Configuring emergency response networks

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Abstract: In the fog and chaos of an emergency it seems difficult to determine which organisations to involve in the response in order to ensure that the organisational network is fit for purpose. In this paper we study three emergencies in the Netherlands in order to find out what patterns are detectable in the network of the responding organisations. Based on qualitative analysis we develop insights about how the composition of the response networks relates to the nature of the emergencies, and the impact they have on the community. We find the community to be an intertwined constellation of networks. A failure in this constellation may result in an emergency situation. The failure itself and any collateral effects from responsive actions ripple through the constellation of networks. We found that the emergency situation and the emergency response network mutually shape each other and are a reflection of each other.

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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 and 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[1] and the local water board.[2] 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 and 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 et al., 2013) or on coordination across the network (Topper and 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 paper, 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.

2 Theoretical framework

In this paper 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 and Dynes, 1985). Examples include social networks of various types, such as community, city or regional networks (Castells, 2004; Hoffman and 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 paper, 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.

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 (Berlin and 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 and Kapucu, 2006; Kapucu et al., 2010; Moynihan, 2009; Robinson et al., 2013; Topper and 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 considers 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 et al. (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 et al., 2010; Dynes, 1994; Garnett and Kouzmin, 2007; Kapucu et al., 2010; Kapucu and Van Wart, 2006; Kapucu et al., 2016; Kusumasari, 2012; Lindell et al., 2006; Lindell and Prater, 2003; Mendonca and Wallace, 2004; Nakagawa and Shaw, 2004; Quarantelli, 1988; Quarantelli and Dynes, 1985; Siciliano and Wukich, 2016; Solnit, 2010; Tierney et al., 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   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 (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 and 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 et al., 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 and 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 LCMS, a crisis management system used in all the safety regions[3] 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 et al. (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 and 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.

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.

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 1 provides a causal diagram of the event, showing the consequences and the response measures taken by the emergency management network.

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.

Figure 1 Causal diagram of the liquid fire in Moerdijk, including the consequences and the response measures (see online version for colours)
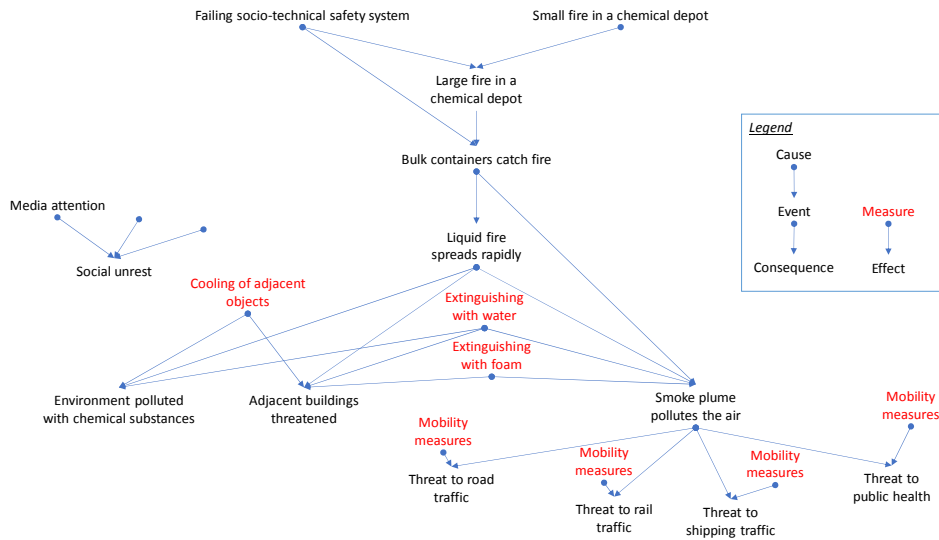
Failure management and consequence management are tightly interwoven in this case. The initial failure directly threatens the local community in several ways. The side effects of managing these consequences lead to failures in several community networks, which must in turn also be managed.

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 2 provides a causal diagram of the event, showing the consequences and the response measures taken by the emergency management network.

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 healthcare 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 healthcare 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.

Figure 2   Causal diagram of the mall shooting at De Ridderhof, including the consequences and the response measures (see online version for colours)
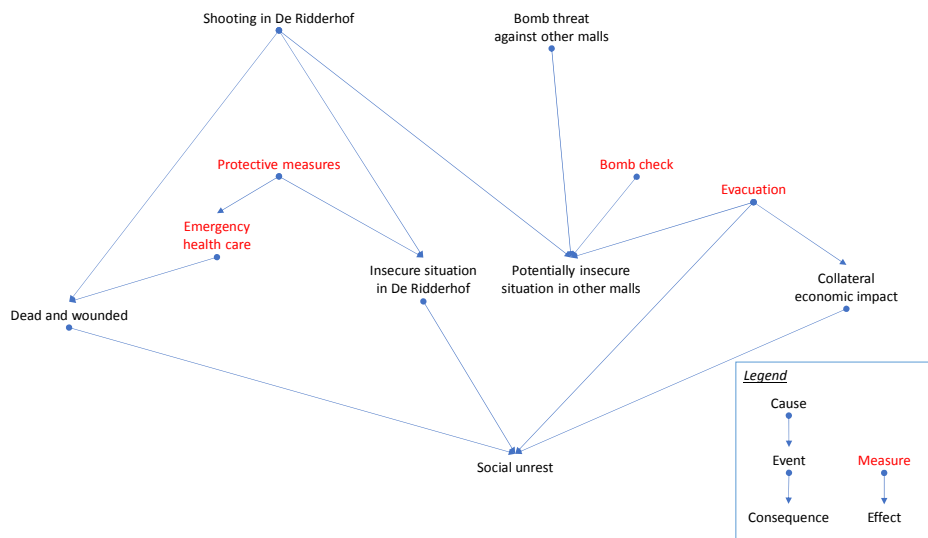
4.3   Collapse of cranes on building project

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 Figure 3.

Figure 3 Causal diagram of the collapse of cranes, including the consequences and the response measures (see online version for colours)
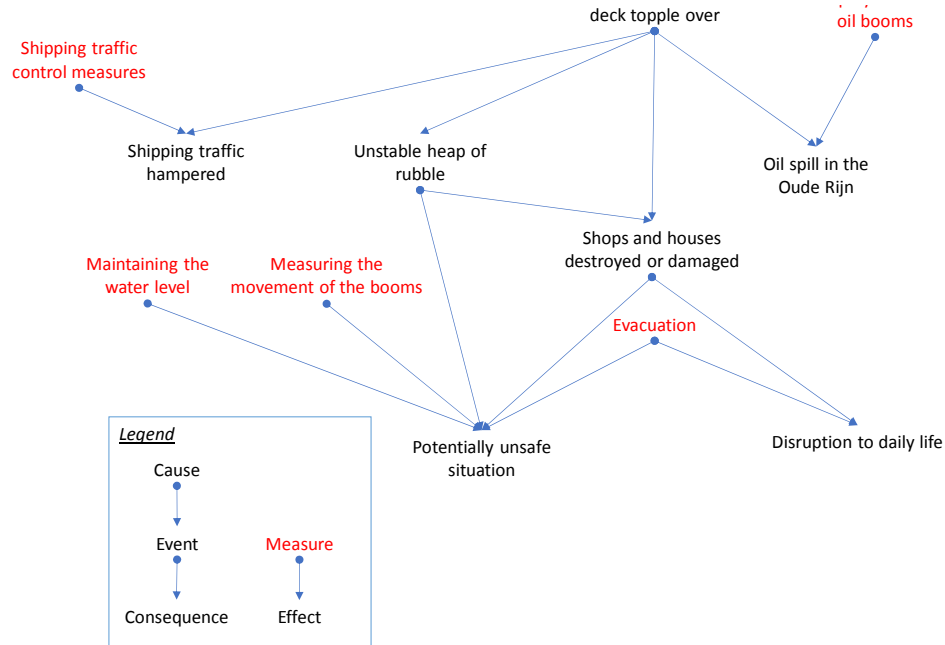
Given the enormous havoc, it is initially thought that there could be up to 20 victims. Miraculously, however, the only victim appears to be a dog. While the search and rescue process is underway, a number of nearby shops and houses are evacuated. The collateral effect of the evacuation is to intensify 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 and 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.

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 et al., 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.

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.

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 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. In reality, 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.

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Notes

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

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

[3]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 healthcare, disaster management and crisis coordination.