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Analyzing the Social Lead-Up to a Human-Induced Disaster: The Gas Extraction-Earthquake Nexus in Groningen, The Netherlands

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Abstract: The overwhelming impact that disasters have on societies is fed by socio-economic vulnerabilities and political-institutional factors. Disasters are, therefore, increasingly regarded as partially created by humans instead of as purely natural events. Although the "social creation" of disasters is assumed to occur "above the ground" and triggered by extreme natural events, this article explores several dimensions to the social creation of disasters, including technological and institutional dimensions from both "above" and "below the ground". It furthers the understanding of disaster governance by investigating processes that generate the social lead-up to a human-induced disaster, and that are installed to deal with its consequences. Focusing on the case of Groningen, the Netherlands, where gas extraction leads to earthquakes, the article looks in particular at the interrelationships between different state and non-state actors in the governance dynamics that structure the processes to deal with the earthquake issues. Based on in-depth interviews with a variety of stakeholders, we found that public-private institutional structures, the nature of the disaster and societal (dis)trust are entangled and influence disaster governance processes mediating resilience and sustainability. The article concludes by arguing that both the causes of (human-induced) disasters and the approaches to disaster mitigation lie in these political-institutional and governance fundaments.

Keywords: socially-created disasters; "natech disasters"; multi-level governance; extractivism; sustainability; public trust; public-private relationships; The Netherlands

1. Introduction: Becoming a Disaster

Disaster scholarship can roughly be divided into two groups. On the one hand, we find studies on natural hazards, climate change, the impact of specific disasters such as flooding or earthquakes, and the resilience of societies to these "natural" disasters [1]. On the other hand, we find research on terrorist and technological disasters, including the 9/11 attacks on the World Trade Center, and nuclear disasters such as Chernobyl or Fukushima [2]. Although these two groups can be placed within the dichotomy of natural versus human-made disasters, in reality, most disaster types are the result of the interrelationships between natural and human processes [3,4]. In the disaster scholarship, the social creation of disasters has already been recognized since the late 1970s. O'Keefe [5] was among the first scholars putting the so-called "naturalness" of (natural) disasters into question, by drawing attention to the social factors that make societies vulnerable to hazards. Academic research on disasters has since then studied the variety of social, economic, political and institutional factors through which disasters unfold [6]. In the context of human-induced disasters, the social factor is considered the trigger of a disaster. With the social

factor or dimension, we refer to, among others, socio-economic conditions, technological resources, and governance structures and dynamics. For instance, in many countries of the world, mining activities and the extraction of resources from the soil—often oil and gas—generate a large number of socio-ecological problems. As a consequence, we can nowadays observe many fracking-related conflicts in the US, UK and Poland [7–9].

New directions for disaster research should therefore not be limited to investigating disasters that are either related to nature or technology. Instead, growing pressure from climate change and urbanization calls for disaster research that transcends the nature-technology binary and fully considers the complex nature-human entanglements in the creation of disasters [10,11]. Acknowledging this interrelationship between natural and technical elements, the concepts of "natech" and "techna" disasters have been introduced to highlight the potential disruptive outcomes of the influence or impact of natural disasters on human technology—such as Fukushima—and vice versa [11]. Bearing this in mind, this article contributes to the disaster scholarship by investigating a disaster that occurs at the crossroads between the two types: it analyses earthquakes in the north of the Netherlands that are caused by gas extraction. We consequently aim to further the understanding of the "social creation" of disasters by exploring several dimensions inherent to the creation processes, including governance. Analyzing the social creation of a disaster in a country of the Global North enriches the understanding of how vulnerability develops, even in a country relatively well-prepared for (water-related) hazards and where basic human needs, including safety, are satisfied.

We investigate several dimensions to the social creation of disasters and illustrate this analysis with the case-study of Groningen where earthquakes are induced by human activities. The extraction of gas results in decreasing pressure in the earth layers, which triggers earthquakes of an increasingly high number and magnitude. Because seismicity does not exist naturally in the (north of the) Netherlands, the built environment is not constructed according to seismic standards. This partially explains why the earthquakes cause considerable damage in the province of Groningen despite their relatively low magnitude. Gas extraction in Groningen was in its heydays widely embraced by the local population as it offered new employment opportunities and pride. However, perceptions changed drastically when the local people were confronted with the negative consequences of the gas industry. A turning point in this public perception was the earthquake with a magnitude of 3.6 on the Richter scale that occurred near the village of Huizinge in August 2012. Since then, public, private, and civil society actors have installed a variety of institutions to deal with the increasing physical and psychosocial damage generated by the earthquakes. At the same time, societal frustration grows as the affected people argue that they do not receive enough compensation for, nor acknowledgment of, the damage. Moreover, they hold the company and the Dutch state responsible for the earthquakes and the consequent problems.

The case of Groningen can be framed as a human-induced disaster and reflects the combination of elements that are inherent to the governance of disaster situations. First, it highlights the lack of preparedness of the local, regional, and national government levels for these kinds of problems. Second, it shows how the institutions for dealing with the problems and controversies revolving around the gas extraction are installed without a proper societal debate and local support. Third, these human-induced earthquakes mirror the uneven way in which a disaster impacts a country and its population, including the mechanisms through which the governance system is part of both the cause and the consequence of the socially-created disaster [12].

In this article, we look into a human-induced disaster and, in particular, into the processes that constitute its social lead-up. Section 2 discusses the theoretical contributions to disaster governance, extractive industries, and the mutual influences between public trust, sustainability, and public-private institutions. Subsequently, we apply these insights to the analysis of the governance dynamics in the case of Groningen. Here, governance processes both lay at the root of the problems and are also set-up to address the consequences of the gas extraction. The configurations between the "natural" processes under the ground and "social" processes above the ground are analyzed by exploring several dimensions the social creation of the disaster. Finally, conclusions are drawn about ways in which

governance can be improved to prevent disasters, prepare for them and be able to better deal with their consequences.

2. Disentangling Socially-Created Disasters

2.1. Mechanisms Intervening in the Social Creation of Disasters

The understanding that natural hazards grow into disasters due to the impact they have on combined human and natural systems has become one of the most important starting points of disaster studies [13,14]. Disasters are not purely natural or human by definition. Instead, the human and natural aspects of disasters are intertwined, causing particular, unpredictable, and complex types of disasters [15]. Moreover, the intertwined social and natural mechanisms that trigger disasters have a direct influence on the institutional and political responses to disasters [16,17]. It is possible to distinguish several layers or facets in the existing conceptualizations of the social side of disasters. Some understandings draw attention to the societal vulnerabilities through which a hazard transforms into a disaster [14], whereas others reach the understanding that the very occurrence of hazards can be blamed on the human influence on global warming [18]. Yet, the scholarship on the social side of disasters shares the common belief that social—or human—factors need to be paid full attention if we want to understand the ways in which disasters arise through and because of human actions [19,20].

In this article, we understand a disaster as a combined natural and social construct [13], or, in the words of Aldrich [21] (p. 3): "an event that suspends normal activities and threatens or causes severe, communitywide damage". There are several grounds through which a hazard grows into a disaster. In the first place, disadvantaged socio-economic conditions make communities vulnerable to the extremes of nature. Indicators that make certain social groups more vulnerable to natural hazards than others include education, class, occupation, income, ethnicity, gender, health status, age, power, access to and exclusion from assets and services, and the nature and extent of social networks [19]. People with a lower socio-economic standing are therefore exposed to higher risks and hazards, as reflected in many examples of settlements located close to the sea, a river or volcano [22,23].

Second, inappropriate governance responses can influence and exacerbate the movement from a hazard into a disaster [12,24,25]. To improve the governance response, resilience is increasingly used as a guiding principle for post-disaster recovery. Resilience can, therefore, be regarded as the counterpart of vulnerability; whereas vulnerability is regarded as a pre-event concept, used to get a grasp of the potential exposure of a society to harm, resilience relates to post-event processes to absorb, respond to and recover (better) from disasters [1,19,20,26]. Consequently, vulnerability and resilience can be seen as complementary when resilience also means reduced vulnerability for future disasters. Moreover, a disaster governance response that strives for finding answers to vulnerability, through for instance a more democratic multi-actor sharing of knowledge and resources, is a key engine for sustainable recovery.

The social creation of disasters can also be examined from the perspective of the perceptions and human subjectivities vis-à-vis natural phenomena and their impact. On the one hand, different types of vulnerability, including location factors, imply that the socio-spatial impact of disasters is uneven [12]. On the other hand, people perceive and endure disasters in different ways, according to their own subjectivities, personal and cultural values and identities, among others [27]. Bearing this in mind, the mere labeling or framing of a situation as a disaster, by some or all groups of actors, also plays a role in the social creation of disasters [18,28].

The lead-up to a disaster by a particular institutional situation, including the exacerbation of the impact due to inadequate governance, is also an important component contained within the social creation of disasters [20]. Wrong socio-political decisions made at crucial moments and disaster governance responses mismatching the actual societal needs usually amplify the impacts of disasters instead of mitigating them [29]. An emblematic situation in this regard concerns those disasters that are (directly) induced by human activities. This last dimension refers, for instance, to the influence of humans on climate change, leading to more extreme and frequent hazards [30]. The induction of disasters

by humans is also reflected in the disastrous consequences of extreme extractivist practices around the globe [31]. In this regard, both the (economic) impact of "natural" disasters on extractive industries are studied [19,32], as well as the potentially disastrous impact of extractive industries on societies [33].

So, we consider the following three aspects as key drivers leading to the creation of a disaster:

1. The presence of a hazard, understood as a potential threat of "natural origin and related environmental or technological hazards and risks" that can unexpectedly happen and cause physical and mental damage, such as a tropical storm or an earthquake [34].
2. Vulnerability of individuals or groups, expressed through a combination of socio-economic, demographic, and educational factors [35]. According to Wisner et al. [14], vulnerability comprises "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (p. 11). When a hazard strikes a vulnerable community, a disaster is often born because of a mix of elements that, in their combination, lead to a disaster. For instance, the technical infrastructure, socio-economic conditions, and demographic characteristics of a community shape the possibilities to absorb, cope with, and resist the threat. In other words, vulnerable groups have limited resources and capacities to face the post-disaster reconstruction and recovery phases, and therefore these groups perpetuate in a vulnerable position vis-à-vis potential future disasters [36].
3. Limited resilience, referring to the capacity of societies to learn from, adapt to, and transform into an enhanced and more sustainable societal system after a disaster [37]. Resilience is intrinsically linked to vulnerability, considering that a genuine socially resilient recovery is one that supports the reduction of vulnerabilities in general, and those to future disasters, in particular.

Table 1 presents a simplified and non-exhaustive overview of the different analytical dimensions of the social creation of disasters as explained in this section.

Table 1. The dimensions of the social creation of disasters (source: authors).

Dimension of the Social Creation of Disasters	Explanation
Vulnerability	- Socio-economic, political and cultural factors: income, education, access to assets, age, ethnicity, gender, etc.
Technical infrastructure	- Disaster prevention and mitigation infrastructure: dikes, storm surges, etc. - Disaster forecasting infrastructure: early warning systems, meteorology, etc.
Institutional system	- Institutional system in which the disaster is embedded - Including political, economic, and financial public and private interests
Governance response	- Response to disasters by the state, private sector, and civil society - Including multi-actor discussion, negotiation, modes of coordination, collaboration, and decision-making processes
Socio-psychological construction	- Perceptions and human subjectivities of hazards, disasters and their impacts - Influenced by people's values and identity
Direct human-induced	- Disasters directly caused by human actions, e.g., earthquakes or floods provoked by extractive activities (fracking, mining, etc.)

2.2. The Growth of Human-Induced Disasters

During the last few decades, disaster studies have developed from a focus on natural disasters towards the inclusion of technological and natural-technological disasters. This also entails the acknowledgment that disasters can be induced by nature and/or humans. The introduction of the concepts of "natech" and "techna" disasters emphasizes the interrelationship between nature and technology through which

disasters can occur and grow [11]. A major distinction between natural and technological disasters refers, first, to the causes of disasters and, second, to whether parties can be identified as responsible and accountable. To be specific, natural disasters can be prepared for but not prevented, whereas technological disasters are caused by human(s) (errors) and could be prevented [9,11,38]. The intense extraction of natural resources leading to negative effects on societies and nature are considered examples of natech and/or techna disasters, as they highlight the inseparability of natural and social causes of disasters. Pritchard [39] calls these "envirotechnical disasters" to denote the "convergence of natural and sociotechnical processes" (p. 220). With this notion, Pritchard [39] simultaneously stresses the influence of nature on technology and "the ongoing ways that environmental processes shape and are shaped by technologies" (p. 229). Where natech disasters refer to disasters that occurred because of the influence of a natural event on technological objects or processes, such as Fukushima in Japan in 2011, techna disasters entail technological disasters that have a disruptive influence on nature and society [11].

The effects of human-induced disasters may have such an impact on societies that present governance systems are no longer able to deal with them [33]. In the case of the gas extraction in Groningen, as discussed in Section 4, the earthquakes and resulting physical and psychosocial damage became highly problematic. This was especially due to the lack of institutional preparedness, but also because the earthquakes in Groningen are not part of the traditional hazardscape in the Netherlands. The exploitation of a resource, in combination with a governance system that is ill-suited for dealing with socio-political and environmental challenges, usually leads to a deeper and more complex situation of crisis. These problematic and unsustainable situations can result in human-induced disasters and widespread disruptions of societies [11,31,38].

Disasters and their underlying governance are often described in terms of a cycle or transition composed by several phases. These range from pre-event stages, including the mitigation and preparedness, to post-disaster phases such as the individual disaster response, response and relief, rehabilitation, and reconstruction [40]. Aini and Fakhrul-Razi [41] applied this transition or cycle perspective to the unfolding of technological—human-induced—disasters. Table 2 shows the eleven sequential stages introduced by these authors.

Table 2. The growth of a human-induced, technological disaster (source: authors, adapted from Aini and Fakhrul-Razi [41]).

Period	Phase	Processes
Pre-disaster	1. Decision-making	- Decision-making processes to give permission to an industry to start operating - Socio-economic, political, and environmental conditions to attract an industry
	2. Operation	- Starting point of the operation of the industry - Incorporation of companies, construction
	3. Incubation	- First malpractices start to occur - Lasts between 1 and 19 years
	4. Forewarning	- First warnings of non-acceptable practices - Often the signals are ignored, neglected or misinterpreted - If appropriate actions were taken in this stage, the disaster could be avoided
	5. Activation	- The direct cause that triggers the disaster - In this stage, often an individual or a specific event is blamed to hide the real causes
Disaster	6. Onset	- Starts when triggering events activate the disaster
	7. Rescue and recovery	- Active response and emergency management - Characterization of the disaster, prevention of escalation, neutralization and creation of a recovery plan - Preventing loss of life, minimizing the destruction of buildings and the environment - Often ineffective measures and actions

Table 2. *Cont.*

Period	Phase	Processes
Post-disaster	8. Inquiry and reporting	- Conducting an investigation after an accident/disaster - Technical investigation - Public inquiry
	9. Feedback	- Receiving feedback - Implementation of the recommendations from the investigation and inquiry
	10. Social justice	- Informing the government, organizations, or victims to take further actions against the responsible party
	11. Social and legislation reform	- Creating social entities, formulating new legislation, and changing laws and regulations - A monitoring authority can aid in the further enhancement of the reforms

Countries often tolerate the negative consequences of extractivism and turn a blind eye to past human-induced disasters due to economic reasons and the contemporary dependence on natural resources for, among others, energy supply and food production. Alternatively stated, economic interests and benefits from (the export of) natural resources and raw materials play an important role in the reproduction of a development model relying on extractive industries. Although companies are increasingly forced to comply with regulations and standards to reduce social and environmental impacts [33,42], goals to safeguard the sustainability of local communities and nature are in many cases rarely met. As such, local communities can simultaneously be victims of the ecological and social malpractices revolving around extractivism, and also be fully part of the territorial dynamics in which these companies operate [43]. In many parts of the world, investments by mining, gas, oil and forestry companies form the basis of local livelihoods and also their major threat. The relationship between local communities and industries evolves over time into a highly ambivalent one. Negative impacts lead to the wish of local people to stop extraction, yet their dependence in terms of income and jobs discourages contestation. Moreover, factors such as the presence of human and social capital and the socio-economic situation of people influence these relationships [7,44]. This equivocal relationship of both interest and dependency interferes with the resolution of local communities to step up against (multinational) corporations and/or state companies responsible for unsustainable extractivist practices [38,44–48].

2.3. Governance for Trust, Resilience, and Sustainability

Disasters induced by nature, such as earthquakes resulting from tectonic seismicity, grow into disasters because the natural event intersects with human factors. Although societal factors and institutions, such as vulnerability and inappropriate governance processes, can be blamed for the disaster response, nature is responsible for the actual cause [41]. This is different in the case of disasters directly induced by humans. Gill et al. [31] used the concept of "recreancy" to describe the dynamics of human-induced—or technological—disasters. Recreancy refers to "the failure of experts or specialized organizations to execute properly responsibilities to the broader collectivity with which they have been implicitly or explicitly entrusted" [49] (p. 116). The allocation of responsibilities to specific actors often triggers sentiments of frustration, betrayal, sadness and an increasing distrust, especially when the belief grows that the disaster could have been prevented [31]. The pre-disaster institutional set-up, governance response, and changes after a disaster are important factors influencing (mutual) trust of and between the state, companies, and citizens.

Creating trust is a process that occurs at the interplay between individual and collective factors. Individuals do not have access to all the information about potential threats and therefore they have to trust authorities and experts [28,50]. According to a study by Wachinger et al. [28], "trust is used as a shortcut to reduce the necessity of making rational judgments based on knowledge by selecting trustworthy experts whose opinion can be considered as accurate. This can result in a reduction of

the uncertainty, but, due to the fundamental affective dimension of trust (which involves items like honesty, integrity, goodwill, or lack of particular interests), individuals may feel more at risk if their trust in experts is lacking or damaged" (p. 1053). Consequently, the important relationship between trust and risk perception of people implies that people feel highly at risk when they lack trust in authorities and/or experts. The personal experience of a natural hazard is another factor influencing risk perception, since it has an influence on trust in both management skills of authorities and experts and also in creating relationships with citizens [45]. However, too high a trust in authorities can lead to blind trust and a lack of criticality. People with high trust in authorities often underestimate risks. Conversely, citizens' negative previous experiences with public authorities regarding their involvement in governance processes usually decrease trust in institutions [28,47]. This is particularly delicate given the fact that one of the most essential factors from which to build trust between citizens and their authorities is through public participation and democratic decision-making [21,50].

Involving different actors in decision-making, negotiation and building collaborations of different types is part of the shift from government to governance. This shift reflects the sharing of governance roles and collective decision-making between different state, market, and civil society actors [51,52]. Sharing of governance roles between a variety of state and non-state actors is crucial for the ability to absorb and adapt after disasters and build trust [48,53]. Co-creating and spreading knowledge through processes of interaction and multi-actor dialogue are essential for building trust. However, people in more vulnerable areas often have limited access to those participatory platforms or spaces in which the relevant information and knowledge are shared, leading to a growing reproduction of social risk in vulnerable areas. In this context, the concept of resilience is often used to express the aim of societies disrupted by disasters to use the disaster situation as an opportunity to rebuild back better and decrease vulnerability [54]. As recovery processes are inherently unstable and uncertain, the sustainability ambition is now often complemented with the one contained in the concept of resilience [55]. Resilience and sustainability are put together as companions to better respond to these dynamic recovery processes, and to encourage development that is simultaneously sustainable and able to absorb and recover from shocks [4,56,57]. As such, resilience and sustainability are increasingly promoted as complementary compasses for guiding and improving the post-disaster recovery and its governance [1].

3. Methods

This research is based on an in-depth case-study focused on the governance of the earthquakes caused by gas extraction in the north of the Netherlands. Prior to conducing fieldwork, we conducted a literature study on the concepts of (the social creation of) disasters, (disaster) governance, resilience, sustainability, institutions, and extractive industries. In mid-2016, we conducted twelve in-depth interviews with actors from a variety of roles involved in the earthquake issues. The interview respondents were selected after an exhaustive stakeholder analysis, aiming at identifying key experts and players in the earthquake-related governance processes. Interviewees consisted of officials from all levels of government (central, provincial and municipal), representatives from the private sector, civil society organizations, and other interest groups such as social organizations representing the interests of the residents regarding the earthquakes (see Appendix A). The in-depth interviews were semi-structured and based on prior informed consent. The interview respondents gave their informed consent for inclusion before they participated in the study by means of a consent form stating the rights of the interviewee and interviewer. The study was conducted in accordance with the Declaration of Helsinki and the protocol was approved by the Ethics Committee of the affiliated faculties of the researchers. The interviews were recorded, transcribed, and coded using the open-coding method. This method entails that the researcher reads through the transcripts and writes a few words next to every piece of the transcript that emerges as an idea based on what is said during the interview [58]. In addition, the authors observed and participated in several workshops, seminars, and participatory meetings to discuss various issues related to the earthquakes, such as information evenings regarding the processes of reclaiming damage and strengthening the houses. Additionally, an analysis of plans,

policies, reports and other secondary sources was conducted to obtain an accurate understanding of the strategies for the future of the region.

4. Four G's: Gas, Ground, and Governance in Groningen

We structure the analysis of the case of Groningen according to three main issues that shape governance processes and the social lead-up to the disaster around the gas extraction and earthquakes: (1) the historical context of the gas extraction in Groningen; (2) the governance of the earthquakes problematics; and (3) public-private relationships and trust. We analyze these three issues respectively below.

4.1. Setting the Scene: Gas in Groningen

The presence of gas in the soil in Groningen was discovered after some test drillings in 1959. Within a few years, the technical infrastructure for the gas extraction was completed and many Dutch households were connected to the—at that time regarded as—clean new energy source. Industrial gas extraction in Groningen has taken place since 1963 and from that year onwards, research has recurrently shown that the volume of gas in Groningen was higher than expected [59]. The gas extraction in Groningen is different than fracking but has many similarities. By fracking, chemicals are used to trigger explosions to release the gas that is stored in the rock. The gas is subsequently pumped up, leaving intoxicated water in the deep soil. In the Netherlands, gas is stored in a gas bubble and pumped up without breaking the rock [60,61].

The company that extracts gas, the *Nederlandse Aardolie Maatschappij (NAM)* (Dutch Oil Company), is a joint venture of the private companies Shell and Exxon Mobil. The Dutch state, represented by the Ministry of Economic Affairs, agrees every five years with the *NAM* upon the amount of gas that they have to deliver to the Dutch state. Although Shell and Exxon are the two shareholders of the *NAM*, the *NAM* is closely linked to the Dutch state given the agreement to sell up to ninety percent of the gas to the Dutch state. The Dutch state, subsequently, can sell the gas on national and international markets for higher and more profitable tariffs. Estimates show that, since 2006, the Dutch state has gained yearly more than six billion euros in revenue, totaling 250 billion euros to date [59,62]. The *NAM* was in the early years of the gas extraction a very welcomed company in the province of Groningen, as it created a lot of direct and indirect employment in the area. After World War II, people in Groningen were proud of their contribution to the economic recovery of the Netherlands by means of the gas revenues [62].

The first signs of ground movement were registered in the 1990s, as illustrated in Figure 1. These first earthquakes started to transform the positive discourse about the gas extraction into a more negative narrative. At that time, the causal relationship between the gas extraction and soil subsidence was studied and acknowledged. Yet, the possibility of the occurrence of earthquakes was still unknown. The first earthquakes were registered in 1998, but for a long time, there were no studies that explicitly connected the gas extraction to earthquakes. A few researchers warned for a possible increase in the number and intensity of earthquakes. Nevertheless, aligning with the forewarning phase of Aini and Fakhrul-Razi's [41] model, these signs were neglected and ignored [63,64]. Before 2002, there were less than twenty earthquakes per year, on average. Nowadays there are more than 120 per year—one every three days—and these are all concentrated in an area which is no bigger than a typical British or American county.

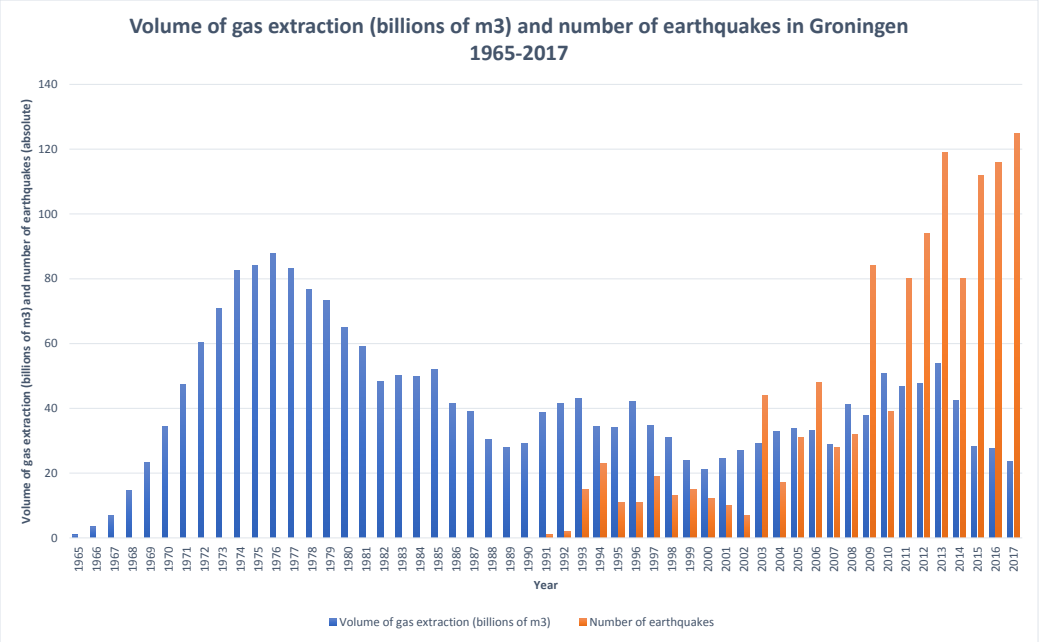


Figure 1. The volume of gas extraction and the number of earthquakes in Groningen (source: authors, based on data from *NAM* [65,66]).

In August 2012, discourses around the gas extraction changed drastically when the first "big" earthquake with a magnitude of 3.6 occurred near the village of Huizinge. Until 2012, there was an occurrence of more than a hundred earthquakes per year. Yet, these ground movements were all of a small magnitude and almost never surpassed 2.5 on the Richter scale, as shown in Figure 2. In January 2013, investigations revealed that the possibility of earthquakes of a higher magnitude—higher than 4.5 on the Richter scale—was no longer excluded [67]. For a respondent from the municipality of Loppersum [67], "that was the moment that we did not just talk about damage, but also about safety because the houses here have not been built to withstand shocks of 5 on the Richter scale, in particular, the old buildings". The Huizinge earthquake triggered a series of changes in terms of institutions and regulations, which are further discussed below.

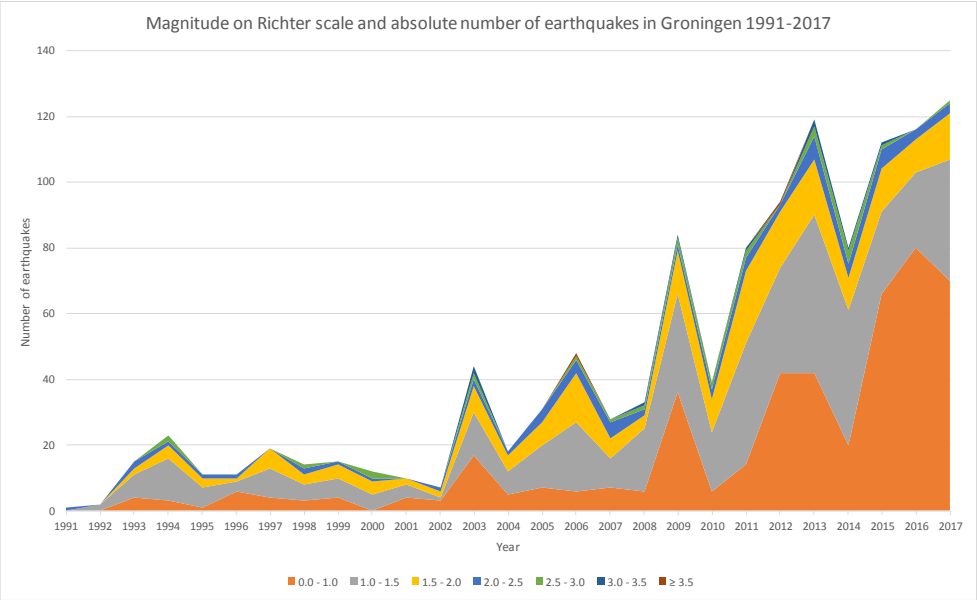


Figure 2. The magnitude and number of earthquakes in Groningen (source: authors, based on data from *NAM* [66]).

4.2. Governance of the Ground Movements

After the earthquake near Huizinge, the Minister of Economic Affairs started fourteen investigations which mainly focused on the technical and geological aspects of the earthquakes. The results of these investigations informed the decision of the Minister to decide upon the amount and regulation of the gas extraction. "People were anxious and angry that the Minister did not follow the [earlier, authors] advice to lower production", argued an interviewee from the Municipality of Loppersum [67]. A year later, numbers about the gas extraction revealed that the gas production in 2013 was the highest in 25 years. In retrospect, people in Groningen criticized the Minister for "using" the delay in obtaining the results of the investigations to extract as much gas as possible in the meantime: "When people found this out in October 2013, they were really angry, deservedly angry, because all the trouble of 2013 has been caused by the way too high production in 2013 [. . .]. And that is why I talk about the 'disaster year' 2013" [67].

The earthquakes that occurred since August 2012 caused considerable damage to the built environment. Until the end of 2016, 76,694 damage claims were reported by individual house owners, companies and other institutions [68]. First, the *NAM* conducted these damage assessments and paid the damage claims. However, this resulted in a situation in which the roles of the causer and the solver were in the hands of the same institution, creating distrust in the handling of the damage claims. Consequently, the Ministry of Economic Affairs and the *NAM* decided in early 2015 to install a private company—*Centrum Veilig Wonen (CVW)* (Center for Safe Living)—responsible for the damage assessment, payout and—if the applicant wished so—repair of the damage. The *CVW* was officially independent yet financed by the *NAM* and therefore operated "at arm's length" from the *NAM* [69]. On the one hand, people regarded the installment of the *CVW* as a positive and trust-building opportunity, as this reduced the involvement of the *NAM* in the damage claims. On the other hand, more skeptical voices argued that the set-up of the *CVW* was an institutional construction allowing the *NAM* to keep an influential position in decision-making processes over damage claims. A respondent from *Stichting Groninger Dorpen* [64] illustrates this: "Look, there is this contract between *NAM* and the Ministry of Economic Affairs that states in the fourth line: "*NAM* is responsible". And as long as *NAM* is responsible, it will keep the control in the *CVW*. And that is why we will never be able to go to one body that only pays, that just won't happen".

The scope and impact of the consequences of the gas extraction were increasingly recognized by local governments in the north of the Netherlands. Commissioned by the Province of Groningen, Committee Meijer was set-up in mid-2013 to make an inventory of possible development paths for the region. Committee Meijer, gathering a variety of actors, including those affected by the earthquakes, advised creating a new institution in the north of the Netherlands to discuss problems and solutions to the earthquake-gas situation. As a result, in early 2014, the *Dialoogtafel* (Dialogue Table) was set-up, consisting of representatives of nine municipalities, the Province of Groningen, affected entrepreneurs and farmers, different civil society groups, the *NAM*, and the Ministry of Economic Affairs representing the Dutch State. The *Dialoogtafel* aimed to build a consensus amongst all its members on its decisions. Moreover, the *Dialoogtafel* was expected to act as a sort of antechamber to discuss the relevant issues prior to their discussion in the different represented institutions and organizations. The aim was to enhance consensus building and support for their decisions [63,67,69,70].

However, several issues led to a hampered success of the table. In general, the traditional governance structures of the member institutions were not suited for such an innovative multi-actor platform. More concretely, first, the roles of the central, regional, and local governments, as well as the relationships with the private sector and civil society, remained in similar hierarchical patterns. Although the members were supposed to discuss on a relatively equal basis in the *Dialoogtafel*, the traditional style of decision-making in which the central government had leadership and concentrated most of the power was reproduced. As such, the *Dialoogtafel* was not successful in generating the expected constructive dialogue and decision-making processes [53,63,69]. The involvement of the representatives of the central and local tiers of government, whose links to either the ministry or the local municipalities prevented them from first building a consensus at the table and then discussing ideas amongst their own institutions, was highly problematic. As argued by a respondent from the *Dialoogtafel* [69]: "So, when the *Dialoogtafel* was installed and we wanted to discuss and decide on several issues, the municipalities discovered—to their surprise—that the *Dialoogtafel* did actually function and have an influence, and they found it quite strange". According to the respondents from the *Dialoogtafel* and the *NCG* [69,71], the representatives of the *NAM* were, in contrast, more flexible and able to adapt to this participative form of governance.

Second, negotiations and discussions at the table were dominated by a select number of participants, mainly from the different tiers of government and the private sector. In the words of an interviewee from the Province of Groningen [72]: "there were different levels of, let's call it, 'governance maturity' at the table". So, some parties had more experience than others with, for instance, discussing and negotiating. Third, the democratic legitimacy and power of the *Dialoogtafel* were questioned. This was not a democratically-elected institution but a group gathering with selected representatives of different public, private, and civil society who had a very limited amount of power in the decision-making processes [69,71]. Due to these reasons, some members, in particular from the civil society organizations, lost faith in the *Dialoogtafel,* which led to its disestablishment by the end of 2015.

The growing impact of the earthquakes and consequent negative perception around the gas extraction urged the central government, in mid-2015, to install a new institution. This was the *Nationaal Coördinator Groningen (NCG)* (National Coordinator Groningen) which acted as a coordinating institution between the nine affected municipalities, the Province of Groningen and the Ministry of Economic Affairs. The *NCG* was set up as part of the Ministry of Economic Affairs, yet it was mostly located in Groningen. Informed by the experience of the *Dialoogtafel*, the *NCG* structured the reconstruction task around three main pillars: damage repair, strengthening and sustainable development. The *Dialoogtafel* transformed into two steering committees of the *NCG*: a public sector committee with representatives from the nine municipalities, the Province of Groningen and the Ministry of Economic Affairs, and a civil society committee consisting of a variety of civil society groups organized in the *Gasberaad* (Gas Discussion); and a civil society group *Groninger Bodem Beweging* (Groninger Ground Movement). The *NCG* discussed issues such as damage assessment procedures with these committees and with the *NAM* separately. Additionally, it aimed at building consensus

amongst all public and private actors and the citizens about strategic plans for the future of the region [63,64,70]. In this way, the *NCG* became an institution coordinating the roles and actions of the national government, the province, the municipalities, the *NAM*, and the local residents in dealing with the earthquake issues.

In general, all interview respondents were positive about the set-up of the *NCG*. They acknowledged the need for a public institution that coordinated decision-making and strategic envisioning processes around the earthquakes. Although most interviewees argued that they would have preferred an independent state authority with more power to lead the governance processes around the earthquake issues, they understood that a coordinating body was most suited to better align and allocate the actions of the different tiers of government, companies, and citizens. However, the *NCG* was only installed in June 2015, which was considered too late by many people. Moreover, the set-up of the *NCG* as part of the Ministry of Economic Affairs generated some skepticism. Some people expressed that this institutional organization reflects the difficult position in which the *NCG* has to operate [69]. This position is particularly difficult because the *NCG* has the formal task to improve the situation resulting from the gas extraction, but its actual power is very limited [54]. The *NCG* cannot decide on the amount of gas extraction since this is a responsibility of the Minister of Economic Affairs who works under the direction of the House of Representatives of the Dutch government. The *NCG* can only engage in issues related to the consequences of the gas extraction [64,67,71–73].

At the time of (the fieldwork for) this research, the institutional set-up was constantly changing, reflecting the dynamic character of the Groningen case (the evolving character of the situation in Groningen is especially highlighted by the occurrence of the second-largest registered earthquake in Zeerijp in January 2018. Although this was beyond the time scope in which the research for this article is conducted, this earthquake—in combination with several small earthquakes in the city of Groningen—led to an increasing awareness that a new protocol for damage assessments was needed. Moreover, it resulted in the advice to lower and even stop the gas extraction, and in the processes to install or change the institutional and governance system for dealing with the earthquake issues). For instance, the *NAM* recently withdrew from the damage assessments and claim processes, following the advisory report by the national research council for public safety [74]. In the meantime, the Province of Groningen moved sustainability goals and the transition towards sustainable energy to the forefront of their agenda [72]. Furthermore, a joint initiative from the Province of Groningen and the *NAM* led to the creation of the Economic Board Groningen (EBG) in 2014. Aligning with the ambition of the Province, the intention of the EBG was to stimulate the economy in the earthquake region and to attract investors for projects aiming at enhancing the sustainable regional development [75]. Additionally, the *Veiligheidsregio Groningen (VRG)* (Safety Region Groningen) became increasingly involved in the earthquake issues, with a focus on the physical safety as well as the social safety, including health and public order. Another important change was that the Ministry of Economic Affairs gave the *NCG* and the Province of Groningen a growing range of tasks and responsibilities, but their powers and resources have not been increased accordingly. In particular, claims of damage that is complex to assess due to multiple and/or recurrent damage to properties were sent, at an early stage, to the *NCG* instead of *CVW* [63,64,67,72,73].

4.3. Public-Private Relationships and Public Trust

The entanglement between the public and private institutions involved in the four Gs is one of the main challenges to the transition towards a more optimal governance system for dealing with the causes and consequences of the earthquakes, including the challenge of rebuilding trust between actors from the public, private, and civil society sectors. This is, for instance, manifested in safety matters, which is a core responsibility of the state. The companies involved in the gas extraction are interwoven with the Dutch state since the *NAM* is owned by the companies Shell and Exxon Mobil. The Dutch State is closely related to the *NAM* through the infinite concession with the *NAM* to extract gas. The *NAM*, subsequently, has to sell the gas to the Dutch State via the *Gasunie* at a price

that is agreed by the Ministry of Economic Affairs (see for a more detailed explanation of the Dutch gas system [59]). The Dutch state can subsequently sell the gas for higher tariffs to other countries. The *Gasunie* is responsible for the trade and transportation of the gas to Dutch households and the industry, and for export to other countries. As can be inferred, the Dutch state has contradictory roles, simultaneously striving for profitable gas revenues and guaranteeing the safety of the population.

The dependence of the Netherlands on its natural gas has been described as the "Dutch disease" [76] to denote the macroeconomic and structural risks of a country's over-reliance on a single natural resource and industry. Further elaborating on this issue, a respondent from the Groninger Bodem Beweging [63] stated: "The absurd thing is that we have gas extraction and the consequences of it. But what lies underneath that, is a company, and that is Shell and Exxon, that together form the *NAM*, that has all control here. And that is very dangerous for a democracy. What you see is that the Minister [of Economic Affairs, authors], but also the NCG and in fact also the Dutch House of Representatives, can't and won't do much against it. On the one hand, they have become highly dependent on the gas, we have made ourselves dependent, but, on the other hand, at the moment that we say that we are going to stop with the gas, Shell is likely going to sue the Dutch State. So, they are trapped!" These concerns obstruct the maintenance and nurturing of the fundamental societal trust that underpins a democratic governance system. Moreover, they are also harming initiatives striving for a transition towards resilience and sustainability.

International studies show that diverging perceptions and viewpoints on what sustainability and resilience mean can lead to tensions. In the case of Groningen, interviewees from the municipalities of Loppersum and Delfzijl [67,73] argue in favor of the installment of the *NCG* as a means to disclose the scope of the problems revolving around the earthquakes. Nevertheless, our interviewees were less convinced about the priority given by the *NCG* to inspection and seismic reinforcement of the built environment over other matters. The *NCG* and *CVW* prioritize the physical solidness of houses, assuming that the safety and resilience of inhabitants will increase with more robust houses. Conversely, civil society organizations believe that citizens will become more resilient by empowering them. This latter point of view entails that citizens regain a say in their own future, get recognition of their disastrous living situations, and that the gas extraction stops or substantially slows down. The following quote by a respondent from the Groninger Bodem Beweging [63] reflects this feeling: "At the moment, we are just nothing more or less than a colony for extraction. And you want to get rid of that! You want to stay in your own power. And in Groningen, we, of course, have an enormous potential with our agriculture, space, gas, if we can extract that in a safe way: alternative energy sources".

The decreasing societal trust in public authorities and private companies came together with a progressive erosion of social capital in local communities. According to respondents from *NCG* [71] and *Stichting Groninger Dorpen* [64], people are more and more skeptical and mistrustful within and between their communities. The way the *CVW* performs damage assessments helps to explain this growing mistrust between people and the *NAM*. Damage assessments classify damage according to three types: damage directly caused by the earthquakes (label A); damage indirectly caused by the earthquakes (label B), and damage not caused by the earthquakes (label C) [77]. A lot of damage is labeled as C-damage, which implies that damage is not caused by earthquakes, but by other reasons such as insufficient maintenance of the houses and buildings [63,67,71,77]. The fact that some properties are assessed as A- or B-damage and others as C-damage provokes suspicion and feelings of distrust, anxiety, and resentment amongst neighbors and communities. This type of community fragmentation is particularly problematic in risk- and disaster-prone places, as social capital and resourceful community networks are considered key ingredients of social resilience. Moreover, the case of Groningen illustrates quite well Wachinger et al.'s [28] argument on how distrust can lead to a higher feeling of being at risk [64,71,72].

The entangled public-private relationships between the *NAM*, the Ministry of Economic Affairs, and the *CVW*, together with the perceived lack of transparency on the way these institutions relate, reinforced skepticism [70,71], as illustrated by a respondent from the *Dialoogtafel* [69]: "The increasing

bureaucracy in the governance response, and the fragmentation of the response, created a lot of extra anger. So, instead of creating goodwill with the response, the governance response itself contributed to, well, a deep feeling of betrayal". The existing regulations, institutions, and modes of governance to deal with the causes and consequences of the earthquakes, combined with the "too-little and too-late" recognition of the different problems, led to the gradual unfolding of what we believe is a disaster. In the public opinion in the Netherlands, the situation in Groningen is not generally perceived as a disaster and the central government, in general, also does not identify it as a disaster.

However, many local residents view the earthquakes as a real ongoing disaster causing multiple disruptions. The decision of labeling the gas-earthquakes situation as a disaster could be a motivation to further rethink a more optimal governance response. This is expressed by members of the *Dialoogtafel* [69] and the *Groninger Bodem Beweging* [63] who describe the situation in Groningen as a "disaster or crisis in slow motion". Subsequently, a respondent from the *Dialoogtafel* [69] believes that governance principles of crisis or disaster management should have been followed: "In my opinion, in times of crisis and also of crisis management, there can only be one boss [. . .]. So, if you would have applied crisis management to this situation, then we would have created a special crisis organization". Further elaborating on a more optimal governance system for Groningen, the same interviewee stated: "I think that you should have responded to this crisis in slow motion with a government intervention that is internally coherent and where the *NAM* did not have his fingers in. And, bureaucratizing the governance approach and the fragmentation of the approach has triggered extra anger. So, instead of creating goodwill with the governance approach, the approach has itself contributed to, well, a deep feeling of being let down and abandoned".

Ambiguity about the responsibilities of the public and private institutions involved, together with the seeming impossibility to change the status quo, are major contributors to the social creation of the disaster in Groningen. A respondent from *Stichting Groninger Dorpen* [64] highlights this: "Things constantly change! Then you have a government for four years that thinks this, and the next four years you have someone else that thinks differently. So, you constantly have to recover things. It is never about people, and that is the only thing that we want to talk about, people, dot, that's it". Furthermore, the social discontent provoked by the lack of clarity about the future development approach to prepare for this kind of problems, and how this might link to a local and national sustainability transition, are also important ingredients of the social lead-up to this disaster. This research shows that the negative impact of this blurred institutional set-up, intermingling public and private interests, on the trust of people is so deep that trust could only be regained when a real institutional reform occurs.

5. Discussion: A Disaster in "Slow Motion"?

The case of Groningen shows the path of the social creation of a disaster that is gradually unfolding, or, in the words of the respondents, a "disaster in slow motion". In addition, Groningen presents a case where the occurring disaster is not typical nor traditionally present in the hazardscape in the (north of the) Netherlands. The rise and fall of the gas extraction in Groningen reveals the changing public perception and framing of an extractive industry. The different phases of the growth of a human-induced, or technological, disaster by Aini and Fakhrul-Razi [41] are somehow reflected in the case of Groningen. However, this model assumes that a disaster is one particular event. A crucial question for (human-induced) disasters which develop and evolve over time has to do with the moment in which these are identified as disasters. Despite the absence of an emergency management or a rescue phase in Groningen, new regulations and institutions are being set up. Groningen, therefore, contains a plea for a more inclusive and systemic conceptualization and analysis of disasters, as many disaster events show a similar path as presented by Aini and Fakhrul-Razi [41].

In addition, whereas the gas extraction was first widely embraced by the local population, coping with the negative consequences became a serious social problem and source of conflict. Although the earthquakes caused by gas extraction in Groningen did (so far) not lead to the complete collapse of

buildings, casualties and other terrible effects that we see in other earthquake-affected places around the world, the governance incapacity observed in this case is leading to an even bigger problem and disaster.

Linked to the findings of Flint and Luloff [46], different social groups from Groningen are striving for a stronger position to step-up against the gas industry. The case of Groningen shows that local knowledge and perceptions are not necessarily anti-corporate and anti-establishment. In fact, local people were in the early years proud of the gas industry. However, the "too high trust" from people in authorities transformed into "blind trust" and an underestimation of the potential risks [28]. Although a few politicians, researchers, and journalists questioned the safety of the gas extraction from the very beginning, the positive message spread by the government and the *NAM* about the Groningen gas as a new green energy source stood out. The endorsement of the local population of this message reflects high trust levels in the state, yet also insufficient critical thinking that could have put this message into question. The gap between the high trust and the occurrence of the earthquakes, combined with the possibility to clearly identify the causes of the earthquakes, resulted in a growing public concern, frustration, disappointment, and distrust amongst the Groningen population. This situation echoes Gill et al. [31] and Freudenburg's [49] concept of "recreancy": knowing that the earthquake problems could have been prevented generates an even higher public mistrust and an expectation gap between the people, the state, and the private sector [47].

The case of Groningen is clearly not a purely technical-natural disaster but a societal cum institutional disaster. The different dimensions to the social creation of disasters, as depicted in Table 1, are reflected in the case of Groningen. As such, the earthquakes in Groningen show that disasters, and in particular human-induced ones, often occur because of a confluence of origins. First, uneven levels of vulnerability lead to unequal impact, meaning that some people are hit harder by the earthquakes and are less able and equipped to protect themselves than others (see the documentary "De Stille Beving" for a further understanding of the different socio-economic situations of people influencing the vulnerability of people on http://www.destillebeving.com/). Second, the built environment in the province of Groningen, and in the Netherlands in general, is not constructed according to seismic standards which exacerbates vulnerability. Third, the institutional system—characterized by a complex myriad of roles and responsibilities of the Dutch State, the *NAM*, the Province of Groningen and the nine municipalities, the *NCG*, the *CVW*, and many others—lies at the root of the earthquakes problem. Fourth, the governance response for dealing with the gas extraction-earthquakes problems in Groningen is intensifying the impact of the disaster. In particular, the physical damage from the earthquakes spread out to Groningen's social fabric through psychosocial damage, feelings of unsafety and destruction of social capital [78]. Fifth, the socio-psychological construction of disasters is manifested through the different perceptions that people in Groningen and in the rest of the Netherlands have about these earthquakes. Sixth, and underlying the other dimensions, the cause of the earthquakes is in itself a result of human actions, and is therefore deeply socially constructed. This is a clear example of how different (inter)personal, socio-economic, and societal processes lead jointly to the social creation of a disaster.

6. Conclusions

The institutional set-up of a society influences the creation and governance response to disasters. In this article, we contributed to further this understanding by disentangling the social creation of a disaster in Groningen. We did this through investigating the stages of social triggering, formation, enhancement, and framing of the disaster. In the case of Groningen, the entangled public-private institutions and their contradicting interests are at the root of the problems and controversies and lead to the ongoing "techna" disaster. Moreover, the endurance of these entanglements interferes with a transition towards a more optimal system of "disaster" governance. It could be argued that the installment of special-purpose institutions, such as the *NCG* and *CVW*, was a step to recognize the scope of the Groningen disaster. Yet, the effort to build these institutions can also be seen as an opportunistic attempt to cool concerns down, at least temporally. We know that trust in institutions is likely to be highest when decision-making processes are transparent, democratic, and inclusive. The case of

Groningen shows how both the injured parties and the local government blame the central government and the *NAM* for operating in what they perceive to be a non-transparent, non-participatory and short-sighted way. The entangled relationship between the state and the *NAM* consequently triggers questions about the veritable interests of the involved parties, in a context in which local people believe that economic interests are prioritized at the expense of their safety.

A divergence is observed in the interests of the various levels of government, the private sector, and civil society actors in Groningen. The central government has to balance public safety vis-à-vis its economic interest in the gas industry. The Province of Groningen focuses mainly on the future of the region with a discourse on sustainability. The different municipalities are directly concerned with damage repair and reconstruction, safety issues, and the restoration of the normal life of residents. Municipalities are also concerned with the identity of the villages from a social and built heritage perspective. The *NAM* is mainly interested in the continuation of the gas extraction and revenues of the company, albeit with the reduction of the negative consequences of the earthquakes. The *NAM* has embraced a discourse that highlights the importance of extracting gas in a safe manner. Other private companies in the region have mixed interests in the future of the gas industry and region in general. Some small and medium enterprises (SMEs) generate an income through damage assessments, repairs, and investigations; at the same time, many of these are also affected by the damage and a troubled living environment. Chemical industries located in the north of the earthquake region are also concerned given the potential risks of heavy earthquakes. Other issues of concern include the impact of the earthquakes on the infrastructure for water protection (i.e., dikes and hydraulic works), which is very important for a country located below sea level. The local residents, finally, are mostly concerned with issues of safety, health, repair of damaged properties and regaining a normal living environment.

These different interests coming from various social groups show the complexity of the governance of this disaster. A multitude of layers and perspectives is involved in the production and reproduction of the disaster. The governance of a disaster of this type, therefore, asks for an understanding that the variety of actors and institutions hold different interests that interact and, in many cases, clash among each other. A participatory process is important to facilitate a dialogue between these different actors and institutions at the service of a co-construction of shared modes of coordination. The interaction between the public and private actors and institutions requires qualified people that inform non-experts in a transparent way, on the one hand, and mechanisms that give people ample access to this information, on the other hand. This interaction is crucial to gain and spread knowledge, deconstruct misconceptions, calibrate interests, and address different needs, as the building of trust relies on the transparent and democratic building of knowledge. However, the case of Groningen shows that building trust is obstructed because of the lack of clarity that results from the high complexity and the multitude of layers and perspectives.

Development plans for Groningen, as well as academic and international protocols on disaster governance, state the ambition to use earthquakes and other types of disasters as a trigger for a transition to a more resilient and sustainable society. In particular, sustainable development is one of the three pillars on which the *NCG* is centered. For instance, people could obtain subsidies for combining damage repair with sustainable energy alternatives. The Economic Board Groningen was also set-up to stimulate the sustainable economic development of the region. Although these initiatives can be seen as innovations from a disaster reconstruction perspective, our interviewees regard these efforts and institutional adjustments as "plasters" and not the real "healing" of the Groningen problem. These only improve a limited part of the problem and are, therefore, still decreasing societal trust in Dutch authorities. The uneven way in which the earthquakes affect society on a national, but also on a local level, leads to the ambiguous recognition of the situation as a disaster. Despite the different stages that can be observed in the Groningen case through which the human-induced disaster unfolds, the situation is not generally regarded as a disaster.

The fact that the case of Groningen is not depicted as a disaster might be explained by the absence of earthquakes within the traditional Dutch hazardscape. Moreover, the novelty of this type of

disaster in the Netherlands brings into being an alarming entanglement between natural, technological, and institutional processes for which responsibilities are still not clearly ascribed. This case also shows that disasters can have multiple origins and that they are often the result of a confluence of issues that can, in their combination, lead to disruption. This conceptualization of the multi-layered character of disasters is in a certain way putting into question the origin of a disaster. Further bringing this conceptualization of disasters into the disaster scholarship can allow for an integral perspective to disasters, including its different layers, processes, and stakeholders. Moreover, it is an invitation to really disentangle what a disaster is as well as its causes and its forms of reproduction. Perhaps labeling the earthquakes in Groningen as a disaster would trigger a more serious and democratic discussion regarding the most optimal decision-making body to deal with the current situation. The entangled public-private institutions and interests can, therefore, be regarded as both a source of the various dimensions of the socially created disaster, and also as the key to an approach towards enhanced resilience and sustainability.

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Appendix

Table A1. The list of interview respondents.

Organization	Stakeholder Group
Groninger Bodem Beweging (Groninger Ground Movement)	Civil society
Stichting Groninger Dorpen (Foundation of Villages in Groningen)	Civil society
Dialoogtafel (Dialogue Table)	Public, private sector & civil society
Gemeente Loppersum (Municipality of Loppersum)	Public sector (local)
Nationaal Coördinator Groningen (National Coordinator of Groningen) and	Public sector (central & local)
Provincie Groningen (Province of Groningen)	Public sector (regional)
Provincie Groningen (Province of Groningen)	Public sector (regional)
Nationaal Coördinator Groningen (National Coordinator of Groningen)	Public sector (central & local)
Gemeente Delfzijl (Municipality of Delfzijl)	Public sector (local)
Centrum Veilig Wonen (left for Safe Living)	Private sector
NAM and Shell (Dutch Oil Company & Shell)	Private sector
Economic Board Groningen	Private sector
Katholieke Universiteit Leuven (Catholic University of Leuven)	Other (research)

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