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Environmental Justice and the Social Impact in the Seismic Area of Groningen

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Master in International Studies

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Abstract

For many years, gas extraction in the province of Groningen, the Netherlands, has evoked earthquakes and subsidence in the area. This research studies the perceived environmental justice in the seismic area of Groningen and the social impact this has had on the people living in this area. To study this, semi-structured interviews were conducted with two groups of participants, one group of residents and another group of non-residents of the seismic area. The data gathered by these interviews was analysed using thematic analysis. Findings show that people, both residents and non-residents, report many issues concerning environmental injustice. All dimensions related to environmental justice, namely distributive justice, procedural justice, recognition justice, and the capabilities approach, were perceived as problematic. Besides, this study shows how the residents of the seismic area feel, and are also perceived by non-residents as having been, negatively impacted by the process leading to and the consequences of the gas extraction. Nonetheless, place attachment is high among the residents of the seismic area of Groningen, suggesting a form of coping mechanism to deal with the problems and risks they are facing. Moreover, the findings of this study suggest a form of solidarity between people living outside the seismic area and the local communities. Future research might build on this, in order to develop suitable and effective solutions to the problems caused by environmental injustice.

Keywords: environmental justice, social impact, place attachment, gas extraction, seismic area

Resumo

Durante muitos anos, a extracção de gás na província de Groningen, nos Países Baixos, provocou terramotos e abatimentos na zona. Esta investigação estuda as perceções de justiça ambiental na área sísmica de Groningen e o impacto social que esta teve nas pessoas que vivem nesta área. Para estudar isto, foram realizadas entrevistas semiestruturadas a dois grupos de participantes, um grupo de residentes e outro grupo de não residentes na área sísmica. Os dados recolhidos nestas entrevistas foram analisados através de análise temática. Os resultados mostram que as pessoas, tanto residentes como não residentes, relatam muitas questões relativas à injustiça ambiental. Todas as dimensões relacionadas com a justiça ambiental, nomeadamente a justiça distributiva, a justiça procedimental, a justiça de reconhecimento e a abordagem das capacidades, foram consideradas problemáticas. Além disso, este estudo mostra como os residentes da área sísmica se sentem como tendo sido impactados negativamente pelo processo que conduziu e pelas consequências da extração de gás, sendo isto também percecionado pelos não residentes. No entanto, o apego ao lugar é bastante elevado entre os residentes da área sísmica de Groningen, sugerindo uma forma de mecanismo de resposta para lidar com os problemas e riscos que enfrentam. Além disso, as conclusões deste estudo sugerem uma forma de solidariedade entre as pessoas que vivem fora da área sísmica e as comunidades locais. A investigação futura poderá basear-se nisto, a fim de desenvolver soluções adequadas e eficazes para os problemas causados pela injustiça ambiental.

Palavras-chave: justiça ambiental, impacto social, ligação ao local, extração de gás, zona sísmica

Index

1. Introduction 7

2. Theoretical framework 10

2.1 Environmental justice 10

2.2 Environmental injustice due to gas mining 11

2.3 The gas field of Groningen 12

2.4 Environmental justice in Groningen 13

2.4.1 Distributive justice 14

2.4.2 Procedural justice 15

2.4.3 Recognition justice 17

2.4.4 Capabilities approach 18

2.5 Research goals 21

3. Method 22

Figure 1. The Seismic Area of Groningen *23*

3.1 Participants 23

Table 1. Participants' Socio-demographic Characteristics 24

Figure 2. Overview of the Residency of the Participants 26

3.2 Procedure and Instrument 26

3.3 Data Analysis 27

Figure 3. The Codebook. 29

4. Results 30

4.1 Environmental justice 30

4.2 Distributive justice 30

4.3 Procedural justice 34

4.4 Recognition justice 37

4.5 Capabilities approach 40

4.6 Changes in environmental justice in Groningen 45

5. Discussion 48
5.1 Limitations and Future Research 53
6. Conclusion 55
7. References 56
8. Annex 1: Interview Guideline 60

1. Introduction

During the 18th and 19th centuries, a major shift in the production and utilization of energy emerged. Before, people would rely on natural sources of energy, like burning wood or using animal power. In the Industrial Revolution, however, people started to make use of other sources to create energy, like coal (Xu, et al., 2018). The Industrial Revolution changed how countries produced products and operated their economies. Factories were powered by steam engines, which made it possible to mechanize formerly manual jobs. Due to this, industries were able to enhance their level of productivity and grow immensely. This growth of the industries completely changed the landscape of energy production (Xu et al., 2018).

After the Industrial Revolution, gas was one of the new fossil fuels that changed the energy production radically (Ryder & Devine-Wright, 2022). Quickly many houses were connected to a gas pipe, which was used for heating their houses and doing their cooking, causing people to quickly become dependent on gas.

In 1959, a large gas field was found in the province of Groningen, the Netherlands. It turned out to be the largest in Europe and one of the largest in the world. In 1963, the gas extraction started (Spisto et al., 2020). Since then, moderate earthquake activity directly related to the gas extraction activities has been recorded in the area (Paolucci et al., 2021).

When the gas production started, conducted by the Nederlandse Aardolie Maatschappij (NAM; i.e., Dutch Petroleum Company), the focus was mainly on the benefits the gas extraction would bring, like economic benefits, energy security and reduced emissions. However, there are also risks involved in the extraction of gas, including environmental degradation, seismicity and public health and safety risks (Finkel, 2015). After some years of production, concerns arose about the risks of gas extraction in the area (Van der Voort & Vanclay, 2015).

One of the main concerns in Groningen regards the distribution of the costs of earthquake damage and the impact of gas extraction on the local communities and the environment (Mulder & Perey, 2018). Moreover, there are also serious concerns about health and safety issues. The earthquakes that happened due to the gas extractions caused many houses to be damaged and unsafe. Moreover, mental health is pressured due to an increase in stress and anxiety in the community as a result of the constant threat of new earthquakes arising and uncertainty about their future (Van der Voort & Vanclay, 2015). However, not all the concerns are directed at the people involved. The long-term damage to the environment is also a very

relevant issue. For example, subsidence, pollution of the soil, and the disruption of the natural habitat and ecological systems are reasons for concern (Van der Voort & Vanclay, 2015).

The social impact plays also a major role in the case of Groningen. People living in the seismic area experience many negative effects of gas extraction. Some people need to leave their houses and places because these are no longer safe to live. This can have a great impact on people since a place itself can affect people's self-perceptions and well-being (Biddau et al., 2023). The relationship between people and their spatial surroundings is also known as 'sense of space'. Place attachment is part of the sense of place and refers to the emotional bond people can experience with a specific place. Place attachment plays a role in people's identity and to what extent people feel the need to protect their place (Biddau et al., 2023).

In the case of Groningen, the anxiety and distrust in politics of the local community eventually caused the gas extraction to be stopped, even though there is still a significant amount of gas under the ground, with a high financial value. The community that lives in the seismic area of Groningen has been systematically ignored in the early years of experiencing environmental damage that emerged due to the gas extractions (Carton & Ache, 2017). Only recently, more attention has been given to the people living there. Due to numerous local protests and campaigns against the gas extraction, the government felt like there was no longer another option than to permanently close the gas field in 2024 (Slomp, 2024). However, even now that the gas extraction stopped, protests are still happening due to dissatisfaction about the compensation and the process behind it (NOS, 2024).

This study will focus on how the social impact of living in the seismic area of Groningen contributes to people's perspectives of socio-environmental justice in the area and their opinion on the gas extraction and the closure of the gas field. To study people's perceptions of environmental justice in Groningen and to better understand the situation lived in Groningen and the public support for this community, this study will include the perception of people living in the seismic area of Groningen and people living in other parts of the Netherlands. This way, a comparison can be made between residents' and non-residents' perceptions of the impact of gas extraction on socio-environmental justice dimensions in Groningen. The goal of this research is to try to understand how the gas extraction affected the community in the area across the last decades, from the start until its closing, as well as what people consider needs to be done in order to achieve justice in the area and for the community. To get a more complete understanding of the social impact and the psychosocial processes mobilized by communities to deal with such situations, this study considers also the place attachment of the local community and how this has been affected by the situation in Groningen.

Due to the unique situation in Groningen, where the gas production is permanently closed, this study can help provide an insight into what impact this has had on the people living there and how socio-environmental injustice may relate to the disempowerment of local communities for dealing with and changing their livelihoods. Besides, this research contributes to explaining how residents experience gas extraction in their living area and what they expect from the government to guarantee their safety and well-being. These results can be used to adjust procedures in other places where the same situation occurs to reduce the impact on people. Moreover, due to the use of two different samples, from residents and non-residents, this study contributes with additional insights to previous research concerning this topic by providing a more comprehensive perspective on how the process and its consequences were conceived within and beyond the local sphere.

For this study, two research questions are addressed. The first research question is: "What is the perceived environmental justice in Groningen concerning the gas extraction from people living in the seismic area and people living outside of Groningen?". The second research question is "What is the social impact of the gas extraction for the local community and to what extent does place attachment play a role in this?" To respond to these research questions, as said, interviews were conducted with people who live both in and outside the seismic area of Groningen. The semi-structured interviews focused on getting a narrative perspective on people's opinions and feelings about the situation in Groningen.

This dissertation has the following structure: first, in the next section, the theoretical framework is presented. In the theoretical framework, first topics on environmental justice and its dimensions are explained, followed by examples of environmental injustice cases due to gas mining around the world. Afterwards, the situation concerning the gas field of Groningen is described, and a reflection on environmental justice in Groningen is given, using the different dimensions of environmental justice. The theoretical framework ends with the research goals for this study. After the theoretical framework, the method for this study's data collection and analysis is explained, followed by the results of the study. Lastly, a discussion of the findings, implications and suggestions for future research is advanced, ending with a brief overall conclusion of this research.

2. Theoretical framework

2.1 Environmental justice

Environmental justice means that all people are treated justly and can have meaningful involvement in any decision-making process concerning human health and the environment. This is necessary in order to protect people from disproportionate burdens and adverse effects concerning their health or environment (EPA, 2024). Environmental justice can be divided into subtopics, namely: distributive justice, procedural justice, recognition justice, and the capabilities approach (Menton et al., 2020). Even though these are different topics aiming at raising awareness and consideration for different forms of justice, there can be some overlap between the concepts and they can interact with one another (Langemeyer & Connolly, 2020).

Distributive justice refers to the fair distribution of environmental costs and benefits. In the case of energy production, distributive injustice means that the burden of energy production is experienced by a disproportionate segment of the population, whereas others mainly experience the benefits of it, without much of a burden (Mueller & Brooks, 2020). This form of environmental justice is really about achieving social equity (Menton et al., 2020). Distributive justice is considered as the start of environmental justice (McGurty, 1997; Mitchell, 2018). It was believed that an improved distribution of wealth would lead to an increased environmental quality (Freeman, 1972). Later however, more dimensions were added to environmental justice. Distributive justice was no longer perceived as being sufficient for solving environmental injustice issues. Nowadays, environmental justice cannot be seen without the other relevant dimensions of it, like procedural justice, recognition justice and the capabilities approach (Mitchell, 2018).

Procedural justice aims to achieve a fair and equal institutional process. Procedural justice is about understanding the way justice is cared for politically and socially. One form of injustice is when patterns of disrespect are institutionalized, for example, inequalities or exclusion in decision-making processes. Often, forms of procedural injustice happen because the people who are in powerful positions in the decision-making process are people who will only experience the benefits, rather than the costs (Folger & Greenberg, 1985; Menton et al., 2020).

Recognition justice on the other hand refers to achieving a just society in a way that a person's and community's dignity and identity are recognized and respected. It is not only focused on self-recognition, but also on recognition of the collective identity and its concerns, needs and livelihoods concerning nature and the environment (Menton et al., 2020; Schlosberg, 2012).

At last, the capabilities approach focuses on people's well-being and the different aspects of that. The capabilities approach focuses on the capacities people need in order to be able to live a good life in the life they choose. Moreover, it does not merely focus on the outcomes of people's well-being, but more on the capabilities leading up to it (Menton et al., 2020; Schlosberg, 2012).

In sum, putting all the sub-topics together, environmental justice is all about equity, participation, recognition, and protection of capabilities (Schlosberg et al., 2017). This plays also a role in how renewable energy innovations are accepted or opposed to by local communities. Batel (2020) describes different aspects that play a role in the perceived negative impacts of renewable energy innovations. Examples of these are issues with health, property values and the local environment. Also perceptions of procedural justice and distributive justice are described to have an impact on how the local community accepts or oppose to the renewable energy innovations in their local environment (Batel, 2020).

The next section will address these dimensions while focussing specifically on cases of environmental injustices due to gas mining.

2.2 Environmental injustice due to gas mining

Around the world, there are several cases of environmental injustice due to gas mining. One example can be found in the United Kingdom. In England, shale exploration creates problems for the local population. Air pollution is a major cause of concern there and the people who live in the area where the shale is exploited face many health problems. Besides, climate change problems have been reported to be caused by the shale exploration in the UK (Watterson & Dinan, 2020). But these problems are consistently downplayed by politicians and scientific research on the consequences of this intervention is often ignored (Watterson & Dinan, 2020). Watterson and Dinan (2020) explain in their research that environmental justice and ethical aspects are absent from the decision-making process of the government. The main reason is the economic profit that is made from the shale exploration.

A similar case can be found in Italy. Gas and oil production is taking place in the region of Basilicata. In this region, people are confronted with serious health problems due to air pollution, including a high risk of tumours (Rampone & Simonetti, 2020). Adding to the health problems, the local community complains about the unfair distribution of the economic profit made in the area. Most of the royalties earned from the gas and oil mining went into other regions of Italy (Rocchi et al., 2015), one example of distributive injustice. Rocchi et al. (2015) found in their research that the long period of distributive injustice had a major social

impact on the local community and also the region's economic growth was difficult to significantly improve even after increasing the amount of royalties reverting back into the area.

Furthermore, in Alberta, Canada, fracking has been linked to the earthquakes occurring in the area. Earthquakes can be measured using the scale of Richter. This is a measurement that indicates the power of earthquakes. The scale of Richter is logarithmic and does not have a defined maximum. However, the highest magnitude ever measured is a magnitude of 9.5 on the scale of Richter (Rafferty, 2024). In 2016, Alberta experienced one of the largest earthquakes, with a magnitude of 4.8 on the scale of Richter. More recently, in March 2024, a large earthquake happened, measuring a magnitude of 4.4 on the scale of Richter. After this second earthquake, it was decided to temporarily close the fracking site, in order to do safety checks. However, in April 2024, the fracking site resumed operation again (Snowdon, 2024). The earthquakes in Alberta have had a great impact on the local population, including trauma, the feeling of helplessness and anxiety, and a lack of recognition of the problems that occur in their place. The residents experience a great deal of discrimination and ostracism, both from authorities and from people living outside of the earthquake zone, as well as from their friends and family (Davidson, 2018).

These examples show how environmental injustice can take part in cases of gas mining around the world. In the examples above, the multiple dimensions of environmental injustice can be found, and they overlap each other. Often, there is not just one dimension of environmental injustice in an area, but multiple dimensions causing problems. This backs up the relevance of the broad concept of environmental injustice (Mitchell, 2018).

The following sections will focus specifically on the situation of Groningen, starting with a description of the gas field in Groningen.

2.3 The gas field of Groningen

In 1959, a gas field was found in Groningen, and it turned out to be the largest in Europe and one of the largest in the world. A couple of years after its discovery, in 1963, the gas field installation was ready for production (Spisto et al., 2020). The field turned out to be much larger than originally thought, and a significant amount of gas was being extracted from it, creating an enormous revenue for the Dutch state. However, there turned out to be a catch; the gas extraction caused gradual subsidence and seismic activity.

The gas field in Groningen has been in use of production for about 60 years now. The company that extracts the gas is the NAM, of which Shell and Exxon are the two

shareholders. However, the NAM is also very closely related to the Dutch state, since there is an agreement that 85% of the gas revenues are allocated to the state (Been, 2022; Shell, 2020). The state then sells the gas at profitable prices on the national and international markets, generating substantial profits from it (Bakema et al., 2018). Therefore, the Dutch state gained considerable wealth from the gas field exploitation. Originally, the gas field contained 2800 billion cubic meters (bcm) of gas. Today, there is still around 600 bcm left in the field. This could allow for about another 30 years of extracting gas with an average of 20 bcm per year (Vlek, 2019). Yet, because of the damage caused by the earthquakes, the government decided in 2020 to close the gas field permanently as of October 2024. However, due to continuous problems in Groningen, it was decided in April 2024 to immediately close the gas production (Slomp, 2024).

The decision to permanently close a functioning gas field is a unique situation. The gas field is highly profitable and allowed a substantial income for the Dutch state. The total profits of the gas field up to 2022 were, adjusted for inflation, around 428 billion euros (Been, 2022). Energy expert Jilles van den Beukel stated that the gas that is still under the ground today, could be worth around 200 billion euros (Nijmeijer, 2023). Therefore, it became a nationwide topic of debate whether it is a good decision to close the gas production permanently (BNNVARA, 2024).

The next section will describe the environmental justice issues that arose in Groningen, using the different dimensions of justice presented above.

2.4 Environmental justice in Groningen

Naturally, seismicity does not occur in the north of the Netherlands. The Groningen earthquakes arose due to the gas extraction. In this case, the gas mining is the cause of the earthquakes, with several consequences happening in the area. For instance, as all the buildings and infrastructure were not designed to be earthquake-proof, there has been considerably large damage in Groningen compared to the relatively low magnitudes of the earthquakes (Bakema et al., 2018).

At the start of the gas extraction, the local people were proud of the gas field that was found under their ground and were embracing the new job opportunities that this created for them (Bakema et al., 2018). Up until then, Groningen had always been one of the poorest areas of the Netherlands. In the early 20th century Groningen relied on factory work. However, due to increased industrialisation and mechanization and the production shifting to low income countries, the factories in Groningen had to close, leaving many people

unemployed (Karel, 2012). This resulted in the decline of Groningen. But in 1959, a source of wealth was found in Groningen, creating hope for the development of the province. However, residents' perceptions changed drastically once they were confronted with the negative consequences of the gas extractions. The main pivotal moment was the earthquake in 2012 near the village of Huizinge with a magnitude of 3.6 on the Richter scale, which was the most powerful earthquake recorded at that time. This earthquake showed people the risks and consequences of the gas extraction (Bakema et al., 2018). Since then, public, private and societal actors created different institutions to deal with the increasing damage caused by the earthquakes. From this moment on, local people's contestation intensified, since they believed they were not compensated enough for the damage. Moreover, they hold the Dutch government responsible for the earthquakes and their consequences. Altogether, the governance response to the earthquakes resulted for locals in a lack of trust in governmental institutions (Bakema et al., 2018).

The problems occurring in Groningen may happen under the ground, but the cause is due to human action. And only human actions can stop the problems too. However, the cause of the earthquakes in Groningen had been ignored for a long time and the local communities were not being taken seriously until the consequences started to become too serious to ignore (Bakema et al., 2018). Below, the situation in Groningen is described using the different concepts of environmental justice.

2.4.1 Distributive justice

Due to continuous subsidence and the accumulation of earthquakes in Groningen over the years, many houses appeared to have large cracks in the walls and damage to the roofs. This caused many of the houses to be unsafe or unliveable. Despite the unsafety, the damage also severely affected the house prices in the area. Especially after the earthquake of 2012, when it became widespread in the national news, house prices declined tremendously, causing people to have substantial devaluation on their properties. Besides, the damage to the houses is also one of the main factors for people being anxious and stressed. They feel insecure in their houses and are scared they might break down in the next earthquake (Van der Voort & Vanclay, 2015).

The feeling of insecurity can lead to many health issues. In the case of people living in the seismic area of Groningen, mainly mental health problems arise. In 2013 in a survey by RegioNoordPanel (a market research panel), 15% of the respondents in the earthquake area of Groningen claimed to be having serious health problems because of the earthquakes,

including stress, anxiety, insomnia and depression (Van der Voort & Vanclay, 2015). Research showed that the more damages people have in their houses, the more they experience feelings of unsafety in their homes (Postmes et al., 2017).

Moreover, the image of Groningen is also impacted by the earthquakes, both as a residential area and as a place to invest. Due to the problems happening in Groningen, it is not attractive for entrepreneurs to invest in the area. This results in a stagnation of the development of the place and of the employment in the area (Kleinhans, 2019). Due to the media attention on the earthquakes, residents worry that this negative image might have a long-lasting effect on the region (Sluiter et al., 2018).

These burdens have negative effects on the people's well-being. Moreover, people experienced the burdens even stronger because they were not recognized for their problems, and not enough compensation was granted. Especially in the beginning, the damage settlement was very difficult for the residents. People believed that the damage settlements were unfair and not transparent (Mulder & Perey, 2018).

2.4.2 Procedural justice

Since 2012 a substantial amount of damage to buildings has been reported. The responsibility to take care of the damage assessment was then handed to the NAM. Often the NAM-experts conclusion was that the damage was not proven to be caused by the gas extraction, and so the NAM could not be held responsible. Therefore, the NAM believed that they did not need to grant compensation for the damages. This resulted in people distrusting the outcomes of the damage assessments, since the NAM played the conflicting roles of being both the causer and the solver. The NAM benefited from maintaining a high gas production, so people did not trust them to adopt an independent perspective on their complaints (Carton & Ache, 2017).

Furthermore, the way the damage was assessed caused anger and contestation among the residents. Damage was classified into three groups, namely either as damage directly caused by earthquakes, damage indirectly caused by earthquakes, or damage not caused by the earthquakes. Many damages were being assessed as 'not caused by the earthquakes'. This implies that the damage is due to other reasons than the earthquakes, like insufficient maintenance for example. The fact that some properties are classified as damage caused by earthquakes, and some are classified as not caused by earthquakes raised distrust and feelings of resentment against other community members. This is another example of how the response of the government left people feeling betrayed and angry (Bakema et al., 2018).

The impact of gas production on the local communities has been since 2012 increasingly noticed by local governments in the north of the Netherlands. In 2014, the *Dialoogtafel* (i.e. Dialogue table) was installed. This was a committee that consisted out of representatives from nine municipalities, the Province of Groningen, affected farmers and entrepreneurs, different local communities, the NAM, and the Ministry of Economic Affairs (Bakema et al., 2018). The *Dialoogtafel* aimed to achieve consensus among all members and make the decision-making process more inclusive. However, as great as the initiative was, in practice it did not work. The main reason for this was that the hierarchical patterns remained intact in the committee. Even though all members of the committee were supposed to have equal voice in the negotiations, this turned out not to be the case. The negotiations and discussions were mainly dominated by people who have more powerful positions in the decision-making process. Because of this, representatives of the people with less powerful positions were still not heard and therefore the decision-making process was not as inclusive as anticipated. This caused some members to lose faith in the committee and therefore the *Dialoogtafel* was disestablished by the end of 2015 (Bakema et al., 2018).

However, meanwhile, the earthquakes became more frequent and stronger, causing the damage to houses to become more severe, and people felt like they were not taken seriously and did not trust the government to protect their interests. Therefore, local citizens started to join an initiative called the Groninger Bodem Beweging, which was established in November 2009 (GBB; i.e., the Groninger Soil Movement). This initiative was founded to advocate the interests of the residents (Vedder, 2019). They also came up with a transparent and clear overview of the earthquake activities, since this was not yet available. Due to this initiative they were able to show data on the issue to the press or researchers when asked, increasing the credibility of their complaints and requests (Carton & Ache, 2017). Initially, the group was a relatively small grassroot organization, consisting of a couple hundred members. However, after the stronger earthquake in 2012, the organization grew tremendously, registering many new members. During this period, the organization professionalized. Today, the GBB is the largest organisation advocating the interests of residents of Groningen (Vedder, 2019). Besides lobbying, the GBB was also involved in many legal proceedings, like a criminal justice trial against the NAM (Zwerver, 2022). Moreover, they initiated many protests and activities to create media attention for the situation in Groningen.

Meanwhile, the negative perception of the impact of the earthquakes was continuously growing, and also affecting the people's trust in the government. Therefore, the government set up a new institution in 2015. This was the Nationaal Coördinator Groningen (NCG; i.e.

National Coordinator of Groningen). Its task was to coordinate between the affected municipalities, the Province of Groningen, and the Ministry of Economic Affairs. The NCG was steered by two committees, one public sector committee and one societal sector committee, including the GBB. The NCG aimed to reach consensus on strategic plans for the future. In general, people were very positive about the instalment of the NCG, although criticism arose since the NCG was in a very difficult position of improving the situation, because it in fact had very little power to actually make a change (Bakema et al., 2018).

2.4.3 Recognition justice

Initially, when the first problems started to occur, the relation between the earthquakes and subsidence was consistently denied by the stakeholders of the gas production. Even though, scientists had been warning about this outcome for a long time (Brandsma et al., 2016). In 1993, the connection between the seismic activity and the gas extraction was already acknowledged. However, it was not until the stronger earthquake in 2012, that people started to realise the extent of the situation and that it was a threat to people's safety and well-being (Vedder, 2019). This earthquake shocked everyone, since most people did not realise that it was possible that an earthquake of this strength could happen in Groningen and would cause as much damage as it did. This earthquake led to more media attention and research on the seismicity in Groningen (Van der Voort & Vanclay, 2015). A study by the State Supervision of Mines (SodM) then found that continuing the gas extraction would lead to more and stronger earthquakes in the area (Muntendam-Bos & De Waal, 2013).

So, after the earthquake of 2012, the consequences of the gas extraction could no longer be ignored. Instead, this earthquake triggered a variety of changes in the institutions and regulations. In 2013, as a result of research findings on the seismicity caused by the gas extraction, it was decided by the Ministry of Economic Affairs to reduce the amount of gas that was allowed to be extracted. However, instead of following the regulations, it turned out that in fact the gas production in 2013 rose to the highest point in 25 years (Bakema et al., 2018).

For a long time, the NAM doubted openly whether the earthquakes had any relationship with the gas extraction. When the connection between the gas extraction and earthquakes and subsidence became inevitable, the NAM said that the occurrence and impact of it was little or mainly caused by other factors (Carton & Ache, 2017). So basically, the NAM did not take responsibility over the environmental damage in the area, even though the relationship between the gas extraction and the earthquakes had been proven. In face of this, residents

complained that the institutions were not taking measures to improve the situation and started protesting and demanding compensation for the damages resulting from the gas production in the area (Postmes et al., 2018). Besides compensation, they also demanded the closing of the gas station. Then, in 2018, the Dutch government decided to phase out the gas production until it would be completely closed by 2030. Even though the local population was glad that the gas station was about to be closed, this still created distrust among them since they were afraid that the gas production might start again when the need for gas became high (NOS, 2023). To appease the people, the government decided in 2023 to stop the gas production immediately and close it off permanently in October 2024. This was a way for the government to show the residents of Groningen that they cared about the problems and started to take them seriously. However, in December 2023, the government temporarily turned on the gas production again because of low temperatures. This made the people of Groningen very angry and confirmed them in their perception that the gas production would just start up again if the need for gas was high (NOS, 2024). So, due to the continuous problems and the dissatisfaction of the residents on how the government was handling the situation, it was decided in April 2024 to close the gas tap immediately and permanently. There was great political support for the permanent closure of the gas field. In the House of Representatives, 146 of the 150 members of the parliament were in favour of this law (Slomp, 2024).

2.4.4 Capabilities approach

As of the last decade, the Dutch government has taken various measures to tackle the problems in the earthquake area. A damage protocol has been established to regulate damage handling, and programs have been initiated to strengthen homes and buildings to make them resistant to future earthquakes (Rijksoverheid, 2018). In addition, gas extraction in Groningen was gradually reduced and gas production eventually stopped completely (Slomp, 2024). Despite these measures however, challenges still remain.

Up till today, discussions are still continuing about the responsibility of the government and gas companies on the damage done to the area and the safety of the people living there (Stroebe et al., 2021). This results in that many of the measures are not being fully proceeded and the processes are very slow.

An example of the slow processes can be found in the cases of people that needed to leave their houses because they were concluded to be unsafe for living. Those people had to move into a temporary house. These temporary houses are very small and often situated in a different place than where people were living, forcing them to relocate to a different physical

and social environment. The people who had to move into such a temporary house were promised to have their own houses fixed, and that they could move back in again, soon. However, various families are living in temporary houses for years, and many of them are still waiting to return to their houses (Ekker & Start, 2023).

2.4.4.1 Place attachment

Place attachment is a concept that refers to the emotional bond people can experience with a specific place. There is a relationship between environmental impact and the experiences and identities of the people who are living in that environment. The attachment to a place is part of people's identity, and the threat that this attachment might be harmed is a cause of environmental injustice issues (Schlosberg et al., 2017).

Positive attachment is seen as a basic need to be able to live a good and functioning life. In the environmental justice domain, the capabilities approach stresses the relevance of keeping these kinds of capabilities and shows that to deny those capabilities is in fact understood as injustice. A functional dimension of place attachment, place dependency, plays a role as well. Place dependency is about the functional bonds people experience with the place. The more a place meets a person's needs and goals, the higher the person's place dependency becomes. This plays a role in acquiring good capabilities and be able to live a good and functioning life in that place (Jansen, 2018). Undermining the capability of attachment, even only threatening to harm the attachment, can cause feelings of distress (Schlosberg et al., 2017).

Moreover, a study by Devine-Wright and Batel (2017) found that residents with strong local attachment are more likely to have a negative perspective on energy infrastructures in their environment and are more likely to protest against this than people with weaker local attachment.

Furthermore, higher place attachment is linked to greater risk perception, and more active coping mechanisms. People with higher place attachment are thus more attentive to potential risks, and this awareness creates more active coping strategies, like problem solving (Parreira & Mouro, 2023). Besides, coping strategies are also influenced by the amount of trust residents have on the authorities responsible for the problem solving. The less trust people have in the functioning of the authorities, the more active coping strategies they apply (Parreira & Mouro, 2023).

In the case of Groningen there are some studies that did some research on the place attachment of residents of the earthquake area. One study found that older people and people who grew up in the area experience higher place attachment. They also found that people with high place attachment are more frightened of the damages caused by earthquakes (Jansen, 2018). Van der Kloet et al. (2024) found that people want to stay in their houses even if it has severe damage to it. The researchers explain that precisely because of the earthquakes and the damages to their houses, people become more aware of their house attachment (van der Kloet et al., 2024).

2.4.4.2 Social Impact

The situation in Groningen impacts the lives of the people living in the area in several ways. Van der Voort and Vanclay (2015) did an analysis of the social impacts in Groningen from media reports at the time. They found that a couple of topics stood out in the analysis, namely damage to properties, a decline in house prices, concerns about the chance of dykes breaking, feelings of insecurity, health issues and increased distrust and anger (Van der Voort & Vanclay, 2015).

For most people, the feelings of insecurity mainly started to grow after the report of the SodM (2013) came out (Van der Voort & Vanclay, 2015). This report explained the consequences of gas production and was published after the strong earthquake of 2012. People started to realise that it was more serious than everyone always said before, increasing people's anxiety. The anxiety was then aggravated, since in the weeks after the report came out a couple of earthquakes occurred, of which some were the most severe in many years, feeding into the growing anxiety of local communities (Van der Voort & Vanclay, 2015). Moreover, the visibility of the damage to houses reinforces the feeling of potential danger (Van der Voort & Vanclay, 2015). A house needs to be a 'safe haven', and when this is not the case this strains on feelings of security, having a major social impact.

Apart from the feelings of anxiety and other negative emotions evoked by earthquakes, studies mention a possible change in the community's social cohesion. In some studies, social cohesion is seen to be a protective factor for people experiencing problems from gas extraction (Ferwerda, 2019). However, other studies mention that changes in a living environment can in fact harm social cohesion (Holsappel et al., 2017). One study also found that the problems in Groningen due to the gas extraction can be a risk for social cohesion even if experiencing a heavy earthquake can also (temporarily) increase social cohesion, because

people realise that they may need to come together to deal with a collective disaster (Busscher et al., 2020).

In the next section, the research goals for this study are described.

2.5 Research goals

Based on the literature review, and in order to answer the research questions stated in the Introduction, some research goals were established. This study has the following research goals:

Research goal 1: "To examine the perspectives of residents and non-residents of the seismic area of Groningen on topics related to gas extraction, using the environmental justice dimensions." Although some studies focused on some of the environmental justice dimensions, this research will present a more comprehensive analysis of the case study by using the four dimensions: distributive, procedural, recognition and capabilities approach. Additionally, the perceptions of the two groups will help better understand the level of public support for the project and these local communities.

Research goal 2: "To examine whether place attachment can be understood as one of the capabilities dimensions of environmental justice, and accordingly act as a buffer for the negative impacts on residents of the seismic area of Groningen."

Research goal 3: "To analyse how residents express their opinions and feelings on the social impact of the project over time. More specifically, it will be examined whether the perceived social impact changed after the gas production was permanently closed."

This study aims to answer these research goals through a qualitative methodology, which will be described in the following section.

3. Method

This study focuses on the perception of people towards the gas extraction in the province of Groningen, the Netherlands, and how this has had an impact on people living in the seismic area and their attachment to the place, as well as the perception of environmental justice in the area related to these events both by residents and non-residents. In order to respond to the research goals, semi-structured interviews were conducted. This method of data collection was selected because it allows participants to talk in detail about their feelings and perspectives. Because gas extraction is of national importance, and the consequences of it were widely discussed in the news and the public sphere, to get a more complete overview of people's opinions and viewpoints on this situation people from both Groningen and from other places in the Netherlands were included in this study. Collecting data from both groups allows to better understand if there are any differences in opinions concerning the advantages and consequences of the gas extraction in Groningen between people living in the seismic area and people who do not live in this area, and to better understand the public support to the gas extraction and, more recently, to its closure.

The area that is considered as the seismic area of Groningen is the area where an earth tremor was measured of at least 2 millimetres per second, and the surrounding six kilometres around the Groningen gas field. This is the area that the Institute of the Mines in Groningen (IMG) considers as the area that needs compensation for the damages of the gas extraction (IMG, 2024). An outline representation of the area that is included as the seismic area can be seen below, in Figure 1. The upper dark blue area is the Groningen gas field including the 6km surroundings around the Groningen gas field.

Figure 1. The Seismic Area of Groningen



The upper dark blue area is an outline representation of the Groningen gas field including the 6km around the Groningen gas field. Therefore, the upper dark blue area is considered the seismic area of Groningen. Image developed by the author using Google Maps.

3.1 Participants

Fourteen participants took part in this study, agreeing to participate in an interview. Participants were aged 18 or older. Furthermore, it was attempted to achieve as much diversity in the participants as possible, including differences in age, gender, place of residency, educational level, etc. For an overview of participants' socio-demographic characterization, see Table 1 below. For a visual overview of the residency of the participants in the Netherlands, in relation to the seismic area of Groningen, see Figure 2.

As mentioned, there were two groups of participants. One group consisted of residents from the earthquake area in Groningen (n= 10), of whom 60% were female, aged between 24 and 73 years (M = 44; SD = 18.2). The other group consisted of people who live in other parts of the Netherlands, also referred to in this study as 'non-residents' (n= 4), of whom 50% were female, aged between 32 and 89 years (M = 62; SD = 27.8). In terms of educational level, four people were having secondary vocational education as highest attained educational level, five people were having higher professional education as highest attained education, and there were four people with a university degree. There is variability in the occupations of the participants. There are four people (all in the residents' group) that have an occupation that is in a way related to the earthquakes in Groningen.

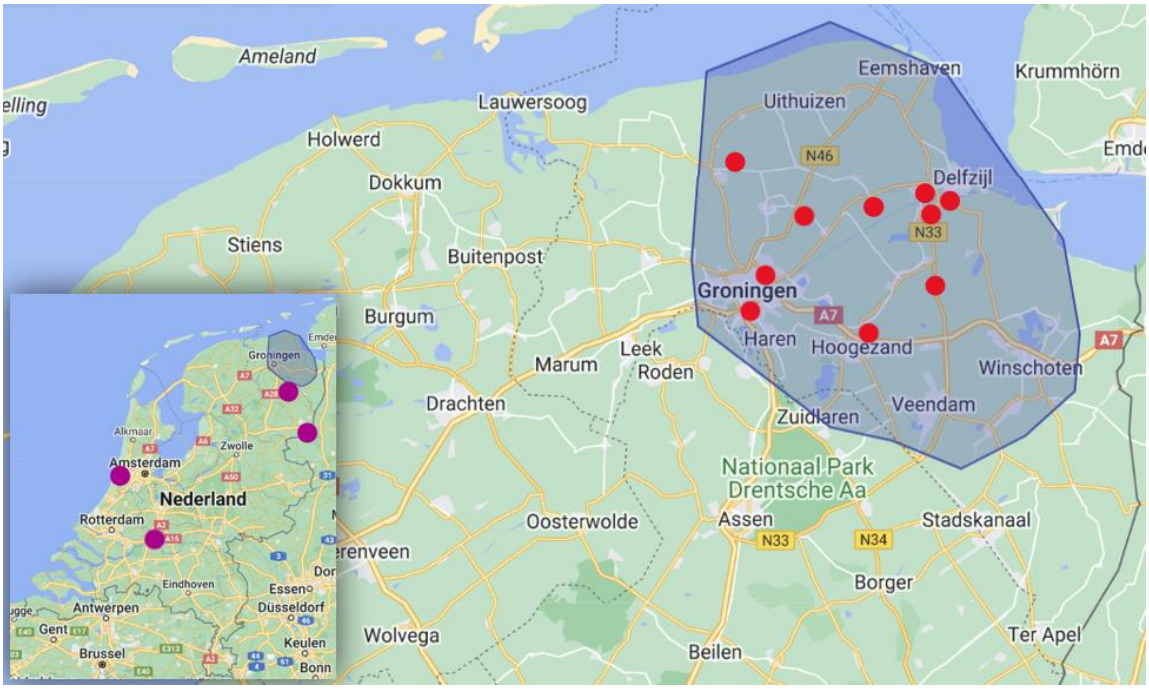
Table 1. Participants' Socio-demographic Characteristics

Participant Number	Resident at Seismic Area?	Residency	Age	Gender	Highest Attained Education	Occupation	Interview Duration
1	No	Assen, Drenthe	62	Female	Higher professional Education	Municipal Official	25 minutes
2	No	Bloemendaal, Noord-Holland	65	Male	University Education	Bank Employee	35 minutes
3	Yes	Siddeburen, Groningen	25	Male	University Education	IT-Consultant	50 minutes
4	Yes	Kolham, Groningen	50	Female	University Education	Secretary Special Situations Committee Groningen*	45 minutes
5	Yes	Appingedam, Groningen	56	Female	Secondary Vocational Education	Schools Facility Manager*	45 minutes
6	No	Emmen, Drenthe	32	Male	Secondary Vocational Education	Electrician	25 minutes
7	Yes	Wirdum, Groningen	42	Male	Higher professional Education	Technician	55 minutes
8	Yes	Appingedam, Groningen	73	Female	Unknown	Retired	40 minutes
9	Yes	Groningen, Groningen	27	Female	Higher professional Education	Employee of NCG (National Coordinator Groningen)*	40 minutes

10	Yes	Appingedam, Groningen	48	Female	Secondary Vocational Education	Unemployed	40 minutes
11	Yes	Groningen, Groningen	30	Male	Higher professional Education	Bank Employee	35 minutes
12	Yes	Winsum, Groningen	24	Female	University Education	Remedial Teacher	33 minutes
13	No	Gorinchem, Zuid-Holland	89	Female	Secondary Vocational Education	Retired	20 minutes
14	Yes	Bedum, Groningen	65	Male	Higher professional Education	Environmental Consultant*	35 minutes

**The participants' occupation is in a way related to the earthquakes caused by the gas extraction in Groningen*

Figure 2. Overview of the Residency of the Participants.



This figure shows the residences of the participants in relation to the seismic area of Groningen. The red dots indicate the residences of participants living in the seismic area of Groningen. The purple dots indicate the residences of participants living in other parts of the Netherlands.

3.2 Procedure and Instrument

Participants were contacted through social media platforms, like WhatsApp, or through e-mails. The sampling of the participants was done using purposive sampling, selecting participants based on certain characteristics, together with the snowball sampling technique, which allows participants to suggest other potential participants for this study (Bloor & Wood, 2006). After the data reached a point of saturation, it was decided to stop the data collection. The interviews were conducted between March and July of 2024. All interviews were held online via facetime, and the duration of the interviews ranged between 20 to 55 minutes, with an average of 38 minutes.

Participation was completely voluntary and all the participants first read the consent form and gave verbal permission before the interview started, which was registered on the voice recorder. The interviews were held in Dutch, they were audio-recorded and later fully transcribed and translated into English. All recordings and transcripts were stored in a safe space at Iscte University cloud. Besides, all the transcripts were anonymized by removing the participants names, so that their privacy is guaranteed.

The interviews were semi-structured interviews. An interview guideline was used to ensure all questions were asked, but the order of the questions was not necessarily set up at front. The interview guideline was developed using the main themes of this research and creating open-ended questions to get a narrative perspective on how people perceive the situation concerning the gas extraction in Groningen and what they think is its social impact, but also in what way they experience place attachment (Annex 1). The participants were given space to tell their own story and the guideline was mainly used to make sure all topics were being covered.

Even though no fixed structure was followed during the interview, the interview started with some general and personal questions of the participant. After this, it focussed on how the participants experience the relationship with their place, in order to get an indication of their place attachment. People were asked to talk about their own living experiences, how they feel about the place they live in and in what way they feel connected to the place. Examples of some questions that were asked on this topic include: “What do you think of the living conditions this place has to offer?”, “Has your relationship with this place changed over time, and if so, how?”, and “Would you like, or prefer, to live in another place in the Netherlands?”

Later in the interview, the focus shifted to the gas extraction and the consequences of this. Participants were asked to generally explain what the gas extraction is and what their opinions are on this. An example of these questions is: “How would you explain the gas extraction in Groningen to someone who is unfamiliar with this topic?” Furthermore, the participants were asked to talk about the social impact of the gas extraction. An example question on this is “Do you think the way of life in Groningen has changed? In what ways?”. Moreover, participants were asked to explain their visions of the four dimensions of environmental justice, namely distributive justice, recognition justice, procedural justice, and the capabilities approach. Some examples of questions on this topic involve: “What have been the burdens for the Groningen community?”, “Do you think the opinions of the Groningen community have been taken into account?”, and “Has the Groningen community been involved in the decision-making process regarding gas extraction? And how?”. Both groups, the residents and non-residents, were asked the same questions in the interview with the exception that non-residents were asked if they would mind living in the seismic area of Groningen.

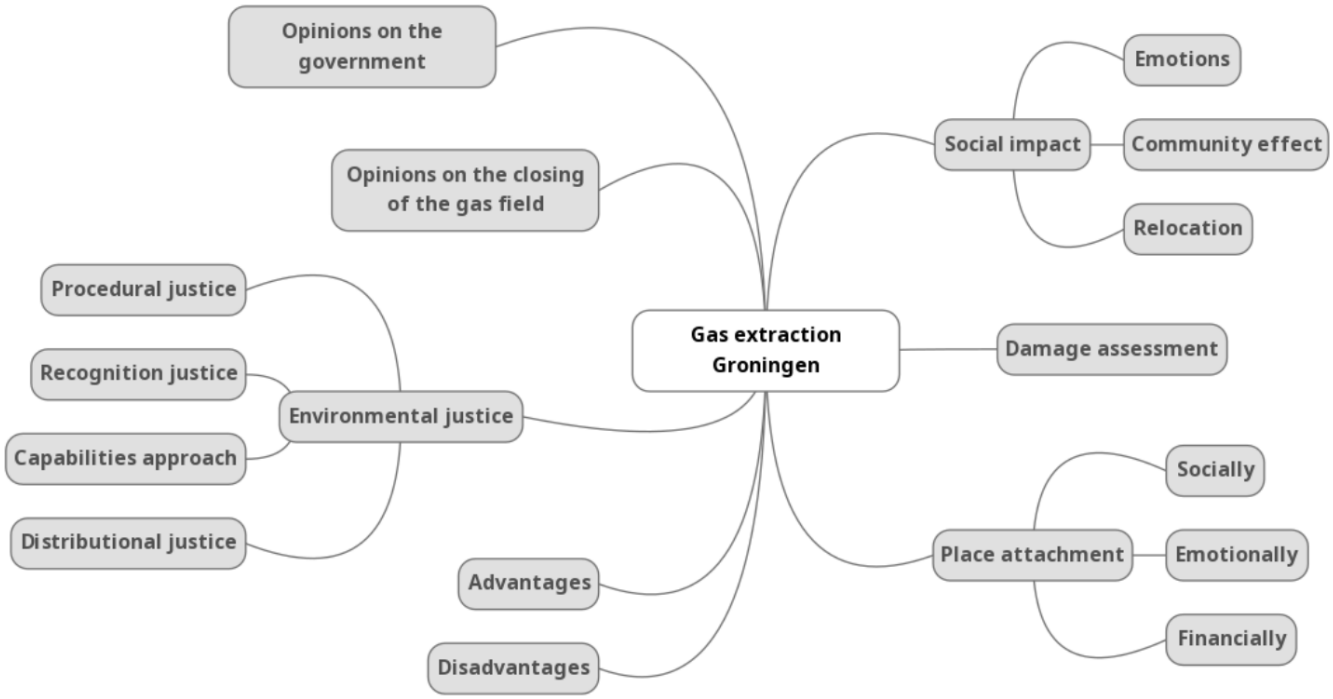
3.3 Data Analysis

After the data collection, a thematic analysis of the textual data was done using a codebook. This method is used to identify, organise and analyse themes within a data set (Braun &

Clarke, 2012). The thematic analysis for this study was done following the phases described by Braun and Clarke (2012). After familiarizing with the data by transcribing and reading it thoroughly, codes were generated from the data, creating a codebook. For this, everything in the dataset that was considered potentially relevant to the research questions was coded. After everything was coded, the next phase started with searching for themes within the codes. A theme captured the important data and was aimed to be relevant to answer the research goals and research questions. Here, the data was analysed, searching for patterns and looking for similarities, or disparities, within the data in order to identify broad topics. The next phase involved reviewing the created themes in the data set, making a couple of adjustments to fit the data even better. Then, the codebook was discussed and this led to a consensual final version of it.

The codebook consists both of deductive codes, which are codes that were derived from theories to interpret the data, and inductive codes, which were derived from what was found in the data itself. Deductive codes are used because the codes are based upon theoretical constructs, for example, topics concerning environmental justice and place attachment. Inductive codes are used because the data focused on people's experiences and opinions. Therefore, to fully capture the meanings and perspectives shared by participants, this data cannot only be analysed using a deductive coding system (Braun & Clarke, 2012). Examples of inductive codes are the participants' opinions on the government and the dissatisfaction concerning the damage settlements, like overcompensation and abuse of compensation. A visual interpretation of the simplified code book is depicted below, in Figure 3. The findings of this data analysis are described below in the results section. Behind every excerpt used in this study, it is indicated to which participant it belonged. This is done using the participants' number and the group to which they belong, either residents (R) or non-residents (NR). For example, (P*n*_R) is used for the excerpt belonging to a participant living in the seismic area of Groningen. For participants living in other parts of the Netherlands (P*n*_NR) is used.

Figure 3. The Codebook.



A simplified visualisation of the codebook used to code the interviews.

4. Results

4.1 Environmental justice

The overarching theme of environmental justice is a major topic in the interviews. Themes concerning the subtopics, like distributive justice, procedural justice, recognition justice, and the capabilities approach were frequently discussed during the interviews, by both residents and non-residents. An interesting finding from the interviews, reflecting the relevance of this theme, is that almost all participants talked about problems linked to environmental justice during the first question they were asked about the gas extraction in Groningen. This was a very general and broad question, namely how they would explain the gas extraction to someone who does not know anything about it. Answering this question, most participants immediately talked about the disadvantages and burdens for the people in Groningen, thus mentioning distributive justice problems. Many of the participants answered this question by stating also how the situation was not acknowledged by the government for a long time, mentioning recognition justice issues. Only three participants answered the question not mentioning any burdens for the people in Groningen, but instead naming the advantages in general of the gas extraction. Of these three participants, two of them were non-residents of Groningen, and one was a resident of the seismic area.

Another notable finding was that participants, both residents and non-residents, shared distinct perceptions of justice when the problems started versus how it is nowadays. People were predominantly negative about the environmental justice issues starting from when the first problems occurred in the area until only a few years back, when the problems were acknowledged. People were more positive about how the situation is handled nowadays, but still feel like the local community has been treated unjustly for many years, and that this is still unforgivable. Below, the subthemes of environmental justice will be discussed separately.

4.2 Distributive justice

Topics related to distributive justice were frequently discussed, by both the residents and non-residents of Groningen, and they had mainly negative perspectives about it. People spoke about how money was more important than the well-being of the people living in the area. The contrast was made between government and the gas companies that have made billions of euros from the gas production, being a major source of income for the Dutch state, while no extra money was put back into the region where this gas came from. Also the non-residents in the interviews were aware of this, *"the money made from the gas went mainly to the Randstad*

and not to the North". (P1_NR). From the beginning, Groningen received no compensation, and all the money was put into the western part of the Netherlands. For Groningen, it has always been a battle to receive money from the government to improve their living standards. One example that is given is that Groningen is trying for years to get better infrastructure, to get a better connection to other parts in the Netherlands. Groningen needs larger roads and a faster train connection to the western part of the Netherlands. *"If you look at the infrastructure and the accessibility of the North, it has always been a struggle to get an express train there" (P14_R).* This, however, has always been denied, and still today Groningen is not provided in this. So, from the start of the gas production, no money was spent back into the region where the gas was extracted. Moreover, also the residents were not compensated for the burdens they experienced due to the gas extraction in the area. Especially, when the earthquakes started many people were experiencing heavy burdens, like damages to their houses and psychological distress. However, they did not get any compensation at the time, making the distribution of burdens and benefits very much skewed and creating an atmosphere where people were not treated justly. Like one non-resident explained: *"I think that the Dutch government benefits a lot from gas production but does not compensate to the people who carry the burden." (P1_NR)*.

Some participants spoke in the interview about how Groningen had missed its opportunity to make a deal right from the start. Comparisons were made to other countries, like Saudi Arabia and Dubai, where a deal was made that the earned money was also partly invested locally. Comparisons were also made to Norway and Denmark. There are some gas fields as well, but those countries put up a fund where money is saved to be able to spend in case of emergencies caused by the gas extraction.

> *"Look, Norway also has a lot of natural gas. And other raw materials, but they put a lot of revenues into a large fund and they can continue with that for generations to come. The Netherlands has not been that smart and that is a pity on the one hand, on the other hand, we do have a very strong economy" (P14_R).*

This also shows that people understand that the gas extraction in Groningen strengthened the Dutch economy tremendously. All participants mentioned the improved economy of the Netherlands due to the gas, which is seen as an advantage. However, when asked about the advantages for the residents of Groningen specifically, most people could not think of a straight answer. Most participants said that there are not any advantages for the residents of Groningen. Most residents immediately started talking about the disadvantages and burdens

they experienced. They mentioned the harm it causes them living in damaged houses without receiving compensation for it.

Something else that came up regularly as a burden is relocation and a change in the type of houses people have. Relocation was considered quite a large burden. Many people in Groningen have a house that will be demolished and built new, so they have to leave their house for a while. People are moved into temporary houses, which are sometimes located in very different neighbourhoods. This means that people have to leave their place of residence to move into a completely different environment, often for a couple of years. This is necessary because their own house is demolished and they are getting a new house. However, some people were very unhappy about the new house they got. Some mentioned that the new house will not be the same as they have now, with one participant even stressing that some people will get a completely different type of house.

> *"There are also a lot of people who live in very small detached houses and then they were told that their house had to be rebuilt. But it can't be a detached house. So those people, who used to live in a nice detached house, are now forced to live in corner houses or in a terraced house or something like that." (P3_R).*

This is, of course, causing people to feel unhappy about it, and feeling treated unjustly.

Where most participants could not think of any advantages for the residents of the earthquake area, a couple of participants mentioned that it did create employment for the people in the area. However, the respondents differed in their perspective on the amount of employment that was created. Some people said that the employment opportunities were low, whereas others said it created much employment for people. As one resident described:

> *"I don't think much. They have to go to surrounding places or to the city to work. There used to be a lot of factories here, so there was plenty of work for everyone, but well, that has all gone away over the years" (P8_R).*

Another of the participants emphasised the fact that *"the head office of the NAM is in Assen […] not in Groningen" (P11_R)*, trying to explain that there was a lot of employment in the gas industry, but it was not located in Groningen. The non-residents were more positive about the amount of employment it offered compared to the residents of Groningen. Most non-residents stated that one advantage of the gas production for Groningen is the amount of employment it created in the area. As one non-resident said: *"Well, it has provided jobs, of*

course" (P1_NR). And another non-resident stated: *"People in the area who were involved for employment, they were able to benefit from it" (P13_NR).*

Moreover, one striking finding was that some residents mentioned the compensation regulations as an advantage of the gas extraction in Groningen. By labelling it as an advantage it could be interpreted as being more compensation than necessary. And this is what many people in fact told, both residents and non-residents. The term 'overcompensation' was used quite a lot by the participants in the interviews. Everyone was obviously very glad that finally compensation regulation was introduced and that it has become easier to receive compensation. However, many people think that in some cases too much compensation is being given, which causes feelings of unfairness. Like one participant explained: *"it misses the mark a bit I think. Just like I said, some people get compensation when they don't need it. But there are also people who need to replace the whole house and that still hasn't happened." (P11_R).* This is an account that came up quite a lot in the interviews. People commented that there is a considerable amount of compensation given now, but it is not going to the people who need it the most. Many participants said that residents who have hardly had any damage can easily get compensated, but those with severe damages find themselves in a struggle to get some compensation.

Especially, participants were critical about the immaterial damage compensation. Almost everyone who lives in the earthquake area is entitled to get compensation for immaterial damage. But this, of course, is costly, which can therefore not go to the people that have really severe damages to their house.

> *"When I hear that everyone around me is getting it, while the immaterial damage is really not that bad for them, then I think, well I don't know. […] I think it is more important that people who are really deputies are properly helped. I think that's the most important thing." (P9_R)*.

In Groningen, there are many properties labelled as cultural heritage. These are often very old farms and townhouses. These buildings are not allowed to be demolished, and therefore need reinforcement to the building. But this is often very expensive, so many residents of these kind of properties find themselves in a struggle to get compensation for the reinforcement (Busscher et al., 2020). This is one situation where participants considered there was overcompensation for the people who barely have harm caused by the earthquakes compared to too little compensation for the people who have really severe problems.

Another thing that was mentioned was the abuse of compensation by some people. *"There are a few people who abuse the approach. In other words, reporting damages that are not actually damages" (P7_R).* This participant was referring to material compensation, saying that the compensation regulations are mistreated by people who might report damages that were not caused by the earthquakes. So, people receive money to renovate their houses, while the damage was not caused by earthquakes or subsidence. But people are also talking about the abuse of the immaterial damage compensation regulations.

> *"I do know that such a form is quite easy to fill in and is not really checked, so if someone says that he has a significant trauma from it, well, then for example € 5,000 is immediately transferred […] while those may not have any damage at all, that I think, yes, that is an easy way to get your money." (P12_R).*

These quotes also reflect the feeling of unfairness. People who are being honest about their damages are being treated adversely. This is a recurring topic of conversation when talking about the compensation regulations. One participant stated: *"It's good that they give compensation, but the way in which it is done doesn't always feel quite right, just not as transparent and neat and fair." (P12_R)*. So, this suggests that the compensation regulations are missing their mark, in the sense that residents expressed dissatisfaction about it not always going to the people that need it the most. People seem very happy that there is compensation available right now, but yet, it seems to be not working optimally. Non-residents were not addressing a sense of unfair compensation in this way.

4.3 Procedural justice

Most of the interviewed residents were negative about topics related to procedural justice concerning the gas extraction in Groningen. Most of them mentioned that it felt like they had not been considered in the decision-making about the gas production. Many people commented on how everything is decided in The Hague, which is the political capital of the Netherlands. As one participant stated: *"In any case, they don't feel like they're involved. There is just a very strong feeling that the people in the West decide that the gas has to be extracted here and that we have earthquakes." (P3_R)*. One resident of Groningen responded: *"No, not at all. No, that is a decision that is made in The Hague." (P11_R)*. These statements show that residents of Groningen feel left out of the decision-making process taken by the government.

This can be related to the residents mentioning a strong feeling of resentment against the government and how the state has handled the whole situation. Like one participant said: *"People are automatically a bit pessimistic about all the decisions that are being made now" (P3_R)*. Other participants also declared the feeling of helplessness and unfairness due to the governance response. Often, they were using language that emphasized their dissatisfaction about it. For example, talking about "*the high lords in The Hague" (P10_R)*, or speaking of the politicians "*sitting on their throne in The Hague" (P5_R).* Statements like this show that residents of Groningen are very distant from how the government is handling the situation in Groningen. People are unsatisfied and many lost their trust in the government because of it: "*the trust in politics is just completely and completely gone" (P14_R)*. People are feeling like the government is not treating them fairly and that they are not allowed to have anything to say about the whole situation. Like one participant said: *"You can't do anything about it. If they decide that there in The Hague, then it will just happen." (P10_R).* This shows that the people of Groningen did not feel like they were involved, or even considered, in decision-making processes. As one resident mentioned: *"People just kind of feel like they have to depend on themselves. They'll take care of it all themselves now." (P3_R).*

Another problem that arose linking to the procedural justice is that many rules keep getting changed, creating unfair situations according to the residents of Groningen. As one participant explained: *"Every time you saw politicians looking for ways to spend less money on compensation" (P14_R).* One example that is mentioned is the change of the earthquake contours, so the area where the damage claims will be considered. This kept being changed, because over the years the earthquakes got weaker, and so the impact got smaller. Therefore, the government decided to decrease the earthquake contours, because that way less buildings were eligible for reinforcement, which saved the government millions of euros. Because of the changes in the earthquake contours, various people in Groningen were getting removed from the considered seismic area and therefore were not eligible for compensation. A resident continued to explain: *"That is because over the years the earthquakes became less. So politicians in The Hague said, well, then we can also compensate less damage. Well, then you get that discussion again, and you're a few years down the road" (P14_R)*. Moreover, many investigative committees were called in to find out exactly what the consequences were of the gas production, slowing down the processes. This delays in the whole process, was considered one of the main sources of frustration for the residents of Groningen. Like one participant stated: *"It has been going far too slow. It really has been far too slow. And then I keep asking myself why. And then I only end up with one thing, and that is money" (P9_R)*.

Other participants also spoke about the change in regulations concerning the damage handling, stating that this is unfair to many people. The regulations and amounts of compensation applicable for residents changed over time. Lately, the compensation rules have been more beneficial than a couple of years ago, resulting in differences in the compensation that people received for similar damages depending on when the damage was reported. This is criticized for leading to frustration and feelings of unfairness and jealousy amongst the residents. One participant explained this by saying *"one person receives € 10,000 from the government and the other only receives € 3,000 for the same damage […] it creates a kind of jealousy and the feeling of unfairness." (P3_R)*.

Other changes that were a cause for concern for many people of Groningen relate to the indecisiveness concerning their houses. Some participants mentioned that during many years the institutions kept changing the decision on what should happen to their house. Some residents said that they were told at first that their house would be reinforced, but some years later they were told that it might be demolished, until only many years later a definite decision was made. Many residents who deal with this situation explained they are feeling stuck because they need to do maintenance to the house, but could not pursuit it, because maybe the house might be demolished anyway, in which case they would lose all the money they put into the maintenance of the house. The decision on whether the house will be demolished or reinforced is another issue residents named. They have a feeling like they have no say in it themselves. A couple of participants noted that what they wanted to happen to their house was not listened to at all. Some participants, whose house was decided to be demolished after all, actually preferred having their houses reinforced. However, they were not heard in their opinions and had to comply with having their house demolished and getting a new house in place for it. This also frustrated the residents, because technically it would have been fine to have their houses reinforced instead of demolished, but mainly due to logistical and practical reasons they had to comply with having their houses demolished.

The problems in terms of procedural justice were mainly present at the beginning of the gas production. One participant explained: *"In the beginning the claims were handled by the NAM itself. But they were not at all interested in acknowledging damages. They wanted to spend as little money as possible." (P7_R)*. In the beginning, when it was decided to install compensation regulations, the NAM was responsible for handling the damage claims. This was perceived as very paradoxical, because the NAM itself was responsible for causing the damages in the first place. Therefore, many people thought that the NAM would not be able to do the damage handling objectively. This caused many people to have feelings of distrust in

the NAM and the government, and stressed the unfairness of the process, like *P7(R)* said:

> *"They have known for a long time that with the extraction of the gas there would be a possibility that there could be vibrations. And they deliberately covered that up. And now you just notice that the whole handling of damage and reinforcements and like, that it is very difficult. And that is just not fair."*.

This is also something that non-residents mentioned:

> *"The damage assessment started partly with the NAM, which is the causer of the damage, and with the Dutch government. But, there are just double interests in it, and so people are being led on and sometimes they are rejected while there is obvious damage. […] So I think the claims settlement is not independent and is not objective." (P1_NR).*

Many participants explained that in order to receive compensation, especially in the early stages of this process, people had to fight for it. They had to prove that the damages to their houses were in fact caused by the gas extraction, from the earthquakes or subsidence. This caused people to get very upset, because it was very difficult to prove their right. People were caught up into bureaucracy, making it very hard to file a damage claim. This is also something that non-residents were aware of and criticized. Like one participant stated: *"People had to fight, fight, fight for their rights, and had to prove things that were actually too crazy to be proven, because the damage was obvious." (P2_NR)*.

All of these struggles caused the local people to get up and protest against the government and the gas production companies. Many demonstrations were held, people went to the municipality to raise awareness and torchlight processions were organized. The reason for the protests was the injustice they experienced. Not only the procedural justice lacked, in their opinions, but their testimonies show that also the dimensions of distributive justice and recognition justice were points of concern.

4.4 Recognition justice

Topics that relate to recognition justice were some of the most mentioned during the interviews. Almost all participants, both residents and non-residents of Groningen, said that especially in the early stages when the problems started, they felt like there was no recognition of the residents' values and knowledge. Only one participant, a non-resident, stated that Groningen benefited from the gas extraction from the beginning, saying

"Groningen suddenly became important. Instead of it always being far away." (P6_NR). The participant explained that Groningen became an important area for the Netherlands since the gas was found there. According to this participant Groningen benefited from this because it became more visible and more employment opportunities came into the area. However, all other participants did not seem to agree with the opinion that Groningen benefited from the gas extraction. Like one participant stated: *"Advantages for the people of Groningen themselves from gas extraction? I really wouldn't know." (P3_R)*.

As mentioned above, in the beginning it was difficult for residents to have institutions crediting the damages to their houses to the gas extraction. Gas companies fought hard to not be held responsible, and the government made no effort to recognize the problems that occurred in Groningen due to the gas extraction. One participant stated *"In the 1960s there was a whistleblower who reported to the NAM that there would be earthquakes as a result of gas extraction. But that has been covered up. I think that came out a few years ago that this is what happened." (P7_R).* This does not only show the lack of acknowledgement of the consequences of the gas extraction, but it also shows the political game that was played. This is another issue that was mentioned multiple times. Participants were stating that: *"it's just a big political game" (P4_R)*, in order to continue filling up the state's treasury.

Not only the government and the gas companies denied the problems happening in Groningen, but many participants mentioned that, in the beginning, also Dutch people from outside Groningen did not recognize and understand the problems in Groningen. One participant for example said: *"I have family in Rotterdam, for example, and they were always sceptical in the beginning, they thought of it as nonsense there in Groningen." (P5_R).* The main reason given to explain this perception is how it was represented in the news and by the media. *"And outsiders, so people who are not from the area, they don't understand these kinds of things. They hear about it in the news and on TV, but they don't understand what it's really like." (P7_R).* Residents explained that when you see and hear about it on the news, people don't realise the size of the problem. The earthquakes are not as strong on the scale of Richter as other earthquakes shown in the news that happened in other places in the world. Therefore, people may be led to conclude that it is not as much of an issue in Groningen, also because they may not know that the houses in Groningen were not built earthquake-proof and are therefore quite seriously damaged by the many smaller earthquakes happening there. Non-residents also spoke about the fact that there was no recognition of how the residents were being affected when the problems started to occur. *"At first, the earthquakes were of course largely unrecognized, people thought it wouldn't be too bad." (P1_NR)*.

Moreover, especially due to the lack of recognition from the government, the people from Groningen started to feel like they were facing this battle on their own. This underlined a perception of Groningen versus the West. Many residents mentioned several times a comparison between Groningen and the western part of the Netherlands. Stating, for example, that if this whole situation had happened in the West, it would have been solved immediately, but as it happened in Groningen, nobody cared about it. As a participant stated: *"if this had happened in the West, it would have been solved a long time ago." (P4_R)*. Almost all the residents in the interviews spoke about this feeling, that they expected that if it had happened in the West, it would have been taken care of right in the beginning. This created a feeling of 'us against them' for the Groningen residents. Like one participant said:

> *"And also the division that Groningen residents feel. The people of Groningen feel a bit like it is us against them. […] People get a bit of an aversion to the West and to the government. And I think that is a consequence of gas extraction" (P3_R)*.

Another recurring theme, linked to this one, is the perception of Groningen being 'far away' from the rest of the Netherlands. Both residents and non-residents referred to this in a negative way, stating that Groningen does not feel like a priority for the politicians. One participant explained: *"I think it's outrageous actually. Then you really see that Groningen is a long way away from the rest of the Netherlands, a bit of the drain of the Netherlands." (P8_R).* For this participant, it seemed clear that Groningen does not matter as much as other parts of the Netherlands and that this should not be considered acceptable. Other participants explained that Groningen is a bit the 'win region' of the Netherlands, presenting the word in a negative light. In other words, it is the place where a lot of production takes place, but that does not reflect in putting any money back into that region. One of the non-residents said:

> *"I mean the word 'win region' is maybe not a nice word, but I think that's kind of how it went. I think all of the Netherlands benefited. And in that sense of course the people from Groningen too, they got the gas too. But I don't think they got much in return forit coming from there." (P2_NR).*

The perception that Groningen is considered 'far away' can also understood from the inferior infrastructure in the province compared to other places in the Netherlands, mentioned earlier.

Years went by before people from outside the area started to recognize the problems and understand that the situation was very bad for many residents in that area. Some participants

explained that it was not until people who were not living in Groningen experienced the consequences for themselves, that they started to realise the problems and the situation the residents were in.

> *"Until ministers themselves sit in people's homes on the kitchen table where water drips down their necks. Then they think, oh, there are a lot of cracks in the walls here. It is serious, though. So they had to experience that for themselves." (P4_R).*

So, it was not until quite late in the process that some recognition came for the people in Groningen. After many years of putting up with the consequences of the gas production, like having cracks in the walls due to the earthquakes and subsidence, the local people started to get acknowledgement. However, even if today most residents are satisfied with how the process was concluded, everyone also thinks that it took far too long. And because it took so long before they got some help, most people voiced that the government cannot make it right anymore, no matter what they do, the damage is done. The trust in the government is gone. Like one resident said: *"You're not making it right. You never make it 100% right. It's unforgivable, but they do what they can" (P9_R)*. Another participant also spoke about how the government is now trying to make up for the damage that was done, saying: *"Well, they have to equalize that, but I don't think they will ever get that scale right again." (P10_R)*.

4.5 Capabilities approach

The capabilities approach is quite tightly linked to the recognition justice in this case. Many participants described a negative perspective on topics that reflect the capabilities approach, making connections with the lack of recognition of local values and knowledge by the state and the gas companies. However, also other aspects of environmental justice were cause for the profound impact of the gas mining on the residents of the seismic area in Groningen.

Especially for the people living in the villages that were hit the hardest by the earthquakes, the impact is substantial. For many people it took a toll on their well-being. People experienced many negative emotions, both from the damage and uncertainties the situation brings, as from the reaction of the government and gas companies on the situation. The feeling of uncertainty was one of the most mentioned emotions in the interviews. From the first earthquake onwards, people were feeling insecure about what the course of the earthquakes would be in the future. *"Especially when it was just starting and it was getting a little bit more intense. Then everyone wondered, how long will it go on and how bad will those*

earthquakes become?" (P3_R). People were worried about the progression of the earthquakes, and what it would do to their houses.

> *"Lately it's just been a lot of hits and yes, then you're scared for your house. That you think, how many cracks are there now and what are they going to do about it now? What misery do I encounter this time." (P5_R).*

This feeling of uncertainty creates a considerable amount of stress and anxiety for many people. Stress about the house, the financial side of it, and how it is being handled by the institutions that are involved. People are also worried about the children that live in those houses. Some children are very anxious about the earthquakes and have trouble sleeping. However, when asked whether they experienced feelings of unsafety themselves, all the residents basically responded that they do not feel very unsafe in their house. They do not believe that their house will actually collapse. *"We don't really feel unsafe here at all. […] no, because then we would leave right away." (P7_R).*

People also experience mainly negative emotions about the bureaucracy to report damage claims, unfair damage settlements and the financial side of it, like the devaluation of the house. People are very frustrated about how their situation is dealt with by the government and gas companies and explained that it is very energy- and time-consuming to arrange damage reports. *"My neighbour has now stopped trying to get anything done. […] he's just tired of fighting." (P7_R).*

What was also very frustrating for some residents is that the people who did the investigation and reinforcing to their houses were not at all skilled in this. The residents noted that investigators or builders came to their homes but had no knowledge on the subject. Residents had to explain themselves what had to happen and how that had to be done. *"That's very annoying, because then I think, like yes, those people come to you, then you assume that they know a little bit about it. […] They have no idea what they are doing." (P10_R).*

Another thing that people in Groningen found hard to cope with was that there were many rules that needed to be followed when measuring the damages, which had adverse effects on the residents. One participant explained:

> *"We happened to have a lot of cracks on the first floor on the outside, but yes, such a person is not allowed to go to the first floor. He can't come on the flat roof. So he couldn't see those cracks, so they weren't noted." (P3_R).*

In the beginning, the damages were also calculated very technically. There was no attention for the residents themselves.

> *"So at first they looked at this project in a very technical way, and only later they realised that there are actually people living in those houses. And that you do all kinds of things to those people. So then gradually more attention was paid to the people." (P4_R).*

Numerous calculations were done, and many investigation committees were involved. And the methods kept being changed in order to get the most beneficial outcome economically for the gas companies and the state. But what was not being considered was the fact that this is not only about the houses. It is about the people that live in those houses. This took a while before realised and before the people were acknowledged in this and that the situation was treated more humanely. This is something that also bothered the non-residents that are interviewed. One of them saying: *"I have a very strong feeling of injustice and anger. Because you're just letting those people down. They are not being listened to and are not being helped." (P1_NR)*.

Many of people's frustrations are directed towards the government. People also experience distrust against the government and its decisions. Especially, concerning the closing of the gas production. This is a decision that is officially decided already. However, the people, both residents and non-residents, do not trust the government on its word. They still believe that it will close now but are worried that it will open as soon as more gas is needed again. This distrust partly arose due to the fact that the government decided to produce more gas than legally allowed, even after stating they had decreased the gas production: *"then an earthquake like that happened, and then they are told not to produce as much anymore. And then you hear later that they have even pumped out some extra." (P10_R).* The distrust continues when later, after the gas production had closed, the gas production opened up again for a couple of days because of low temperatures in the winter of 2023. This then emphasized the reason for many people to not trust the government on the closing of the gas station. *"You're always a bit cynical and a bit sceptical about it, because does it really stop?" (P8_R).* Also non-residents realised the injustice that this brings to the people, one participant mentioning: *"I do think that justice has to be done to the people and that promises should be kept." (P13_NR)*.

So, there are numerous things that cause people to experience negative emotions. One common emotion is the feeling of unfairness concerning the damage settlements, like was

written above. Moreover, this has a considerable impact on the social cohesion in the area. Many residents describe how the atmosphere and social cohesion has changed over time due to the problems with the gas extraction and damage settlements. For a long time now, it has been the main topic of conversation in the villages. The residents describe that no matter where you go, everyone will always be talking about the problems that arose due to the earthquakes. The topics are usually about the problems of getting things arranged, and the unfairness of damage settlements between people. People are just very unhappy about it. And it affects the way people interact with each other in the village.

> "*You see that people are arguing with each other, are jealous of each other. One area got something and the other didn't. Also, the new houses have been placed differently on the plot. So, well the whole social cohesion in the village is just completely gone." (P4_R).*

So, not only the people's feelings, but also other aspects of the situation in Groningen causes a change in the social cohesion. Many people were temporarily relocated to another area. This, of course, has an impact on the community. People have different neighbours, kids have to change to different schools, and people are removed from the environment they are familiar with. When people come back to their original place, things are different. People have a different house and, in some cases, even the type of house has changed, or the house has been put differently on the plot than it used to be, causing a great deal of anger and jealousy among residents. Jealousy is a common issue in the villages. The general feeling is that the compensations are not distributed fairly.

> *"It is true that it causes a lot of discord in society. Because there is so much arbitrariness in the reimbursement and rebuilding and repairing and strengthening of homes. Sometimes you have streets where one side of the street is demolished and gets a new house, and the other side of the street is only reinforced, or nothing is done at all. Well, then you've always been good friends with your neighbours across the street and now they look down on you. One gets a nice new house in return, which is of course worth much more later if you would sell it." (P8_R).*

All in all, there are numerous situations that cause people to feel angry and jealous of other residents which, of course, negatively influences social cohesion. This in turn impacts the lives of the people that live in those villages considerably.

Interestingly, the residents of Groningen reported high place attachment. Many residents stated they would not leave Groningen, even if the problems would get worse. Even though there are considerable problems in the area, and they have damage to their houses, people still feel attached to the place. One participant said: *"I'm really attached to my place. I would definitely continue to live here, even if it got worse. Even then, I would stay." (P5_R).* And another participant stated: *"No, despite all the troubles perhaps. No, I wouldn't want to move." (P8_R).* This clearly shows the attachment to the place they live in, even though they experience numerous issues affecting their living environment and well-being.

Another thing that seems to help people to have high place attachment are the activities that are organised in the place. This is part of place dependence. These activities play a role in the social connections people are able to have in a place. Many residents talked about the many activities that are organized in their villages, especially during summertime. The people of Groningen seem to have high social place attachment, they have many social connections close by. Many family members are also living in the same area too. This makes the place attachment for people higher. Only one participant mentioned being dependent on the place financially, because they depend on their job that is in the area. All the other residents mentioned other reasons that explained their place attachment in the interviews, mainly social and environmental reasons. As one resident declared: *"No I'm not going out of the province. I'm not leaving Groningen. […] No, I can't, no, I can't. I'm really too much of a Groninger for that. I was born and raised here, so no I'm not leaving here." (P9_R)*.

The non-residents that were interviewed all mentioned to rather not live in the earthquake area of Groningen. But almost all of them mentioned that they would not like to live in Groningen anyway. Because of the location and the environment there. On the question whether or not they would like to live in the earthquake area, they mentioned other aspects of Groningen than the earthquakes to explain why they would not like to live there. Two of the non-residents continued by saying that if they did have to live in the earthquake area, they would not mind it, as long as they were living in an earthquake proof house: *"Look, I personally wouldn't like living in Groningen because for me it is too rural. But if I were to live in the earthquake area at all, I would want to live in an earthquake resistant house." (P2_NR)*.

Besides, almost all non-residents mentioned Groningen as a deprived area in their perspective and that it is not a place they would like to live in. One participant explained: *"I would not want to live in the areas where unemployment is very high and there is a lot of poverty." (P1_NR).* Another participant also explained that: *"From the West, Groningen was*

often perceived as a bit backward and a bit stupid." (P2_NR). A third person went on to explain that: *"people who live in the West think Groningen is very far away. That it is the 'far north'." (P6_NR).* This might explain why the problems in Groningen had been ignored for a long time before they were taken seriously. People from the West might not feel as much connected to Groningen. Which shows again the feeling people experience of Groningen versus the West, which was mentioned earlier.

In the next section, the changes over time in Groningen are described.

4.6 Changes in environmental justice in Groningen

Written above are mainly the negative perspectives on the environmental justice issues. The negative feelings prevail when speaking about the situation in Groningen. People generally feel like they were not taken seriously for a very long time and this set some bad blood. However, lately people are more positive about the aspects concerning environmental justice in Groningen. Even though everyone noted that it is long overdue, nowadays they generally do feel like they are getting recognition, are being heard and receive enough compensation. Therefore, many of the participants are quite content when discussing the current situation. They are happy that it gets the attention it needs right now.

The participants spoke about the turning point when suddenly ministers, Prime Minister Rutte, and even the king came to the earthquake area and saw with their own eyes what problems were going on in Groningen.

> *"Prime Minister Rutte had also been here a few months ago. He spent the night in one of the temporary homes. So, in itself, I do notice that politicians want to show a bit of involvement and want to hear the people of Groningen" (P3_R).*

The residents noticed a change since politicians started to get more involved. They noticed that there are now more people working on the damage settlements, which makes the process go much faster than before. Moreover, they feel like other people, so people outside of Groningen, start to realise the real problems in Groningen too now. *"This is kind of a feeling that we have won now. Finally Groningen is also on the map, and a lot of things are happening here too" (P5_R).* That people are more aware of what is happening in Groningen also shows in the interviews with the non-residents. All the people that were interviewed, who do not live in Groningen themselves, were aware of the problems in Groningen that were caused by the earthquakes. Besides, they described feeling negative emotions concerning the

situation in Groningen. These are signs that at the moment there is less recognition injustice for Groningen.

Furthermore, the compensation regulations help to get better distributive justice. However, for the residents themselves, it feels like this would not be able to accomplish complete justification, since so much has happened in the past in which they were treated unjustly. Like one participant explained: *"Now they see that it's wrong, so now they listen. But I think they should have listened much earlier. But for now, they're handling it well. But whether that is in proportion to what has happened, I don't know." (P9_R).* The fact that the government reacted far too late is a topic that kept coming back in all the interviews. However, some participants also defended the point of view of the government and mentioned they understood why certain decisions were made. Especially, people considered justified the decision to start the gas production after it was discovered. *"It was absolutely justifiable that the decision was made to switch from coal to natural gas. And that, in addition to a much better living environment, has also brought the Netherlands a lot of money." (P14_R).* Almost all participants also explained that when the gas production started, people were not aware of the harm it would cause. Another resident also explained that it is understandable that the government cannot just stop the gas production right away, since it has certain budget plans and the gas production created billions of euros to fund these. However, even though some participants considered understandable some of the decisions the government took, the feeling that the government failed in this situation prevailed.

Furthermore, people were somewhat divided on whether or not the closure of the gas production was the right decision. Generally, people are content with the decision made and especially most of the residents are pleased about it, however not everyone thought this was the best decision. One resident was very clear about thinking it was not the best option, stating:

> *"I think it's a bit of the easy way out. I am not in favour of it. […] I think there is still enough in it to supply Europe with gas for another 30 years or so. There is so much money in there." (P11_R).*

Also one non-resident doubted whether it is the best decision:

> *"You have to make sure that the people who live there are compensated, and that those houses are modified. And, I think you have to let the residents benefit from the profits that it generates. But to turn off that gas tap now and thereby stop the state's gigantic income, I wonder if that's the right way to go." (P1_NR).*

Some people also explained that they are worried about where else the gas supply will need to come from, especially with the war between Russia and Ukraine. One of the residents said: *"And now you have to have it delivered from Russia. So then I think, yes, why would you buy your gas there in Russia, when you just have it here in the North. If you organize that well and make everything construction-proof, it will also be much cheaper. And then you also help the world a little." (P11_R).* And another resident explained: *"As a result, we may become more dependent on other countries" (P12_R)*. These findings show that there is some doubt on whether it was the best decision to close the gas station in order to solve the problems occurring in Groningen. Most residents seemed happy about the decision, but some people were critical of the decision, stating there would have been other options that would have suited the situation.

The results of this study are further discussed below in the discussion section.

5. Discussion

This study aimed to analyse how people perceive environmental justice issues in the seismic area of Groningen and what its social impact is on the residents of the area. To study this, two groups were included in this study, consisting of residents and non-residents of the seismic area of Groningen. For this research, two research questions were formulated. The first being: "What is the perceived environmental justice in Groningen concerning the gas extraction from people living in the seismic area and people living outside of Groningen?". And the second research question was: "What is the social impact of the gas extraction for the local community and to what extent does place attachment play a role in this?". In order to effectively guide this study towards answering the research questions, three research goals were established to include additional specificity.

The findings show a comprehensive overview of the perceptions of environmental justice in the seismic area of Groningen, both from residents and non-residents. Besides, it gives a clear picture of the social impact the gas extraction has had on the people living there. To answer the first research question: "What is the perceived environmental justice in Groningen concerning the gas extraction from people living in the seismic area and people living outside of Groningen?", there are multiple reasons to believe that in the case of Groningen there is environmental injustice perceived by both groups. There are clear examples of distributive injustice, procedural injustice, recognition injustice, and problems concerning the capabilities approach.

Distributive injustice seems widely present in the seismic area of Groningen. Mainly the damages to the houses as well as the psychological damages people experience are burdens for the residents of the earthquake area. However, even though distributive justice is the starting point of environmental justice, environmental justice cannot be thoroughly understood without the other relevant dimensions of it (Mitchell, 2018). This is also clearly visible in the interviews, even though more distributive justice is created by compensation regulations, it can still feel like injustice when there is not enough attention for the other dimensions, like procedural justice, recognition justice and capabilities. Although residents are being compensated now, they still feel like they are being treated unjustly. People still feel like the residents are mistreated and they do not think that the government can make this right by providing compensation only. This shows that just 'paying off' the burdens of the community does not solve the environmental injustice. This is different from how environmental justice issues were addressed years ago, when an improved distribution of environmental quality was thought to be achieved once there was an increased distribution of

wealth (Freeman, 1972). This study thus contributes to stressing the relevance of the broader concept of environmental justice, which also includes other relevant aspects to achieve a sense of environmental justice.

Procedural justice in the situation of the gas extraction in Groningen is questionable. It has not been a very inclusive decision-making process. Residents felt like they had not been involved in the decision-making processes, and also non-residents stated it was not an inclusive process. Interestingly, the government did try to set up institutions in order to make the decision-making more inclusive. They installed institutions like the Dialogue Table and the NCG, that involved input from local communities and the societal movement committee GBB (Bakema et al., 2018). However, the decision-making in these forums was still dominated by the people with the most political power, and so local communities did not have enough power to influence the decision-making (Bakema et al., 2018). So, in practice, the attempted inclusivity in the decision-making processes did not work. Therefore, residents of Groningen felt like they were not involved. Interestingly, in the interviews no one mentioned the attempted involvement of local committees. On the other hand, almost all participants stated that the residents of Groningen were not at all involved in the decision-making about their living environment. In fact, many residents claimed that the government consistently ignored the opinions of the residents, causing people to feel resentment against the governmental institutions. Residents repeatedly spoke about the feeling of 'us against them', referring to the feeling that the government is not protecting their safety and well-being.

The feeling of being ignored was a frequent recurring topic in the interviews, relating to recognition injustice. Both residents and non-residents explained that it took years before the problems in Groningen were taken seriously. Already in 1993, the connection between the gas extraction and the earthquakes was made. However, only in 2012 it became urgent and people realised that it is a threat for the people's safety and well-being (Vedder, 2019). This shows that even though the consequences were clear, the residents were not taken seriously. The gas production was prioritized over the well-being of the residents of Groningen. This caused great anger and distrust among the population, especially the residents, but also the non-residents expressed their anger about this. Residents especially mentioned how they felt neglected at the beginning, when the problems started to occur. They stated that nobody understood their situation. They explained that the media played a role in creating a negative image of Groningen. The media presented the earthquakes in a way that it seemed very small, not considering the fact that houses were not build earthquake proof in this region. Therefore, people not living there did not understand the intensity of the problems. However, it did give

Groningen a bad reputation because of the earthquakes happening there. Companies did not want to invest there anymore, and people did not want to buy a house there, causing the house prices to drop (Sluiter et al., 2018). Even though, the residents mainly discussed the negative role the media played in the situation, it also had a positive influence later, creating recognition for the problems. After the earthquake of 2012 the media created attention for the situation in Groningen, having a positive effect (Mulder & Perey, 2018). So, even though the problems still continued and people continued being very unsatisfied with how the government was handling the situation, there was more recognition concerning the situation and the residents. In April 2024, it was decided to close the gas tap immediately, with great political support, namely 146 out of the 150 members of the parliament were in favour of this law (Slomp, 2024). So, finally, the local people were acknowledged in their problems, and their problems were prioritized over the profit that was being made from the gas production.

Although, more recognition was given to the problems caused by the gas extraction, it seems like Groningen has not yet recovered from a negative image. The non-residents in this study talked about how they perceive Groningen as a deprived area, stating it as poor and not as developed as other parts of the Netherlands, confirming the findings of Sluiter et al. (2018) that the negative image of an area might have long-lasting effects. The community was already underprivileged, with not having very strong connections to the wealthier part of the Netherlands, but now it has even less capabilities for creating good life opportunities.

As described above, both residents and non-residents expressed problems with issues concerning environmental justice. This answers the first research goal which focussed on the perspectives of both the residents and non-residents concerning environmental justice issues related to the gas extraction in Groningen. Both groups expressed similar concerns on all dimensions of environmental justice. Apart from more detailed and particularized accounts from residents, there was not a substantial difference noticed between the two groups in terms of the topics and opinions expressed.

Furthermore, the second research question will be discussed, which was formulated as: “What is the social impact of the gas extraction for the local community and to what extent does place attachment play a role in this?”. This will be discussed describing the second and third research goal. The second research goal focussed on whether place attachment can be understood as a buffer and whether it can be seen as part of the capabilities dimension. Place attachment is in some way linked to environmental justice. The combination of place attachment and threats to that place, like environmental degradation, can be understood as environmental injustice. But, although the places of the residents are threatened, their place

attachment seems very high. The findings of this study are in line with the findings of Van der Kloet et al. (2024), people want to stay in their houses even if it has severe damage to it. Van der Kloet et al. (2024) described that people become more aware of their attachment to their houses because of the earthquakes and damages. This is one of the reasons why they want to stay in their houses, despite the risks. It seems like there is a form of risk normalisation happening in Groningen. People do not mind living there despite the risks they face. The high place attachment can be a way to cope with the situation and deal with the environmental injustices they have faced. This would be in line with the findings of Parreira and Mouro (2023), who found that higher place attachment leads to active coping mechanisms. The place attachment seems to work as a sort of a buffer to cope with the negative emotions they experience (Luís et al., 2018). The connection they feel to their place makes it better to handle the stress and frustration they experience on a daily basis. Parreira and Mouro (2023) also found in their study that less trust in the authorities responsible for solving the problems leads to better coping mechanisms. This could also be the case in Groningen, because all the residents expressed feelings of distrust in the involved authorities.

Even though residents expressed high levels of place attachment, residents also described many negative emotions as a result of the situation they live in. These negative feelings harmed local people's well-being. People felt stressed, anxious, angry, and powerless and its impacting in their daily lives. This is in line with the findings of Van der Voort and Vanclay in 2015. Almost ten years later, local people are still reporting many similar concerns, like feelings of anger, and distrust and also worried about the damages in their houses and the devaluation of their properties.

Apart from the negative emotions the situation evokes in people, the problems also effect the community. Some residents described how the social cohesion has changed. Especially, unfairness within the damage settlements is given as a reason for changes in the social cohesion, causing jealousy and rivalry between neighbours. This finding contributes to the existing data on this, since there were contradicting findings on how social cohesion is affected by gas extraction and earthquakes. Some studies presented data that experiencing collective problems can enhance the social cohesion (Busscher et al.,2020; Ferwerda, 2019). Nonetheless, Busscher et al. (2020) also found that the problems in Groningen could be a risk to the social cohesion. Other findings also suggested that changes in the living environment can harm the social cohesion (Holsappel et al., 2017). The results of this study seems to be in line with these latter findings, that the problems are harming the social cohesion in Groningen.

Currently, there are many developments taking place concerning the situation in Groningen. For example, the better accessibility to compensation, including psychological compensation, and the permanent closure of the gas production. People talked about being happy about all these developments and the attention and urgency that is being given to the situation in Groningen. However, not all problems causing negative social impact are solved with the current developments. These findings address the third research goal, focussing on a difference in social impact over time, specifically on whether the permanent closure of the gas station has changed the social impact. The residents expressed many issues concerning the social impact due to the gas extraction. They described how it has affected their well-being for a long time, especially from the pivotal moment in 2012 and onwards. Moreover, even after the permanent closure of the gas station, residents expressed still a negative social impact. This is mainly focussed on the perception of unfair damage settlements, affecting the social cohesion in the community and creating jealousy and anger among the residents. The study of Batel (2020) showed that local residents perceive the impact of energy innovations as more negative when problems occur concerning people's health, property devaluation and environmental issues. Also when problems with procedural and distributive justice are perceived, people tend to be more negative about the impact of the energy innovation in their environment. The examples mentioned by Batel (2020) all occurred in the situation in Groningen, and can also help explain the negative perception of residents of Groningen on the entire situation.

Moreover, also non-residents were expressing many negative emotions about the situation in Groningen, mainly feeling angry about how the government is dealing with the situation and about how the residents are treated. All non-residents described that they thought the residents must be feeling stressed and feel unsafe in their homes. Interestingly, the residents all stated to not feel unsafe at all in their homes. This is something that is also different from previous research. Research by Van der Voort and Vanclay (2015) and Postmes et al. (2017) found that people feel insecure and unsafe in their homes and are scared that their house might collapse. Results from this study show completely different findings, since no resident stated to feel unsafe in, or wishing to leave, their homes.

In sum, this study has a couple of implications. Firstly, by comparing the two different groups in this study, residents and non-residents, this study can help distinguish differences in perceptions and opinions towards the environmental justice issues and social impact of it. This study contributed to previous research by providing data on how direct exposure to seismic activity affects the perspectives and opinions of people on the situation compared to

people who are not directly exposed to the problems in the area. For example, this study showed that it not only affects the local community, but also outsiders are concerned about the issues linked to environmental injustice in a specific area. The participants in this study who were living outside of the seismic area were very much aware of the situation happening in Groningen and also expressed negative emotions concerning that, like anger and frustration. These results can help stress the importance of achieving environmental justice by involving also non-residents, since not only local communities are troubled by environmental injustice practices, but it also affects the rest of the population as well. Since this study showed that people living outside of the seismic area were still very aware of the situation and problems in Groningen and were also emotionally involved, it highlights the sense of national solidarity and support for affected regions, also showing in the support from the House of Representatives. This can be used in other cases of environmental injustice around the world to invent more unified response strategies.

Besides, by addressing place attachment in this study, it provided insights into how people feel connected to their place, even when a place is in a state of degradation. It showed that people seem to be having certain coping mechanisms to cope with the risks they encounter. These results can help create more effective community support programs in order to increase people's well-being.

5.1 Limitations and Future Research

Despite the implications and contribution of the findings in this study, there are some limitations to discuss. First of all, during the interview period, some important decisions were made by the government concerning the gas production in Groningen. For example, in the midst of the interviewing process, it was decided to immediately close the gas production permanently. This might have influenced some people's perspectives and may have created differences between the interviews that were held before this decision was taken versus after this decision. Furthermore, even though data saturation was reached in this study, generalization to the population must be handled with caution due to a relatively small sample. This study showed that the perceived environmental injustice issues have a large impact on the people living in the seismic area. People experienced many psychological problems and it is still interfering with their well-being. Therefore, future research could focus on developing effective community support programs, in order to help people cope with the negative emotions the situation has evoked and act as a protective factor for their well-being.

Furthermore, this study started including perceptions and opinions of non-residents on the problems occurring in the seismic area of Groningen. The findings of this study suggest that non-residents feel solidarity with the residents of the seismic area. Further research could elaborate on these findings in order to find out what makes people outside the area to feel involved and to feel solidarity with the local community. Findings like this can help other cases of environmental injustice to raise awareness among the population and to help find effective solutions for the problems that are broadly supported by the population. With more public support for the situation, politicians and policymakers are more likely to make drastic decisions to solve the problems (Burstein, 2003).

In the next section, a short conclusion of this study is written.

6. Conclusion

To conclude, this study provided some new insights concerning the issues in the seismic area of Groningen, interviewing both residents and non-residents of the area. People from the Netherlands, both residents and non-residents, hold the view that there are problems concerning issues linked to environmental justice in Groningen. Topics concerning distributive injustice, procedural injustice, recognition injustice and the capabilities were mentioned as problematic in the seismic area of Groningen. Moreover, the problems in Groningen impact the lives of the people living in the area, interfering with their well-being and causing psychological harm. Nonetheless, the residents of the seismic area still seem to have high place attachment, and do not want to move, despite the problems and risks they are facing. Moreover, the non-residents in the interviews were very much aware of the situation in Groningen, and seemed to be involved with the problems that are occurring there. This shows a form of solidarity among the population for the disadvantaged community. All in all, the findings in this study show what topics are sensitive among the people and what consequences the gas extraction has had on the residents in the area. Further research can focus on creating more practical implications in order to come up with solutions for the problems and help develop social support programmes to increase the residents' well-being.

7. References

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8. Annex 1: Interview Guideline

Introductory questions:

First I will pose some questions to learn a bit more about you and your relationship with this place:

What is your age?

What is your gender?

What is your level of education?

What do you do for a living?

What is your hometown?

Were you born and/or raised in this area?

How long have you lived in this place?

Do you own a house in this area?

Do you work in this area? Is your work in any way related to gas extraction or the gas field?

How do you feel about this place?

Which locations do you usually visit? Which locations would you recommend to visitors? And which locations do you avoid?

Do you believe this place provides good living conditions? At the social level (e.g. housing, employment)? At the environmental level (e.g. access to natural areas, state/quality of environment)?

Has your relationship with this place changed over time? In what ways? Would you like or prefer to live in another place in the Netherlands?

Can you tell me about important people for you in this area (e.g. family/ friends/ neighbours).

How do you think other people feel about this place? What do they think about it?

Questions on gas extraction in Groningen:

Now I am going to ask you some questions more specifically about the gas extraction in Groningen, to get to know your perspective and opinions on this issue:

What can you tell me about gas extraction in Groningen? If you had to tell someone unfamiliar with this topic about gas extraction in Groningen, what would you say?

When and how did it start, from what you can recall? What were the main events from then until today?

What do you think has changed since the gas production started?

Do you think Groningen's community way of living has changed? In what ways?

What do you personally think about gas extraction in Groningen?

Tell me about what you think are the benefits of this extraction in general.

Tell me about the costs/ burdens in general.

What do you think have been the benefits for the Groningen community? Social impacts/ economic impacts/ environmental impacts.

What has been the burden for the Groningen community?

Are there changes in the environment (e.g. pollution) or in the landscape? Are there natural places that also became affected, and therefore avoided? And has there been reparation for that?

Can you tell me about the earthquakes happening in Groningen?

Can you tell me about the governance response to the earthquakes?

- Was the response adequate in your opinion? Can you explain?

Can you tell me about the damage assessment in Groningen?

How do you feel the national government is handling it?

How do you feel the provincial government is handling it?

Has the community been involved in the decisions taken regarding the gas extraction? In what ways? Should it have been different?

Has the community tried to share their perspectives on this topic? Can you give examples?

Do you think the opinions of the community were considered?

Why were people from Groningen not heard in the first place?

Could or should people from Groningen have done anything else to deal with this situation?

Do you believe Groningen has been compensated by the Dutch government for the gas extraction? If yes, in what ways? Was this sufficient?

Has gas extraction in Groningen provided you with anything (e.g. employment)?

For people who do not live in the earthquake area: Would you mind living in the earthquake area yourself? Can you explain why?

Can you tell me how the situation in Groningen makes you feel?

Can you indicate on a scale of 0 to 10 how safe you feel in your living area? Can you explain this?

- Has your home suffered damage from an earthquake?

What do you think about the decision to stop the gas production? How will it affect the Groningen community?

What is your opinion on the transition to cleaner energy, like wind and solar energy?

Recently the gas tap was opened again for a few days because of low temperatures. What do you think about this?

In October 2024, the gas tap will be closed permanently. How do you feel about this?

Is there anything that needs to change in your opinion?

I don't have more questions to ask you, but I would like to know if there is anything else you want to say or discuss that we haven't touched upon yet?