retention part of the collaborative sensemaking processes of the organisations involved in the emergency response (denoted by the small coloured barrels in Figure 23).

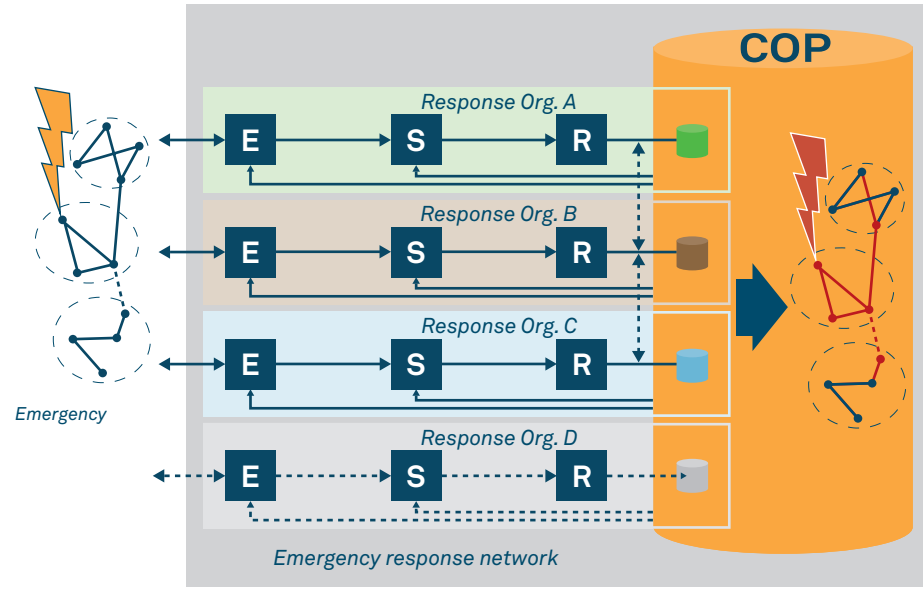


Figure 23 – Pictorial summary of the main findings

In Chapter 3 I zoomed in on the challenge of determining the extent and composition of the organisational network responding to an emergency. I studied several emergency response cases because I wanted to find out how the emergency and the emergency response activities mutually interact. I did this to advance our understanding of how to shape and configure an emergency response that is trustworthy, decisive and fit for purpose.

I found that the community impact of an emergency – rather than the initial cause – can be used as a starting point for deciding which organisations and community networks to involve in the emergency response process. An emergency can be seen as a failure rippling through a constellation of community networks (denoted by the lightning bolt striking the interconnected networks on the left-hand side of Figure 23). The organisations and agencies responsible for the functioning of those networks under normal circumstances are still responsible for limiting and reducing degradation of the networks as a result of an emergency. The authorities and public agencies are responsible for dealing with very acute risks to community safety and for ensuring that the organisations responsible for failing systems and networks take their responsibilities seriously.

I found that the emergency situation and the emergency response network mutually shape each other and are a reflection of one another. Failing to detect or ignoring ripple effects shapes the scope of the emergency and the response to it differently. My findings support the idea that the shaping of the emergency response network in a way *enacts* (Weick, 1979) the emergency. In Figure 23, the congruence between the emergency-stricken community networks and the emergency response network is shown by the fact that each of the community networks affected is paired with a particular response organisation.

Developing a causal network of the emergency and its consequences helps in determining what organisations to involve in the emergency response. This is shown in Figure 23 by a representation of the perceived causal network in the common operational picture. In my thesis I have shown how this perceived causal network can be derived from the way in which the situation is perceived by the organisations involved in the emergency response – denoted by the coloured barrels. Determining the causal network is typically done through a continuous and iterative process of collaborative framing, elaboration, questioning and reframing (Klein et al., 2010). If the common operational picture includes a causal network of the emergency and its consequences, and given the fact that the emergency situation and the emergency response network are reflections of one another, the shaping of the emergency response organisation can be driven by the common operational picture. It is therefore important that all the organisations involved contribute to it. When this happens, the common operational picture becomes a representation of the emergency and expresses what is known about the emergency and its extent. It indicates which community networks are affected by the emergency or by the responsive actions, and thus it also gives an indication of which organisations to involve in the emergency response network. The process of charting the relevant societal impact of the emergency and weighing the potential consequences of actions that might be taken requires the expertise of all the various organisations involved or that may need to be involved.

It is important to emphasise that the findings of Chapter 3 focus primarily on the composition of an emergency response network in *qualitative* terms. I studied which organisations were involved in the response and how their interests and responsibilities related to the nature and the societal consequences of the emergency. I did not study the emergency response network composition in *quantitative* terms in the sense that I did not look at how much capacity of each of the organisations was involved in the response.

In Chapter 4 I examined the interaction between the organisational emergency response network and the broader community. I argued that the professional emergency responders should seek to strike a balance between directive command and control and more empathic coordination and cooperation. By initiating actions and paying heed to the response of the community, the collective of responding organisations seeks to separate out combinations of activities which are sensible, reasonable and helpful from those which are not. This requires adequate interaction between the emergency response network and the community. The way in which people within the community interpret information from the authorities is important for the emergency response organisations so that they can adapt to ongoing developments and match their communication more effectively to the affected communities. In the immediate and acute response to an emergency, a directive approach might be the most effective in dealing with the cause of an emergency and containing the immediate danger. At the same time, crises are embedded in the community, and any direct actions taken, whether long-term or short-term, will affect this complex context. When major crises develop, a more hybrid approach might be more effective. By this, I mean an approach that gives the organisational response network room to respond based on the principles of continuity, coordination and cooperation. This might provide the best balance in terms of the mutual shaping of the emergency response and the citizen experience during crises. The connection I made to the public relations debate may offer emergency response organisations a more extensive repertoire of communication approaches, enabling it to strike this balance.

I found that the planning approach adopted, which then dominates thinking in the emergency response network, seems to be reflected in its crisis communication. Whether the emphasis is on directive command and control or on more empathic coordination and cooperation is reflected in five aspects of communication:

- *Type of language* used in the communication to the public – expressing the main perspective voiced in relation to the emergency;
- *Reading* of the emergency organisation as those within it make sense of the emergency – expressing their understanding and interpretations of the emergency;
- *Disclosure of information* when communicating new developments – expressing the changes over time in terms of how much information is revealed to the public;
- *Connectedness* of the response organisation to the community;
- *Direction* of the response organisation as it engages with the community in shaping the consequences of the emergency.

The common operational picture can be used as the basis for open and empathic communication with the community as long as it is not only direct operational processes that are taken into account but also considerations at the tactical and strategic level. As a crisis can be thought of as essentially a failure rippling down through a constellation of community networks, that crisis is embedded in the community and cannot be seen as a phenomenon to be considered in isolation. Involving the broader community helps to make that community better able to deal with the emergency and also allows it to contribute to the response. My research also shows how openness and empathy towards the broader community can be given shape in crisis communication language.

In Chapter 5 I examined the role of the common operational picture in supporting the collaborative decision-making process. Adequate interaction and information exchange throughout the emergency response network contribute to the coherence of the various response activities. In this interaction, knowledge can be seen to be exchanged at three levels (Figure 24). Sharing of information at the syntactic level, i.e. in terms of facts, provides a solid basis for coordination. If there are lacunae or inconsistencies in the common operational picture, however, this can easily lead to misunderstandings and tensions in the emergency response network. Because of the often fickle dynamics and the societal impact of the emergency, novel differences often come to light and novel dependencies often arise between organisations in the emergency response network.

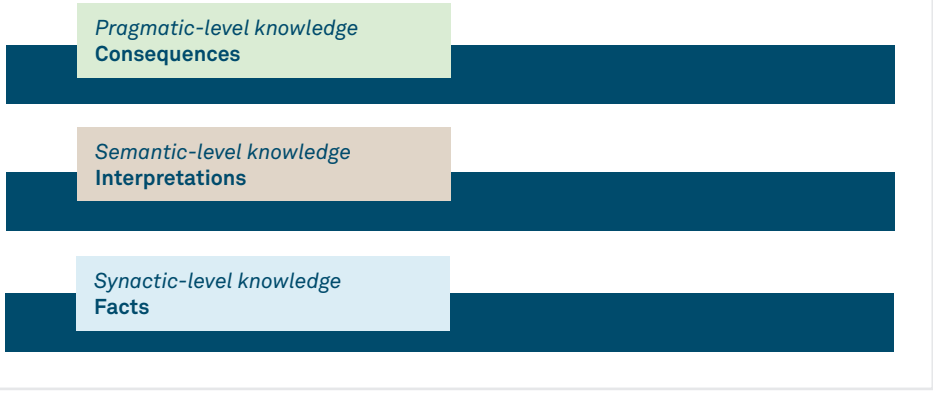


Figure 24 – Knowledge exchange within the emergency response network at three different levels.

In terms of information sharing at the semantic level, i.e. at the level of interpretations, first of all the emergency response organisation needs to be very precise in its use of terminology. Also, at this level information relating to a specific discipline is connected to multidisciplinary coordination themes (i.e., key decision-making topics) in which expectations with respect to the developing situation and intended actions of the responding organisations are shared and combined.

Where there is deep uncertainty or hitherto unknown dynamics or complexities, arranging monodisciplinary information in terms of multidisciplinary themes and straightforward prognoses of the developing situation – as is typically done at a semantic level of information sharing – is not sufficient to coordinate the work. More complex negotiation of interests is needed at the pragmatic level: integrated and shared creative problem-solving across cognitive and functional barriers. In emergency response, multidisciplinary scenarios need to be developed to provide the insights needed and to develop coherent courses of action.

An example of the switching between the three levels of knowledge sharing can be found in the mall shooting incident I studied in Chapter 5. In parallel with the registration of the dead and wounded, several working arrangements were made in order to establish a clear overview of how many people were dead or wounded. These arrangements included a categorisation of the severity of the injuries. Minor injuries were those that could be taken care of by a general practitioner. Major injuries were those for which hospital treatment was necessary. These additional working arrangements relate to *semantic-level* knowledge sharing and they were necessary for the *syntactic-level* registration to complete a meaningful victim overview. Several hours after the initial emergency call, the overview of the dead and wounded was almost complete, except for one key uncertainty. The actual status of several of the wounded victims could not be verified because of privacy regulations to which hospitals must comply. This status information included information about any people who had died as a result of their injuries. To arrive at a final tally of the dead and wounded – and again in parallel with the registration effort – negotiations and transboundary escalations were needed at the *pragmatic level*. In the meantime, despite the registration effort, uncertainty remained over the precise number of dead and wounded. Intervention by the Inspectorate of Public Health – i.e., the supervisory body of the Ministry of Health, Welfare and Sports – was needed to determine the conditions needed to end the period of uncertainty and to pave the way for the necessary sharing of factual (i.e., *syntactic-level*) information.

I also found that a common operational picture is not always adequate in terms of the information exchange between the front line and the remote response network. Especially if those at the front line are experiencing very rapidly changing dynamics, and much uncertainty and complexity, it is challenging for them to codify all the relevant aspects of the situation in real time.

In Chapter 6 I argued that collaboration awareness, in addition to situation awareness, is a necessary condition for emergence response coordination to be effective. By collaboration awareness I mean the state of having knowledge about the formal and informal structures and ways in which organisations collaboratively do their work and achieve their goals. Lack of collaboration awareness often appears to cause problems in emergency response collaboration. These problems include not knowing that specific organisations of teams are involved in the response, overlooking the interests represented by particular organisations, and not knowing how organisations organise their work and how they can be communicated with. The conclusion to be drawn from my research is that collaboration awareness can be improved by working on it in the period beforehand as well as during the actual emergency response collaboration. In both of these phases, collaboration awareness can be fostered through task organisation activities and through explicit exchange of information about the involvement, plans and actions of the organisations and teams involved in the collaboration.

As we also saw in Chapter 3, even if collaboration awareness is not *explicitly* supported by exchanging information about the organisations and teams involved in the collaboration, it is nevertheless often possible to infer information about this from the common operational picture and to deduce from it which organisations are involved in the crisis response.

7.2 The common operational picture as an enabler of emergency response collaboration

What are the lessons learned about how a common operational picture supports the emergency response network? And what are the possible implications of the research documented in this thesis for emergency response practice? In short, the common operational picture ties in with the dominant logic of organisational emergency response networks, namely *fragmentation logic* as opposed to integration logic (Wolbers, 2016). *Coordination during the response operation [...] shows a [...] logic, in which* emergent *adaptations, the negotiation of the relevance of* expert *judgments, and the changing configuration of a multi-organizational response* network *features. This entails that during emergency response operations coordination is not a state of integration that can be achieved, but that coordination efforts are consciously aimed at segmentation to keep sufficient speed in the response operation* (Wolbers, 2016, p. 174).

The common operational picture supports the three approaches to coordination – emergent, expert and network coordination – that are characteristic of the fragmentation logic of organisational emergency response networks. It facilitates *emergent coordination* because all the various organisations involved have their own information domain within it and can use it as a means to synchronise their work. If the common operational picture is more than just an information warehouse, it also facilitates *expertise coordination* because it can make the process of negotiation between experts and between those from different expertise domains meaningful and transparent. The common operational picture facilitates *networked coordination* by connecting organisations, allowing them to share information and to coordinate on this basis. In the following subsections, I will discuss my scientific contribution and the most important practical implications of my findings. As collaboration on the basis of a common operational picture has several pitfalls, these practical implications include the 'ifs and buts' of using this approach. The conceptual underpinning of netcentric collaboration in emergency response depicted in Figure 25 will be used to structure this discussion.

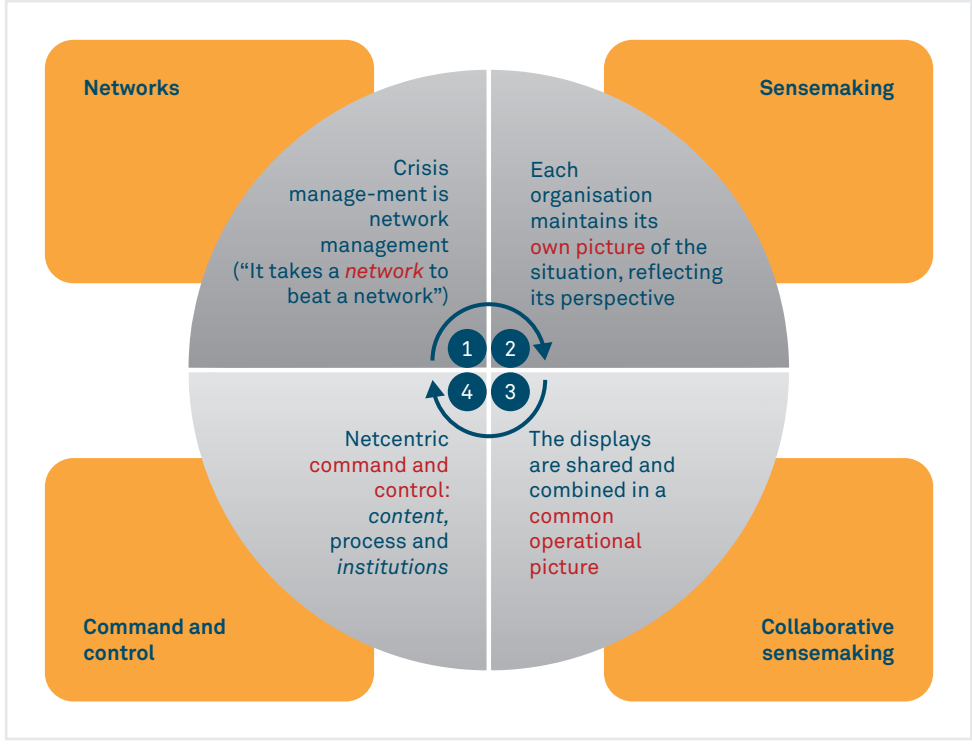


Figure 25 – The conceptual underpinning of netcentric collaboration in emergency response

7.2.1 Crisis management as network management

In Chapter 2 I have argued that crises and emergencies are network phenomena (Figure 25, quadrant 1) that can best be tackled using an organisational network, i.e., an organisational structure where the dominant focus is on emergent dynamics in collaboration and on common goals and mutual dependencies, and where there is less reliance on formal hierarchical structures. In short: crisis management is network management and this is true in two ways. First, a crisis is a network phenomenon that has to dealt with, and second, the crisis response organisation itself is also a network that must be managed.

The common operational picture can be a catalyst for scaling up and shaping the organisational emergency response network. The emergency itself, the common operational picture, and the organisational emergency response network should be seen as reciprocally related. The common operational picture captures how the emergency, including its broader impact on the community, is perceived by the emergency response network. If the common operational picture is only shared within the organisational emergency response network, however, this may easily lead to blind spots. There might be cascading effects on specific critical infrastructures or on specific community functions that can best be identified or foreseen by organisational bodies that are responsible for

these infrastructures or functions but are not (yet) involved in the emergency response network. The common operational picture is therefore best shared not only within the organisational response network but also with other organisations or agencies that have responsibility for infrastructures or services that are not thought as yet as being affected by the emergency. This then enables these organisations and agencies to identify and assess any broader effects that the emergency might have, and might in turn suggest reasons for expanding the emergency response network.

When deciding about whether or not to expand the emergency response network, it is important to realise that the scope and nature of an emergency is dependent to a considerable extent on the choices made by the response network itself. It is up to the network to decide whether or not to see certain forms of societal impact as part of the emergency. Keeping specific societal impacts out of the scope of the emergency – either *explicitly* by deciding not to involve particular organisations in the emergency response or *implicitly* by omitting to involve them – may lead to longer-term consequences that are undesirable and difficult to manage.

So, actively involving the relevant organisations in the emergency response promotes societal continuity. After all, an emergency is an event that impacts the regular societal structures, and these regular structures eventually have to absorb it. The organisational emergency response network exists only temporarily. For this same reason, namely societal continuity, crisis communication should be as open and transparent as is practically and legally possible. Here, the common operational picture can play a valuable role as well. It captures the perspectives of the teams and organisations involved on the emergency situation and can thus serve as a fruitful basis for consistent and up-to-date crisis communication.

In a way the crisis response network can be even seen as extending into the broad community of societal actors. Although the core of the network is formed by professional organisations, the network is not sharply delineated. In many cases groups of volunteers, whether organised or not, are part of the response and can be seen as part of the crisis response network (Schmidt, 2019). Moreover, the broader community, including all its citizens and social networks, is affected by the crisis and as such influences its development. The core of the crisis response network ignores the broad extent of the crisis response network at its peril. Its potential can be enormous and also if it is not treated as part of the crisis response network, it will impact on how the crisis develops in any case. When considering the broader community as part of the crisis response network, it is important to take into account that the strategic orientations (Herranz, 2008) of the different parts of the network may differ. Whereas in the core of the crisis response network active forms of coordination are convenient, coordination with more peripheral parts of the network may be more effective when it is more contingent or reactive in nature (Treurniet et al., 2014).

7.2.2 Common operational picture

In Chapter 2 of this thesis I conceptualised the common operational picture as the *memory* or *precipitation* of the sensemaking process of the organisational emergency response network, including its feedback loops. It is important that the common operational picture should indeed be common and not the product of a data collection and analysis process carried out solely by specialist data and information specialists. Ideally, it should reflect the iterative and collaborative sensemaking process and the different organisations, teams and team members involved in the emergency response should therefore agree with what is recorded in it on their behalf.

I argued that the common operational picture can be seen metaphorically as a two-way, semi-transparent mirror between the emergency situation and the emergency response network, in that it provides a coherent view on both. I also argued that this view needs to be multi-faceted as well as multi-level in order to be effective. Let us elaborate on these two attributes.

The view provided by the common operational picture should be *multi-faceted* in the sense that it is composed of the different perspectives that the collaborating teams and organisations have on the emergency situation – denoted by the coloured barrels in Figure 23. Within the emergency response network, each team needs to maintain its own representation of the situation that reflects the perspectives and responsibilities of that team (Figure 25, quadrant 2). That representation is continually fed by a cyclical process of sensemaking. These different perspectives should be available to all teams and organisations to feed into the sensemaking processes of the organisations involved, as indicated by the feedback loops in Figure 23. However, they are also needed to support the continuous and cyclical *collaborative* sensemaking process of framing, questioning and reframing the emergency (Klein et al., 2010), as represented by the large arrow in Figure 23. The representations maintained by the organisations involved in the response should be widely shared throughout the emergency response network and together constitute the common operational picture (Figure 25, quadrant 3).

In terms of contributing to the common operational picture, this is likely be most effective if the various team each stick closely to their own area of expertise or responsibility, as this will help avoid misunderstandings. It is important that the representation maintained by each team really matches the team's responsibilities and expertise. It is best if individual teams do not try to interpret information or data shared by other teams. Uncertainties or lacunae in the information shared by other teams are best resolved not by trying to fill in the blanks oneself but by giving feedback and asking questions to clarify matters. The other side to this is that ideally a contribution to the common operational picture should be understandable, concise, clearly structured and free of unnecessary jargon. The common operational picture is not an objective entity but is created through a social process involving a wide variety of different actors (Mulder et al., 2016).

Based on the research conducted for this thesis we can say that achieving a truly 'common' operational picture is by no means easy, as it can easily be affected by the one-sidedness, blind spots, presuppositions or prejudices of those organisations contributing to it. It therefore remains very important that organisations should continually question each other critically on this point and should not rely too readily on the information shared by others. The iterative nature of the collaborative sensemaking process and the various feedback loops within it (see also Figure 23) are important to keep the common operational picture closely aligned with reality.

The different perspectives are thus combined and contrasted with one another to identify commonalities and differences and to arrive at a clearer overall perspective on the situation, one which accommodates all the various views and is as accurate as possible. In this way the common operational picture provides a view on the emergency situation, including the equivocalities and uncertainties involved. Which perspectives are relevant – or how multi-faceted the common operational picture should be – is in the end a choice to be made by the organisations in the emergency response network. If the common operational picture accommodates all the various views, it will reflect the scope of the emergency and show what ripple effects or other forms of impact on the community are considered to fall within the remit of the emergency response network. It then provides a view on both the emergency and the response network, and on the interaction between them. The view on the emergency enables the *situation awareness* throughout the response network, while the view on the emergency response network enables the *collaboration awareness* I discussed in Chapter 6.

As reflected in the title of this thesis – between chaos and continuity – the common operational picture serves as the anchor for the emergency response network as a whole as well as for the individual organisations involved in the response. It helps in establishing an orderly response to the chaos of the emergency and in shaping and organising that response so that it can pave the way for the eventual reversion to the regular community structures. There is no quick fix for making that transition from chaos to regular structures. The collaborative sensemaking process, which involves framing, elaborating, questioning and reframing, is an ongoing process that in principle continues for as long as the emergency response collaboration itself.
The view provided by a common operational picture also needs to be *multi-level,* in the sense that it is used to share not only factual information but also higher levels of knowledge. Wolbers and Boersma (2013) have already touched upon this, and my research has zoomed in on these higher levels of knowledge in more detail. Sharing information at the interpretations level or the consequences level is necessary to break through any confusion and tension at the syntactic or semantic level and to coordinate the work throughout the organisational emergency response network.

So, the common operational picture can best be understood as something more than an information warehouse that supports knowledge sharing between organisations at the factual and syntactic level. Tensions or confusions in the collaborative decision-making process may be overcome by deliberately choosing to include higher levels of knowledge exchange. Confusions are often ultimately caused by misunderstandings about the terms used. In that case, it is recommended that time should be taken to reach agreement on the semantics. Since differences of understanding over the meaning of terms can give rise to confusion, a practical recommendation might be to set up a multidisciplinary register of terms that might be regarded as problematic or potentially unclear. If one of these terms is then used in the common operational picture, the system used for accessing the common operational picture might suggest inserting a hyperlink to the formal definition.

Where there is a high degree of uncertainty or a conflict of interest, knowledge exchange is needed at the pragmatic level of explicating and negotiating interests. In such cases developing multidisciplinary scenarios might help to provide the insights needed. The causal network captured in the common operational picture can be of great help in developing these scenarios.

The multi-faceted and multi-level characteristics of a common operational picture enable collaborative sensemaking throughout the emergency response network and can also provide the organisational emergency response network with a basis for open and transparent communication with the broader community. A multi-faceted and multi-level common operational picture captures how the emergency situation is framed and it also captures the sometimes deep uncertainties that have to be dealt with. The higher levels of knowledge are necessary for meaning-making in relation to the emergency (Boin et al., 2005) or – as indicated by the title of this thesis, *between chaos and continuity* – for helping to involve the broader community in responding to emergency situations that are often chaotic.

Ensuring that a multi-faceted and multi-level common operational picture is up to date and sufficiently rich in content takes considerable effort. Codifying complex and rapidly changing situations and sharing this codified perspective with other actors in the network may therefore not always be possible in real time. Think, for example, of the challenge of bridging the gap between the chaotic frontline processes and the more deliberate processes in the remote part of the emergency response network. Consequently, the common operational picture is limited in terms of how accurately it can capture the changing perspectives of the teams and organisations. Not all relevant knowledge relating to the emergency and its potential consequences can be codified sufficiently quickly. In particular, the often equivocal combination of information and observations from the front line, typically from the area in which the emergency originated, is hard to convey to those in more remote parts of the organisational emergency response network. When the cyclical sensemaking process of enactment, selection and retention is very dynamic, it is difficult

to identify essential observations and information elements and to determine what should be retained and shared with the rest of the emergency response network, via the common operational picture. Information can still be shared but the collaborating officers should be aware that other means of coordination will also be needed to convey the uncertainties, concerns and gut feelings that cannot be easily codified[20]. One might think of traditional means of communication such as radio and telephone, but it may be even better to use richer media as well, such as video-conferencing facilities, to convey non-verbal cues more effectively. It is also very important that there is a sufficient level of interpersonal trust between frontline officers and their counterparts in the remote parts of the emergency response network. Establishing interpersonal trust should therefore be an important aspect of emergency response preparation (Uhr, 2009).

A multi-faceted, multi-level and up-to-date common operational picture can facilitate collaborative emergency response. This finding is not new but is important enough to stress. Emergency response can be seen as a continuous cycle of taking action and sensemaking. By mindfully initiating actions and sensing what effect these may have on the situation, the emergency response network seeks to identify which actions will be the most feasible and useful. Helpful representations of reality are developed by taking action and acquiring information. This is what a common operational picture can be: a coherent set of helpful representations of reality that facilitate coordination throughout the emergency response network (Okhuysen & Bechky, 2009). All the various nodes and parts of the emergency response network – regional, supra-regional, national and international – contribute their representation of the situation in order to maintain an overall representation that is as unequivocal as possible. If the common operational picture represents a causal network of the emergency, its cascading effects and societal impact, it can provide the emergency response network with insights into which interventions might be considered and what collateral effects these might have.

7.2.3 Netcentric command and control

The last quadrant (Figure 25, quadrant 4) is about command and control within the network, and how it relates to the common operational picture. Although I have not gone into this fourth quadrant in depth in this thesis, I discuss it briefly in this final chapter for the sake of completeness.

20 As stated in Section 1.2.3 I studied the role of the common operational picture in the metaphorical sense of synthesised information and not in the literal sense of visualisation of this information. In terms of how easily certain aspects of a situation can be codified and whether or not certain aspects can be conveyed through the common operational picture, this is not determined purely within the information domain. The visualisation and representation of the common operational picture as well as how operational teams are able to interact with it come into play here as well. I did not conduct a structural study of the role of visualisation and the various possible forms of interaction.

What the findings of this research suggest is that it is important that a team – and especially the team lead – agrees with what is recorded by the team in the common operational picture. Ideally, a team's contribution to a common operational picture should reflect its iterative and collaborative sensemaking process.

How does working on the basis of a common operational picture subsequently lead to coherent, goal-directed collaboration? Klijn and Koppenjan (2016) distinguish three complementary angles from which the management of an organisational network can be approached: content, process and institutions. The *content* angle concerns ensuring that the relevant goals and interests of the various actors are satisfied. To put it more precisely, the focus is on the quality of the collaborative sensemaking process in terms of the completeness of the common operational picture and how well it reflects what is going on at any given moment in time – including how well it captures the relevant perspectives on the situation and how up to date it is. The *process* angle concerns the interaction between the organisational actors involved in the organisational network, and the *institutions* angle concerns the structure and composition of the organisational network.

In addition to situational awareness, collaboration awareness also plays a key role in netcentric command and control. The common operational picture already *implicitly* provides some insight into the composition of the emergency response network and the characteristics of the organisations involved in the response, but *explicit* exchange of information about the involvement, plans and actions of the organisations and teams involved in the collaboration provides further support for netcentric command and control. When looking at collaboration from the content angle discussed above, it is important that the interests represented by the organisations involved in the emergency response are respected or at least considered and weighed against each other. This can only be done if these interests have actually been made apparent. When looking at collaboration from the process angle, it is important to know, for example, who in a specific organisation is entitled to make decisions and what lead times might be required to provide information or make decisions.

Approaching it from the institutions angle, it is important to have an overview of the composition and structure of the emergency response network in terms of the organisations and teams involved, the lines of command and the lines of communication.

7.3 Reflection on the research approach

In this section I reflect on the implications of my professional position in the field of research and on how this position relates to the way in which the research was conducted. At the same time as I was conducting this research I was also involved in the development and the implementation of netcentric principles in the crisis management sector in the Netherlands.

My research also focuses on netcentric collaboration, particularly on the role of the common operational picture in this collaboration. Based on this positioning, I can characterise my role in the field as that of a *reflective practitioner* (Schön, 2017) switching back and forth between being a researcher and a practitioner when carrying out this study. This, however, doesn't mean that my researcher role was like "marking my own homework", nor did I have problems maintaining the detachment required to conduct objective research.

Since I am not a first responder myself but a specialist in the field of crisis information management, the object of the research was not *my own consultancy practice* but rather the *emergency response practice* I have helped to shape. That gave me the opportunity to focus on how the netcentric principles I helped to shape worked out in actual emergency response practices. Rather than assessing my own work or its outcomes, the aim was to gain more insight in how the practice I had helped to shape actually works. In this way, my consultancy work in crisis information management and my research work on emergency response practices reinforced one another.

My role as a crisis information practitioner was extremely helpful in giving me access to the details of actual practices and to the practitioner networks. My involvement in the emergency response domain also helped me in the data analysis and in problematising the challenge of collaborating on the basis of a common operational picture. There were benefits to be gained from combining the roles of researcher and practitioner: it enabled there to be a very smooth flow of knowledge and information from practice to research and likewise the insights from the research could be readily applied to my own consulting practice. However, it is important to note that I did not conduct the research simply as part of my consultancy practice, which demanded careful consideration with respect to data collection and analysis.

What does all this mean for the research design I set up? The benefit of my involvement is that on the one hand I had a close-up view of the practice. Crisis management research is complex and large-scale experiments are difficult to understand. Studying such practices in detail requires a great deal of knowledge of the operational context. Considering many details in the analysis of cases automatically means that the number of cases studied is limited. Conducting this type of research is a conscious choice that fits my role in consulting on crises information practices. To compensate for any loss of objectivity which can easily occur (Schön, 2017), I deliberately discussed my research design, methods and findings with other researchers in the field of crisis (information) management during informal meetings and conversations, workshops and (international) conferences for the purposes of validation.

I also focused deliberately on incidents that were more manageable in terms of their scale. The cases studied were large enough to necessitate scaling up of the response effort, but not so large that they were no longer manageable. After an initial short period of chaos, in all of the cases studied informed decisions became possible again. Relatively small-scale emergencies like the ones I selected for my research occur more often, which means that not only are there more empirical cases to choose from but also the insights from the research may be easier to apply in practice.

As this research is part of an ongoing scientific debate on the role of common operational pictures in crisis management I encourage and even challenge other scientists to take my findings further. The next section offers a number of suggestions for how this might be done.

7.4 Directions for future research

This thesis has advanced our understanding of how the common operational picture facilitates emergency response collaboration. It has also identified some limitations and issues in terms of what can be expected from a common operational picture shared throughout an organisational emergency response network. As always, advancing insights also leads to new questions or helps us to articulate existing ones more precisely. This thesis does not therefore pretend to be more than a contribution to the ongoing and cyclical scientific game of rock-paper-scissors (Abbott, 2004) with regard to how emergency response is organised. First I will suggest some directions for future research connected with the findings in the Chapters 3 to 5 of this thesis. In the following subsection I will suggest some directions for future research that come to mind if I zoom out from some of the methodological choices I made.

7.4.1 Building on the findings

What avenues for future research can be identified in relation to the findings in this thesis? In Chapter 3 of this thesis I looked at the *composition* of emergency response networks. However, a first direction for future research would be to explore how the *structure* of these networks develops over time. I and my research colleague conducted some exploratory research in this area, which we described in Treurniet and Van Buul-Besseling (2015). Inspired by Alberts, Huber, and Moffat (2010) we distinguished the following four archetypal network structures in this study:

- *Fragmented*: the organisational collective functions as a number of disjointed organisations. The organisations working together in the emergency response do not have a collective objective, or at least not one that they explicitly agree on. The only way they relate to each other is via the operational context in which they are operating.[21]

21 This fragmented archetype is not to be confused with the fragmentation logic that is dominant in organisational emergency response networks in general (Wolbers, 2016). See also Section 7.2. One could say that in the fragmented network, very little or no use tends to be made of the three coordination approaches (emergent, expert and network) that are characteristic of fragmentation logic.

- *Deconflicted*: the participating organisations interact and exchange information at the organisational level, i.e., as interconnected monolithic entities. The collaboration is primarily aimed at avoiding adverse cross-impacts.
- *Coordinated*: the participating organisations interact not only at the organisational level but also at more detailed operational levels. A common operational picture is typically used to guide the coordination process. Coordination is aimed not only at avoiding adverse cross-impacts but also at acquiring mutual support that can help the organisations meet their objectives.
- *Collaborative and agile*: the collaborating organisations share a collective purpose and have a shared plan. The emergent dynamics of the networked collaboration tend to prevail over the autonomous dynamics of the participating organisations.

How does the nature of an emergency response organisation in terms of these four archetypes correlate to its effectiveness? To investigate this, a longitudinal study of a developing emergency response organisation could be conducted. Also, how can one build in the agility required to transition between the different types of network? When there is an emergency, the organisational response network typically seems to make a transition from collaborative and agile to coordinated. The performance of the emergency organisation during that transitional phase is very critical, as is reflected in the term 'golden hour', often used of the very first phase of emergency response. Another important research question is what arrangements may be most appropriate to ensure the emergency response organisations can be relied upon during the very early phase of a crisis. At that point, decisive action by responders is crucial but at the same time the organisations involved in the response should be starting to move towards a more coordinated way of working. The key issue here is to establish what is needed – and what is feasible – to ensure that the organisational response network can make this transition without any adverse effects on its performance.

The second avenue for follow-up research would be to examine more closely the coordination between the professional emergency response network and the broader community. In Chapter 4 I focused on how crisis communication can best help the community to play a well-balanced role in the emergency response. A common operational picture can contribute to the openness and transparency of communication initiated by the organisational emergency response network. After all, an emergency is an event that impacts the community, and consequently *the community* will eventually have to deal with it. The professional emergency response network and the broader community being on speaking terms paves the way for better absorption of the emergency impact. Research into specific societal indicators, which could be used to analyse the developments within community during an emergency, can be of importance in helping the emergency response organisations to strike the right balance in their approach. Identifying such indicators can give us a better understanding of what is happening within the community and can help us to develop practical ways of deciding if and when to adapt to changing situations.

Also, the continuity, coordination and cooperation planning model has been developed to make use of and capitalise on social capital and on capacity of varying kinds within society. A growing number of scholars stress the logic of this aspiration (Dupont, 2004; Helsloot & Ruitenberg, 2004; Nakagawa & Shaw, 2004; Quarantelli & Dynes, 1985).

The question remains, however, as to what the best division of labour is between professional responders and the affected community and how this then relates to the nature and scale of the incident at hand. What tasks can be assigned to – or left up to – the community? What coordination mechanisms can be applied to ensure there is overall coherence, or at least that coordination is not neglected (Heath & Staudenmayer, 2000), conflicts do not arise, or the work does not become fragmented? Another relevant direction for future research would be to investigate how both the optimal division of labour between professional responders and the affected community and the communication strategy adopted are linked to the cultural context. How might one combine the differing strategic orientations (Herranz, 2008) of the broader community and the professional response network or ensure that they do not conflict with one another? For a response organisation to justify to the general public the actions it has taken and to provide some insights into the underlying rationale – as happened with the mall shooting in Alphen aan den Rijn – might not be the best approach in every country or even in every Dutch municipality.

My third direction for future research concerns the question of how to overcome the limitations I identified regarding the codification of relevant knowledge. In Chapter 5 I argued that both those at the front line and those in more remote parts of the response network should be aware that a common operational picture can fall short in terms of providing essential information in a timely fashion. Deliberate sensegiving, sensedemanding and sensebreaking may be necessary to advance understanding on both sides (Vlaar et al., 2008). Sensegiving and sensebreaking involve actively and directly influencing the understanding of others by expressing visions and beliefs (sensegiving) or by questioning existing understandings (sensebreaking). Sensedemanding prompts others to express or clarify their understandings. As stated also by Christianson (2019), further research is needed to investigate how this might be done in emergency management.

7.4.2 Shifting the methodological focus

In the previous subsection I identified three directions for future research connected with the findings of this thesis. In this subsection I suggest some further areas for research connected to the methodological focus of this thesis.

The fourth avenue for future research arises from the type of research I chose. This thesis is based primarily on small-N qualitative case studies, and this provided an opportunity to explore the data in greater detail.

However, there is also scope for future studies to substantiate the findings both through syntactic validation (Abbott, 2004) and a broader analysis of other historic cases.

While this thesis focuses on the role of a common operational picture in relatively small-scale emergencies, the fifth avenue for future research concerns the role and content of a common operational picture in responding to a large and protracted crisis such as the COVID-19 pandemic in which the organisational network involved is very extensive. Evaluations in the Netherlands suggest that collaboration on the basis of a common operational picture in such extensive organisational networks is problematic or at least might require some additional measures. If we look at it from the perspective of those receiving information, does the broad sharing of information not lead to information overload, and can all information really be properly understood without the necessary domain expertise? From an information-sharing perspective, the vastness of the organisational network might complicate matters as well. As an example, Verheul et al. (2021, p. 29) raise the question of whether in a crisis such as the COVID-19 crisis, which impacts on so many different areas of life, it is even possible to create a workable common operational picture. The vast number of crisis organisations involved make it difficult to get a complete overview of what is going on and as a consequence, it is often not known who has access to the information shared through the common operational picture. Earlier in this thesis, I argued that mutual trust is an important condition for effective collaboration in an organisational network (Das & Teng, 1998, 2001; Hayes, 2007; Whelan, 2012) and emphasised how collaboration awareness is important in helping to build trust (Chapter 6). In a vast organisational network in which it is virtually impossible for the organisations involved to be fully aware of each other's roles, personnel, characteristics, capabilities, expertise, practices and procedures, organisations may find it difficult to build sufficient trust to establish a foundation for information sharing.

8 References

Abbasi, A., & Kapucu, N. (2012). Structural dynamics of organizations during the evolution of interorganizational networks in disaster response. *Journal of Homeland Security and Emergency Management, 9*(1). doi: 10.1515/1547-7355.1975

Abbott, A. (2004). *Methods of Discovery: Heuristics for the Social Sciences*. New York: W.W. Norton & Co.

Abeel, B. (2006). *Multi-Casualty Mass Decontamination Guidance Document For First Responders*. Mather, CA: Governor's Office of Emergency Services.

Acquier, A., Gand, S., & Szpirglas, M. (2008). From Stakeholder to StakeSholder Management in Crisis Episodes: A Case Study in a Public Transportation Company. *Journal of Contingencies and Crisis Management, 16*(2), 101-114.

Ahmed, S., Nelson, D. A., Biedrzycki, P. A., Sandy, M. G., Opel, S., & Franco, Z. (2012). *Community engagement for translational disaster research: fostering public, private & responder group partnerships.* Paper presented at the Proceedings of the 9th International ISCRAM Conference.

Alberts, D. S., Garstka, J. J., & Stein, F. P. (1999). *Network centric warfare : developing and leveraging information superiority* (2nd Edition (Revised) ed.).

Alberts, D. S., Huber, R. K., & Moffat, J. (2010). *NATO NEC C2 maturity model*.

Allen, K. M. (2006). Community- based disaster preparedness and climate adaptation: local capacity- building in the Philippines. *Disasters, 30*(1), 81-101.

Allen, L. Y. H. (2011). Organizational collaborative capacities in disaster management: Evidence from the Taiwan red cross organization. *Asian Journal of Social Science, 39*(4), 446-468.

Ansell, C., Boin, A., & Keller, A. (2010). Managing transboundary crises: Identifying the building blocks of an effective response system. *Journal of Contingencies and Crisis Management, 18*(4), 195-207.

Bardach, E. (2017). Networks, hierarchies, and hybrids. *International Public Management Journal, 20*(4), 560-585.

Baron, R. M., & Misovich, S. J. (1999). On the relationship between social and cognitive modes of organization. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 586-605). New York, NY, US: Guilford Press.

Barton, M. A., & Sutcliffe, K. M. (2009). Overcoming dysfunctional momentum: Organizational safety as a social achievement. *Human Relations, 62*(9), 1327-1356.

Barton, M. A., Sutcliffe, K. M., Vogus, T. J., & DeWitt, T. (2015). Performing under uncertainty: Contextualized engagement in wildland firefighting. *Journal of Contingencies and Crisis Management, 23*(2), 74-83.

Beck, T. E., & Plowman, D. A. (2014). Temporary, emergent interorganizational collaboration in unexpected circumstances: A study of the Columbia space shuttle response effort. *Organization Science, 25*(4), 1234-1252.

Beck, U. (1992). *Risk society: Towards a new modernity* (Vol. 17). London: Sage.

Bedny, G., & Meister, D. (1999). Theory of activity and situation awareness. *International Journal of cognitive ergonomics, 3*(1), 63-72.

Bennett, P. G. (1995). Modelling decisions in international relations: game theory and beyond. *Mershon International Studies Review, 39*(Supplement_1), 19-52.

Berlin, J. M., & Carlström, E. D. (2008). The 90- Second Collaboration: A Critical Study of Collaboration Exercises at Extensive Accident Sites. *Journal of Contingencies and Crisis Management, 16*(4), 177-185.

Berlin, J. M., & Carlström, E. D. (2011). Why is collaboration minimised at the accident scene? *Disaster Prevention and Management: An International Journal*.

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, 27*(2), 352-371.

Bijker, W. E., & Law, J. (1992). *Shaping Technology/Building Society: studies in socio-technical change*: the MIT Press.

Bittner, E. A. C., & Leimeister, J. M. (2014). Creating Shared Understanding in heterogeneous work groups - Why it matters and how to achieve it. *Journal of Management Information Systems, 31*(1), 111-143.

Boehm, M. (2018). Recalling the performativity of the body in frontline command. *Journal of Contingencies and Crisis Management, 26*(4), 461-468.

Boersma, F. K., Wagenaar, P., & Wolbers, J. J. (2012). Negotiating the 'Trading Zone'. Creating a Shared Information Infrastructure in the Dutch Public Safety Sector. *Journal of Homeland Security and Emergency Management, 9*(2).

Boin, A. (2009). The new world of crises and crisis management: Implications for policymaking and research. *Review of Policy research, 26*(4), 367-377.

Boin, A., 't Hart, P., Stern, E. K., & Sundelius, B. (2005). *The politics of crisis management: Public leadership under pressure*. Cambridge: Cambridge University Press.

Boin, A., Brown, C., & Richardson, J. A. (2019). *Managing Hurricane Katrina: Lessons from a Megacrisis*. Baton Rouge, LA: Louisiana State University Press.

Booth, W. C., Colomb, G. G., & Williams, J. M. (2003). *The craft of research*: University of Chicago press.

Bos, J. H. G., & Verberne, E. M. J. (2012). *GRIP 3 Ouwerkerkse Kreek - Lessen uit de aanpak [GRIP 3 Ouwerkerk Creek - Lessons from the approach]*. The Hague, The Netherlands: COT Institute for Safety and Crisis Management.

Bosomworth, K., Owen, C., & Curnin, S. (2017). Addressing challenges for future strategic- level emergency management: reframing, networking, and capacity- building. *Disasters, 41*(2), 306-323.

Brainich von Brainich Felth, E. T. (2007). Rijksheren in het moderne crisismanagement [Government lords in modern crisis management]. Haarlem, The Netherlands: Provincie Noord-Holland.

Brainich von Brainich Felth, E. T. (2012). *Bestuurlijke Netwerkkaarten Crisisbeheersing [Administrative Network Maps Crisis Management]* (Vierde druk ed.). Haarlem, The Netherlands: Provincie Noord-Holland.

Brooks, J. M., Bodeau, D., & Fedorowicz, J. (2013). Network management in emergency response: articulation practices of state-level managers—interweaving up, down, and sideways. *Administration & Society, 45*(8), 911-948.

Busch, N. E., & Givens, A. D. (2013). Achieving resilience in disaster management: the role of public-private partnerships. *Journal of strategic security, 6*(2), 1-19.

Bye, R. J., Almklov, P., Antonsen, S., Nyheim, O. M., Aalberg, A. L., & Johnsen, S. O. (2019). The institutional context of crisis. A study of the police response during the 22 July terror attacks in Norway. *Safety science, 111*, 67-79.

Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization Science, 13*(4), 442-455.

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science, 15*(5), 555-568.

Carter, H. E., Drury, J., Rubin, G. J., Williams, R., & Amlôt, R. (2013). Communication during mass casualty decontamination: highlighting the gaps. *International Journal of Emergency Services, 2*(1), 3-3.

Castells, M. (2004). *The network society A cross-cultural perspective*. Cheltenham: Edward Elgar.

Chen, R., Sharman, R., Rao, H. R., & Upadhyaya, S. J. (2008). Coordination in emergency response management. *Communications of the ACM, 51*(5), 66-73.

Christchurch Central Development Unit. (2013). Aspirations. Retrieved 12 July 2013, from http://ccdu.govt.nz/plan/aspirations

Christianson, M. K. (2019). More and less effective updating: The role of trajectory management in making sense again. *Administrative Science Quarterly, 64*(1), 45-86.

Cinque, M., Esposito, C., Fiorentino, M., Carrasco, F. J. P., & Matarese, F. (2015). *A collaboration platform for data sharing among heterogeneous relief organizations for disaster management*. Paper presented at the ISCRAM 2015 Conference, Kristiansand , Norway.

Coase, R. H. (1937). The nature of the firm. *economica, 4*(16), 386-405.

Cohen-Hatton, S. R., Butler, P. C., & Honey, R. C. (2015). An investigation of operational decision making in situ: Incident command in the UK Fire and rescue service. *Human Factors, 57*(5), 793-804.

Comfort, L. K. (2007). Crisis management in hindsight: Cognition, communication, coordination, and control. *Public Administration Review, 67*(s1), 189-197.

Comfort, L. K., Birkland, T. A., Cigler, B. A., & Nance, E. (2010). Retrospectives and prospectives on Hurricane Katrina: Five years and counting. *Public Administration Review, 70*(5), 669-678.

Comfort, L. K., Dunn, M., Johnson, D., Skertich, R., & Zagorecki, A. (2004). Coordination in complex systems: increasing efficiency in disaster mitigation and response. *International journal of emergency management, 2*(1-2), 62-80.

Comfort, L. K., & Kapucu, N. (2006). Inter-organizational coordination in extreme events: The World Trade Center attacks, September 11, 2001. *National Hazards, 39*, 309-327.

Copeland, J. (2008). Emergency response: Unity of effort through a common operational picture: ARMY WAR COLL CARLISLE BARRACKS PA.

Corbin, J., & Strauss, A. L. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*: Sage.

Curnin, S., Brooks, B., & Owen, C. (2020). A case study of disaster decision- making in the presence of anomalies and absence of recognition. *Journal of Contingencies and Crisis Management*.

Curnin, S., & Owen, C. (2013). Obtaining information in emergency management: a case study from an Australian emergency operations centre. *International Journal of Human Factors and Ergonomics, 2*(2-3), 131-158.

Curnin, S., Owen, C., Paton, D., & Brooks, B. (2015). A theoretical framework for negotiating the path of emergency management multi-agency coordination. *Applied ergonomics, 47*, 300-307.

Curnin, S., Owen, C., Paton, D., Trist, C., & Parsons, D. (2015). Role clarity, swift trust and multi-agency coordination. *Journal of Contingencies and Crisis Management, 23*(1), 29-35.

Danielsen, O. A., & Førde, J. S. (2018). Beyond Loose Couplings in Crisis Preparedness: The Role of Coordination Agencies in Sweden and Norway. In P. Lægreid & L. H. Rykkja (Eds.), *Societal Security and Crisis Management: Governance Capacity and Legitimacy* (pp. 53-71). London, UK: Palgrave Macmillan.

Das, T. K., & Teng, B.-S. (1998). Between trust and control: Developing confidence in partner cooperation in alliances. *Academy of management review, 23*(3), 491-512.

Das, T. K., & Teng, B.-S. (2001). Trust, control, and risk in strategic alliances: An integrated framework. *Organization Studies, 22*(2), 251-283.

Davis, G. L., & Robbin, A. (2015). Network disaster response effectiveness: the case of ICTs and Hurricane Katrina. *Journal of Homeland Security and Emergency Management, 12*(3), 437-467.

De Bas, M. (2012). *Sociale media: zegen of zorg tijdens een crisis [Social media: blessing or concern during a crisis].* (Master), VU University Amsterdam, Amsterdam.

DeMarco, D. L. (2016). *A visual language for situational awareness.* Monterey, California: Naval Postgraduate School.

Deverell, E., Alvinius, A., & Hede, S. (2019). Horizontal Collaboration in Crisis Management: An Experimental Study of the Duty Officer Function in Three Public Agencies. *Risk, Hazards & Crisis in Public Policy, 10*(4), 484-508.

Dörner, D. (1996). *The logic of failure: Recognizing and avoiding error in complex situations*. New York: Metropolitan Books.

Douglas, S., Berthod, O., Groenleer, M., & Nederhand, J. (2020). Pathways to collaborative performance: examining the different combinations of conditions under which collaborations are successful. *Policy and Society, 39*(4), 638-658.

Drabek, T. E. (1983). Alternative patterns of decision-making in emergent disaster response networks. *International Journal of Mass Emergencies and Disasters, 1*(2), 277-305.

Dupont, B. (2004). Security in the age of networks. *Policing and Society: An International Journal of Research and Policy, 14*(1), 76-91.

Dutch Safety Board. (2006). Brand cellencomplex Schiphol-Oost [Fire Detention Centre Schiphol-East]. The Hague, the Netherlands.

Dynes, R. R. (1994). Community Emergency Planning: False Assumptions and Inappropriate Analogies. *International Journal of Mass Emergencies and Disasters, 12*(2), 141-158.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review, 14*(4), 532-550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: opportunities and challenges. *Academy of Management Journal, 50*(1), 25-32.

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors, 37*(1), 32-64.

Espinosa, J. A., Lerch, F. J., & Kraut, R. E. (2004). Explicit vs. Implicit Coordination Mechanisms and Task Dependencies: One Size Does Not Fit All. In S. M. Fiore, E. Salas & J. A. Cannon-Bowers (Eds.), *Team Cognition: Process and Performance at the Inter and Intra-Individual Level* (pp. 107-129). Washington, D.C.: American Psychological Association.

Essens, P. J. M. D., Spaans, M., & Treurniet, W. (2007). Agile Networking in Command and Control. *The International C2 Journal, 1*(1), 177-210.

Estes, C. L. (1983). Social Security: The Social Construction of a Crisis. *The Milbank Memorial Fund Quarterly. Health and Society, 61*(3), 445-461. doi: 10.2307/3349867

Falkheimer, J., & Heide, M. (2006). Multicultural crisis communication: Towards a social constructionist perspective. *Journal of Contingencies and Crisis Management, 14*(4), 180-189.

FEMA. (2014). National Incident Management System (NIMS) Student Manual IS-700.A. Communication and Information Management.

Ferrante, P. (2010). Risk and Crisis Communication. *Journal of Professional Safety*, 38-45.

Firestone, W. A. (1993). Alternative arguments for generalizing from data as applied to qualitative research. *Educational researcher, 22*(4), 16-23.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative inquiry, 12*(2), 219-245.

Franco, Z., Ahmed, S., Kuziemsky, C., Biedrzycki, P., & Kissack, A. (2013). *Using Social Network Analysis to Explore Issues of Latency, Connectivity, Interoperability & Sustainability in Community Disaster Response*. Paper presented at the 10th International ISCRAM Conference, Baden-Baden, Germany.

Ganor, B. (2009). Terrorism networks: it takes a network to beat a network. In P. R. Kleindorfer, Y. R. Wind & R. Gunther (Eds.), *The Network Challenge: Strategy, Profit, and Risk in an Interlinked World* (pp. 453-470). New Jersey: Prentice Hall Publishing.

Garcia-Magarino, I., & Gutiérrez, C. (2013). Agent-oriented modeling and development of a system for crisis management. *Expert Systems with Applications, 40*(16), 6580-6592.

Garnett, J. L., & Kouzmin, A. (2007). Communicating throughout Katrina: competing and complementary conceptual lenses on crisis communication. *Public Administration Review, 67*(s1), 171-188.

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research notes on the Gioia methodology. *Organizational Research Methods, 16*(1), 15-31.

Glynn, M. A., & Watkiss, L. (2020). Of Organizing and Sensemaking: From Action to Meaning and Back Again in a Half-Century of Weick's Theorizing. *Journal of Management Studies, 57*(7), 1331 - 1354. doi: 10.1111/joms.12613

Grisogono, A. M. (2006). *The implications of complex adaptive systems theory for C2*. Paper presented at the Command and Control Research and Technology Symposium.

Grisogono, A. M., & Radenovic, V. (2007). *The Adaptive Stance - Steps towards teaching more effective complex decision-making.* Paper presented at the Eighth International Conference on Complex Systems.

Groenendaal, J., De Bas, M., & Helsloot, I. (2012). Twitter tijdens flitscrises, een onderbelicht potentieel? [Twitter during emergencies, a neglected potential?]. *Tijdschift voor Veiligheid, 11*(4), 3-16.

Groenendaal, J., & Helsloot, I. (2018). A closer examination of command and control practices by incident commanders during realistic operational exercises in the Netherlands. *International journal of emergency management, 14*(1), 51-71.

Groenewegen-ter Morsche, K., & Oberijé, N. (2010). Burgerhulp bij rampen [Citizen assistance in the event of disasters]. Arnhem: Netherlands Institute for Safety (NIFV).

Hayes, R. E. (2007). It's an Endeavor, Not a Force. *The International C2 Journal, 1*(1), 145-176.

Head, B. W. (2008). Wicked problems in public policy. *Public policy, 3*(2), 101-118.

Head, B. W. (2019). Forty years of wicked problems literature: Forging closer links to policy studies. *Policy and Society, 38*(2), 180-197.

Heath, C., & Staudenmayer, N. (2000). Coordination Neglect: How Lay Theories of Organizing Complicate Coordination in Organizations. *Research in Organizational Behaviour, 22*, 155-193.

Helsloot, I., & Ruitenberg, A. (2004). Citizen Response to Disasters: a Survey of Literature and Some Practical Implications. *Journal of Contingencies and Crisis Management, 12*(3), 98-111.

Helsloot, I., Scholtens, A., Groenendaal, J., & Stapels, A. (2012). De Nederlandse burger nader verkend: nuchter mits geïnformeerd [The Dutch citizen explored: level-headed if well informed].

Herranz, J. (2008). The multisectoral trilemma of network management. *Journal of Public Administration Research and Theory, 18*(1), 1-31.

Hoffman, S. M., & Oliver-Smith, A. (2002). *Catastrophe and Culture; The Anthropology of Disaster.* Paper presented at the School of American Research Advanced Seminar Series.

Houdijk, R. (2009). Handreiking Regionaal Risicoprofiel [Regional Risk Profile Guidelines] (1.10 ed.).

Hutchins, E. (1995). *Cognition in the Wild*. Cambridge, MA: MIT Press.

Hyllengren, P., Larsson, G., Fors, M., Sjöberg, M., Eid, J., & Olsen, O. K. (2011). Swift trust in leaders in temporary military groups. *Team Performance Management, 17*(7/8), 354-368.

Inspectorate of Public Order and Safety. (2011a). Brand Chemie-Pack Moerdijk - Een onderzoek naar de bestrijding van (de effecten van) het grootschalig incident [Fire Chemie-Pack Moerdijk - An investigation on fighting (the effects of) the large-scale incident]. The Hague: Ministry of Security and Justice, The Netherlands.

Inspectorate of Public Order and Safety. (2011b). Schietincident in 'De Ridderhof' Alphen aan den Rijn [Shooting incident in 'De Ridderhof' Alphen aan den Rijn]. The Hague, The Netherlands: Ministry of Security and Justice, The Netherlands.

Inspectorate of Safety and Justice. (2016). Gasstoring Velsen-Noord [Gas failure Velsen-North]. The Hague, The Netherlands: Ministry of Security and Justice, The Netherlands.

Jansen, G. J., Fernandes Mendes, H. K., Rook, M., Stordiau-van Egmond, A. M. E., & Van Zanten, P. J. (2012). Onderzoek asbestvondst Kanaleneiland [Investigation Asbestos Discovery]. Utrecht, The Netherlands.

JulianRubenNL. (2013). VERMIST / MISSING / FEHLT Julian & Ruben. from http://julian-ruben-vermist.webklik.nl/page/vermist-julian-ruben

Kalkman, J. P., Kerstholt, J. H., & Roelofs, M. (2018). Crisis response team decision-making as a bureau-political process. *Journal of Contingencies and Crisis Management, 26*(4), 480-490.

Kapucu, N., Arslan, T., & Collins, M. L. (2010). Examining Intergovernmental and Interorganizational Response to Catastrophic Disasters: Toward a Network-Centered Approach. *Administration & Society, 42*(2), 222-247.

Kapucu, N., & Garayev, V. (2013). Designing, managing, and sustaining functionally collaborative emergency management networks. *The American Review of Public Administration, 43*(3), 312-330.

Kapucu, N., & Hu, Q. (2016). Understanding multiplexity of collaborative emergency management networks. *The American Review of Public Administration, 46*(4), 399-417.

Kapucu, N., Hu, Q., & Khosa, S. (2017). The state of network research in public administration. *Administration & Society, 49*(8), 1087-1120.

Kapucu, N., & Van Wart, M. (2006). The evolving role of the public sector in managing catastrophic disasters: Lessons learned. *Administration & Society, 38*(3), 279-308.

Kapucu, N., Yuldashev, F., & Feldheim, M. A. (2016). Nonprofit organizations in disaster response and management: A network analysis. *European Journal of Economic and Political Studies, 4*(1), 83-112.

Kennedy, J., Ashmore, J., Babister, E., & Kelman, I. (2008). The Meaning of 'Build Back Better': Evidence From Post- Tsunami Aceh and Sri Lanka. *Journal of Contingencies and Crisis Management, 16*(1), 24-36.

Klein, G. A. (1993). *A recognition-primed decision (RPD) model of rapid decision making*: Ablex Publishing Corporation New York.

Klein, G. A., Calderwood, R., & Clinton-Cirocco, A. (1986). *Rapid decision making on the fire ground.* Paper presented at the Proceedings of the human factors society annual meeting.

Klein, G. A., Wiggins, S., & Dominguez, C. O. (2010). Team sensemaking. *Theoretical Issues in Ergonomics Science, 11*(4), 304-320.

Klijn, E. H., & Koppenjan, J. F. M. (2016). *Governance networks in the public sector*. New York: Routledge.

Kusumasari, B. (2012). Network organisation in supporting post-disaster management in Indonesia. *International Journal of Emergency Services, 1*(1), 71-85.

Lam, J., & Kop, N. (2020). Schouder aan schouder: Burger- en politieparticipatie tijdens de vermissing van Anne Faber [Shoulder to shoulder: Citizen and Police Participation during the missing of Anne Faber].

Langley, A. (1999). Strategies for theorizing from process data. *Academy of management review, 24*(4), 691-710.

Lauras, M., Truptil, S., & Bénaben, F. (2015). Towards a better management of complex emergencies through crisis management meta- modelling. *Disasters, 39*(4), 687-714.

Leedom, D. K. (2003). Functional analysis of the next generation common operating picture. *analysis, 69*(2), 149-163.

Lindell, M. K., Perry, R. W., Prater, C., & Nicholson, W. C. (2006). *Fundamentals of emergency management*. Washington, DC: FEMA.

Lindell, M. K., & Prater, C. S. (2003). Assessing community impacts of natural disasters. *Natural Hazards Review, 4*(4), 176-185.

Little, R. L., & Krannich, R. S. (1988). A model for assessing the social impacts of natural utilization on resource-dependent communities. *Impact Assessment, 6*(2), 21-35.

Looney, C. G. (2001). Exploring fusion architecture for a common operational picture. *Information fusion, 2*(4), 251-260.

Lorenz, D. F. (2013). The diversity of resilience: contributions from a social science perspective. *Natural Hazards, 67*(1), 7-24.

Luiijf, E. A. M., & Klaver, M. H. A. (2006). Protection of the Dutch critical infrastructures. *International Journal of Critical Infrastructures, 2*(2/3), 201-214.

Luiijf, E. A. M., Nieuwenhuijs, A. H., Klaver, M. H. A., Van Eeten, M., & Cruz, E. (2008). *Empirical Findings on Critical Infrastructure Dependencies in Europe.* Paper presented at the 3rd International Workshop on Critical Information Infrastructures Security, October 13-15, 2008, Frascati (Rome), Italy.

Luokkala, P., Nikander, J., Korpi, J., Virrantaus, K., & Torkki, P. (2017). Developing a concept of a context-aware common operational picture. *Safety science, 93*, 277-295.

MacKenzie, D., & Wajcman, J. (1999). *The social shaping of technology*: Open University Press.

Manoj, B. S., & Baker, A. H. (2007). Communication Challenges in Emergency Response. *Communications of the ACM, 50*(3), 51-53.

Maslow, A. H. (1943). A theory of human motivation. *Psychological review, 50*(4), 370.

Mathbor, G. M. (2007). Enhancement of community preparedness for natural disasters the role of social work in building social capital for sustainable disaster relief and management. *International Social Work, 50*(3), 357-369.

McConnell, A. (2011). Success? Failure? Something in-between? A framework for evaluating crisis management. *Policy and Society, 30*(2), 63-76.

Mendonca, D., & Wallace, W. A. (2004). Studying organizationally-situated improvisation in response to extreme events. *International Journal of Mass Emergencies and Disasters, 22*(2), 5-30.

Menon, K. U., & Goh, K. T. (2005). Transparency and trust: risk communications and the Singapore experience in managing SARS. *Journal of Communication Management, 9*(4), 375-383.

Merkus, S., Willems, T., Schipper, D., van Marrewijk, A., Koppenjan, J., Veenswijk, M., & Bakker, H. (2017). A storm is coming? Collective sensemaking and ambiguity in an inter-organizational team managing railway system disruptions. *Journal of Change Management, 17*(3), 228-248.

Meso, P., Troutt, M. D., & Rudnicka, J. (2002). A review of naturalistic decision making research with some implications for knowledge management. *Journal of Knowledge Management, 6*(1), 63-73.

Messemaker, M., Wolbers, J. J., Treurniet, W., & Boersma, F. K. (2013). *Shaping societal impact: between control and cooperation.* Paper presented at the 10th International ISCRAM Conference, Baden-Baden.

Meyerson, D., Weick, K. E., & Kramer, R. (1996). Swift trust and temporary groups. In R. Kramer & T. Tyler (Eds.), *Trust in Organizations: Frontiers of Theory and Research* (pp. 166-195). Thousand Oaks, CA: Sage.

Ministry of Security and Justice. (2013). *Nationaal Handboek Crisisbesluitvorming [National Handbook Crisis Decision-making]*. The Hague, the Netherlands.

Ministry of the Interior and Kingdom Relations. (2010a). Besluit veiligheidsregio's [Ministerial Order Safety Regions].

Ministry of the Interior and Kingdom Relations. (2010b). Wet veiligheidsregio's [Safety regions act].

Moynihan, D. P. (2009). The network governance of crisis response: Case studies of incident command systems. *Journal of Public Administration Research and Theory, 19*(4), 895-915.

Mulder, F., Ferguson, J., Groenewegen, P., Boersma, F. K., & Wolbers, J. J. (2016). Questioning Big Data: Crowdsourcing crisis data towards an inclusive humanitarian response. *Big Data & Society, 3*(2), 2053951716662054.

Muller, E. R., Berndsen, M. A., De Graaf, B., Kramers, N. E., Schneiders, B. B., & P., V. (2020). Evaluatie Wet veiligheidsregio's: naar toekomstbestendige crisisbeheersing en brandweerzorg [Evaluation safety regions act: towards future-proof crisis management and fire services]. The Hague, the Netherlands: Evaluatiecommissie Wet veiligheidsregio's.

Muller, E. R., Brainich von Brainich Felth, E. T., Brouwer, J. G., & Schilder, A. E. (2017). *Openbare orde en veiligheid: Tekst & Commentaar [Public Order and Safety: Text and Commentary]*. Deventer: Wolters Kluwer.

Nakagawa, Y., & Shaw, R. (2004). Social Capital: A Missing Link to Disaster Recovery. *International Journal of Mass Emergencies and Disasters, 22*(1), 5-34.

NCTV. (2019). Nationale Veiligheid Strategie [National Security Strategy]. The Hague, the Netherlands: National Coordinator for Security and Counterterrorism of the Dutch Ministry of Safety and Security.

Njå, O., & Rake, E. L. (2008). An essay on research methodology: An alternative approach to incident command research through participatory action research. *Journal of Contingencies and Crisis Management, 16*(2), 91-100.

Njå, O., & Rake, E. L. (2009). A discussion of decision making applied in incident command. *International journal of emergency management, 6*(1), 55.

Nohrstedt, D. (2018). Networking and crisis management capacity: a nested analysis of local-level collaboration in Sweden. *The American Review of Public Administration, 48*(3), 232-244.

Nohrstedt, D., Bynander, F., Parker, C., & 't Hart, P. (2018). Managing crises collaboratively: Prospects and problems—A systematic literature review. *Perspectives on Public Management and Governance, 1*(4), 257-271.

Nowell, B., Steelman, T., Velez, A.-L. K., & Yang, Z. (2018). The structure of effective governance of disaster response networks: Insights from the field. *The American Review of Public Administration, 48*(7), 699-715.

O'Brien, A., Read, G. J. M., & Salmon, P. M. (2020). Situation Awareness in multi-agency emergency response: Models, methods and applications. *International Journal of Disaster Risk Reduction*, 101634.

O'Toole Jr, L. J. (1997). Treating networks seriously: Practical and research-based agendas in public administration. *Public Administration Review, 57*(1), 45-52.

Okhuysen, G. A., & Bechky, B. A. (2009). Coordination in Organizations: An Integrative Perspective. *The Academy of Management Annals, 3*(1), 463-502.

Oomes, A. H. J. (2004). *Organization awareness in crisis management.* Paper presented at the International workshop on information systems for crisis response and management (ISCRAM), Brussels.

Owen, C., Brooks, B., Bearman, C., & Curnin, S. (2016). Values and Complexities in Assessing Strategic- Level Emergency Management Effectiveness. *Journal of Contingencies and Crisis Management, 24*(3), 181-190.

Paradis, S., Roy, J., & Treurniet, W. (1998). *Integration of all data fusion levels using a blackboard architecture*. Paper presented at the International Conference on Data Fusion-EuroFusion'98, Great Malvern, UK.

Perrow, C. (2011). *Normal Accidents: Living with High-Risk Technologies (Updated)*. Princeton: Princeton University Press.

Pfaff, M. S., Klein, G. L., Drury, J. L., Moon, S. P., Liu, Y., & Entezari, S. O. (2013). Supporting complex decision making through option awareness. *Journal of Cognitive Engineering and Decision Making, 7*(2), 155-178.

Powell, W. (1990). Neither Market Nor Hierarchy: Network Forms of Organizations. *Research in Organizational Behaviour, 12*, 295-336.

Power, N. (2018). Extreme teams: Toward a greater understanding of multiagency teamwork during major emergencies and disasters. *American Psychologist, 73*(4), 478.

Provan, K. G., Fish, A., & Sydow, J. (2007). Interorganizational Networks at the Network Level: A Review of the Empirical Literature on Whole Networks. *Journal of Management, 33*, 479-516.

Provan, K. G., & Lemaire, R. H. (2012). Core concepts and key ideas for understanding public sector organizational networks: Using research to inform scholarship and practice. *Public Administration Review, 72*(5), 638-648.

Quarantelli, E. L. (1988). Disaster crisis management: A summary of research findings. *Journal of Management Studies, 25*(4), 373-385.

Quarantelli, E. L., & Dynes, R. R. (1985). Community Response to Disasters. In B. J. Sowder (Ed.), *Disasters and Mental Health: Selected Contemporary Perspectives* (pp. 158-168). Rockville, MD: National Institute of Mental Health.

Quinn, R. W., & Worline, M. C. (2008). Enabling courageous collective action: Conversations from United Airlines flight 93. *Organization Science, 19*(4), 497-516.

Raab, J., & Kenis, P. (2009). Heading toward a society of networks: Empirical developments and theoretical challenges. *Journal of management inquiry, 18*(3), 198-210.

Rasmussen, J., Pejtersen, A. M., & Goodstein, L. P. (1994). *Cognitive systems engineering*. New York, NY: Wiley.

Regtvoort, F., & Siepel, H. (2007). Risico en crisiscommunicatie; succesfactor in crisissituaties [risk and crisis communication; success factors in crisis situations]: Bussum: Uitgeverij Coutinho.

Reynolds, B., & Seeger, M. W. (2005). Crisis and Emergency Risk Communication as an Integrative Model. *Journal of Health Communication, 10*(1), 43-55.

Rico, R., Sánchez-Manzanares, M., Gil, F., & Gibson, C. (2008). Team implicit coordination processes: A team knowledge–based approach. *Academy of management review, 33*(1), 163-184.

Rimstad, R., & Sollid, S. J. M. (2015). A retrospective observational study of medical incident command and decision-making in the 2011 Oslo bombing. *International journal of emergency medicine, 8*(1), 4.

Rittel, H. W. J., & Webber, M. M. (1974). Wicked problems. *Man-made Futures, 26*(1), 272-280.

Robinson, S. E., Berrett, B., & Stone, K. (2006). The development of collaboration of response to Hurricane Katrina in the Dallas area. *Public Works Management & Policy, 10*(4), 315-327.

Robinson, S. E., Eller, W. S., Gall, M., & Gerber, B. J. (2013). The core and periphery of emergency management networks. *Public Management Review, 15*(3), 344-362.

Romascanu, A., Ker, H., Sieber, R., Greenidge, S., Lumley, S., Bush, D., . . . Brunila, M. (2020). Using deep learning and social network analysis to understand and manage extreme flooding. *Journal of Contingencies and Crisis Management, 28*(3), 251-261.

Rosenthal, U., Boin, A., & Comfort, L. K. (2001). *Managing crises: Threats, dilemmas, opportunities*. Springfield, IL: Charles C. Thomas.

Salmon, P. M., Stanton, N. A., Walker, G. H., Baber, C., Jenkins, D. P., McMaster, R., & Young, M. S. (2008). What really is going on? Review of situation awareness models for individuals and teams. *Theoretical Issues in Ergonomics Science, 9*(4), 297-323.

Sarter, N. B., & Woods, D. D. (1991). Situation awareness: A critical but ill-defined phenomenon. *The International Journal of Aviation Psychology, 1*(1), 45-57.

Schakel, J. K., & Wolbers, J. J. (2019). To the edge and beyond: How fast-response organizations adapt in rapidly changing crisis situations. *Human Relations*, 0018726719893450.

Schmidt, A. J. (2019). Tensions and Dilemmas in Crisis Governance: Responding to Citizen Volunteers. *Administration & Society, 51*(7), 1171-1195.

Schmidt, A. J., Wolbers, J. J., Ferguson, J. E., & Boersma, F. K. (2018). Are you Ready2Help? Conceptualizing the management of online and onsite volunteer convergence. *Journal of Contingencies and Crisis Management, 26*(3), 338-349.

Scholtens, A. (2008). Controlled Collaboration in Disaster and Crisis Management in the Netherlands, History and Practice of an Overestimated and Understimated Concept. *Journal of Contingencies and Crisis Management, 16*(4), 195-207.

Schön, D. A. (2017). *The reflective practitioner: How professionals think in action*: Routledge.

Schwartz-Shea, P., & Yanow, D. (2009). Reading and writing as method: In search of trustworthy texts. *Organizational ethnography: Studying the complexities of everyday life*, 56-82.

Schwartz-Shea, P., & Yanow, D. (2013). *Interpretive research design: Concepts and processes*. New York: Routledge.

Seawright, J., & Gerring, J. (2008). Case selection techniques in case study research: A menu of qualitative and quantitative options. *Political research quarterly, 61*(2), 294-308.

Seeger, M. W. (2006). Best practices in crisis communication: An expert panel process. *Journal of Applied Communication Research, 34*(3), 232-244.

Sellnow, T. L., Seeger, M. W., & Ulmer, R. R. (2002). Chaos theory, informational needs, and natural disasters. *Journal of Applied Communication Research, 30*(4), 269-292.

Siciliano, M. D., & Wukich, C. (2016). Network Formation During Disasters: Exploring Micro-Level Interorganizational Processes and the Role of National Capacity. *International Journal of Public Administration*. doi: 10.1080/01900692.2016.1140200

Slovic, P. (1987). Perception of risk. *Science, 236*(4799), 280-285.

Smith, K., & Hancock, P. A. (1995). Situation Awareness Is Adaptive, Externally Directed Consciousness. *Human Factors, 37*(1), 137-148.

Solnit, R. (2010). *A paradise built in hell: The extraordinary communities that arise in disaster*. London: Penguin Books.

Spaans, M., Spoelstra, M., Douze, E., Pieneman, R., & Grisogono, A. M. (2009). *Learning to be Adaptive.* Paper presented at the 14th International Command and Control Research and Technology Symposium (ICCRTS).

Standish, R. K. (2008). Concept and Definition of Complexity. In A. Yang & Y. Shan (Eds.), *Intelligent Complex Adaptive Systems* (pp. 105-124). Hershey PA: IGI Publishing.

Stark, D. (2001). Ambiguous assets for uncertain environments: Heterarchy in postsocialist firms. In P. Dimaggio (Ed.), *The twenty-first-century firm: Changing economic organization in international perspective* (pp. 69-104). Princeton, NJ: Princeton University Press.

Steelman, T. A., Nowell, B., Bayoumi, D., & McCaffrey, S. (2014). Understanding information exchange during disaster response: Methodological insights from infocentric analysis. *Administration & Society, 46*(6), 707-743.

Steinberg, P. E., & Shields, R. (2008). *What is a city?: rethinking the urban after Hurricane Katrina*: University of Georgia Press.

Stern, E. K. (2003). Crisis Studies and Foreign Policy Analysis: Insights, Synergies, and Challenges. *International Studies Review, 5*(2), 155-202.

Strauss, A. L. (1993). *Continual permutations of action*: Transaction Publishers.

Stronkman, R. (2011). Exploiting Twitter to fulfill information needs during incidents. *Delft: TU*.

Tatham, P., Spens, K., & Kovacs, G. (2017). The humanitarian common logistic operating picture: a solution to the inter-agency coordination challenge. *Disasters, 41*(1), 77-100. doi: 10.1111/disa.12193

Taylor, R. M., & Selcon, S. J. (1990). *Cognitive quality and situational awareness with advanced aircraft attitude displays.* Paper presented at the Proceedings of the Human Factors Society Annual Meeting.

Ten Dam, M. (2018). Bestuurlijke Netwerkkaarten Crisisbeheersing (handreiking) [Administrative network maps (guidance)]. Arnhem, the Netherlands: Institute for Safety.

Thompson, J. D. (2003). *Organizations in action: Social science bases of administrative theory*. New Brunswick: Transaction publishers.

Tierney, K., Bevc, C., & Kuligowski, E. (2006). Metaphors matter: Disaster myths, media frames, and their consequences in Hurricane Katrina. *The Annals of the American Academy of Political and Social Science, 604*(1), 57-81.

Topper, C. M., & Carley, K. M. (1999). A structural perspective on the emergence of network organizations. *Journal of Mathematical Sociology, 24*(1), 67-96.

Treurniet, W. (2014). Shaping Comprehensive Emergency Response Networks. In T. J. Grant, R. H. P. Janssen & H. Monsuur (Eds.), *Network Topology in Command and Control: Organization, Operation, and Evolution* (pp. 26-48). Hershey, USA: IGI Global.

Treurniet, W., Boersma, F. K., & Groenewegen, P. (2019). Configuring emergency response networks. *International journal of emergency management, 15*(4), 316-332.

Treurniet, W., & Korpel, M. (2015). Referentiekader Netcentrische Crisisbeheersing 2015 [Reference Framework Netcentric Crisis Management 2015]. Arnhem, the Netherlands: Institute Physical Safety.

Treurniet, W., Logtenberg, R. A., & Groenewegen, P. (2014). *Governance of occasional multi-sector networks.* Paper presented at the 11th International ISCRAM Conference, University Park, Pennsylvania, USA.

Treurniet, W., Messemaker, M., Wolbers, J. J., & Boersma, F. K. (2015). Shaping the societal impact of emergencies: striking a balance between control and cooperation. *International Journal of Emergency Services, 4*(1), 129-151. doi: 10.1108/IJES-06-2014-0007

Treurniet, W., & Van Buul-Besseling, K. (2015). *Four archetypal networked organisations.* Paper presented at the 12th International ISCRAM Conference, Kristiansand, Norway.

Treurniet, W., Van Buul-Besseling, K., & Wolbers, J. J. (2012). *Collaboration awareness - a necessity in crisis response coordination*. Paper presented at the 9th International ISCRAM Conference, Vancouver, Canada.

Treurniet, W., van Delft, J., & Paradis, S. (1999). *Tactical information abstraction framework in maritime command and control*. Paper presented at the RTO SAS Symposium on "Modelling and Analysis of Command and Control", Issy les Moulineaux, France.

Treurniet, W., & Wolbers, J. J. (2021). Codifying a crisis: Progressing from information sharing to distributed decision-making. *Journal of Contingencies and Crisis Management, 29*(1), 23-35.

Turner, B. A. (1976). The organizational and interorganizational development of disasters. *Administrative Science Quarterly, 21*(3), 378-397.

Turner, B. A., & Pidgeon, N. F. (1997). *Man-made disasters* (2 ed.). Oxford: Butterworth-Heinemann.

Uhr, C. (2009). *Multi-organizational emergency response management: a framework for further development*. Lund, Sweden: Lund University.

Ungar, S. (2001). Moral panic versus the risk society: the implications of the changing sites of social anxiety. *British Journal of Sociology, 52*(2), 271-291.

United Nations Office for the Coordination of Humanitarian Affairs. (2013). Humanitarianism in the Network Age; including world humanitarian data and trends 2012 *OCHA Policy and Studies Series*: UN Office for the Coordination of Humanitarian Affairs (OCHA).

Van Aart, C. J., & Oomes, A. H. J. (2008). *Real-Time Organigraphs for Collaboration Awareness*. Paper presented at the 5th International ISCRAM Conference, Washington, DC, USA.

Van Baars, S. (2005). The horizontal failure mechanism of the Wilnis peat dyke. *Géotechnique, 55*(4), 319-323.

Van de Ven, J. G. M., Van Rijk, R., Essens, P. J. M. D., & Frinking, E. (2008). *Network Centric Operations in Crisis Management.* Paper presented at the 5th International ISCRAM Conference, Washington, DC, USA.

Van de Walle, B., Brugghemans, B., & Comes, T. (2016). Improving situation awareness in crisis response teams: An experimental analysis of enriched information and centralized coordination. *International Journal of Human-Computer Studies, 95*, 66-79.

Van Duin, M. J., Tops, P., Wijkhuijs, V., Adang, O., & Kop, N. (2012). *Lessen in crisisbeheersing: dilemma's uit het schietdrama in Alphen aan den Rijn [Lessons in crisismanagement: dilemmas from the shooting disaster in Alphen aan den Rijn]*: Boom Lemma uitgevers.

Van Duin, M. J., & Wijkhuijs, V. (2016). *Lessen uit crises en mini-crises 2015 [Lessons from crises and mini-crises 2015]*. The Hague, the Netherlands: Boom bestuurskunde.

Van Duin, M. J., Wijkhuijs, V., & Jong, W. (2013). *Lessen uit crises en mini-crises 2012 [Lessons from crises and mini-crises 2012]*. The Hague, the Netherlands: Boom Lemma uitgevers.

Van Lakerveld, J. A., & Wolbers, J. J. (2020). State of the Art Crisisbeheersing Fase 2 [State of the Art Crisis Management Phase 2]. The Hague, the Netherlands: Research and documentation centre WODC.

Van Ruler, B. (2004). The communication grid: an introduction of a model of four communication strategies. *Public Relations Review, 30*(2), 123-143.

Van Trijp, J. M. P., Boersma, F. K., & Groenewegen, P. (2018). Resilience from the real world towards specific organisational resilience in emergency response organisations. *International journal of emergency management, 14*(4), 303-321.

Veil, S. R., Bühner, T., & Palenchar, M. J. (2011). A Work-In-Process Literature Review: Incorporating Social Media in Risk and Crisis Communication. *Journal of Contingencies and Crisis Management, 19*(2), 110 - 122.

Verheul, M., van der Vlies, V., Stadhouders, L., Peeters, M., Vlagsma, J., Hylkema, D., & van Engelshoven, E. (2021). Evaluatie van het Netcentrisch Werken tijdens de eerste maanden van de coronacrisis [Evaluation of Netcentric Operations during the first months of the corona crisis]. Utrecht, the Netherlands: Berenschot.

Vlaar, P. W. L., Fenema, P. C. v., & Tiwari, V. (2008). Cocreating understanding and value in distributed work: How members of onsite and offshore vendor teams give, make, demand, and break sense. *Management Information Systems Quarterly, 32*(2), 227-255.

Waldman, S., Yumagulova, L., Mackwani, Z., Benson, C., & Stone, J. T. (2018). Canadian citizens volunteering in disasters: From emergence to networked governance. *Journal of Contingencies and Crisis Management, 26*(3), 394-402.

Walker, W. E., Lempert, R. J., & Kwakkel, J. H. (2013). Deep uncertainty. In S. I. Gass & M. C. Fu (Eds.), *Encyclopedia of operations research and management science* (pp. 395-402). New York: Springer.

Warren, R. (1972). *The Community in America*. Chicago: Rand McNally.

Weggeman, M. C. D. P. (1997). *Organiseren met kennis [Organising with Knowledge]*. Schiedam, the Netherlands: Scriptum.

Weick, K. E. (1979). *The social psychology of organizing*. New York: McGraw-Hill, Inc.

Weick, K. E. (2005). Managing the Unexpected: Complexity as Distributed Sensemaking. In R. R. McDaniel Jr & D. J. Driebe (Eds.), *Uncertainty and Surprise in Complex Systems: Questions on Working with the Unexpected* (pp. 51-78). Berlin, Germany: Springer-Verlag.

Weick, K. E. (2012). *Making sense of the organization: Volume 2: The impermanent organization*. Chichester, UK: John Wiley & Sons Ltd.

Weick, K. E., & Sutcliffe, K. M. (2007). *Managing the unexpected: resilient performance in an age of uncertainty* (2nd ed.). San Francisco: John Wiley & Sons, Inc.

Whelan, C. (2012). *Networks and National Security; Dynamics, Effectiveness and Organisation*. Surrey, England: Ashgate Publishing Limited.

Wijngaert, L. A. L., Dijk, J. A. G. M., & Tije, S. (2014). *Project X Haren: The Role of Media Influence and Social Influence, in Present-Day Event Mobilization.* Paper presented at the ICA 64th annual conference "Communication and 'the good life'", Seattle.

Williams, R., & Edge, D. (1996). The social shaping of technology. *Research Policy, 25*(6), 865-899.

Williamson, O. E. (1975). *Markets And Hierarchies: Analysis and Antitrust Implications: A Study In The Economics Of Internal Organization*. New York: Free Press.

Wimelius, M. E., & Engberg, J. (2015). Crisis Management through Network Coordination: Experiences of Swedish Civil Defence Directors. *Journal of Contingencies and Crisis Management, 23*(3), 129-137.

Wolbers, J. J. (2016). Drawing the Line. Cross-Boundary Coordination Processes in Emergency Management.

Wolbers, J. J., & Boersma, F. K. (2013). The Common Operational Picture as Collective Sensemaking. *Journal of Contingencies and Crisis Management*, 186-199.

Wolbers, J. J., & Boersma, F. K. (2019). Key challenges in crisis management *The Routledge Companion to Risk, Crisis and Emergency Management* (pp. 17-34). New York: Taylor and Francis.

Wolbers, J. J., Boersma, F. K., & Groenewegen, P. (2018). Introducing a fragmentation perspective on coordination in crisis management. *Organization Studies, 39*(11), 1521-1546.

Wolbers, J. J., Groenewegen, P., Mollee, J., & Bím, J. (2013). Incorporating time dynamics in the analysis of social networks in emergency management. *Journal of Homeland Security and Emergency Management, 10*(2), 555-585.

Yanow, D. (2015). Making sense of policy practices: Interpretation and meaning *Handbook of critical policy studies*. Cheltenham, UK: Edward Elgar Publishing.

You, M., & Ju, Y. (2019). Salience of public leaders' "meaning making" in news coverage of a health crisis. *Journal of Contingencies and Crisis Management, 27*(4), 400-405.

9 Summary

I view modern communities as tight webs of interdependent institutions, social networks, physical entities and critical infrastructures. A crisis boils down to a failure that ripples through the fabric of the community and directly or indirectly threatens or impacts vital community interests. In this thesis I focus specifically on *emergencies*, which I define as crises with a fast rise rate.

The tightly woven nature of modern communities makes them vulnerable. There are many interdependencies which help to spread the impact of failure, and if regular structures fail, new interdependencies and unforeseen interactions can easily emerge.

Fortunately, communities are inherently resilient as well. There is much coping capacity in the community fabric, even if it has holes, tears and frays caused by emergencies. The private sector and the general public, including individual citizens and groups of citizens, exhibit constructive responses to emergencies.

Given their complex and wicked nature, crises and emergency situations can best be responded to by a networked collective of organisations. A typical organisational response network is a broad, mixed-sector network which includes all relevant expertise. The network is mixed-sector because it is typically composed of governmental organisations, commercial organisations and citizen collectives.

Given the high stakes involved in emergency situations, the organisational emergency response network should also be a high-reliability network. Such a network should be intent on avoiding failure, wary of over-simplification, sensitive to operations, and committed to resilience, and it should defer to expertise. A common operational picture is often seen as a valuable contribution to a networked response. It can be seen as the shared memory of the network and it results from the retention element of the enactment–selection–retention cycle in the response network's sensemaking process. The constituent parts of the network maintain and share their own picture of the emergency situation as part of the common operational picture, and in so doing they continually and iteratively frame, elaborate, question and reframe the situation.

In this thesis I set out to look at three areas in which there are knowledge gaps:

- What patterns of involvement can be discerned in organisational networks that respond to emergencies?
- How can the communication strategy of a collaboration of emergency response organisations make a difference to an emergency's overall impact on the community?
- How does maintaining a common operational picture during an emergency response contribute to collaborative sensemaking between those at the front line and those in more remote parts of the response network?

The common operational picture is mentioned explicitly in the last one of these three questions, but I also look closely at its role when addressing the first two.

In addressing the first of these challenges I find that the emergency situation and the organisational response network are reflections of one another. A common operational picture, representing a causal network of the emergency and its consequences, can be used to determine what is considered part of the emergency and also to determine which organisations to involve in the response. It is recommended that the common operational picture should be shared broadly in order to enable organisations to assess any impact on the particular community functions for which they are responsible.

In addressing the second challenge I argue that the professional part of the emergency response network should seek to strike a balance between directive command and control and more empathic coordination and cooperation. I find that one of the indicators of whether or not the balance has been achieved is how those in the professional response network communicate with the broader community. I distinguish five aspects of communication: type of language, reading, disclosure of information, connectedness, and direction. My recommendation is that a common operational picture, which sets out clearly and coherently what is known and what is not, should be used to provide a common basis for crisis communication.

In addressing the third challenge I find that the common operational picture should be more than a warehouse for storing and distributing factual information about the emergency situation. The common operational picture should also be used to convey more abstract knowledge at the level of semantics or interpretation and at the level of interests of organisations involved in the response. I also find that a common operational picture often falls short in terms of conveying the rapidly changing dynamics at the front line, even though this information can be crucial in helping those in the response network to gain an adequate understanding of the emergency situation and its likely consequences.

A key finding from our study is that the common operational picture can be seen as a two-way, semi-transparent mirror between the emergency situation and the emergency response network, providing a coherent view on both. A second important finding is that, to be effective, this view needs to be both multi-faceted and multi-level. It needs to be *multi-faceted* in that it is made up of the different perspectives that the collaborating teams and organisations have on the emergency situation. These different perspectives need to be available to all teams and organisations to help with the continuous and cyclical collaborative sensemaking process of framing, questioning and reframing the emergency. The common operational picture needs to be *multi-level* in that it is used to share not only factual information but also higher levels of knowledge. Significant effort is required to provide a multi-faceted and multi-level common operational picture that is both up to date and sufficiently rich in content; it may therefore not always be possible to codify complex and rapidly evolving situations and to share this codified perspective with others in the network in real time.

The common operational picture provides a solid basis for command and control throughout the organisational emergency response network, as it reflects both the goals and interests of the organisations involved and the response measures. In this way, it can easily be used to monitor the progress of the response and to ensure that all interests are properly weighed against each other. Because the common operational picture also provides a view on the emergency response organisation itself, it also provides a basis for continuously shaping the response network.

Not only is shared situational awareness an important condition for effective emergency response collaboration, but so too is collaboration awareness. Organisations that are involved in occasional collaboration networks should have a collaborative stance and should therefore be open to collaborating with others with which they have never worked before. Trust can be built up swiftly through the process of jointly developing a common operational picture. Collaboration awareness can be further enhanced by sharing information about the organisations involved in the emergency response, including details of their formal responsibilities, interests, structures and decision processes as well as their particular perspectives on the emergency.

10 Samenvatting

Ik zie moderne gemeenschappen als hechte netwerken van onderling afhankelijke instituties, sociale netwerken, fysieke entiteiten en vitale infrastructuren. Een crisis komt in essentie neer op een verstoring die zich door dit weefsel van de gemeenschap voortplant en direct of indirect vitale belangen van de gemeenschap bedreigt of aantast. In dit proefschrift richt ik mij specifiek op *noodsituaties*, een term die ik gebruik voor zich snel ontwikkelende crises.

De hechte verwevenheid van moderne gemeenschappen maakt ze kwetsbaar. Er zijn veel onderlinge afhankelijkheden die helpen de impact van een verstoring zich voort te planten, en als reguliere structuren falen, kunnen er ook gemakkelijk nieuwe onderlinge afhankelijkheden en onvoorziene interacties ontstaan.

Gelukkig zijn gemeenschappen van nature ook veerkrachtig. Het weefsel van een gemeenschap kan veel hebben, ook al heeft het gaten, scheuren en rafels, veroorzaakt door noodsituaties. De particuliere sector en het grote publiek, inclusief individuele burgers en burgergroepen, reageren er veelal constructief op.

Op crises en noodsituaties kan, gezien hun complexe en ongestructureerde aard, het beste worden gereageerd door een netwerk van organisaties. Een responsnetwerk is typisch een breed netwerk, met organisaties uit verschillende sectoren dat alle relevante expertise omvat. Het netwerk is opgebouwd uit verschillende sectoren in die zin dat het doorgaans is samengesteld uit overheidsorganisaties, commerciële organisaties en burgercollectieven.

Gezien de grote belangen die op het spel staan bij noodsituaties, moet het organisatorische responsnetwerk ook een netwerk met hoge betrouwbaarheid zijn. Zo'n netwerk moet erop gericht zijn om falen te voorkomen, op zijn hoede zijn voor oversimplificatie, aandacht hebben voor de uitvoering en gericht zijn op veerkracht, en het moet expertise op waarde schatten. Een gedeeld operationeel beeld wordt vaak gezien als een waardevolle ondersteuning van genetwerkte respons. Het kan worden gezien als het collectieve geheugen van het netwerk. Het is het resultaat van het onderdeel *retention* van de *enactment-selection-retention*-cyclus in het *sensemaking*-proces van het responsnetwerk. De onderdelen van het netwerk onderhouden en delen hun eigen beeld van de situatie als onderdeel van het gedeeld operationeel beeld, waarbij ze voortdurend en iteratief de situatie framen, uitwerken, kritisch beschouwen en herframen.

In dit proefschrift heb ik gekeken naar drie gebieden met kennislacunes:

- Welke patronen kunnen worden onderscheiden in welke organisaties betrokken zijn in organisatienetwerken die reageren op noodsituaties?
- Hoe kan de communicatiestrategie van een samenwerkingsverband van responsorganisaties een verschil maken in de algehele impact van een noodsituatie op de gemeenschap?
- Hoe draagt het onderhouden van een gedeeld operationeel beeld tijdens de respons bij aan gezamenlijke sensemaking van actoren nabij de plaats incident en actoren met meer afstand tot de plaats incident?

Het gedeelde operationele beeld wordt expliciet genoemd in de laatste van deze drie vragen, maar ik kijk ook naar de rol ervan bij het bestuderen van de eerste twee.

Bij het aanpakken van de eerste van deze uitdagingen merk ik dat de noodsituatie en het responsnetwerk een weerspiegeling van elkaar zijn. Een gedeeld operationeel beeld, zeker als dat een causaal netwerk van de noodsituatie en de gevolgen ervan weergeeft, kan worden gebruikt om te bepalen wat wel en wat niet als onderdeel van de noodsituatie wordt beschouwd en ook om te bepalen welke organisaties bij de respons moeten worden betrokken. Het wordt aanbevolen dat het gedeelde operationele beeld breed wordt gedeeld, zodat organisaties zelf de eventuele impact op de specifieke functies waarvoor zij verantwoordelijk zijn, kunnen beoordelen.

Bij het aanpakken van de tweede uitdaging bepleit ik dat het professionele deel van het responsnetwerk moet streven naar een balans tussen directieve commandovoering en meer empathische coördinatie en samenwerking. Ik merk dat één van de indicatoren voor het al dan niet bereiken van die balans is hoe het professionele responsnetwerk communiceert met de bredere gemeenschap. Ik onderscheid vijf aspecten van communicatie: taalgebruik, interpretatie, ontsluiten van informatie, verbondenheid en richting. Mijn aanbeveling is dat een gedeeld operationeel beeld, dat duidelijk en coherent beschrijft wat bekend is en wat niet, zou moeten worden gebruikt om een gemeenschappelijke basis te bieden voor crisiscommunicatie.

Bij het aanpakken van de derde uitdaging merk ik dat het gedeelde operationele beeld meer moet zijn dan een depot voor het opslaan en verspreiden van feitelijke informatie over de situatie. Het gedeelde operationele beeld moet ook worden gebruikt om meer abstracte kennis over te brengen op het niveau van semantiek of interpretatie en op het niveau van belangen van organisaties die bij de respons betrokken zijn. Ik merk ook dat een gedeeld operationeel beeld vaak tekortschiet als het gaat om het overbrengen van de snel veranderende dynamiek rond de plaats van het incident, terwijl deze informatie cruciaal kan zijn om het responsnetwerk te helpen een goed begrip te krijgen van de situatie en de eventuele gevolgen ervan.

Een belangrijke bevinding uit ons onderzoek is dat het gedeelde operationele beeld kan worden gezien als een halfdoorlatende spiegel tussen de situatie en het responsnetwerk, waardoor een coherent beeld van beide ontstaat. Een tweede belangrijke bevinding is dat dit beeld, om effectief te zijn, zowel veelzijdig als multi-level moet zijn. Het moet *veelzijdig* zijn omdat het is samengesteld uit de verschillende perspectieven die de samenwerkende teams en organisaties hebben op de situatie. Deze verschillende perspectieven moeten beschikbaar zijn voor alle teams en organisaties om bij te dragen aan het continue en cyclische gezamenlijke proces van sensemaking; van het framen, uitwerken, kritisch beschouwen en herframen van de situatie. Het gedeelde operationele beeld moet *multi-level* zijn in die zin dat het wordt gebruikt om niet alleen feitelijke informatie te delen, maar ook hogere kennisniveaus. Er is aanzienlijke inspanning nodig om een veelzijdig en multi-level gedeeld operationeel beeld te onderhouden dat zowel actueel als voldoende inhoudrijk is; Het zal daarom niet altijd mogelijk zijn om complexe en zich snel ontwikkelende situaties te codificeren en realtime met anderen in het netwerk te delen.

Het gedeelde operationele beeld biedt een stevige basis voor leiding en coördinatie in het responsnetwerk, omdat het zowel de doelen en belangen van de betrokken organisaties als ook de genomen maatregelen weerspiegelt. Op deze manier kan het worden gebruikt om de voortgang van de respons te monitoren en ervoor te zorgen dat alle belangen goed tegen elkaar worden afgewogen. Omdat het gedeelde operationele beeld ook zicht geeft op de responsorganisatie zelf, biedt het ook een basis om het responsnetwerk continu vorm te geven.

Niet alleen gedeeld situationeel bewustzijn is een belangrijke voorwaarde voor effectieve samenwerking, maar ook samenwerkingsbewustzijn. Organisaties die betrokken zijn bij organisatorische gelegenheidsnetwerken moeten een collaboratieve houding hebben en moeten daarom openstaan voor samenwerking met partijen waarmee ze nog nooit eerder hebben samengewerkt. Vertrouwen kan snel worden opgebouwd door gezamenlijk een gedeeld operationeel beeld te ontwikkelen. Het samenwerkingsbewustzijn kan verder worden vergroot door informatie te delen over de organisaties die betrokken zijn bij de respons, inclusief details over hun formele verantwoordelijkheden, belangen, structuren en besluitvormingsprocessen, evenals hun specifieke perspectieven op de situatie.

11 Dankwoorden

Na ruim tien jaar onderzoeks- en schrijfwerk ligt het proefschrift er dan eindelijk. Tijd om terug te blikken en om heel veel dank uit te spreken. Dank aan velen die het werk mede mogelijk maakten door er aan bij te dragen, door het te begeleiden, door er kritisch mee en tegen te lezen, door te ondersteunen, door er ruimte voor te maken, door aan te moedigen of zelfs alleen maar door het te gedogen.

Het idee voor dit onderzoek werd geboren in de tijd van het project netcentrisch werken dat in de jaren rond 2010 werd uitgevoerd. Dat project was erop gericht om de netcentrische werkwijze en het hieraan ondersteunende landelijk crisismanagement systeem (LCMS) te implementeren binnen de veiligheidsregio's. Vanuit de TNO-afdeling *Networked Organizations* heb ik een bijdrage geleverd aan dat project. Vanuit de afdeling organisatiewetenschappen van de VU-faculteit sociale wetenschappen deden Jeroen Wolbers, Kees Boersma en Jaap de Heer in het kader van datzelfde project een cultuuronderzoek naar multidisciplinaire samenwerking en gezamenlijke operationele beelden in de veiligheidsregio's. We ontdekten dat de TNO-afdeling *Networked Organizations* en de VU-afdeling organisatiewetenschappen zich voor een deel met dezelfde thematiek bezig hielden. Binnen TNO meer toegepast en binnen de VU meer academisch. Samenwerking leek voor beide afdelingen interessant. Het idee ontstond dat de samenwerking verder gestalte kon krijgen door een AIO te werven met één been bij de VU en één been bij TNO. Ik ben toen een onderzoeksvoorstel gaan schrijven en kwam tijdens het schrijven tot de ontdekking dat ik dat onderzoek eigenlijk zélf wilde gaan doen. Na niet al te lang dubben is de knoop doorgehakt en ben ik begin 2012 gestart met Peter Groenewegen en Kees Boersma als promotoren. Er is vanaf het begin veel eigen tijd in gaan zitten – over die kwalificatie "eigen" later meer – maar ik dank TNO voor de ruimte en het vertrouwen dat ik kreeg. Van Robin de Haas en Eddy Boot bijvoorbeeld.

In 2015 ben ik bij TNO vertrokken en overgestapt naar het NIPV (destijds IFV). Ik kijk met veel plezier terug naar mijn tijd bij TNO. Het voert te ver om alle TNO-collega's bij naam te noemen maar Kim van Buul, Marcel van Hekken en Maartje Schuurmans noem ik hier toch expliciet. Dank voor de collegialiteit en de betrokkenheid en de stimulans die er steeds zijn geweest. Kim, ik heb het logboek nog steeds bij me, ook al doe ik tegenwoordig alles digitaal.

Veel dank gaat ook uit naar Peter Groenewegen en Kees Boersma. In de loop van de ruim tien jaar onderzoek zijn de rollen van Peter en Kees verwisseld. Na het emeritaat van Peter nam Kees het promotorschap over en werd Peter copromotor. Dank ook voor júllie vertrouwen, de support, de stimulans, de gastvrijheid en wat niet al.

Peter, ik hoop niet dat ik je al te lang van je emeritaatsrust heb afgehouden. Als je me zat was, heb je dat goed weten te verbergen.

Zeker de eerste jaren van het onderzoekstraject heb ik zeer prettig samengewerkt met een aantal andere buitenpromovendi. Ik noem met name Rianne Gouman, Remco Groet, Willem van Santen en John van Trijp. Ook de samenwerking met de 'reguliere' promovendi Jeroen Wolbers, Arjen Schmidt en Jori Kalkman was uiterst plezierig. Dank voor de inspirerende gesprekken. Dank ook voor de ervaren collegialiteit en de stimulans die er steeds van onze contacten uitging.

Ik heb in het onderzoek intensief gebruik gemaakt van data van echte crisisgebeurtenissen. Dat heeft altijd wel wat dubbel gevoeld. Het ging om situaties waarbij sprake was van écht leed bij échte mensen. Waarbij vaak ook sprake was van dodelijke slachtoffers. Ik ben me daar bij het analyseren van de data steeds van bewust geweest. Gebeurtenissen die voor mij onderwerpen van analyse en bronnen van inzicht waren, zijn voor anderen dramatisch geweest en zijn dat soms nog. Ik realiseer me dat dit geldt voor al het onderzoek dat wordt verricht naar crisisgebeurtenissen, maar ik hecht er aan deze ambivalentie in dit dankwoord expliciet te benoemen.

Dat brengt me ook bij het brede veld aan crisisbeheersingsprofessionals. In mijn reguliere werk bij het NIPV mag ik dagelijks met hen werken. Op deze plaats spreek ik mijn dank uit voor de openheid en voor de vele inzichten die die contacten ook voor dit onderzoek hebben opgeleverd. Meer specifiek denk ik aan wie ik voor dit onderzoek ook uitgebreid heb geïnterviewd. Ik ga hier geen namen noemen; dat heb ik in de verschillende hoofdstukken van dit proefschrift ook niet gedaan. Veel dank voor de bereidwillige medewerking en voor de openheid.

Ik gaf al aan dat ik in 2015 de overstap maakte van TNO naar het NIPV. Ook na die tijd is er veel eigen tijd in het onderzoek gaan zitten maar ik dank ook het NIPV voor de ruimte en het vertrouwen dat ik kreeg. Ik denk hierbij met name aan Gerrit Amsing en aan Patrick Jansen. Maar ik denk ook aan de directe collega's en (inmiddels) ex-collega's: Mark Aukema, Marloes Bisseling, Norbert Bosman, Volkan Cetintas, Elnathan van Dijk, Wendy van de Graaff, Anja Kools, Martijn Korpel, Maarten van Leeuwen, Wouter Mesie, Duuk Mouris, Maxim Plessa, Raymond Schram, Jeroen Steijsiger, Vincent Suitela, Elske Veldhuisen, Bregje Veldman, Marije Visscher en Theo van Vuuren. Voor schrijfwerk moest ik soms flinke blokken in m'n agenda reserveren. Dat kwam de bereikbaarheid en de mogelijkheid om gezamenlijke afspraken te plannen niet altijd ten goede. Dank voor het al die tijd niet al te veel hierover mopperen – naar mij toe althans. Dank voor de flexibiliteit en ook voor de uitstekende balans in het meeleven: wel interesse tonen maar niet te vaak vragen naar de voortgang en de planning.

Ik bedank ook de diverse coauteurs met wie ik heb mogen samenwerken. Ik noemde eerder Kees Boersma, Kim van Buul, Peter Groenewegen en Jeroen Wolbers al. Ik noem ook Rozemarijn Logtenberg en Manne Messemaker. Ik heb jullie met veel plezier mogen begeleiden bij jullie masteronderzoek. In beide gevallen heeft deze samenwerking uiteindelijk ook één of meer gezamenlijke publicaties opgeleverd.

Ik noemde eerder al dat er veel eigen tijd in het onderzoek is gaan zitten. Maar dat was natuurlijk helemaal geen “eigen” tijd. Dat was vooral tijd die ook samen met diverse anderen had kunnen worden besteed. Binnen de kerkelijke gemeente bijvoorbeeld. Maar meer nog, samen met mijn vrouw Marianne en onze kinderen Andrea, Aline, Harriët en Marte. Ik wil ook jullie super bedanken. Ik realiseer me dat de onderzoeksjaren ook van jullie heel veel hebben gevraagd. Of – wat eerlijker geformuleerd – dat ik jullie die jaren veel heb onthouden. Met name tijd en aandacht. Ja, ik weet dat Marianne me destijds zelf heeft gestimuleerd om het avontuur aan te gaan, maar – gelukkig – konden we toen nog niet helemaal overzien waar we aan begonnen. Niet alleen voor mij maar ook voor Marianne voelt de publicatie van dit proefschrift als het einde van een tijdperk en het begin van een nieuw.

Ik wil dit dankwoord graag eindigen door uit te spreken dat ik bovenal God dankbaar ben. Hij heeft mij de energie, de gezondheid en de verdere mogelijkheden gegeven om dit werk te doen. Nee, dat is allemaal niet uit de lucht komen vallen. Daarin hebben vele anderen een rol gespeeld: mijn ouders natuurlijk en vervolgens een steeds verder uitdijende groep andere mensen om me heen. Maar uiteindelijk, in dat alles weet ik dat *mijn hulp komt van de HEER, die hemel en aarde gemaakt heeft* (Psalm 121 : 2).

12 About the author

After completing an MSc in informatics I started a that combined applied research and consultancy. I was involved in a research programme on command and control, studying the feasibility of substantially reducing the size of frigate-level command teams. I was the lead author of the Royal Netherlands Navy's command, control, communications and information policy, and as an information architect I also co-authored the corporate information architecture of the Dutch Ministry of Defence. As a programme manager of several command and control research programmes, I was responsible for developing a vision on command and control in future military operations. After switching to the application domain of crisis management, I continued to apply and develop my experience in information management and netcentric operations.

During this part of my career I found out that in general the technical aspects of problems and solutions are the least complex ones. In most cases the human, cultural, organisational and process aspects are more determinative but at the same time less pliable. As these non-technical aspects appeared to be the most interesting, the focus of my research and consultancy gradually shifted to the non-technical side. I advised many organisations, including various Dutch safety regions, water boards, the Rijkswaterstaat (the executive agency of the Ministry of Infrastructure and Water Management) and drinking water companies, on the implementation of netcentric collaboration. In an observation and evaluation role, I have been involved in dozens of crisis management exercises carried out by safety regions and their crisis partners. I was also involved in evaluations and sessions focusing on the lessons learned from real-life incidents. Such incidents included the high water levels in 2012 in the northern areas of the Netherlands, which were caused by extreme rainfall and led to a number of cascading effects and threats in the water networks, including waterlogging and piping, and a shooting in Utrecht in 2019. Finally, I was an observer in several teams coordinating events.

The common element in all my various consultancy, observation and evaluation roles was netcentric collaboration and information management. This comprises aspects such as the quality of the operational picture, how the information management roles in the coordination teams are fulfilled, how information management processes are organised, and how the common operational picture is used in assessing the situation and in decision-making. I have been observing, analysing and discussing the practical performance of many teams and individuals, both in real life and in exercise situations. I also have developed a framework for observing and assessing the above-mentioned areas objectively and I have co-authored several editions of a frame of reference for the netcentric crisis management practice in the Netherlands.

A common operational picture is often seen as a valuable contribution to a networked response to crises and emergencies. The constituent parts of the network maintain and share their own picture of the emergency situation as part of the common operational picture, and in so doing they continually and iteratively frame, elaborate, question and reframe the situation.

This thesis sets out to look at three areas in which there are knowledge gaps:

- What patterns of involvement can be discerned in organisational networks that respond to emergencies?
- How can the communication strategy of a collaboration of emergency response organisations make a difference to an emergency's overall impact on the community?
- How does maintaining a common operational picture during an emergency response contribute to collaborative sensemaking between those at the front line and those in more remote parts of the response network?

A key finding from the study is that the common operational picture can be seen as a two-way, semi-transparent mirror between the emergency situation and the emergency response network, providing a coherent view on both. A second important finding is that, to be effective, this view needs to be both multi-faceted and multi-level. It needs to be multi-faceted in that it is made up of the different perspectives that the collaborating teams and organisations have on the emergency situation. These different perspectives need to be available to all teams and organisations to help with the continuous and cyclical collaborative sensemaking process of framing, questioning and reframing the emergency. The common operational picture needs to be multi-level in that it is used to share not only factual information but also higher levels of knowledge. Significant effort is required to provide a multi-faceted and multi-level common operational picture that is both up to date and sufficiently rich in content; it may therefore not always be possible to codify complex and rapidly evolving situations and to share this codified perspective with others in the network in real time.

The common operational picture provides a solid basis for command and control throughout the organisational emergency response network, as it reflects both the goals and interests of the organisations involved and the response measures. In this way, it can easily be used to monitor the progress of the response and to ensure that all interests are properly weighed against each other. Because the common operational picture also provides a view on the emergency response organisation itself, it also provides a basis for continuously shaping the response network.

ISBN: 9789090362403