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The Pitfalls of Crisis Coordination

Insights From Three Netherlands-based Crises.

Abstract

Crises are the bane of governments, as pre-crisis existing structures are tested and challenged, and are prone to becoming a political crisis. Knowing why and how coordination fails could potentially improve future crisis response endeavours, aiding governments in protecting their citizens and critical infrastructures. In this study, the pitfalls of coordination are identified, and their effects studied in three Netherlands-based crises: the Chemie-pack crisis in 2011, the MPSO2 Shell Explosions in 2014, and the Noord-Holland power blackout in 2015. Central in this study are the expected effects of individual operational perspectives, lack of role clarity, allocation of authority, and the introduction of new actors within a crisis response network. The three chosen case studies were derived from a list of crises compiled of investigations by the Dutch Safety Board and the Inspectorate of Justice and Safety, in which using a most-likely case selection strategy ensured the cases to have a high probability of confirming the applied propositions. The analysis revealed that individual operational perspectives, lack of role clarity, and allocation of authority do indeed contribute to failure in coordination, whereas omitting these factors, and properly structuring allocation of authority contributes to successful coordination. Additionally, this study found that the distance in authority between actors of higher authority and those under their command can foster individual operational perspective, especially in centralized coordination schemes with few rules or communication between actors. This correlation is recommended for future research, as studying this was not the initial aim of this research. Overall, this study contributed to crisis management studies by applying common pitfalls onto new study grounds.

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1. Introduction

In crisis response, coordination plays a vital role in determining the overall effectiveness of the response. Coordination can be defined as the practice of aligning competences and expertise of different relevant actors and organizations to achieve a shared goal, which includes delegating tasks and assigning responsibilities (Comfort, 2007). An ever-recurring challenge in crisis response is to decide which actors and expertise are appropriate to address the crisis at hand. However, the task of analysing where coordination fails is also challenging in itself. The structure of crisis response, the number of actors, resources and responsibilities assigned in crisis coordination vary per occasion, making it difficult to pinpoint causes of failure and success (Topper and Lagadec, 2013; Boin and Bynander, 2015). While the changing nature of crisis responses and coordination efforts do not disregard the benefit of preventative measures, the general assumption is that crises cannot be addressed with pre-crisis bureaucratic policy routines and procedures alone (t Hart, Rosenthal, and Kouzmin, 1993; Rosenthal, Charles, and 't Hart, 1989; Boin, 't Hart, Stern and Sundelius, 2005; Roux-Dufort, 2007; Boin and Bynander, 2015).

Crises are the bane of governments, not only because pre-crisis existing structures are tested and challenged, but also because failed disaster management is often prone to turn into a political disaster if not addressed appropriately (Boin and Bynander, 2015; 't Hart). With the media being an almost omnipresent entity, first impressions of perceived deficiencies in the crisis response will come to light swiftly, with the government taking the centre-stage (Boin and Bynander, 2015). With coordination essentially shaping the response, it is therefore often depicted to be the reason for a successful response to a crisis or escalation of a crisis. However, there is no consensus on what the precise causes for failure are when it comes to a failed coordination endeavour (Boin and Bynander, 2015; Nohrstedt, Bynander, Parker,. and 't Hart,. 2018).

Not only is the general debate on causes for failure in crisis coordination ongoing in all its ardour, but also every new crisis produces further unique challenges. It is therefore fair to state that the challenge of analyzing where and why coordination fails is indeed challenging in itself. The structure, number of actors, resources and responsibilities assigned in crisis coordination vary per occasion, making it difficult to pinpoint causes of failure and success across different cases (Boin and Bynander,

2015; Nohrstedt et al., 2018). For one, this is largely due to the ever-changing nature of crises and disasters. Because of this ambiguity concerning the pitfalls of coordination and the uniqueness of every crisis, this research has two inter-connected aims. Initially, it seeks to identify what the common pitfalls in crisis coordination are; looking into previously considered factors such as the presence of new actors, the lack of role clarity between actors, individual operational perspectives, and allocation of authority. Secondly, it seeks to study these common pitfalls in a few case studies, which forms the main part of this research. Understanding the pitfalls of coordination holds societal relevance as it could potentially improve future crisis response endeavours, aiding governments in their responsibility to protect their citizens. After scoping out the common pitfalls, studying existing theories and assumptions, they will be applied in three case studies that constitute new environments, unique situations and perspectives (Boin and Bynander, 2015; Nohrstedt at al., 2018). Applying existing theory in new environments and crises will it provide a new contribution to studies of crisis management, whilst refining existing theoretical assumptions. To do this, the central research question is: *To what extent do individual operational perspectives, the lack of role clarity between actors, allocation of authority, and the presence of new actors foster failure in coordination efforts within network crisis responses?*

To answer the research question, a comparative case study design is used, in which three cases will be analysed on the actors' crisis coordination efforts. Prior to discussing the cases, chapter two of this research consists of a literature review, which will provide a theoretical framework to be applied to the chosen cases. The core features of the literature review refer to the dynamics of individual operational perspectives, lack of role clarity, allocation of authority, and the presence of new actors within network crisis responses. Also, within this chapter, five hypotheses will be put forward connecting to each of the variables in the research question

Chapter three constitutes the methodological chapter, and will elaborate on the rationale for the chosen cases and the method used to compare them. A most-likely case selection strategy has been used, which is a strategy that selects cases that are most likely to confirm the hypotheses under examination (Rohlfing, 2012). The cases were chosen from a list compiled of investigation reports by the Dutch Safety Board and the Inspectorate of Safety and Justice. Subsequently, this list was narrowed down by only including cases involving inter-regional crises and networks of actors. As a

result, the following three cases studied were: 1) The Chemie-pack Industrial incident in 2011, 2) The explosions MSPO2 at Shell in 2014, 3) The power outage in the Dutch province Noord Holland 2015. The Dutch Safety Board concluded that the Chemie-pack crisis was a case of failed coordination, whereas the MSPO2 explosions at Shell crisis was considered a successful coordination endeavour. Contrary, the coordination endeavour in the Noord-Holland power blackout was regarded a failure. This study is limited to three cases as having more could have compromised the quality of the research due to time constraints.

Chapter four will analyse the cases using the theoretical framework provided in chapter two using content-analysis, in which *different operational perspectives, lack of role clarity between actors, allocation of authority* and *the presence of new actors* are the key categories. The cases will be briefly described, in which all cases are simultaneously analysed per category to create contrast between the cases. In chapter five, a discussion will take place where the hypotheses are considered alongside the findings from the analysis. The conclusion section will then answer the main research question. Finally, recommendations for further research will stated.

2. Literature Review/Theoretical Framework

2.1. Crisis, Disasters, and Emergencies

Prior to hypothesizing answers to the pitfalls in crisis coordination, it is important to define what a crisis or emergency is in the context of this paper. This is because a crisis can range from large-scale natural hazards, economic collapse, and terrorist attacks, to smaller scale crises such as house fires (Nohrstedt et al,. 2018). Generally, a crisis can be defined by the extent to which it poses a threat to society's core values, the safety of its people and/or the critical infrastructures (Rosenthal et al. 1989; Boin et al. 2005). In addition, these concerns are met under conditions of great uncertainty and time pressure, and require critical decision making (Rosenthal et al. 1989; Boin et al. 2005). Roux-Dufort (2007), and Shaluf, Fakhru'l-Raz, and Aini (2003) concur, and state that crises are by definition characterized by uncertainty, which subsequently signifies an abrupt change from a perceived normal situation to one considered a crisis. Similarly, the abrupt changes caused by a crisis can bring about a deficit in a government's capacity to protect its citizen, making an adequate response paramount (Boin & Bynander, 2015). The implications cause an emergency, in which routine and

pre-existing procedures fall short or simply fail in addressing the crisis or disaster at hand ('t Hart et al., 1993; Rosenthal et al. 1989; Boin et al. 2005; Roux-Dufort, 2007; Boin & Bynander, 2015).

Many views on crises make it seem like they occur sporadically. Contrary to this, Roux-Dufort considers crises to be a process (2007), where crises represent an accumulation of deficiencies, in which the actual event of a crisis brings those deficiencies to light (Roux-Dufort, 2007). Even more challenging is that crises do not necessarily affect one enclosed geographical area. Instead, they often transcend these boundaries and can affect multiple critical infrastructures rather than a single one, and in which the source area cannot always be easily be pinpointed (Boin, 2009). Additionally, this makes it hard to determine where in time a crisis started (Boin, 2009).

Having considered numerous conceptions of what a crisis, disaster or emergency implies, this research defines a crisis as an event that occurs suddenly and makes evident the deficiencies of the government's pre-existing measures aimed at protecting the normality of society in terms of physical safety of its people and its critical infrastructures (Rosenthal et al. 1989; McMullan, 1997; Boin et al. 2005; Roux-Dufort, 2007). When a crisis occurs, the first priority of the government is to address the crisis, which is where coordination comes in.

2.2. Coordination

Coordination is a broad term and is widely used in various fields of study and work. In the introduction coordination was defined as the practice of aligning competences and expertise of different actors that are relevant to achieving a shared goal, which includes delegating tasks and assigning responsibilities (Comfort, 2007). However, coordination can be seen as both a process and a product.

As a process, Okhuysen and Bechky (2009) argue that coordination is characterized by having elements of decoupling processes, which is to improve the efficiency of the process as a whole. For example, decoupling manufacturing processes divides the overall process across several departments, assigned with unique responsibilities, in which coordination ensures that these separate departments contribute to the overall process (Okhuysen and Bechky, 2009). Similarly, when authority is decentralized during a crisis response, coordination fulfils the role of aligning the actions of these decentralized bodies ('t Hart et al., 1993). Specialization

is also a key characteristic that conjured the need to integrate the various activities through communication as part of coordination. As a result, there was an increasing demand to improve communications between various departments of activities (Scott and Davis, 2007; Okhuysen and Bechky, 2009).

Contrary to coordination as a process is defining coordination as product. Paramount in this perspective is the emphasis on contingency planning and addressing the uncertainties in the environment. In turn, coordination as product ought to provide some sort of resilience to these uncertainties and contingencies (Taylor, 1916; Fayol, 1949; Okhuysen and Bechky, 2009). As such, successful coordination is the result of relying on "the various specifications of exchanges between areas of work through roles, rules and structures" (Okhuysen and Bechky, 2009, p.467). This could make coordination a very rigid process, thereby susceptible to the risks that come with formalized, planned, and systematic organisation. For example, such rigid systems of coordination lack adaptability and responsiveness to those events that are not directly taken into account in the coordination system's design. After all, a crisis can occur very suddenly and create situations for which contingency plans are simply not prepared (Roux-Dufort, 2007).

In more recent approaches, coordination is indeed defined as a product, but also a continuous process. More specifically, crisis coordination is characterized by the adjustment of actions and decisions to integrate activities under a clear task-division based on what relevant actor's expertise is needed; while at the same time, collecting and sharing information under conditions of task interdependence, uncertainty and pressure to foster shared situational awareness (Lewis, 2003; Moreland and Argote, 2003; Faraj and Xiao, 2006; Drabek, 2007; Majchrzak et al., 2007; Okhuysen and Bechky, 2009; Koop and Lodge, 2014). Wegrich and Štimac (2014) add to this, arguing that a clear overview of responsibilities is important to ensure no jurisdictional overlap. In other words, a clear chain of command to structure the process of coordination. Majchrzak et al., (2007) concur, but also emphasizes the elements of credibility and reliability among the relevant actors' expertise, along with task coordination based on who knows what within the network or group, which allows for successful coordination. Moreover, this accounts for coordination within and outside the organizational design, meaning that apart from pre-set contingency plans, all departments, personnel and the entire organization should be able to adapt if necessary (Okhuysen and Bechky, 2009).

Indeed, it is as Faraj and Xiao (2006, p.1157)   argue, that coordination refers to "a temporarily unfolding contextualized process of input regulation and interaction articulation to achieve a collective performance". With an emphasis on ''temporarily'', this definition fits neatly with the earlier establish concept of a crisis or incident, in which it was stated that crises or incidents are sudden events. In line with a crisis response, Faraj and Xiao's (2006) definition would imply a degree of improvisation and adjustment appropriate for the crisis at hand, contrasting planned structures of coordination.

Having a flexible coordination scheme is a requisite in crisis management simply because one particular response does not necessarily work for the next crisis (Majchrzak et al. 2007). To illustrate, a crisis within agricultural industry includes actors from the agricultural industry, in which their expertise and knowledge needs to be coordinated with a relatively stable set of emergency response teams, such as fire fighters and the police force. However, a crisis in the industrial industry would include different actors, and might even include actors outside the industrial industry - if, for example, the leaking toxins affect the water supply, this would include actors from the regional water authorities as well. It is as Weick (1993) argues, that coordination should include problem-fit actors that have the needed attributes to handle the crisis at hand. Problematic here, is that all these actors from various industries, as well as the emergency response teams retain unique perspectives should a crisis occur, making necessary the coordination of information as well (Boin and Bynander, 2015). In addition, on some occasions actors might even refuse to give up authority in case of escalation of authority (Moynihan, 2009). Apart from the different actors, the overarching structure also influences the way coordination is done ('t Hart et al., 1993; Moynihan 2009; Boin and Bynander, 2015). There is the question whether to remain by the planned the design or operate outside it. That said, adapting to events outside the planned design is no easy feat, especially in crisis management.

The challenges discussed above all portray factors that Okhuysen and Bechky's (2009) regard as pivotal in successful coordination. Okhuysen and Bechky's (2009) emphasize defining responsibilities and tasks, developing familiarity among actors to improve credibility and reliance on each other, creating a common perspective to enhance the speed and accuracy of information sharing. When contrasted with the challenges above, four common, recurring themes are found that determine the success or failure according to literature. These themes are: Operational Perspectives,

Role Clarity, Allocation of Authority, and introduction of New Actors (Okhuysen and Bechky, 2009).

2.3. Operational Perspectives

When we talk about a shared situational awareness, it refers to the process of generating a collective situational understanding of the crisis among relevant actors involved (Turner, 1976). However, on some occasions, established actors or emerging networks/groups of actors, can maintain individual specific operational perceptions of what the crisis constitutes and what ought to be done (Turner, 1976; Koppenjan and Klijn, 2004; Majchrzak et al., 2007; Boin and Bynander, 2015; Wolbers et al., 2017).

Ideally, integrating various operational perspective to create a Common Operational Perspective (hereafter COP) is desired. A COP is also referred to as *sense-making*. The concept of sense-making entails all activities and processes of producing and sharing relevant information about the risks and scope of the crisis, the relevant actors and available resources, which are integrated in a shared common perspective among various actors (Baber, Stanton, Atkinson, McMaster, and Houghton, 2013; Laakso and Palomäki, 2013; Wolbers and Boersma, 2013; Luokkala et al., 2017). As seen in the section 2.2, successful coordination heavily relies on sharing information and shared situational awareness. In turn, the omission of key information concerning one of the COP's elements can thereby harm coordination. For example, information pertaining to the use of resources or involved actors. To illustrate the gravity of sense-making, Moynihan's (2009) re-examination of the Katrina disaster's crisis response revealed that coordination became problematic because of the presence of many individual operational perspectives. As the response network was considerably large and complex, the involved actors faced many disagreements concerning what should be prioritized and what should be done (Moynihan, 2009). The importance of coming to a collective understanding through information-sharing is also supported by Boin and Bynander (2015), who argue that information asymmetries can lead to different operational perspectives, but can also be caused by different operational perspectives, especially when emerging groups or new actors are involved in the response network.

To achieve a shared goal, all crisis responders and relevant actors have to coordinate their actions across organizational boundaries, in which navigating the different norms, meanings, and interests among all actors is paramount (Kellog,

Orlikowski, and Yates, 2006; Wolbers and Boersma., 2013). If this is not the case, the presence of different or individual operational perspectives are likely to slow down coordination by obstructing the distribution and collection of relevant knowledge (Laakso and Palomäki, 2013; Wolbers and Boersma, 2013). Without a collective picture of which actors are relevant and what information is needed, coordinating activities and actions are bound to experience at least some delay (Majchrzak et al., 2007). Consequently, and more importantly, this may lead to poor decision-making, which may cost lives in the worst case-scenario (Baber et al., 2013; Wolbers and Boersma., 2013; Boin and Bynander, 2015). In such a scenario, decision-making actors fail to grasp the full scope of the situation, and are essentially forced to make decisions based on incomplete information (Wolbers and Boersma., 2013; Boin and Bynander, 2015). Therefore, based on the literature, the theoretical assumption of failing coordination in this research holds:

Hypothesis 1: Different operational perspectives will cause delayed information sharing, thereby obstructing coordination efforts.

To briefly reiterate the theory behind operational perspectives, it is evident that they are key in coordination as they either make more efficient or slow down coordination by effective management and allocation of information and knowledge. Logically, a shared operational perspective would support a collaborative purpose due to having the knowledge as to what actors can do and what needs to be done to address the crisis (Majchrzak et al., 2007). However, with regards to this collaborative purpose, Boin and Bynander (2015) argues that familiarity is key in sustaining this. Boin and Bynander (2015) add that trust goes hand-in-hand with functionality, which refers to a collaborative purpose - namely one focused on addressing the crisis. In turn, a collaborative purpose requires the ability to depend on other actors, or at least their expertise. In order to do so, it is imperative for the involved crisis response actors to understand one another's expertise and roles within the network (Hyllengryn et al., 2011). Role clarity is therefore the next key factor to be discussed.

2.4. Role Clarity In Crisis Coordination

Role clarity in organizational management is often equated with trust, which is defined as the ability to rely on the advice offered by others – be it organizations or actors – and includes a set of mutual expectations (Curnin, Owen, Paton, Trist, and

Parsons, 2015). This conception is also understood by Wray, Rivers, Whitworth, Jupka, and Clements (2006), who emphasize the impact of mutuality and interpersonal exchanges. Role clarity, being the more technical term for trust, includes the same dynamics, but stresses more the professional capabilities and reliability in one's competences within a working relationship instead of personalized relationships (Meyerson, Weick, and Kramer, 1996; Curnin et al., 2015). As such, hereafter role clarity will be referred to rather than trust.

The advantages of reliable mutual expectations of role performance and competences are that they are assumed to enhance information sharing between actors, and the overall effectiveness of coordination cooperation and task delegation (Okhuysen and Becky, 2009). Boin and Bynander (2015) concur and argue that functionality, which is the structure and control of the overall coordination scheme, heavily depends on how well different actors can rely on one another. Dirks and Ferrin (2001) agree, and stress the importance of familiarity among crisis network actors. An adequate example of how trust improves coordination is portrayed in the Oklahoma bombing case. During the incident, pre-existing working relationships in command helped assign responsibilities and improve problem solving among various actors (Moynihan, 2009). Indeed, the clarity and familiarity of roles and expertise among actors improved the speed by which responsibilities were assigned. However, Moynihan (2009) admits that having a consistent pre-emergency group of responders considerably increases the development of role clarity and familiarity. While this was indeed the case in the Oklahoma bombing, it might not be in other crises. For example, Curnin et al.'s (2015) research revealed that emergency response teams found it difficult to work with actors from critical infrastructures, simply because they did not know what to expect from them.

To conclude, role clarity allows for reliability among actors, fostering a fast response through reliable expectations of other actors' competences, capabilities and role performances to achieve their respective tasks and assignments within the overall coordination scheme (Adams and Webb, 2002; Okhuysen and Bechky, 2009; Curnin et al., 2015). Improving role clarity can be a mechanism in which it provides the potential for actors to rely on each other. As such, it holds striking similarities with Boin and Bynander (2015) claim on functionality, which subsequently feeds into role clarity. Contrary, the omission of role clarity can delay the responses, as actors do not sufficiently understand the value of the expertise and competences of other actors, or

perceive them credible enough to rely on (Boin and Byander, 2015; Curnin et al, 2015). For example, as result of a lack of role clarity, some actors might be less willing to transfer or surrender certain responsibilities/authority to other actors, or have wrong expectations of the capabilities and/or deliverables expected of certain actors. Therefore, the literature suggests:

Hypothesis 2: A lack of role clarity causes delayed coordination responses due to a lack of credible expectations of capabilities and expertise among actors.

While role clarity along with operational perspectives takes a pivotal role in coordination, another factor that greatly influences – if not structures – a crisis response is the allocation of authority.

2.5. Allocation of Authority

Generally, there are various assumptions on how crisis coordination ought to be structured, from hierarchical centralized structures, to decentralized network governance approaches (Moynihan, 2009; 't Hart et al.,1993). A centralized structure is often characterized by command and control, centralized decision-making, strict protocols, plans and routines (Okhuysen and Bechky, 2009). The advantages of such a structure, is that relying on plans, protocols and rules allows for an easier process of defining responsibilities of tasks, resource allocation, and coming to agreements with relevant actors (Okhuysen and Bechky, 2009)

However, a centralized approach such as described above can be critiqued on its reliance on pre-established measures. The volatile nature of a given crisis could deem any planning redundant ('t Hart et al., 1993; Boin and Bynander, 2015). Furthermore, centralizing decision-making to a small group of actors can invoke group-think. Group-think refers to the phenomena where decision-making actors are more interested in seeking group harmony, consensus and avoiding disputes within the group, which can lead to faulty and dysfunctional decision (Hood, 1991; 't Hart et al., 1993). As such, it can cause the views of other actors to be excluded, thereby potentially omitting good ideas and perspectives to the crisis at hand ('t Hart et al., 1993). In similar fashion, deciding on a course of action on both the strategic and operational level can also be subject to dominant rigid perceptions (Turner, 1976). As Turner argued in his article of *Failure of Foresight*, such rigid perceptions are

embedded in belief systems, and might not be compatible with the situation at hand, causing certain risks, hazards, and other relevant actors to be ignored (1976). As a result, key-actors may therefore be excluded from information-sharing as they are not perceived relevant ('t Hart et al., 1993).

A more subtle implication of centralizing authority is the increased distance that is created between actors (Allen, 1977). In organizational management, distance refers to the extent by which the various departments in an organization can see the actions of others, including their results, which makes adjusting one's actions accordingly easier (Goffman, 1963; Okhuysen and Bechky, 2009). Close proximity between different departments, or different actors in crisis coordination is preferred to establish effective communication (information-exchange), and familiarity between actors. Contrary, it is therefore likely that increased vertical distance in the chain of command harms coordination, as operational-level actors may not be able to adjust their actors accordingly to changes made on the strategic level. This also works vice-versa, in which strategic-level actors lose control and oversight on operational-level actors.

On the other end of the spectrum is a more decentralized approach. This approach is characterized by decentralization of authority, collaboration and increased flexibility (Boin and Bynander, 2015; Dynes, 1994). Actors regain some degree of autonomy to take actions and make decisions. Even with a pre-emergency centralized approach in place, research suggests that some degree of decentralization is inevitable (Boin and Bynander, 2015). In addition, research showed coordination of complex tasks can information-overload due to the larger volumes of information exceeding processing capabilities of the person or actor responsible (Whelan and Teigland, 2011). Therefore, decentralizing authority can benefit information-sharing by avoiding one actor being overwhelmed by large quantities of information. However, Wolbers et al.'s (2017) research pointed out that allocating responsibilities/authority to certain actors comes at the risk of obstructing the creation of a common operational perspective. In delegating tasks, the actors responsible for completing them gain some degree of autonomy, in which they might address their given tasks through their own operational perspective (Wolbers et al., 2017). Hence, delegating tasks could potentially foster the presence of individual operational perspective within the network.

Furthermore, research also pointed out that characteristics typical of centralized approaches often help to structure decentralized coordination approaches. For example, coordination practices within a hospital revealed that a heavy reliance on protocols and simple rules helped define roles, which eventually helped ad-hoc collaboration during an emergency between independent actors (Faraj and Xiao, 2006). This would imply that in crisis management, there is a thin line between complete centralized or decentralized approaches. Generally, there is a common agreement that the allocation of authority, be it centralized or decentralized, will often be adapted to accommodate the nature and impact of the crisis to formulate the best response possible ('t Hart et al., 1993; Faraj and Xiao, 2006; Boin and Bynander, 2015). This could bring implications for crisis coordination drawn from theory of both centralized and decentralized approaches.

Apart from the more typical challenges encountered in both centralized and de-centralized approaches, new challenges emerge in the event of escalation of authority. For example, in the Oklahoma city bombing, while coordination benefited from pre-existing working relations between responders, local responders were the first to establish a command centre (Moynihan, 2009). When Federal Emergency Management Agency (FEMA) sought to escalate authority to higher levels of management, the local command centre refused to surrender its authority (Moynihan, 2009). The bombing itself was treated as homicide by the local authorities, whereas it was treated as a crisis on the national level.

Thus it is without doubt that the structure of crisis coordination influences a large share of factors. Faraj and Xiao's (2006) research indicated that having procedures and protocols helps establishing roles and clarity of expertise, which are simultaneously attributes located within the concept of trust. However, the way authority is allocated or appointed can have several implications for the way coordination plays out. A decentralized approach can foster different operational perspectives, whereas centralized and hierarchical approaches can lead to group think ('t Hart et al., 1993). In addition, up-scaling authority from one actor to another higher up the hierarchy can also lead to clashes of authority, which was the case on the Oklahoma bombing (Moynihan, 2009). Consequently, with different actors claiming authority, it caused confusion throughout the crisis response, a seen in the Katrina disaster (Moynihan, 2009). Based on the literature, the following expectations can be formulated:

Hypothesis 3: Centralized authority to one actor or a small group of actors within the crisis-response network obstructs the information-management due to the increased distance between strategic and operational level actors.

Hypothesis 4: Decentralized authority within the network can obstruct the creation of a common operational perspective due to various actors having the autonomy of deciding what needs to be done, causing confusion in the line of command and affecting the success of coordination.

Structuring the coordination response requires all actors to be aware of the prevailing chain of command, in which effective coordination requires the involved actors to sustain role clarity and maintain a COP. While this remains an ever-difficult challenge, this is especially the case when including new actors in the response network.

2.6. New Actors in Existing Response Networks

New actors can be defined as existing organizations that are not formally part of an integrated emergency response network. Such new actors be classified as expanding organizations, which expand their normal tasks into new organizational structures, whereas extending organizations perform new/novel tasks but stay within their normal organizational structures (Dynes, 1976; Yousefi & Pilemalm, 2013; Boin and Bynander, 2015). With regards to extending organizations, Yousefi & Pilemalm (2013) defines such organizations as semi-professionals. The primary activities of semi-professional organizations are not crisis-related, but can support the crisis response if such organizations extend their expertise/activities (Yousefi & Pilemalm, 2013). Boin et al. (2015) give the example of Walmart using its commercial distribution network to transport water and food. Furthermore, these organizations, be it extending or expanding organizations, can range from NGOs, private companies, public institutions, local organizations, and pre-crisis established volunteer organizations.

In contrast to new actors in existing networks, an emergent network is characterized by unplanned participation of emerging groups and actors (Boin and Bynander, 2015; Dynes, 1994). As such, emerging networks are networks of either

new actors or existing actors, but have in common that they operate in a network setting that did not exist prior to the crisis.

Based on definitions of both new actors and emerging networks, new actors are defined as established organizations, classified by either expanding or extending their operations, which operate within an existing network for the very first time. However, it is important to note that this research will focus existing networks that may or may not include new actors. This is due to the Dutch Regional Coordination Management System (GRIP) regulation active in all crisis or incidents in the Netherlands. GRIP defines the scale and scope of a crisis based on five levels, in which each level involves a certain set of actors, and appoints authority of decision-making to certain active actors (IFV, 2014). Therefore, emerging networks are less likely to occur in this paper's Netherlands-based case studies, as the networks evolve with an established set of actors regulated by GRIP. However, it would allow for new actors to become involved.

As for the implications of integrating new actors, literature suggests several recurring concepts. First of all, new actors may have different operational perspectives, which can clash with the more collective operational perspectives held by established actors in the response network (Turner, 1976; Drabek, 1985; Dynes, 1994; Majchrzak et al., 2007; Boin and Bynander, 2015; Wolbers et al., 2017). Secondly, new actors may increase the likelihood of a lack of role clarity, as they are not familiar with the details of the their partner actors' expertise and capabilities. This was apparent in large disaster such as Katrina, but in smaller incidents where emergency response teams had to work with actors from the critical infrastructure for the first time (Moynihan, 2009; Curnin et al, 2015). Thirdly, the allocation of authority concerning decision-making, and adherence to procedures may be hindered by involving new actors (Wolbers et al., 2017; Moynihan, 2009; 't Hart et al., 1993). New actors may obstruct the chain of command, or are not be aware of the prevailing chain command (Moynihan, 2009). These three factors will be discussed in the following sections. Generally, as seen above, the literature suggests that the presence of new actors relates to several other factors that may potentially obstruct coordination. As such, the impact of new actors are expected to have the following dynamic in relations to coordination:

Hypothesis 5: New actors in the crisis response network will increase the likelihood of different operational perspectives being present among actors, including a lack of role clarity and confusion of authority, thereby hampering coordination.

3. Methodology

3.1. Rationale Comparative Case Study Design

This paper aims to apply the hypothesized causes of failure in crisis coordination onto three cases of crises that have occurred in the Netherlands: The Chemie-pack crisis of 2011, the MSPO2 Shell Explosions in 2014, and the power blackout in the Dutch province of Noord-Holland in 2015. Based on the literature review, this research's theoretical framework is built around four recurring themes: *different operational perspectives, lack of role clarity, allocation of authority*, and *the introduction of new actors* within an existing network of cooperation. In particular, this research will focus on coordination as an outcome rather than a process. The outcome is defined in either *failed* or *successful coordination,* which this study seeks to explain by applying a theoretical framework (see section 3.4.3 for the operationalization of both the dependent and independent variables*)*. Despite no explicit research gap, the very essence of crises being volatile in nature demands continuous application, testing and refining of theory (Nohrstedt et al., 2018). Indeed, the application of theory stands central in this research, in which the chosen crises cases constitute new learning environments on which the theory will be applied. As such, a positivist approach is taken, which will seek to explain the reality of the cases without value judgements as to what course of action would have been better or what ought to have been done instead (Yin, 2009; Toshkov, 2016). In turn, this makes a comparative case study design a logical choice, as it will help substantiate the outcome of the cases by (Rohlfing, 2017; Toshkov, 2016).

3.2. Defining Scoping Conditions and Case-selection criteria

To choose the cases, three scoping condition were set to identify cases appropriate for the application of the theoretical framework. Logically, all selection criteria relate to the independent variables, and are found in the Dutch Regional Coordination Management system (GRIP) (IFV, 2014). GRIP measures coordination relative to the

magnitude of an incident, which determines the amount of actors, and degrees of (de)centralization (IFV, 2014). As GRIP categorises crises into a number of different classes of severity and magnitude, it was important to set the case-selection criteria accordingly. This was to only consider crises involving multiple actors, different levels of authority, and cases that actually require a crisis response rather than routine measures. In turn, this makes crisis from GRIP 3 and above especially interesting for this research.

GRIP 3 implies that the crisis response moves away from pre-established measures and routines, and with the mayor involved it becomes a political crisis as well (IFV, 2014). As such, coordination needs strategic steering from the mayor who is supported by a municipal policy support team (GBT) along side a regional operational team (ROT). Similarly, GRIP 4 involves a ROT, a regional policy support team (RBT), and a transfer of authority from the mayor to the chairman of the involved Dutch safety region, who assumes responsibility for coordinating the crisis response. This implies that the scale of the crisis moves away from the local to regional level. Lastly, GRIP 5 includes crisis that require inter-regional coordination, and include an multiple ROTs, RBTs and CoPIs found in each involved safety region. As for GRIP 0 to 2, these level would refer to all minor and small incidents, in which normal bureaucratic routines and procedures are sufficient (IFV, 2014). Only GRIP 2 includes a ROT, but requires no strategic steering. For this reason, GRIP 0 to 2 crises are irrelevant for this research.

As a result, only cases categorised as GRIP 3 or above were considered, as they include 1) A coordinated response as the crisis exceeds the capabilities of routine measures, 2) A network of actors in which there is an evident need for coordinating their actions, and 3) different levels of authority.

Thus, to reiterate, incidents ranging from GRIP 3[1] to GRIP 5[2] are most interesting because they include crises exceeding normal routines, involve a network of actors, and different levels of authority. Also, GRIP 3 or above by definition includes a network of actors. This will allow for testing hypothesis 5, which refers to

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[1] GRIP levels zero, one, and two do not meet the scoping conditions requirements. Crises within these levels are dealt with by standardized or even day-to-day routines.

[2] GRIP also includes the level GRIP RIJK which involves national government, however this level of GRIP is deemed irrelevant for this research as they have never occurred since the establishment of GRIP (IFV, 2014)

the impact of new actors in a network (Majchrzak et al., 2007). Research suggested that emerging networks and actors are more likely to have differing *operational perspectives, role clarity,* and issues related to the *sharing of authority* obstructing coordination (Boin and Bynander, 2015).

A positive outcome of this research would state that the independent variables (X): *Individual operational perspective (X1), lack of role clarity (X2), centralized authority (X3), Decentralized authority (X4),* and *New actors in the existing network (X5)* do lead to *failed coordination* (Y). A negative outcome is formulated as: *the independent variables (X1, X2, X3, X4, X5) are not causing failure in coordination.*

3.3. Case-selection Strategy

Prior to selecting the cases, a list was compiled consisting of all research investigations between 2010-2018 by the Dutch Safety Board. The list included incidents from before and after the implementation of the Dutch Regional Coordination Management system (GRIP) in 2013 (IFV, 2014).

The *most-likely case selection strategy* was chosen for this research, which is widely regarded as the most appropriate for theory-centered case studies (Rohlfing, 2012; Toshkov, 2016). Most-likely case selections strategies select cases that have a high likelihood of confirming the hypotheses under scrutiny (Rohlfing, 2012, p.84). To reiterate, this study aims to study the causal mechanism between the independent variables: N*ew actors in an existing network, different operational perspectives, lack of role clarity, and different forms of allocation of authority,* and the dependent variable *successful-*and *failed coordination.* Therefore, a most-likely case selection strategy is used. The aim is to find out whether the theory hold in different cases, in which a most-likely case selection allows for pinpointing those case that have a high probability of confirming the expected outcome - hampered coordination. Note that the dependent and independent variables are operationalized in section 3.4.3.

By deriving the theoretical concepts from earlier work, this research is expected to have some degree of generalizability or external validity. The theories to be tested are recurring themes in large-scale and small-scale crises, drawn from existing literature. This would imply that the theoretical concepts have been tested or applied before in crises likely similar to the chosen cases in this research. As Milton et al. (2010) argue the assumptions drawn in the research should conform with the expected outcome, which increases external validity. Indeed, the question to be asked is

whether *theory and assumed causes of coordination failure accurately explain why coordination failed in the chosen cases?*

Ultimately, the case selection strategy led to three cases that met the scoping conditions criteria, and are appropriate for this research: 1) The Chemie-pack Industrial incident in 2011, 2) Explosions MSPO2 Shell in 2014, and 3) the power outage in the Dutch province of Noord-Holland in 2015. The three cases were addressed at GRIP levels 3-4 which implies the presence of a network response, a crisis exceeding pre-crisis routine measures, and different levels of authority.

3.4. Data-Analysis Methods

3.4.1. Within-case analysis and process tracing

The chosen cases will be analysed through process tracing. Process tracing is the method by which one attempts to identify causal mechanisms or processes between an independent variable (the cause) and the outcome of the dependent variable (George and Bennett, 2005). As such, this research seeks to examine the causal processes between the independent variables (cause) and failed/successful coordination (outcome). More specifically, in this research the anticipated causes for failed coordination (i.e the independent variables: *different operational perspectives*, *lack of role clarity*, *allocation of authority)* are studied in relation to the actual outcome of coordination specified in the cases (dependent variable: *failed/successful coordination).* Specification of the dependent variables will be elaborated on in chapter 4.2. Thus, process tracing is deemed a logical choice, by studying the causal relation between independent and dependent variables within the three cases (Vennesson, 2012).

Furthermore, in terms of data, process tracing can be applied onto a variety of sources, such as interviews and documents. As this research largely depends on the use of secondary data, process tracing is a valuable and logical method of analysis (Vennesson, 2012). Important to note is that the time frame of the crises that are examined in this research ranges from the start of the crisis until the GRIP scale is set back to GRIP 0. This is because GRIP 0 would imply that pre-crisis bureaucratic routines can be resumed indicating that the crisis phase is over.

Regarding data collection, the reports of each case will be retrieved from the Dutch Safety Board or the Inspectorate of Justice and Security to ensure credible data

is used in the analysis. Process tracing falls within the within-case level analysis, and is therefore a preferred method when testing, applying, or refining theoretical concepts through the assessment of individual cases (Mills et al., 2010). As such, it benefits this research's focus on the causal mechanisms that could potentially lead to failure in cooperation. The phenomenon to be studied is failure of coordination, in which this research posits the question *why did it fail?*

3.4.2. Content analysis

In line with process tracing, content analysis will be employed to analyse textual information derived from the inquiry reports. Content analysis refers to the research technique used to study documents by making replicable and valid inferences from texts to the contexts of their use (Krippendorff, 2004). It allows for precise examination of information contained in documents or other forms of communication/media respective to what a researcher attempts to research (Neuman, 2014). Indeed, it implies a heavy reliance on secondary data; more often than not written documents. In turn, this is partly what makes content analysis a logical choice for this research, as it allows for an efficient and effective way to analyse documents, reports, journals and other secondary data sources. Limiting the type of data to secondary sources is a deliberate choice, as crisis studies allow for easy access and large quantities of documents to be available (Moynihan, 2009).

In line with the general guidelines on content analysis, a so-called unit of analysis needs to be established (Holsti et al., 1969; Krippendorff, 2004; Berg, 2007). The unit of analysis indicates the size and scope of the content that will be examined, which can range from characters, paragraphs, and concepts to semantics (Berg, 2007). For this research, however, the cases will be analysed heuristically in order to assess the interaction of independent and dependent variables in their context. The idea closely relates to having *themes* or *concepts* as unit of analysis, which focuses on the effects and dynamics of the categories within its respective context (Berg, 2007). Subsequently, with themes varying in size, the textual units for this research typically vary between three to ten sentences. For replicability purposes, the page number of the original documents will be noted in the code sheet as well as in the analysis, which should mitigate any relative inconsistency of having a unit of analysis that can vary in size.

To measure the independent variables through content analysis, appropriate categories need to be established. Krippendorf (2004) and Holsti et al. (1969), make explicit the importance of having categories adequately reflecting the research question and research purpose. As such, it is logical choice to directly translate the independent variables into categories, because that is precisely what this research seeks to measure. To reiterate, this research seeks to test whether the key independent variables *different operational perspectives, lack of role clarity, allocation of authority, and the presence of new actors* obstruct coordination in networks.

In line with Holsti et al. (1969), the next step would be to define clear definitions of the categories to be measured. In the next section on the operationalization of the independent variables, all categories are displayed in table 1 and 2 along with their definitions and indicators. The definitions as seen in both tables 1 and 2 below are derived from the literature review to ensure that they represent concepts attributed in the context of crisis management (Krippendorff, 2004). Similarly, the indicators of the categories are also derived from the literature review, which ensures that the key words/sentences adequately represent categories to context of their use, which are primarily contexts of crises and emergencies.

Several coding rules will be adhered to. First, one text unit can hold several categories, which are documented in the code sheet. Secondly, the analysis of the cases will look at how each category is present in coordination. This means that the effect of the category in successful and failed coordination is observed. The code sheet (appendix) will be sent separately to the supervisor and second reader of the research.

In terms of reliability, the studied textual units in the documents will all be included in the code-sheet to insure transparency of the research process. Doing so will improve the reliability of this research by way of increasing the replicability of the research design.

3.4.3. Operationalization

To conduct the analysis, it is crucial to operationalize the key concepts into proper measurable constructs. As mentioned in the previous section, in table 1 and 2 below both the dependent and independent variables are presented with their respective definition, and operationalized constructs. Table 1 operationalizes coordination into three categories :*coordination, successful coordination,* and *failed coordination.*

While the interest of this research lies primarily why coordination fails, having a working definition for *coordination* and *successful coordination* will clarify where the line between failure and success in coordination. As such, it will help define and identify failed coordination in the three cases, which will be discussed in chapter 4.

Table 1: Operationalization of Coordination

Dependent variable (Y)	*Definition*	*Indicators*
Coordination	The integration of tasks, actors, information, activities, and the competences of multiple actors under the conditions of task interdependence, uncertainty and pressure to achieve a shared goal (Faraj and Xiao, 2006; Comfort, 2007; Majchrzak et al., 2007; Okhuysen and Bechky, 2009).	Distribution of information; delegation of tasks; role specific activities, allocation of authority
Successful Coordination	When actors with relevant expertise display appropriate behaviour to effectively address the problem at hand, and maintain a high collective level of situational awareness; work within a clear division of work with limited overlap; in which coordination does not create problems within existing jurisdictional boundaries making it unclear to whom one should report to (Weick, 1993; Majchrzak et al., 2007; Okhuysen and Bechky, 2009; Wegrich and Štimac, 2014).	Involvement of problem-fit actors; timely sharing of information; clear task divisions; clear understanding of what needs to be prioritized; clear understanding of who to report to during the crisis
Failed Coordination	When actors with the relevant expertise are either not involved or fail to display behaviour appropriate to address the problem at hand, lack the adequate level of situational awareness, and do not have a clear understanding of task division (Weick, 1993; Majchrzak et al., 2007; Okhuysen and	Actors are not aware of the scope of the crisis; actors that do not have the correct expertise are involved; confusion as to who is responsible for certain tasks;

Bechky, 2009; Wegrich and Štimac, 2014).   confusion of who to report to

The independent variables constitute the key factors discussed in the theoretical framework. In line with content analysis, table 2 below presents each concept translated as category with a code, a working definition and its operationalized construct in the form of indicators. Some categories are taken directly from the theoretical framework, except for *Operational Perspectives* and *Allocation of authority,* which have been divided in sub-categories to ensure them to be mutually exclusive (Krippendorf, 2004). *Allocation of authority* is therefore operationalized in *Centralized-* and *-Decentralized authority,* and *Operational perspectives* in *Collective-* and *-Individual Operational Perspectives.*

Table 2: Operationalization of Independent variables

Categories	*Code*	*Definitions*	*Indicators*
Common Operational Perspective	*A*	Common understanding among actors in the crisis response network regarding the risks and scope of the crisis, the available resources and personnel, the needs of partner actors, and the allocation of responsibilities and the beliefs and values that entail taken decisions and actions (Carley, 1991;Wolbers and Boersma, 2013; Baber et al., 2013; Wolbers et al., 2017).	Group-consensus in decision-making; smooth sharing of information; collective understanding of the risks pertaining a crisis; collective understanding of what needs to be done during the crisis; clear understanding of how to use the available resources
Individual Operational Perspective	*A1*	An actor's individual sense of awareness and understanding of what the crisis constitutes, such as the prevailing structure and the specific beliefs and values that entail this understanding expressed in what a particular actor prioritizes in terms of courses of actions (Tuner, 1976 ; Dynes, 1994; Wolbers and	Differentiated perceived priorities of actors; actions taken based on own perspective rather than in coherence with the views of other actors; differentiated understanding of the dangers pertaining a crisis;

			Boersma, 2013; Boin and Bynander, 2015).	Inadequacy in information sharing within the network;
Role Clarity	B		A relationship between different actors that work together that displays levels of mutual expectations and functionality, either through pre-crisis existing inter-personal trust, or through role clarity built on clarity of competences, expertise, and roles rather than personalities (Boin and Bynander, 2015; Curnin et al, 2015; Moynihan, 2009).	Group-consensus in decision-making; smooth Prior working relationships within an existing network; clear role specification within a network response; clear understanding of actors' expertise; collective understanding of actors' capabilities
Centralized Authority	C		Direct operational leadership appointed to a specific actor or group of actors concerning particular tasks within the network crisis response, that include clear structures allocating responsibilities often embedded in but not excluded to hierarchical decision-making (Goffman, 1963; Allen, 1977; 't Hart et al., 1993; Faraj and Xiao, 2006)	Clear rules and protocols within the network response; decision making allocated to one or small group of actors; ability to command other actors within the network; intervention of authority, escalation of authority, allocating responsibilities
Decentralized Authority	C1		Authority becomes shared or dispersed among various actors within the network, that retain a certain degree of autonomy in terms of decision-making in which they become directly accountable for their contributions, and could potentially disrupt the overall coordination scheme ('t Hart et al., 1993; Faraj and Xiao, 2006; Wolbers et al., 2017)	Delegation of particular tasks within the response; decision making, confusion of authority, independent of approval of other actors; relative lack of strict protocols and rules; Shared command between actors; cross-jurisdictional

			competition between two or more actors; transfer of authority; collaborative decision making
New Actors	D	Existing organizations that are not formally part of an integrated emergency response system, and either extend their tasks within their prevailing organizational structure or expand their activities within new organizational structural arrangements (Yousefi & Pilemalm ,2013; Boin and Bynander, 2015; Dynes 1994). These organizations can range from NGOs, private companies, public organizations, local organizations, and pre-crisis established volunteer organizations.	New actors that have not been part of the existing crisis network; Extending operation without changing one's organization structure; Expanding activities by taking on a new organizational structure;

As for the independent variables, failed coordination constitutes an outcome and will therefore not be given a code. In the table below both coordination and its failed counterpart are given working definitions to accurately depict what will be measured in the case studies.

3.5. Limitations in Validity and Reliability

One possible weakness of this research's case study design is the risk of lacking objectivity. According to Becker and Bryman (2004) small-n case studies are at risk of being shaped by the interests of the researcher. In order to remain as objective as possible, two rules for the design were set. Firstly, by ensuring that the operationalization of the independent variables are void of value laden properties, it becomes possible to avoid biased findings that only favour the hypothesized outcomes. This means that the results may include findings that go beyond this research's theoretical framework and its hypotheses. While this may result in potential rejections

of the hypotheses, the outcome of the analysis would constitute a fair and honest answer to the research question. Secondly, the process of content analysis will be accurately documented in a code sheet as evidence, thereby ensuring maximum transparency. Adhering to these rules would increase the internal validity of this research, as well as the reliability through transparency.

Furthermore, due to small-n case study research, generalizing the results might be a challenging endeavour. Time constraints only allow for a limited amount of cases to be studied, in which it is not possible to generalize the results of these few crises onto larger population of crises. As Rohlfing (2012) argues, typical qualitative small-n studies lack the tools necessary for testing and refining theories. However, to mitigate the limited external validity in this research, the scoping conditions included some of the assumed causes (independent variables) for failed cooperation (Rohlfing, 2012). Doing so reduces the population of cases to only those where the same scoping conditions apply. Moreover, all cases were taken from concluded or ongoing investigations by the Dutch Safety Board or the Inspectorate of Justice and Security to ensure a credible source of information. In this research, crisis of GRIP 3 and above, along with the presence of a network response, and different levels of authority were key. As seen in the literature review, the independent variables of different operational perspectives, lack of role clarity, allocation of authority, and new actors in networks are all included with incidents/crises from GRIP 3 or above.

With regards to actual data collection, it is worth noting that for the MSPO2 Shell Explosions' case, a limited amount of data was found. To reiterate, the core sources used are reports either by the Dutch Safety Board or by the Inspectorate of Safety and Justice. Other respectable organizations, such as the NCTV and the IFV are consulted for additional information, which was successful for the other cases. However, for this MSPO2 explosions case, both the NCTV and IFV relied on the report by the Dutch Safety Board rather than having conducted their own investigations. Having such organizations rely on the Dutch Safety Board's investigation does infer some credibility, however, the fact is that the analysis for this case will be based on less data than the other cases.

4. Analysis

In the analysis the theoretical framework of this research is applied onto the three chosen case studies. First, a brief summary of each case is given to provide some situational context of the incidents, followed by an analysis of the dependent variable of the coordination efforts in each of the three cases. Subsequently, having defined successful or failed coordination, the last section of the analysis will try and explain these outcomes by measuring the cases through the independent variables.

With regards to the category *new actors,* the analysis if this factor will be applied throughout all the subsections. This is done to avoid repetitions, as the impact of new actors is expected to influence the other categories (i.e operational perspectives, lack of role clarity, and allocation of authority).

4.1. Case Summaries

4.1.1. Chemie-pack Fires Cases

On a Wednesday on the 5th of January 2005, a fire broke out on the terrain of the industrial chemical company Chemie-pack in Moerdijk – a municipality in the province Noord Brabant. The fire initially started at one of the pumps when employees tried to pump highly inflammable chemicals from one container – also called intermediate bulk container (IBC) – to another (Inspectie Openbare Orde en Veiligheid, 2011, p.26 ; Dutch Safety Board, 2012, p.27). The containers were stored outside, thereby violating several safety regulations[3]. The cold weather froze the pumps at several places, ceasing the flow of liquid, at which point the decision was made to heat up the pipe with a gas burner, eventually setting it ablaze (Dutch Safety Board, 2012, p.27). Several plastic bulk containers caught fire including their contents, causing a considerable amount of chemicals to spread across the terrain (Inspectie Openbare Orde en Veiligheid, 2011, p.26). Most of the Chemie-pack complex burned down as a result (Inspectie Openbare Orde en Veiligheid, 2011, p.26; Dutch Safety Board, 2012, p.27). Upon arrival of the fire brigade, the decision was made to let the fire burn out on its own (Dutch Safety Board, 2012, p.27).

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[3] Chemie-pack violated several safety regulations. For one, it was prohibited to transport inflammable liquids to another property, including storing the liquids outside (Inspectie Openbare Orde en Veiligheid, 2011, p.26; Dutch Safety Board, 2012, p. 27).

The fires caused no serious casualties or deaths; however, several days after the fire, approximately 545 health complaints were reported (Dutch Safety Board, 2012, p.27). The fires caused a smoke cloud that passed through Hollands Diep towards Hoeksche Waard and Dordrecht (Dutch Safety Board, 2012, p.27). The most detrimental effects of the fire were severe environmental and air pollution, which could take years to recover (Dutch Safety Board, 2012, p.27; Volkskrant, 2014).

The fire at Chemie-pack was considered unique by the Inspectie Openbare Orde en Veiligheid due not only to its size and intensity, but also due to the inter-regional scope of the incident, which rarely occurs in the Netherlands (Inspectie Openbare Orde en Veiligheid, 2011, p.26). Several safety regions were involved, the most important being Midden-West Brabant (hereafter MWB) and Zuid-Holland Zuid (hereafter ZHZ).

4.1.2. MSPO2 Explosions at Shell

On the 25th of May 2015, Shell Moerdijk paused the operations of MSPO2 plant for planned maintenance. Part of the scheduled maintenance was replacing catalyst pellets in two of its reactors in unit 4800, which is part of the MSPO2 plant (Dutch Safety Board, 2015, p.6). Having replaced the catalyst, common procedures were followed to prepare the unit for normal operations, which was done by heating up the reactors with liquid ethylbenzene. The warming-up procedures commenced around 21:00, however, the operators felt it took too long to reach the desired temperature, in which the decision was made to manually increase the heat of the ethylbenzene (Dutch Safety Board, 2015, p.6). Despite several signals indicating irregularities in the warming-up procedure, the process was not halted. Unexpected chemical reactions between the ethylbenzene and catalyst pellets started to take place, which went unnoticed by the operators. Eventually, the chemical reactions triggered an explosion in the reactor (Dutch Safety Board, 2015, p. 7). Large sections of the plant, mainly unit 4800, were blown away at a range of 250-800 metres.

The explosions caused the two operators to suffer minor injuries to second-degree burns. The explosions resulted in a smoke cloud of considerable size, which drifted towards Hollands Diep and the province Zuid-Holland (Dutch Safety Board, 2015, p. 7). The involved safety regions in this incident were MWB) and ZHZ safety regions. The safety regions escalated to GRIP 3 and no further.

4.1.3. Noord-Holland Power Blackout

In the morning of the 27th of March 2015, a large power blackout occurred in the 380 kV station located in Diemen (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.6). Large parts of the provinces of Noord Holland and smaller parts of the province Flevoland suffered from the fallout of the power blackout. Approximately one million households were without electricity, public transport was crippled, bridges and traffic signs were disabled, on-line payments systems went off-line, and multiple reports surfaced of people stuck in elevator (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.12). In addition, large traffic jams around were caused across the regions, obstructing the transport goods, and all flights were cancelled.

The immediate response called for extra police on the streets, and fire units were ordered to report to their respective fire brigades as preventative measure. Large organizations and institutes, such as the Amsterdam Science Park, Nuclear Reactors, hospitals and Media Park Hilversum were forced to switch to their back-up power generators. The power blackout also affected several telecommunication services, which were dependent on their network grids disabled by the blackout.

A total of six safety regions were involved in the crisis: Amsterdam-Amstelland (hereafter AA), Flevoland, Gooi and Vechtstreek, Kennemerland, Noord-Holland Noord, and Zaanstreek-Waterland. Noord-Holland Noord escalated to GRIP 2, and Flevoland stayed at GRIP 0. All other safety regions decided to escalate authority to GRIP-level 4,   The source area was located in the safety region AA.

4.2. Outcome of Coordination in the Cases

This section will briefly address the outcome of each case's crisis response in relation to the dependent variable (failed/successful) coordination. This will be done by positing the conclusions drawn by the Dutch Safety Board and the Inspectorate of Justice and Safety with the concepts of *successful-* and *-failed coordination* as defined in the theoretical framework. To reiterate *failed coordination* is defined as the failure to involve the relevant (problem-fit) actors, a lack of situational awareness of the involved actors, unclear task division, and confusion with regards to the chain of command (Weick, 1993; Majchrzak et al., 2007; Okhuysen and Bechky 2009; Wegrich and Štimac, 2014). In contrast, *successful coordination* is defined as having

the problem-fit actors involved, a collective situational awareness of the crisis, a clear task division, and also a clear chain of command[4].

Chemie-pack - The DSB identified several key issues related to coordination that were detrimental to crisis response – in particular, crisis-communication, and communication with the public. In terms of escalating authority, the DSB states that the mayor of Moerdijk did not act accordingly considering the magnitude of the crisis, thereby compromising the operational escalation that would have provided adequate crisis-communications possibilities (Dutch Safety Board, 2012, p.130). Overall, the DSB states that steering the involved actors towards a working cooperation was also strenuous, which hampered the clear and timely communication of relevant information to the crisis actors (Dutch Safety Board, 2012, p. 130). The result was that collective and constructive situational awareness could not be established.

The communication with the press and public was also delayed, and was not consistent with what the public wanted to know. This was caused by a lack of clear task division when deciding who was responsible for informing the public of behavioural guidelines. The MWB and ZHZ assumed the BOT-MI was responsible, which was not the case. Another issue was that both safety regions lost control of the management of measurement data concerning the potential health hazards to the population (Dutch Safety Board, 2012, p. 130/131). This was caused because the BOT-MI was confused as whom it was to report to. A clear chain of command was missing, hence the BOT-MI's confusion.

Based on the three key issues mentioned above, coordination fails on the following elements: situational awareness, clear task division without overlap, and a clear chain of command. The Chemie-pack crisis is therefore a case of *failed coordination*.

The MSPO2 Shell Explosion - The DSB stated that the fires as result of the explosions were repressed through an effective collective effort by the involved fire brigades (Dutch Safety Board, 2015, p86). While the Moerdijk-Haven fire brigade

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[4] As stated in chapter 3.4.3, the full definition of successful coordination holds: the involvement of actors with relevant expertise displaying appropriate behaviour to effectively address the problem at hand, and maintain a high collective level of situational awareness, while working within a clear division of work with limited overlap, in which the coordination does not create problems within existing jurisdictional boundaries making it unclear whose responsibility belongs to who (Weick, 1993; Majchrzak et al., 2007; Okhuysen and Bechky, 2009 Wegrich and Štimac, 2014).

was new to the response, no issues were experienced with integrating them in the chain of command headed by WMB fire brigade. The goal of letting the fire die out naturally by controlling the fire from spreading was successfully achieved (Dutch Safety Board, 2015, p86). All fire brigades arrived within the appointed time limit, sufficient equipment was available to repress the fire, and the OvD made excellent use of the industrial fire brigade's specialization in industrial fires, which helped the fire brigade realize its fire repression strategy (Dutch Safety Board, 2015, p.86-87). A clear task division based on expertise supported the fire repression efforts.

On the strategic level, the DSB commended both MWB and ZHZ for having displayed collective situational awareness in having chosen a differentiated escalation of authority on the GRIP scale that led to a coordinated crisis response between both regions.

Thus, with both safety regions escalating authority appropriately to the crisis, and no issues in the fire brigades' operational command structure, the DSB concluded a positive result of the crisis response, albeit with some issues in information management. The outcome of the *Shell MSPO2 Explosions* crisis can therefore be deemed as successful coordination, as situational awareness on the strategic level was present, command structures were clear, and no elements of failed coordination were mentioned by the DSB[5].

Noord-Holland Power Blackout - The inspectorate investigated the power blackout to evaluate the effectiveness of inter-regional coordination. Inter-regional coordination refers to the coordination of the activities between safety regions concerning information-management, communication between safety regions and with the public, and integrating each safety regions' perspective into a collective one. That in mind, the inspectorate concluded that inter-regional coordination failed on each of its respective key elements (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.7). Differentiated escalation of authority on the GRIP ladder, inadequate information management and confusion as to what inter-regional coordination meant were the biggest obstacles (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.7). Communication between communication-advisers

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[5] Elements of failed coordination: omitting relevant actors, a lack of situation awareness of the involved actors, unclear task division, and confusion with regards to the chain of command (Weick, 1993; Majchrzak, 2007; Okhuysen and Bechky 2009; Wegrich and Štimac, 2014)

and mayors/chairmen of the affected municipalities was also hampered and obstructed (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.30).

With the inspectorate concluding that inter-regional coordination has failed, it suffices to say that the Noord-Holland Power Blackout portrays a case of *failed coordination*.

Two cases presenting failed coordination, and one being deemed as successful coordination, conjures up the puzzling question: *why did coordination fail in the Chemie-pack-and the Noord-Holland power blackout cases, but not in the MSPO2 Shell Explosions' case?* In order to find out, the following section will attempt to explain the differences in the outcome of coordination in each case (dependent variable) by applying the theory revolving around the four categories: (individual) operational perspectives, lack of role clarity, allocation of authority, and new actors.

4.3. Operational Perspectives

In this section, the impact of individual operational perspectives is measured. Individual operational perspectives are expected to delay information sharing due to the actor's own beliefs of what should be prioritized in terms of information sharing and courses of action. These are not only the result of the actor's unique set of values and beliefs that define what the crisis constitutes in terms of risks, but also what the prevailing work structure is for that particular actor (Dynes, 1994; Turner, 1976; Wolbers and Boersma, 2013; Boin and Bynander, 2015). Subsequently, the following hypothesis is tested: *Hypothesis 1: Different operational perspectives will cause delayed information sharing thereby obstructing coordination efforts*

The common operational perspective (COP) will also be measured on its actual presence When an individual operational perspective is present in the response network, the COP[6] is by definition disrupted (Majchrzak et al., 2007). To adequately study the impact of individual operational perspectives on information sharing, the presence of a COP needs to be studied as well. The COP is dependent on information sharing between actors, and should an individual operational perspective be present,

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[6] The COP refers to a shared understanding of the scope and risks pertaining a crisis, the awareness of the required resources expertise, relevant actors, and allocation of responsibilities to the appropriate actors (Carley, 2002; Wolbers et al.,2017)

theory holds that the COP should be disrupted (Weick, 1993; Majchrzak et al., 2007; Okhuysen and Bechky, 2009 Wegrich and Štimac, 2014).

4.3.1. Individual Operational Perspectives in the Chemie-pack Fires Case

On the operational level, it seemed that coordination suffered from the fire brigades not having the necessary situational awareness of the available resources. For example, many fire units were not used to using the UGS, which refers to a specific rendezvous point. The result was that many units would not report to the UGS, but operated independently[7] (Inspectie Openbare Orde en Veiligheid, 2011, p.67). It is evident that the fire-units were not familiar with working through a UGS, which portrays an example of an inadequate COP. Conversely, a sufficient COP would include an awareness and understanding of available resources, including tactical resources (Carley, 1991; Wolbers et al., 2017).

Furthermore, coordinating the fire units' activities also became strenuous due to an inadequate COP. In particular, information on the magnitude of the crisis as well as on work structure were omitted, making the COP inadequate. For instance, the Inspectorate stated explicitly that the fire-control strategy devised by the CoPI lacked crucial information on the scale of the fire and the prevailing work structure through which the fire units were to operate (Inspectie Openbare Orde en Veiligheid, 2011, p.73). The reason for missing such important information was that the OvD, who is responsible for steering the fire units and for informing the CoPI on the situation, failed to provide a constructive perspective on the situation (Inspectie Openbare Orde en Veiligheid, 2011, p.73). This caused many fire-units and active OvD's to not be fully aware of what the CoPI's strategy entailed in terms of command-structures. Additionally, the fire units also did not evaluate the effectiveness of their tactical efforts. For example, when the CoPI ordered the fire-units to reduce water usage due to contaminated water mixing in with surface water, many were unaware of this and continued using contaminated water (Boin et al., 2018, p. 140). It is evident that due to the inadequate COP, many of the fire units were not aware of the situation, which is

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[7] UGS includes a UGS-officer who together with the fire-brigade's officers in command decides which units are under whose command, as well as where the fire units should go (Inspectie Openbare Orde en Veiligheid, 2011, p.67).

characteristic of failed coordination (Okhuysen and Bechky, 2009; Wegrich and Štimac, 2014).

However, the OvD was not entirely at fault for being unable to provide a constructive perspective to the CoPI. Arguably, the various individual operational perspectives of the large number of fire units made it difficult for OvD's to integrate the surveillance data into a COP. For example, the inspectorate revealed that the then-present and en-route fire units and other assisting OvDs operated independently, based on what they perceived was the correct course of action (Inspectie Openbare Orde en Veiligheid, 2011, p.73). This was also evident in the earlier mentioned complications in the fire unit's use of the UGS (Inspectie Openbare Orde en Veiligheid, 2011, p.67). It is therefore not unlikely that individual operational perspectives did in fact obstruct information sharing between the OvD and the fire units, leading to an inadequate COP among the OvD and CoPI. As such, it caused situational awareness to be omitted from the coordination scheme as seen in the CoPI's fire control strategy, where many units did not where to be and what to do (Okhuysen and Bechky, 2009; Wegrich and Štimac, 2014).

It is important to note that the Inspectorate also emphasizes that the OvD became overwhelmed by a congregation of tasks[8], which may have influenced the OvD's task of creating a constructive picture of the situation.

The omission of a COP was also apparent between the safety regions and the BOT-MI, and caused the management of information concerning the measurement data of potential toxins in the smoke cloud coming from the fires to be disrupted. For example, the DSB notes considerable delays in the deployment of the MOD, who is part of the BOT-MI, to ZHZ because the MOD was already dispatched to MWB[9] (Dutch Safety Board, 2012, p.112-113). The independent actions taken by the BOT-MI became problematic for information sharing because the BOT-MI was responsible for providing advisory reports on what measures to take in case of toxins or other health hazards being present in the smoke cloud that erupted from the fires (Dutch Safety Board, 2012, p.112-116). It is evident that due to the BOT-MI's independent operations, the safety regions suffered delays in integrating the

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[8] The OvD's tasks included steering the fire units, repressing the fires, as well as surveying the incident site (Inspectie Openbare Orde en Veiligheid, 2011, p.73).

[9] The MOD arrived in MWB around 15:50 and only arrived in ZHZ at 19:30 (Dutch Safety Board, 2012, p.112)

BOT-MI's measurement data into the COP, seen in the inconsistent message about the dangers to the public. One could then argue that individual situational perspectives and the independent actions that come with it can delay or obstruct information management (Wolbers and Boersma, 2013).

However, one could also argue that the actions taken by the BOT-MI were caused by a COP not being present in the first place, not necessarily by an individual operation perspective as discussed above. For example, the BOT-MI stated that any attempts to contact safety region ZHZ failed, at which point they decided to commence their operations in MWB being the source area of the incident[10] (Dutch Safety Board, 2012, p.112-113). However, it does not explain the fact that the BOT-MI ignored official procedures that explicitly state that in the scenario of having two or more safety regions involved, the BOT-MI is to provide data to both the source and effect regions (Dutch Safety Board, 2012, p.113). A possible explanation to support the claim that the BOT-MI's individual operational perspective did delay the provision of measurement data is that it claimed to work under the ministry of infrastructure and environmental affairs, and reported to the ministry instead of to the safety regions (Dutch Safety Board, 2012, p.113). Apart from the BOT-MI independent operations, it is evident that the BOT-MI had a unique situational understanding of who it should report to, which diverged from official procedures stating that the BOT-MI was to report to the safety regions. Coordination therefore seemingly failed as an individual operational perspective obstructed key information to be timely allocated to relevant actors (Weick, 1993; Majchrzak et al., 2007; Wegrich and Štimac, 2014).

On the strategic level, it was also problematic to arrive at a common (operational) perspective, which hampered information-exchange between the safety regions MWB and ZHZ. The mayor of Moerdijk explicitly mentioned that he believed the fire at Chemie-pack was under control at GRIP 2, and thus perceived little incentive to escalate authority to GRIP 3, unlike ZHZ who were already operating at GRIP 4 (Dutch Safety Board, 2012, p.118; Inspectie Openbare Orde en Veiligheid, 2011, p.75). The consequences of this disproportionate escalation of authority between the two safety regions hampered the information exchange, because the ZHZ's communications team did not have an equally able communications counterpart in

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[10] Chemie-pack is located in the municipality of Moerdijk that is part of MWB.

MWB (Boin, 2018, p.142-143). The mayor's actions were evidently motivated by an individual perspective of the situation, as they directly related to his perspective on the dangers of the crisis. Additionally, the mayor contacted ZHZ about the potential fallout of the crisis, indicating that the mayor was aware of the cross-regional character of the fire (Dutch Safety Board, 2012, p.118). The difficulties in information exchange between MWB and ZHZ were likely caused by the mayor's individual operational perspective to not escalate authority. From this perspective, individual perspectives did indeed obstruct information exchange (Wolbers et al., 2017).

However, the mayor's individual operational perspective cannot fully explain the obstruction of information. While it is surprising that the mayor did not take responsibility for public communications, as he should have, the obstruction of information was exacerbated by the individual operational perspective of the ROT as well. To substantiate, the ROT, who is formally appointed to coordinate the operational level of the crisis response, disproportionally divided the crisis-communications responsibilities for the MWB between the CoPI and the ROT (The Dutch Safety Board, 2012, p.118). This became problematic, as the CoPI was responsible for the source region, which was relatively larger compared to the affected region in MWB, which was under the responsibility of the ROT (The Dutch Safety Board, 2012, p.118). As a result, while safety region ZHZ installed a regional policy support team (RBT) next to the ROT, MWB's crisis and press communication were both done by the CoPI, who became overwhelmed by information requests; this hampered the communication with its colleagues in both WMB and ZHZ. Evidently, the combination of the mayor's and ROT's individual operational perspectives contributed to the difficulties of exchanging information between MWB and ZHZ.

4.3.2. Operational Perspectives in the MSPO2 Explosions Shell Case

In contrast to the fire response in the Chemie-pack case, a common operational perspective (COP) was successfully established among the different fire brigades that were active during the MSPO2 Explosions at shell. This considerably benefited coordination. The DSB concurs and commended the directing officers in charge on their effective information exchange with one another in terms of roles, task division, and the available resources to create collective situational awareness (Dutch Safety Board, 2015, p.76). As a result, the fire response did not suffer from any confusion of who to,, nor by independent actions taken by any of the fire units, which is reflected

in a successful fire-repression strategy (Dutch Safety Board, 2015, p.77). Thus, through effective information sharing, a collective operational perspective regarding the situation and what needs to be done was achieved (Carley, 1991; Wolbers and Boersma, 2013). This would explain the success of coordination, which benefits from collective situational awareness and clear task divisions (Wegrich and Štimac, 2014).

Apart from effective communication between the fire brigades and a clear chain of command as explained above, the factor of familiarity might also have played a role. For example, the DSB stated that pre-crisis training programs increased role clarity between the fire brigades, thereby making easier to coordinate the activities of different fire brigades, as well as the transfer of authority and working with a liaison (Dutch Safety Board, 2014, p. 85-86). Being familiar could therefore foster the COP, by making smooth transfers of authority, and by providing a clear line of authority when working with multiple actors defining who does what and who reports to whom (Carley, 1991; Wolbers and Boersma, 2013).

This COP remained evident throughout the lifeline of fire control efforts. For example, the fire reached its peak intensity around 22:56, at which point the commander in charge escalated the situation accordingly to ensure sufficient materials and personnel were available (Dutch Safety Board, 2015, p.79). The COP was maintained, as theory, as an adequate understanding of what resources and personnel are required was displayed (Wolbers et al., 2017).

On the strategic level, very little complications were found, which is likely due the safety regions MWB and ZHZ successfully having established a COP. As such, strategic and operational understanding appeared to be parallel in accommodating each other. For example, both the safety regions MWB and ZHZ, and the mayor of Moerdijk came to a consensus that escalating authority to GRIP 4/5 would not be of any additional value to the crisis response (Dutch Safety Board, 2015, p. 81). The active communication between the safety regions and the consensus in decision making evidently helped establishing the COP (Wolbers and Boersma 2013). In turn, coordination suffered no delays in information exchange, in which the key strategic actors displayed appropriate behaviour in line with the collective situational perspective (Bechky and Okhuysen, 2009; Wegrich and Štimac, 2014). Having likely maintained a COP (between MWB and ZHZ), coherent decisions on escalating authority were made, which was not the case during the Chemie-pack crisis (Dutch Safety Board, 2012, p.118; Inspectie Openbare Orde en Veiligheid, 2011, p. 75).

In terms of information sharing, management of information between the safety regions MWB and ZHZ experienced some minor difficulties due to inability and/or not being aware of the available communication resources. For example, the DSB states that the inability of the safety regions (MWB/ZHZ) to operate the LMCS system caused some information to be excluded from the overall information-management (Dutch Safety Board, 2015, p.81). In addition, neither of the safety regions had the required personnel, or information managers available to operate the LMCS. Evidently, the safety regions were not aware what resources or knowledge was needed to operate the LMCS. Also, it was not clear to either of the safety regions whether the information inserted by one municipality was open for external use, or whether the actor accessing it was authorized to use it (Dutch Safety Board, 2015, p.81). Not being aware of the necessary resources in terms of personnel, and the required know-how to use the available (communications) tools indicate not having a COP (Carley, 1991; Wolbers and Boersma, 2013).

A likely consequence of the inability to use the LMCS was that several crisis teams used WhatsApp groups to communicate instead. Whether that is because of the experienced technical difficulties with the LMCS cannot be confirmed (Dutch Safety Board, 2015, p.82). However, information exchanges in such groups fall outside the official communication channels and cannot contribute to the COP. Nevertheless, the issues encountered with the LMCS were insignificant to the overall coordination scheme.

4.3.3. Operational Perspectives in the Noord-Holland Power Blackout case

The safety regions' individual perspective played a considerable role in obstructing the common operational perspective (COP) from being established, causing inter-regional coordination to fail in terms of information management. To substantiate, the inspectorate revealed that information sharing through the LMCS remained strenuous – similarly to the Shell case – in which the safety regions mainly gathered information, rather than sharing it (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). While the system allows for transparency, with other safety regions able to access information about each regions incident, it does not provide a collective operational perspective (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). As such, the safety regions prioritized reinforcing their own individual operational perspectives rather than sharing their perspectives

and information. This conflicted with what the inspectorate stated should have been the safety regions' shared goal: establishing an integrative perspective to foster inter-regional coordination (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.7). It is evident that coordination failed due to not achieving a shared goal, caused by individual operational perspectives obstructing the creation of the COP (Carley, 1991; Beckhy and Okhuysen, 2009; Wolbers and Boersma, 2013; Wegrich and Štimac, 2014).

Furthermore, the information exchange between TenneT and Liander, and the safety regions experienced delays due to the strong presence of the safety regions' individual operational perspectives. For example, the safety regions did not share information with the energy sector, and were more occupied with gathering information from TenneT and Liander and others in the energy sector (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.26). This caused the safety regions to be unaware of the information needs of their partner actors in the energy sector, in which the efforts made to assist these organizations were all for nothing[11] (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.26). As such, individual operational perspectives obstructed the allocation of relevant information to relevant actors, which should have been done to create the COP (Wolbers and Boersma, 2013).

During the crisis response, decision making concerning what mitigating measures to take for damages in the telecommunication sector also suffered delays as result of a lacking COP. Many telecommunication organizations stated that they could not make a proper decision due to the lack of information coming from the safety regions (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25-26). It seems that the relevant information was not allocated to the relevant actors, which obstructed the COP (Wolbers and Boersma, 2013). In turn, an inadequate COP delayed decision making.

In addition to the safety regions' cooperation with the telecommunication sector, their independent operational perspectives also risked inability to devise appropriate measures to address a potential scenario of the crisis communication tools being disrupted by the blackout. It is, as the inspectorate emphasizes, the lack involvement

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[11] Constructing individual perspectives is not counter-productive per se, provided that these perspectives are integrated into a COP with the relevant actors (Carley, 1991; Wolbers and Boersma, 2013)

of the telecommunication organizations that made it difficult for the safety regions to access information about the impact of the blackout for the safety regions' communications-infrastructure [12] (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.26). It is evident that the safety regions individual operational perspective obscured the relevance of the telecommunication sector. It prevented adequate information exchange and caused coordination to omit the relevant problem fit actors, which is characteristic of failed coordination (Carley, 1991; Wolbers and Boersma, 2013; Wegrich and Štimac, 2014).

The delays in information exchange with the telecommunication sector were also furthered delayed by the individual operational perspective of the national agency for telecommunications (Agentschap Telecom). Agentschap Telecom is responsible for deciding whether a power blackout is a threat to critical infrastructures, in which such a judgement call is subject to the agency's own perspective on the situation (Auditdienst Rijk, 2015, p10). As a result, Agentschap Telecom did not inform the EZ within 24 hours (Auditdienst Rijk, 2015, p.10). In other words, the national agency made decisions based on their own perspective of the situation, rather than in coherence or collaboration with the EZ or safety regions (as pointed out in the afore going section). Individual operational perspectives therefore obstructed information exchange (Dynes, 1994; Wolbers and Boersma., 2013).

4.4. Role Clarity

The effectiveness of cooperation between a set of actors is considerably influenced by the extent to which they are able to rely on each other's expertise, or more simply put to what extent they have trust in each other. To reiterate theory, role clarity in the context of crisis management can be defined as a working relationship between two or more actors, in which both actors display levels of mutual expectations and functionality through the clarity of competences, capabilities, expertise and roles (Moynihan, 2009; Boin and Bynander, 2015; Curnin et al., 2015). To measure whether *role clarity* was indeed a key factor in determining the outcome of the cases, the following hypothesis will be tested: *Hypothesis 2: A lack of trust causes delayed*

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[12] Similarly to the safety regions' cooperation with the energy section, the inspectorate explicitly emphasizes the need for closer cooperation to enhance the information exchange (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.26).

coordination responses due to a lack of credible expectations of capabilities and expertise among actors.

4.4.1. Role Clarity in the Chemie-pack Fires Case

The Chemie-pack crisis features several occasions where problems arose in terms of trust and role clarity. One major obstacle between the safety regions and the Policy Support Team of Environmental Incidents (BOT-MI) was the confusion of task division, which delayed the safety regions' collection of measurement data on potential health hazards.

The BOT-MI is responsible for delivering the measurement data to the safety regions MWB and ZHZ (Dutch Safety Board, 2012, p.112). However, the DSB stated that the safety regions had certain expectations of the BOT-MI – in particular the speed in which advice and data could be provided – that went beyond the BOT-MI's actual capabilities (Dutch Safety Board, 2012, p.114). The safety regions' expectation of the speed by which the BOT-MI was to complete the assigned tasks was incoherent with the time that was allocated for the BOT-MI to complete their tasks. To substantiate, the BOT-MI explicitly stated that the analysis of potential health hazards in the smoke cloud was a complex task and would require more time. The DSB stressed that the agreements between the Safety Regions and the BOT-MI lacked clarity, which resulted in the MWB and ZHZ safety regions' heightened expectations of the BOT-MI (Dutch Safety Board, 2012, p.112). Coordination therefore failed as the distribution of information was delayed as a result of lacking role clarity in the division of tasks (Okhuysen and Bechky, 2009; Curnin et al., 2015). However, the DSB also argued that the BOT-MI's marketing gave of wrong impressions, as their slogan stated them to always be available (Dutch Safety Board, 2012, p.114). Clarity is important as it improves the creation of mutual expectations between actors (Curnin et al,. 2015). As result, this also delayed informing the public about potential hazards and behavioural guidelines (Dutch Safety Board, 2012, p.112)

Another issue caused by a lack of role clarity in task division was that the safety regions were under the impression that the advice coming from the BOT-MI included recommendations concerning appropriate courses of behaviour (Dutch Safety Board, 2012, p.116). Indeed, it is true that the BOT-MI is formally tasked with offering suggested measures to those authorized with decision making, including suggestions concerning public information, but not to provide concrete guidelines about what

people should or should not do (Dutch Safety Board, 2012, p.115). The DSB states that the role specifications and expectations of both the Safety Regions and the BOT-MI were not properly specified into a working agreement (Dutch Safety Board, 2012, p.115). Clear role specifications are imperative in creating mutual expectations among actors, which foster the allocation of tasks to relevant actors (Moyniahn, 2009; Curnin et al., 2015). Evidently, clarity of roles and tasks were missing between the BOT-MI and safety regions.

More confusion about roles and tasks regarding the BOT-MI became evident when the National Crisis Centre (NCC) and Interdepartmental commission for crisis management (ICCB) intervened[13]. The DSB reported that the involvement of the NCC confused the BOT-MI to who to report to, in which they thought it had to be sent to the NCC prior to presenting it to the safety regions (Dutch Safety Board, 2012, p.117). To the BOT-MI and Safety Regions, it was unclear what the role of the NCC and ICCB was (Dutch Safety Board, 2012, p. 117). This was arguably caused by the NCC taking on a different role, further confusing the BOT-MI. For example, the NCC claimed not to have a coordinating role, but an assisting role. However, to the safety regions and the BOT-MI it felt that the NCC took on coordinating role, especially with regards to communication with the public (Dutch Safety Board, 2012, p.120). With the NCC taking on another role, it likely caused confusion of task division and as to who was responsible for informing the public on dangers of the crisis, which was actually the responsibility of both the MWB and ZHZ. The DSB also stated that it could not fathom why the NCC intervened when the crisis was clearly not on national scale (Dutch Safety Board, 2012, p. 116). As such, the safety regions and BOT-MI had to deal with an actor that was new to initial set of actors as defined by GRIP[14]. Arguably, the combination of the NCC not taking its original role, whilst intervening in a crisis that was not national increased the confusion of role clarity.

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[13] The iCCB functions under the National Coordinator for Security and Counterterrorism (NCTV) and advises the Ministerial Crisis Management Committee (MCMC) on taking decision affecting the overall crisis response in situations that pertain threats to national security (National Coordinator for Security and Counterterrorism (NCTV), 2016).

[14] Grip 3 includes a COPI, ROT and GBT, whereas GRIP includes similar actors but replaces the GBT with the RBT.

Additionally, the Ministry of Safety and Justice arguably exacerbated this confusion by sending letters to the Safety Regions and the BOT-MI stating that the NCC was responsible for providing a clear perspective of the situation to the public (Dutch Safety Board, 2012, p. 121). This would further support the lack of role clarity concerning who was responsible for informing the public. Clarity about roles within the coordination scheme fosters mutual expectations through a clear representation of what that actor is to deliver (Curnin et al., 2015). Thus, a lack of role clarity obscured a clear task division, which caused coordination to fail in terms of distributing the relevant information to the relevant actors (Wegrich and Štimac, 2014; Curnin et al., 2015.

Lastly, on the operational level there seemed to be some confusion regarding roles in controlling the fire, which made the fire repression more difficult than it should have been. The OvD arrived first at the incident site, and immediately had to deal with several tasks at the same time. For example, forming an operational perspective of the situation together with Chemie-pack's safety-coordinator, while directing the different fire brigade units arriving at the incident site (Inspectie Openbare Orde en Veiligheid, 2011, p.70-71). As a result, this complicated the OvD's role of directing tasks, making it unclear for the arriving fire units and officers who assumed a coordinating role (Inspectie Openbare Orde en Veiligheid, 2011, p. 70-71). The lack of clarity as to who was in command confused, and delayed the activities of many fire units. More importantly, is caused the fire units to be uncertain about their own role in the fire response. For example, the (non)alarmed officers that arrived were confused what they were supposed to do (Inspectie Openbare Orde en Veiligheid, 2011, p. 70-71). While not obstructing the repression of the fire itself, key elements of failed coordination are evident, such as confusion of who to report to and the lack adequate allocation expertise (Okhuysen and Bechky, 2009; Wegrich and Štimac, 2014).

4.4.2. Role Clarity in the MSPO2 Shell Explosions Case

In the Shell case, coordinating the activities of various fire brigades was successful due sufficient role clarity between the involved actors, reinforced by pre-crisis training programmes. According to the DSB, both Shell's industrial fire brigade and the Moerdijk-Haven fire brigade occasionally participated in joint training programmes on how to effectively address industrial fires (Dutch Safety Board, 2015,

p.86). Interestingly, the joined training programmes were installed in response to the difficulties experienced in the fire response in the Chemie-pack crisis. As the theory suggests, prior-working relationships can be of considerable benefit in creating trust and reliability between actors, and training programmes can effectively improve this (Curnin et al., 2015). This might also explain why the response was effective despite having the Moerdijk-Haven fire brigade involved in an official crisis response for the first time.

The DSB seems to concur and concludes that there is indeed a high probability that the joint-training programmes contributed to effective join fire control efforts (Dutch Safety Board, 2015, p.87). More evidence to support the positive impact of role clarity on coordination is seen in the OvD's display of having sufficient knowledge of the expertise of Shell's industrial fire brigade. For example, the OvD classified the fire as one of "considerable size", and gained access to the industrial fire brigade's equipment specialized for industrial fires (Dutch Safety Board, 2015, p.87). In turn, this implies that the officer in charge understood and could clearly identify the value of the industrial fire brigade's expertise and capabilities. Thus, contrary to the Chemie-pack case, operational coordination efforts in the *MSPO2 Shell Explosions* case has seen considerable improvements. The DSB states that the successful fire control strategies came forth as a collective effort by different branches of fire brigades (Shell's industrial-, Moerdijk-Haven-, and WMB fire brigades), in which a clear role and task division helped to devise an appropriate strategy (Dutch Safety Board, 2015, p.86).

Overall, the crisis response to the MSPO2 explosions at Shell did not include any of the assumed implications related to lacking role clarity, such as delayed coordination or distribution of information, nor misconceived expectations of what partner actors were to deliver. Conversely, it's evident that there was an excellent understanding of the value of the available expertise among fire brigades – unlike the Chemie-pack case with confusion of who was in command. For example, even though the Moerdijk-Haven and Shell's industrial fire brigade arrived first at the scene (so-called first responders), by the time the OvD of WMB's fire brigade arrived, authority was smoothly transferred and cleared to all officers on duty (Dutch Safety Board, 2015, p.76). In turn, it portrays an adequate understanding of role specification among the different fire brigades (Curnin et al., 2015).

As for the impact of new actors, one could argue that Moerdijk-Haven brigade

was a new actor in the response, as it was its first time to be formally admitted to a response network. Evident is also that with the help of pre-crisis joint training programmes, the expected implications of involving new actors - which delayed coordination due to increased role clarity - was avoided. Indeed, joint training programmes are known to increase familiarity, which benefits coordination through increasing role clarity between actors before the crisis occurs (Curin et al., 2015; Comfort, 2007).

4.4.3. Role Clarity in the Noord-Holland Power Blackout Case

In establishing inter-regional coordination between the six relevant safety regions, the management of information was mostly influenced by the lack of role clarity between the regions. For example, in the event of a power blackout, it is imperative to request a liaison from Liander, who is the grid operating company responsible for distributing electricity and gas in the Netherlands (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.24-25). The liaison would inform relevant crisis actors about the details and scope of the power blackout, and therefore plays a key role in information management. However, for reasons unknown, the safety regions involved assumed that Liander was unable to provide a liaison for each active ROT in the safety regions (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.24). In hindsight this appeared to be untrue. There is no explicit reason for this assumption, other than having underestimated Liander's capabilities. It is likely that the safety regions were not aware of Liander's capabilities when it comes to providing liaisons and therefore assumed they were unable. It is evident that a lack of role clarity caused the development of faulty expectations (Curnin et al., 2015).

The safety regions also assumed that safety region AA had direct access to information from Liander, which in hindsight was not the case (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.24-25). This also indicates that apart from their faulty expectations of Liander, the partner safety regions also misunderstood the role of AA. Their expectations were that AA would collect and distribute information from Liander to the safety regions (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.24). This likely fed into why the other safety regions did not contact Liander for a liaison for each ROT.

Another coordination issue occurred when the NCC allocated the safety region AA with the responsibility to lead inter-regional coordination efforts. In the wake of

the power blackout, the NCC called for inter-regional coordination to effectively manage all the in-and outgoing information between the safety regions. However, this became problematic when the NCC tasked the safety region AA with the information management between the crisis organizations and their telecommunication partner actors[15] (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.24). AA was not able to fulfil this role, in which the inspectorate assumes that the task was likely to complicated and too big. As a result, information-management and creation of a COP (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22).

Furthermore, when it became apparent that inter-regional coordination was failing, the lack of role clarity between the safety regions made it difficult to transfer safety region AA's responsibility to a more suitable safety region. For example, a requisite to transfer the responsibility of facilitating inter-regional coordination to another region that is that all regions need to understand each other's capabilities (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.23). In addition, it is key to understand how and where each safety region can contribute to ensure successful inter-regional coordination (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.23). The fact that AA did not transfer its responsibility, whilst struggling to facilitate could indicate that there was a lack of clarity of roles and capabilities among the safety regions. It is evident that coordination, in particular task division and the distribution of information, were delayed as a result of this lack (Wegrich and Štimac, 2014; Curnin et al., 2015).

However, it is not completely certain AA's capabilities were lacking. For one, the inspectorate explicitly stated not having investigated why AA was unable to fulfil its task a facilitator for inter-regional coordination (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22). Needless to say, while there may indeed be other factors that played part in the strenuous effort facilitating inter-regional coordination, the evidence presented above suffices to say that a lack of clarity of roles/functions, and capabilities between the safety regions factored. To substantiate, the inspectorate stated that in general it is a difficult task to transfer the facilitating role for inter-regional coordination from one safety region to another (Inspectie Veiligheid en

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[15] As defined by the GRIP regulation, when a crisis involves multiple safety regions, the source-region is appointed to facilitate inter-regional coordination when the source area of the crisis is clearly defined (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.23)

Justitie & Agentschap Telecom, 2016, p.23). To reiterate, it requires extensive awareness of how each region can complement inter-regional coordination (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.23).

Another minor issue related to role clarity is evident between between TenneT's liaison and the ministry of economic affairs (EZ). The ministry of EZ's auditor reported that the liaison was not familiar working with the EZ's working procedures, used jargon, role divisions and what the mutual expectations were between the EZ and TenneT's liaison[16] (Auditdiest Rijk, 2015, p.22). It is apparent that there was a lack of role clarity concerning mutual expectations and working procedures (Curnin et all., 2015). Additionally, the fact that the ministry of EZ had never worked with TenneT's liaison that was physically present may have increased role ambiguity, in which the liaison constituted a new actor. It is then not surprising that role clarity factored, as new actors are known to obstruct coordination due to not being familiar with the roles and expertise of other actors, making cooperation and task allocation more difficult (Majchrzak, et al., 2007; Boin and Bynander, 2015 However, despite the liaison's experiences constituting clear signs of a lack of role clarity, there were no implications on coordination. The auditor did emphasize that these findings are aspects due to improvement in the future.

4.5. Allocation of Authority

The theoretical framework defined allocation as authority in either *centralized* and *decentralized*. For *centralized authority*, the expectation holds that information-management may be obstructed as the result of the distance between the strategic and operational command that is created as the result of centralizing authority vertically (Goffman, 1963; Allen, 1977; Faraj and Xiao, 2006; Okhuysen and Bechky, 2009). The hypothesis to be tested holds:

Hypothesis 3: Centralized authority to one actor or a small group of actors within the crisis-response network obstructs the information-management due to the increased distance between strategic and operational level actors.

Decentralized allocation of authority is expected to increase other actors' individual operational perspective due to the relative increased autonomy ('t Hart et

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[16] TenneT's liaison added for future reference that clearer specifications concerning the different tasks, functions, roles, and expectations of the EZ's department would be highly beneficial to working as a liaison within the EZ (Auditdiest Rijk, 2015, p.22).

al., 1993; Faraj and Xiao, 2006; Wolbers et al., 2017). Authority becomes dispersed among or shared by various actors in the crisis-response network, in which they gain the authority to decide on what courses of action to take to fulfil or abstain from their obligations ('t Hart et al., 1993; Faraj and Xiao, 2006; Wolbers et al., 2017). The hypothesis to test this expectation holds:

Hypothesis 4: Decentralized authority within the crisis network results in more dominant individual operational perspective of each actor thereby obstructing the creation of a common operational perspective.

4.5.1. Allocation of Authority in the Chemie-pack Fires Case

The BOT-MI started their operations in safety regions MWB based on their own perspective of the situation. However, the BOT-MI's choice on following up on its own perspective can be seen as the result of how authority was allocated. For example, the BOT-MI was under the impression that it worked under the ministry of infrastructure, while   formal procedures in GRIP clearly state that it worked under – or at least with – both MWB and safety regions ZHZ[17] (Dutch Safety Board, 2012, p.113). The DSB concluded that the confusion was likely caused by the inter-regional character of the crisis. More confusion arose when the ministry additionally sent environmental deployment teams (Boin et al., 2018, p. 139). This likely further blurred the lines of authority for the BOT-MI. Even if official procedures stated that the safety regions were the highest authority involved, for the BOT-MI it seemed multiple nodes of authority (i.e. the safety regions and NCC) were present and sharing it. Shared authority can delay coordination through obstructing the information distribution (Moynihan, 2009).

Another reason for the BOT-MI to act independently was because of the lack of rules and procedures between the BOT-MI and ZHZ, which created administrative distance between the two actors. For example, the DSB stated explicitly that safety regions did not have specified working agreements with the BOT-MI concerning its deployment (Dutch Safety Board, 2012, p.114). This would indicate that the BOT-MI's actions were not under the scrutiny of the safety regions, thereby creating

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[17]The mayor has the highest authority to not only make decisions concerning the crisis response, but also to give commands to network crisis actors, and only if more municipalities are involved can a transfer of authority be done from the mayor to the chairman of the safety region (Dutch Safety Board, 2012)

distance between the safety regions' administrative oversight and the BOT-MI on the operational level. Strategic-operational distance delays coordination due to the inability of rapid adjustment, which is caused by not being aware of the actions of partner actors (Goffman, 1963; Okhuysen and Bechky, 2009).

Additionally, when the NCC tried to correct the confusion, it unintentionally worsened the situation. As mentioned in the section on operational perspectives, the NCC claimed to have a facilitating role, and tried to have the BOT-MI provide their advisory reports in a more timely fashion (Dutch Safety Board, 2012, p.114). This may be true; however, the BOT-MI and safety regions experienced the NCC more in a directing role rather than facilitating[18]. The NCC seemingly intervened, and with formally holding a position of higher authority, it likely disrupted the chain of command for the BOT-MI.

Administrative distance between the safety regions, and ROT and CoPI also contributed to the difficulties encountered in informing the public on the dangers of the crisis. When the mayor of Moerdijk eventually escalated authority to GRIP 4, the action-communications centre in Moerdijk remained the central point for all communications (Dutch Safety Board, 2012, p.118). In turn, the DSB was surprised that the RBT[19] did not take any responsibility or claim responsibility to correct public communications. Arguably, with the RBT being responsible for coordinating crisis-communication, the fact that no adjustments were made to mitigate the difficulties experienced by the municipal communications-action centre could imply its lack of involvement.

Similarly, the mayor did not step in when the CoPI was overwhelmed by having to process the crisis- and public communication of the source area in MWB (Dutch Safety Board, 2012, p.118). At the time, GRIP 3 was in effect, meaning that the mayor is still formally responsible for the communication with the public. The fact that the mayor did not step in could indicate that there was administrative distance

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[18] The ministry of safety and justice added to this confusion by sending the relevant actors a formal letter stating that the NCC would be responsible for coordinating public-and press-communication (Dutch Safety Board, 2012, p.121).

[19] The RBT is tasked with coordinating crisis-communication, which essentially refers to gathering, processing and providing information to those in need of specific data (Dutch Safety Board, 2012, p.118; Inspectie Openbare Orde en Veiligheid, 2011, p.76).

between the mayor and the CoPI. Having increased distance between the strategic- and operational level activities in coordination often delays making adjustments to the coordination scheme or do not occur at al (Goffman, 1963; Okhuysen and Bechky, 2009). This would explain why the mayor did not step in to assist or take over public communications from the CoPI, as he might not have been aware of the problems.

On the operational level, most of the coordination issues relate to the decentralized authority of the fire brigades involved, in which they can act independently until a formal chain of command has been established. For example, when the fires at Chemie-pack became known, a large number of fire units arrived at the scene (Boin et al., 2018, p.139). The large number itself challenged coordination, especially when the non-alerted fire units headed towards the incident scene, as they were not under the command of the OvD nor CoPI (Boin et al., 2018, p.139). In combination with not knowing how to use the UGS, many units acted upon their own individual perspective.

To make things worse, the OvD arrived first at the scene and failed to establish a formal chain of command, and without this central point of command, the various fire units acted out of their own perspective on the situation. As the Inspectorate stated, because the OvD arrived first at the scene, he had to survey the area, give orders to the en-route fire units on where they should go, whilst having to provide a collective perspective to the CoPI, and suppress the fire until the fire units arrived (Inspectie Openbare Orde en Veiligheid, 2011, p.73). Such tasks are normally dealt with by first responding fire units, in which the OvD would be directly commanding the en route fire units, and deciding on a strategy with the CoPI (Inspectie Openbare Orde en Veiligheid, 2011, p. 70; Boin et al., 2018, p.139). However, the various tasks that the OvD took on pushed him away from its directing role, causing many fire units to act upon their own individual operational perspective. Indeed, in some cases, the omission of a central command can make actors more likely to act upon their own individual perspectives (Wolbers et al., 2017). Consequently, the Inspectorate explicitly stated that not only did the lack of command obstruct task allocation, but also made the creation of a collective operational picture of the situation more difficult (Inspectie Openbare Orde en Veiligheid, 2011, p.73). Coordination fails when tasks are not allocated properly and clear lines of command are missing, including the inability to come to a COP (Wegrich and Štimac, 2014).

4.5.2. Allocation of Authority in the MSPO2 Shell Explosions Case

The fire brigade's approach to the shell crisis went relatively smoothly, in which the fire repression strategy was successfully realized, mainly due to a clear chain of command. First at the scene of the incident was the OvD of the Industrial fire brigade and the Moerdijk-Haven fire brigade along with several fire units, which subsequently started their reconnaissance of the incident site (Dutch Safety Board, 2015, p.76). Upon arrival of the OvD of the MWB fire brigade, both the OvD's of the industrial- and Moerdijk-Haven fire brigades transferred command to the OvD MWB (Dutch Safety Board, 2015, p.86). It created a clear command structure and allocation of tasks among the different fire brigades, which helped create a collective response (Dutch Safety Board, 2015, p.75-76). Evidently, having a clear chain of command did indeed benefit coordination. Centralized authority allows for easier allocation of tasks, provided a clear chain of command has been established, structured by clear rules and procedures (Faraj and Xiao, 2006). Clear rules and agreements were key in the Shell case, which were missing in the Chemie-pack case. Indeed, according to the DSB, it was through effective communication with one another that the different fire brigades managed to come to agreements and rules that structured the coordinated fire response, making it a success (Dutch Safety Board, 2015, p. 75).

Additionally, looking at the Chemie-pack crisis, the fire response was deemed uncoordinated as a result of the OvD failing to establish a central point of command at the incident site (Inspectie Openbare Orde en Veiligheid, 2011, p.70; Dutch Safety Board, 2015, p. 77). It portrays contrast between the implications that occurred when central authority of command is established and when it is not.

However, the DSB argues that the presence of the new Moerdijk-Haven fire brigade also factored in the successful fire repression. The Moerdijk-Haven brigade provides the Shell Industrial brigade with the basic necessities for preliminary responses to industrial fires (Dutch Safety Board, 2015, p.75). Also, the joint exercises appeared to have a beneficial effect on making centralized authority work amidst a transfer of authority from the OvDs of the industrial and Moerdijk-Haven fire brigades to the OvD MWB (Dutch Safety Board, 2015, p.87). One could argue that familiarity and role clarity might have played a role as well, as familiarity is created through clarity of expertise and roles, which benefit the allocation of tasks (Curnin et al., 2015; Boin and Bynander, 2015).

The only challenge with regards to authority was the lack of a central command in terms of coordinating the number of units, materials and equipment, which resulted in a surplus of personnel and materials (Dutch Safety Board, 2015, p.88). While this did not affect the effectiveness of controlling the fire, it made coordinating the fire units more sensitive of a task than it should have been.

On the strategic level, escalation authority on the GRIP scale also went considerably better than during the Chemie-pack crisis, in which there were no independent operational perspectives as result of decentralized authority. For example, both the mayors of Moerdijk (WMB) and Dordrecht (ZHZ) provided a coherent response in terms of what GRIP level was appropriate for both the source and the affected region[20] (Dutch Safety Board, 2015, p.80). Additionally, consensus was also reached with regards to potentially escalating authority to GRIP 4 or 5, which was ultimately rejected (Dutch Safety Board, 2015, p.81). This indicates that while de-centralized nodes of authority were present in the response network, they did not obstruct coordination by incoherent decision-making by different actors ('t Hart et al., 1993; Wolbers et al., 2017).

In addition, setting the appropriate GRIP levels in both MWB and ZHZ also helped in allocating responsibilities for public communications, in which there was no strategic-operational distance. To substantiate, the safety regions MWB and ZHZ coordinated their communications' strategies to the public with one another, where MWB took responsibility on creating a common perspective of the situation, and ZHZ focussed mainly on information the residents of the region (Dutch Safety Board, 2015, p.90). Arguably, with the safety regions having worked together on setting the appropriate GRIP level, as well as on a joint communication strategy, more emphasis was placed on what was needed for both communications teams to make this work. Closer proximity between actors is known for creating more awareness of other actors' actions, making it easier to adjust accordingly

While the information exchange or communication suffered delays, this was not caused by a lack of oversight, such as was the case in the Chemie-pack incident. Indeed, the DSB stated explicitly that this problem was due to the MWB not having included an export on toxins (Dutch Safety Board, 2015, p. 90). In addition, the DSB

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[20] Both safety regions came to a consensus, in which MWB escalated authority to GRIP 3, whereas ZHZ escalated to GRIP 2 (Dutch Safety Board, 2015, p.80).

adds this delay could not have been prevented, even if the safety regions had escalated to GRIP 4 or 5 (Dutch Safety Board, 2015, p.90).

4.5.3. Allocation of Authority in the Noord-Holland Power Blackout Case

The core problems of inter-regional coordination during the power blackout revolved around inadequate information management and the lack of collective understanding among all safety regions. However, one could argue that these problems could have been mitigated to some extent if the NCC was more closely involved. For example, the NCC's role in inter-regional coordination is to combine the different information flows from the involved safety regions, to create a common perspective, and to distribute relevant information to the problem-fit crisis actors involved (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.23). Yet, during the crisis, when safety region AA appeared to be ill equipped for facilitating inter-regional coordination, the NCC did not intervene. This surprised the inspectorate, who then stated that the NCC could bear an important role in helping to establish information management (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22-23). Arguably, had the NCC been more closely involved, the issues concerning information management and the creation of a collective situational perspective might have been far less strenuous. After all, closer proximity between actors can make it easier to adjust actions in case things go wrong (Goffman, 1963). However, this only speculation, because as seen in the Chemie-pack case, the NCC's involvement can also cause more confusion.

Similarly, closer involvement of the NCC during the process of establishing inter-regional coordination could also foster a better understanding of what needs to be done among all safety regions involved. For example, when AA was unable to effectively facilitate inter-regional coordination, the omission of information management caused the other safety regions to become confused about what inter-regional coordination actually referred to (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22-24). More involvement of the NCC would also have benefited AA in transferring its facilitating responsibility to another safety region. Such a transfer requires all safety regions to understand what needs to be, and how they can contribute (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22-24). Apart from directing and steering coordination between safety regions when something goes wrong, the NCC's closer involvement right from the start could lead

to the safety regions being better informed. It would benefit coordination as close proximity between actors creates more awareness of all actions taken within the crisis response, making correcting them easier (Goffman, 1963, Okhuysen and Bechky, 2009). In addition, this infers situational awareness among crisis actors, thereby benefiting the creation of a COP (Goffman, 1963, Wolbers and Boersma, 2013; Wegrich and Štimac, 2014).

Furthermore, as mentioned in the section on operational perspectives, the safety regions were primarily occupied with gathering information for their own individual perspective. This was likely exacerbated by the fact that there are very few rules that instruct them otherwise. For example, for inter-regional coordination the involved safety regions do not have escalate authority of GRIP equally, in which each safety region can decide whether doing so is of value to them (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22). For them to make this decision, situational awareness is key, which could have motivated to gather more information for themselves instead of sharing it.

Another issue related to information delay is that the ministry of EZ did not manage to get its hands on crucial information on the scale of the power blackout in a timely manner. As mentioned in the section on the COP, the reason why TenneT did not inform the Agentschap Telecom - part of the EZ - within 24 hours is due to ambiguous criteria on which they define the severity of the power blackout (Auditdienst Rijk, 2015, p. 10). In addition, the inspectorate found that TenneT had no specified timeframe allocated for when to signal a severe power blackout to the EZ (Auditdienst Rijk, 2015, p.10). This would indicate distance between different levels of authority, as TenneT's decision-making processes were not checked by Agentschap telecom. As the inspectorate suggested, establishing rules that structure and mitigate the subjectivity of TenneT's decision-making processes are desired (Auditdienst Rijk, 2015, p.10). Desiring more rules is not surprising as centralized authority in coordination works best with stricter rules, as it provides strategic level actors with more control while not needing to be involved. As such, by increasing control, stricter rules could potentially reducing distance of authority between actors (Goffman, 1963; Xiao and Faraj, 2006; Okhuysen and Bechky, 2009).

A more obvious case of distance between levels of authority is seen in the exclusion of private organizations in the Noord-Holland power blackout case. Interviews conducted by the Inspectorate with several private organizations indicated

that many felt not included in the network, and barely received any information on the crisis (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). For example, when Mobile network providers received several warning signals about errors on their networks' power supply, neither the safety regions or Agentschap telecom provided them with a proper explanation about the situation (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). This is surprising because mobile network providers are of key importance in ensuring communication is possible, including crisis communication. Exclusion of relevant actors from the network can omit relevant views, thereby obstructing the COP ('t Hart et al., 1993). At the same time, it shows the lack of involvement of crisis actors, and their inability to involve the relevant actors (Wegrich and Štimac, 2014)

5. Discussion/Conclusion

In this section an analysis of the independent variables will discussed in relation to the dependent variables. In order to do so in an organized manner, each hypothesis will be considered separately before the paper will ultimately present a consolidated answer to the main research question, along with potential recommendations for future research.

To reiterate the conclusions drawn from chapter 3.2 discussing the dependent variable, both Chemie-pack and the Noord-Holland power blackout are cases of failed coordination, in which the DSB and the inspectorate primarily emphasize the obstruction and delays in information management. In contrast, the response to the MSPO2 Shell Explosions incident was defined as a case of successful coordination by the DSB.

5.1. Hypothesis 1: Individual Operational Perspectives and COP

Different operational perspectives will cause delayed information sharing thereby obstructing coordination efforts

The general concern around individual operational perspectives is that they delay or obstruct the collection of relevant information (Wolbers and Boersma, 2013; Boin and Bynander, 2015). The analysis revealed that the presence of individual operational perspectives do indeed obstruct information sharing, which was a decisive factor in

two of the three cases, namely in the Chemie-pack and Noord-Holland power blackout case. This hypothesis therefore holds for two cases, in which the MSPO2 Shell Explosions case indicate how not having individual operational perspectives, and maintaining a collection operational perspectives fosters successful coordination. The analysis of the outcome of coordination in both cases indicated that both were deemed a failure on situational awareness and information management.

The analysis revealed that individual operational perspectives can delay information sharing in several ways. One recurring dynamic was where one particular actor operated dependently based on its own initiative. In both the Chemie-pack and the Noord-Holland power blackout case, it was evident that this caused crucial information to be omitted from the COP. For example, in Chemie-pack case, the BOT-MI's actions lead to a delay of the measurement data needed to inform the public, whereas in the Noord-Holland case, TenneT's judgement call lead delayed information on the scale of the power blackout (Dutch Safety Board, 2012, p.116; Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25-27). As theory would suggest, a COP is obstructed if relevant information concerning the dangers and scope of the crisis is missing (Laakso and, Palomäki, 2013; Wolbers and Boersma, 2013). This conforms with the outcome of both cases. Interestingly, in both cases there seemed to be a lack of clear rules and procedures, which appears to have fostered the individual operational perspectives. This will be elaborated on in the discussion on hypothesis 3, in which distance of authority plays a key role.

On the strategic level, a similar dynamic is apparent in which individual operational perspectives can harm the overall crisis communication between actors. For example, in the Noord-Holland power blackout case, all safety regions were focused on reinforcing their own understanding of the crisis, causing the information management between the safety regions to be obstructed (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). Similarly, in the Chemie-pack case, the mayor of Moerdijk did not timely escalate to GRIP 3 in line with safety region ZHZ who was already at GRIP 4, causing its communications team to be inadequately equipped to effectively communicate with safety region ZHZ (Dutch Safety Board, 2012, p.118). The COP therefore failed in both cases, because the actors involved prioritized taking actions based on there own individual understanding, disrupting the COP (Dynes, 1994; Wolbers and Boersma, 2013; Boin and Bynander, 2015). In the Chemie-pack case, it caused the safety regions to have inconsistent, and differentiated

messages to the public, while in the Noord-Holland power blackout case this led to a lack of situational understanding (i.e COP) among all safety regions (Dutch Safety Board, 2012, p.130-131;Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). The involved actors did not show the appropriate behaviour, and lacked situational awareness in terms of what needed to be prioritized in making coordination a success, hence why both outcomes are deemed failures (Wegrich and Štimac, 2014; Weick, 1993; Okhuysen and Bechky, 2009; Wolbers and Boersma., 2013).

The analysis also revealed that where a COP is present, individual operational perspectives are not, resulting in no obstructions of information exchanges. In contrast to Chemie-pack, in the Shell case this is likely due to the closer cooperation between both the safety regions, which led to a coordinated escalation of GRIP between MWB and ZHZ (Dutch Safety Board, 2015, p. 81). Coordinated escalation of GRIP is significant in terms of the COP, because GRIP directly influences the capabilities of the CoPI, ROT and GBT/RBT. The result was that coordination was deemed a success. This is not surprising, as the actors in play displayed appropriate behaviour consistent with a collective operational picture, which characterize successful coordination (Wolbers and Boersma, 2013; Wegrich and Štimac, 2014).

Another factor evident in all cases was the inability to use the available resources during the crisis response. Knowledge on how to use these resources is part of the COP, and while the omission of this knowledge does not indicate the presence of individual operational perspectives, it does signal an inadequate COP (Carley, 1991; Wolbers and Boersma, 2013). To substantiate, in both the Shell case and the Noord-Holland power blackout case, the inability to use the LMCS communications channel caused the crisis actors to gather information rather than sharing it, assuming that inserting information would create a collective picture (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.25). Another example is how the fire units in the Chemie-pack response did not know how to use the UGS (designated rendezvous point), and thus ventured out alone to do reconnaissance. Overall, all cases showed how important it is to understand the available resources. In Chemie-pack and the power blackout case this directly contributed to failed coordination, as it fostered or contributed to individual operational perspectives.

5.2. Hypothesis 2: The Impacts of Lacking Role Clarity

A lack of trust causes delayed coordination responses due to a lack of credible expectations of capabilities and expertise among actors.

The hypothesis assumed that a lack of role clarity makes coordination more strenuous or obstructs it all together (Curnin et al., 2015). Indeed, a clear task division and allocation of roles is key in successful coordination, which neatly relates to role clarity, as it presents one's role as defined by its expertise and what other actors can expect (Weick, 1993; Majchrzak et al., 2007; Okhuysen and Bechky, 2009; Curnin et al., 2015). The analysis showed that hypothesis 2 holds for two of the cases, in which the MSPO2 Shell Explosions' case actually shows how having role clarity contributes to successful coordination.

In both Chemie-pack and the Noord-Holland power blackout case, role clarity distorted the prevailing work structure by blurring the chain of command between the crisis actors. In terms of role clarity, ambiguity concerning who to report to, or who is authorized to give commands can obstruct the chain of command, which is a key element of failed coordination (Majchrzak, 2007; Okhuysen and Bechky, 2009; Wegrich and Štimac, 2014). To substantiate, in the Chemie-pack case, the NCC, safety regions, and the ministry posed as authoritative bodies, which confused the BOT-MI as to who to report to (Dutch Safety Board, 2012, p.117). To make things worse, the NCC claimed to have an assisting role, yet was experienced by both the safety regions and the BOT-MI as a coordinator, particular with regards to information management. Without a clear chain of command, coordination is likely to fail (Wegrich and Štimac, 2014). This was also apparent in the Noord-Holland power blackout case. When safety region AA could not establish inter-regional coordination, other safety regions could have taken over this task (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.23). This did not happen, allegedly due to neither of the safety regions knowing how they are able to contribute in a way that makes inter-regional coordination work. The dynamic aligns with the theory stating the importance of role clarity in helping to allocate expertise (Curnin et al., 2015).

It is interesting that the MSPO2 Shell explosions case showed excellent degrees of role clarity. This can explained with Curnin et al.'s (2015) insights, stating that role clarity and familiarity can be increased by joint training programmes. As such, the

DSB stated explicitly that due to joined training programmes, clarity and familiarity with working with one another was fostered (Dutch Safety Board, 2015, p.87). Coordination was therefore considered a success by the Dutch Safety Board. When juxtaposed to the coordination efforts in the other two cases, the omitted element is indeed training and familiarity.

Apart from role ambiguity, it was also evident that misconceived expectations can delay coordination. For example, in the Chemie-pack case, the safety regions MWB and ZHZ expected the BOT-MI to provide suggested measures on behavioural guidelines for the populations along with the measurement data on possible health hazards in the smoke cloud (Dutch Safety Board, 2012, p.116). However, according to the BOT-MI, this was not their task, which caused the safety regions to provide a public message, incoherent with what the public wanted to know (Dutch Safety Board, 2012, p.115). In addition, the safety regions expected the BOT-MI to supply the information faster than the amount of time allocated to the BOT-MI's operations. Indeed, as theory expected, coordination was delayed because of wrong expectations about tasks division tasks, as well as about the time allocated for completion of these tasks (Moynihan, 2009; Curnin et al., 2015). Thus, role clarity does indeed delay coordination through obscuring a clear task division, which is characteristic for failed coordination (Weick, 1993; Majchrzak, 2007; Okhuysen and Bechky, 2009)

5.3. Hypothesis 3: Centralized Allocation of Authority

Centralized authority to one actor or a small group of actors within the crisis-response network obstructs the information-management due to the increased distance between strategic and operational level actors.

The distance that is created when allocating authority vertically has implications for the operations on the operational level. As argued by Goffman (1963), Allen (1977), and Okhuysen and Bechky (2009), distance between actors' operations obstructs coordination due to increased difficulty of adjusting errors, which are caused by a lack of information exchange between actors. This hypothesis holds for both the Chemie-pack and the Noord-Holland power blackout case, whereas the MSPO2 Shell Explosions case shows how active communication between the safety regions can reduce the expected effects on distance in authority.

This suggested dynamic was evident in two cases in which the sheer lack of communication between strategic level actors created distance between actors lower down the chain in command. For example, in the Chemie-pack case, when the CoPI failed to manage both crisis and public communications, the mayor as strategic level actor did not step in, despite public communication being his responsibility. Furthermore, in the Noord-Holland power blackout the inspectorate stated that the NCC could have been more involved to assist the safety region AA's ongoing struggles in facilitating coordination, but ultimately did not (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22-24). What these two events have in common is that there was distance between actors of higher authority (the mayor of Moerdijk and the NCC) and actors lower down the command chain. As theory suggests, distance between actors is likely to reduce the awareness of other actors' activities and encountered problems, obstructing the information exchange between them, thereby the needed correctional adjustments (Allen, 1977; Goffman, 1963; Okhuysen and Beckhy, 2009). The MSPO2 Shell Explosions' case poses a clear juxtaposition to the other two cases. Close communication between the safety regions resulted in a coherent communications strategy, and a coherent escalation of authority on the GRIP scale (Dutch Safety Board, 2015, p. 81).

It is evident in the cases that distance of authority is indeed related to inadequate information management (Noord-Holland power blackout case), and an incomplete shared perspective on the situation expressed in public communications (Chemie-pack). It is also evident that the omission of distance of authority by closer cooperation and communication (MSPO2 Shell Explosions case) causes no information delays between actors.

More interestingly, the analysis revealed a correlation between distance in authority, lack of rules in centralized authority, and individual operational perspectives. As argued by Xiao and Faraj (2006), clear rules and procedures often structure centralized coordination in a working manner. However, as seen in the analysis, the lack of such rules increases the distance between actors, through the strategic level actors' loss of control over operational level activities. Indeed, both the BOT-MI and TenneT operated within few or no rules or agreements between them and their strategic level counter-parts. The DSB emphasized that the BOT-MI's independent actions were likely related to the lack of agreements and communication with the safety regions and the BOT-MI (Dutch Safety Board, 2012, p.112). Similarly,

TenneT's task of defining the severity of a crisis was void of any strict criteria or rules laid down by Agentschap Telecom. Apart from TenneT eventually reporting to the Agentschap Telecom, there was no communication between them. It appears here that the lack of communication created distance between actors, causing them not to respond to the problems encountered by actors lower down the command chain – in which control was lost over the activities of operational level actors through the omission of rules (Allen, 1977; Goffman, 1967; Okhuysen and Beckhy, 2009).

5.4. Hypothesis 4: Decentralized Allocation of Authority

Decentralized authority within the network can obstruct the creation of a common operational perspective due to various actors having the autonomy of deciding what needs to be done, causing confusion in the line of command and affecting the success of coordination.

The analysis revealed that this hypothesis is supported by two cases - the Chemie-pack case and Noord-Holland power blackout case, in which the MSPO2 Shell Explosions case reveal that active communication can act as counter-measure for the creation of potential individual operational perspectives As theory holds, decentralization of authority can harm coordination in two ways. Firstly through the obstruction of the creation of a common operational perspective, by providing several actors with sufficient influence to obstruct coordination as result of their actions ('t Hart et al., 1993; Faraj and Xiao, 2006; Wolbers et al., 2017).

Decentralized authority played a role in obstructing the overall information management. However, this also has much to do with the lack of clear guidelines on what needs to be done or a lack of communication. For example, in the Noord-Holland power blackout case, the guidelines on inter-regional coordination stated that each safety region has to decide for themselves which GRIP level is deemed appropriate, and to do so, it needs to build situational awareness (Inspectie Veiligheid en Justitie & Agentschap Telecom, 2016, p.22). This does not imply that the safety regions have to fine-tune their GRIP level to one another. This could explain why the safety regions prioritized gathering information for themselves. Decentralizing, or demarcating tasks is known to foster individual operational perspectives (Wolbers and Boersma., 2013). However, decentralizing the authority of escalating GRIP to higher levels is not problematic in itself. For example, in the

MSPO2 Shell explosion case the two safety regions reached consensus on both regions' GRIP level, due to structured information exchange between them (Dutch Safety Board, 2015, p.80).

In contrast to the MSPO2 Shell explosions case, a lack of communication or on GRIP escalations the Chemie-pack case led to incoherence between partner regions. The mayor of Moerdijk refused to escalate GRIP to level 3 or 4, causing its communications department to be inadequate to deal with the large volume of information, thereby also disrupting its communication with partner safety region ZHZ (Dutch Safety Board, 2012, p.118). This indicates that lack of communication has a similar effect as a lack of rules, and potentially reinforced individual operational perspectives, especially so in the context of decentralized authority.

While rules and procedures are by definition different than communication with the purpose of creating a coherent response, they do provide some sort of guidance. Again, in the MSPO2 Shell explosions case, active communication between both safety regions (MWB and ZHZ) led to consensus on the appropriate GRIP level. Considering that clear rules and active communication were not present in the Chemie-pack and Noord-Holland power blackout case, these missing elements can arguably reinforce individual operational perspectives. For example, on the operational level, a similar dynamic was apparent. In the Chemie-pack case it was seen that the various fire brigades operated independently, until the OvD and CoPI established a central command point. Prior to this central point of command, the various fire units did not know where to report for duty, nor what their tasks were, and so they acted upon their own initiative.

5.5. Hypothesis 5: The Impact of New Actors

New actors in the crisis response network will increase the likelihood of different operational perspectives being present among actors, including a lack of role clarity and confusion of authority, thereby hampering coordination.

New actors are expected to increase a lack of role clarity, individual operational perspectives, and confusion of authority due to the fact that they are new to the network (Boin and Bynander, 2015). This is because new actors have never before worked within the respective crisis network, and so are not aware of the dominant norms and values that justify certain actions (Dynes, 1994; Majchrzak et al., 2007).

Additionally, due to being new, low awareness of other actors' expertise and, as well as common working procedures, it conjures role ambiguity between the new actor and network actors, making it difficult to integrate a new actor into the existing chain of command (Moynihan, 2009).

Generally, the analysis showed little evidence of the above-described dynamics taking place. Generally, there were no actors that were not already established actors defined by GRIP. Instead, the actors that could be regarded new were those actors that operated outside their initial GRIP-level, or actors who were admitted to a crisis network for the first time.

As to whether hypothesis 5 holds or not, the answer is no for all cases, as the evidence provided is simply not strong enough, or no issues were encountered at all. For example, in the Chemie-pack case, the actor closest to resembling a new actor was the NCC as it should not have been involved during GRIP 3 and 4. Its presence in the Chemie-pack crisis caused confusion of authority for the BOT-MI. However, this was not due to presence of being a "new actor", but because the NCC took on an assisting role in relation to the safety regions, rather than its original coordinating role (Dutch Safety Board, 2012, p. 121). As seen in the section on hypothesis 2 and 3, there is more concrete evidence to argue that confusion of authority was related to NCC's role ambiguity by taking on a new role, as crisis actors associated its presence with its original coordinative role. Similarly, in the Noord-Holland power blackout case, the analysis indicated that TenneT's liaison was physically present at the ministry of EZ for the first time. However, interviews with members of the ministry stated having positive experiences working with a physical liaison from TenneT. While the actor's physical presence was new, the EZ's work with a liaison was not, so this case merely presented a new manner of work. Lastly, in the Shell case, the Moerdijk-Haven fire brigade was admitted in the response network. However, as mentioned in the section on role clarity, pre-crisis joint training programmes ensured no implications.

Thus reflecting on all cases, none of the cases provide evidence to say that a new actor reinforces the expected implications of individual operational perspectives, lack of role clarity, or allocation of authority (centralized/decentralized). However, it is important to note that the actors in these cases were established actors and known actors. For example, the NCC, and TenneT were actors that were known to be involved in the crisis network. Therefore, while having adjusted the definition of new

actors accordingly to this research (*see table 2*), there might have been an incompatibility with the theory. For example, the work of Majchrzak et al. (2007) and Boin and Bynander's (2015) discusses the implications of new actors in the context of catastrophes and disasters, whereas the crises discussed in this research involve large scale incidents, but not comparable to natural disasters/catastrophes.

Table 3: Overview of hypotheses[21]

	Chemie-pack	*MSPO2 Shell Explosions*	*Noord-Holland power blackout*
Hypothesis 1	Yes	N/A	Yes
Hypothesis 2	Yes	N/A	Yes
Hypothesis 3	Yes	N/A	Yes
Hypothesis 4	Yes	N/A	Yes
Hypothesis 5	No	N/A	No

6. Conclusion

This research sought to scope out the pitfalls of crisis coordination, and explain why crisis coordination in some causes fails. Five hypotheses were constructed to systematically apply this research's theoretical framework in order to answer the following research question: *To what extent do the presence of new actors, lack of role clarity between actors, different operational perspectives, and allocation of authority foster failure in coordination efforts within network crisis responses?*. Based on the analysis, the answer indicates that the factors in question do indeed obstruct crisis coordination, with the exception of new actors.

Hypotheses 1 to 4 reveal sufficient evidence that helps to explain the identified outcome of each of the chosen cases. In the Chemie-pack case, and the Noord-holland power blackout case, the following elements of failed coordination were found: no shared situational picture between crisis actors, unclear tasks division, and confusion in the chain of command. The analysis found that individual operational perspectives

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[21] N/A refers to not applicable, as the MSPO2 Shell Case was not a case of failed coordination.

can indeed obstruct shared situational perspectives (referred to as COP), in which the lack of role clarity blurs tasks divisions and the chain of command. At the same time, the distance of authority between actors in command and those under their command was seen to obstruct the information exchange between actors, and in combination with a lack of rules, it reinforces individual operational perspectives.

Furthermore, evidence yielded by the MSPO2 Shell Explosions case showed how crisis coordination can be successful when a collective operational perspective is established, role clarity is present, and allocation authority is properly structured into a clear chain of command. It therefore reinforces the claim that the applied independent variables are indeed causal for failed coordination.

6.1. Limitations and Future Research

The answer to the main research question is a preliminary answer due to having encountered a few limitations. First of all, while the three cases were thoroughly investigated using data by the Inspectorate of Justice and Safety, the NCTV and the Dutch Safety Board, the cases represent only three particular crises out of many. For that reason, the outcome of this research can only be generalized for cases that fall within the set-case criteria as specified in the methodology section (chapter 3). While including more cases would have been preferred, it would likely have compromised the quality and depth of the analysis due to time constraints. Secondly, it would have been worthwhile to conduct interviews with representatives or officers of some of the crisis organizations that were discussed in this research. This would have undoubtedly improved the depth of this research. However, as mentioned afore, time constraints limited this research to content analysis only.

Despite the limitations, this research contributed to crisis management studies by applying existing theoretical assumptions onto new learning grounds represented in the three chosen case studies. Apart from the applied categories and hypothesis, the analysis yielded new correlations that were not expected beforehand. For example, the correlation between distance of authority and a lack of rules in centralized coordination structures appeared to more likely increase individual operational perspectives than the expected outcome of decentralized coordination. Furthermore, it was also evident that role clarity has a positive effect on establish a chain of command and reinforcing the COP, by making clear who one has to report to.

Moreover, in line with the limitation of not having been able to do interviews, it is recommended to further research the correlations between distance of authority, lacking rules or communication, and the reinforcement of individual operational perspectives. This is because this correlation combines several variables in which it is assumed various causal dynamics are possible. For example, this research has not explicitly paid attention to crisis communication, and how that may mitigate the lack of rules, or exacerbate the presence of individual operational perspectives.

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