Stakeholder engagement in sustainable development: A social network analysis of the gas phase-out in Twekkelerveld, Enschede, The Netherlands

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University of Twente
Mart Morskieft
S1495518

Supervisor: Dr. F.A. Metz
Co-supervisor: Dr. G. Özerol

Acknowledgement

Before you lies the thesis ‘Stakeholder engagement in sustainable developement: a social network analysis of the gas phase-out in Twekkelerveld, Enschede, The Netherlands ’. For this thesis, the network of stakeholders is analyzed in the neighborhood Twekkelerveld in Enschede. It was written in the context of the Master program ‘Environmental & Energy Management’ (MEEM) at the University of Twente between April 2021 and August 2021.

The research process was a complex journey from start to finish and after using both quantitative and qualitative methods, an answer could be formulated to the main research question. During the research, I enjoyed the contact with participants from different organizations. With the COVID-19 measures, these meetings were a nice change of view compared to the online lectures of the previous months.

I would like to thank my supervisors, dr. Florence Metz and dr. Gül Özerol, for their continued support throughout the thesis writing. I enjoyed the meetings we had and gained many insights that helped me complete the work. I would also like to thank my respondents for this thesis, as without them I would not have been able to do research.

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I hope you enjoy reading.

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Abstract

Through the overall sense that climate change needs to be dealt with, the Paris Agreement and the Dutch Climate Accord have set certain goals to limit the emissions of CO2. To fulfill these goals, the Netherlands wants to phase-out natural gas for the purpose of heating buildings. The national government has opted for a local-level appraoch, putting municipalities in charge of planning and implementing the phase-out of gas. So far, few studies have looked into the participatory decision-making processes of these local-level gas phase-out projects. This study aims to analyze the relationships among stakeholders and their ability to contribute to the decision-making process.

The data is gathered through stakeholder interviews and a survey. Stakeholders were identified using snowball sampling, leading to seven participants for interviews. Afterthat they were categorized into a power-interest matrix and their relationship was analyzed using social network analysis.

Stakeholders involved are the government, knowledge institutes, housing corporations, energy grid operators, societal organizations, and citizens. Key stakeholders are those that are part of the structural meetings regarding the gas phase-out in the neighborhood, which are the municipality, housing corporations, and the citizens. Stakeholders shape their ability to contribute by distinguishing in hard power to influence and having many connections to other stakeholders outside of their category (i.e., soft power).

Content

Acronym list

PAW – Programma Aardgasvrije Wijken
RES – Regional Energy Strategy
NIMBY – Not In My Back Yard
SWT – Strength of Weak Ties
SH – Structural Holes
SNA – Social Network Analysis
NMO – Nature and Environment Overijssel
EZK – Ministry of Economic Affairs and Climate
RVO – Rijksdienst Voor Ondernemend Nederland
IPCC – Intergovernmental Panel on Climate Change

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1. Introduction

At the time of writing, the sense of climate change and its consequences are becoming more and more a priority for governments around the world. Although there have been energy transitions in the past, the current shift towards more sustainable resources is different because of the diversity of drivers leading it. Past transitions were almost exclusively driven by new energy sources to exploit with little consideration for the environment or the social impacts it might have. Moreover, these transitions were mostly organized in a top-down manner with centralized energy systems controlled by a few corporate actors (Lennon et al., 2019). In the Netherlands, the government plans to implement an energy phase out of natural gas. Years of gas extraction in the North of the country have led to a degradation of the ground which can no longer be ignored. The Paris Agreement of 2015 and the Dutch Climate Accord of 2019 have stipulated goals in order to reduce the CO2 emissions of countries. The latter states that by 2030, the emission of greenhouse gasses needs to be halved and by 2050 the total energy consumption needs to be generated by renewable sources.

The 'Programma Aardgasvrije Wijken' (programme on natural gas free neighborhoods, PAW) was implemented in 2018 in order to start the process of the gas phase out before 2050. The first pilot projects started in 27 neighborhoods of different cities in the country. In 2020, 19 more neighborhoods were added. These pilot projects have the aim to gather knowledge and experience with other methods and sources for heating with different housing types in collaboration with stakeholders. Moreover, these projects will hopefully improve the resilience of these neighborhoods in terms of climate change and climate adaptation. Eventually, a total of 7 million homes and 1 million buildings need to be free of natural gas use by 2050. (PAW, 2021a)

Municipalities play an important role in this gas phase-out. The approach that is taken by the national government is to work on a neighborhood basis. As such, planning and implementation take place on a local level. Municipalities decide which neighborhood will be first to undergo the transition and which ones follow. In order to do this, the Regional Energy Strategy (RES) contains a transition vision for heating. The RES is the strategy to guide the country towards more sustainable energy sources and to reach the goals set out by the Paris Agreement of 2015 and the Dutch Climate Accord of 2019 (RES, 2021). The Netherlands is divided into 30 regions that will each produce a plan on how and where renewable energy generation can take place. The municipalities of each region will state which energy sources they will use for heating.

The city of Enschede is the largest city in the Twente region, which is also one of the RES regions. In the neighborhood Twekkelerveld, a project has been set in motion and over the years, the neighborhood will undergo a transformation. Now, the important task for policymakers of the municipalities is to develop and implement a plan that includes the necessary and important stakeholders. The inclusion of stakeholders is an important pillar in the entire energy transition and in the RES. Participation in local government has often been spoken of as a way to enhance the communication between the government and citizens. It can build more trust and it can lead to more support for local government goals (Berner et al., 2011). However, research also shows that increased input can have negative outcomes such as an increased workload for local government staff in terms of paperwork, increased level of public scrutiny, negative media coverage and increased levels of distrust towards the government (Berner et al, 2011). Participation is a complex puzzle with different stakeholders that have different opinions and influence. Therefore, this research aims to get closer to an understanding of stakeholder involvement in local gas transition projects by taking Twekkelerveld as a case study.

1.1 Research objective and research questions

The main question is '*How do interactions among stakeholders shape their ability to contribute to the decision-making process in the phase-out of natural gas?*'. Answering this question requires analyzing the stakeholders and their relationship to the decision-making process. For this purpose, the following four sub-questions are formulated-

(a) What is the participation process in the heating transition?
(b) Which stakeholders are involved in Enschede?
(c) What is the relationship between the involved stakeholders?
(d) Which stakeholders are crucial to involve and why?

The research objective for this study is to analyze the interactions between stakeholders within the setting of the Twekkelerveld project. This is done by first identifying all relevant stakeholders. What follows is categorizing them, and thereafter, investigating the ties between stakeholders to draw conclusions about their ability to contribute to the decision-making process. The scientific relevance of this research is that it adds to the literature on stakeholder engagement and analysis in sustainable transitions in the setting of local governance. Existing

literature seems to be thin on the phasing-out of gas as a focal point, as this is a relatively new phenomenon and the program in the Netherlands was recently set up. The social relevance of this study is that it adds understanding and knowledge of stakeholders within the gas phase-out in the neighborhood context. The road to the complete gas phase-out is long and many projects alike are currently being set up in the Netherlands. The conclusions of this thesis might be able to better guide policy- and decision-making in future projects.

2. Context and Case

In this chapter, the context of participation of the gas phase-out in the Netherlands is explained. Thereafter, the case and the specific path of the gas phase-out of the case is presented.

2.1 Context: Participation in the heating transition in the Netherlands

The phase-out of gas is a challenging aspect of the larger energy strategy and some like to call it 'the greatest infrastructural challenge since the rebuilding of the country after the Second World War' (Lachmeijer, 2018). To successfully implement the planned changes and to fulfill this large challenge, it is important to create a solid support base among stakeholders so that they feel involved in the decision-making process. It is up to the region to fulfil the participation process. Here it is important to look at the best 'fit' in terms of participation processes to include not only citizens, but also societal organizations and businesses. The national program sketches two pathways to take; the indirect and direct route.

The indirect process encompasses the inclusion of representatives of the people (elected officials). It is then up to them to shape the way in which they want to be involved in the entire process. In order for them to make a somewhat informed choice, a spectrum was developed (figure 1). The horizontal axis represents in what sense, individual or together, representatives want to be included in the entire RES process. The vertical axis indicates where in the process representatives want to be included, ranging from the entire process to only the formal decision-making of the RES 1.0. One of the first steps could be to make an inventory of the representatives in terms of positioning on the spectrum. This can be done by city council, provincial government, or general meetings of the water boards (Democratie in actie, n.d.). In the execution of the participation plan, representatives of the people can take on a framing role, where they voice their ideas on the plans in terms of delineating processes, determining scale and selecting stakeholders to be involved. Another role they can take on in the execution is focused on actually representing the people. By listening to different societal organizations, citizens, and businesses they can shape the participation plans.

The direct route of participation that the RES sets out focuses on the involvement of citizens, societal organizations and businesses. The first step is then to determine which actors need to be involved and why, in order to define the way of participation. Are actors involved to increase

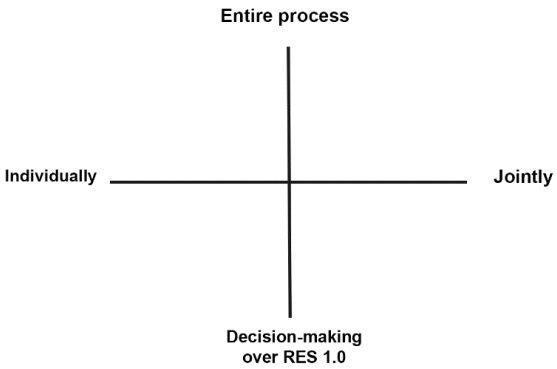

Figure 1. Spectrum of involvement (adapted from Democratie in actie, n.d.)

acceptance? Are they involved to increase the knowledge and improve the quality of the RES? Different choices lead to different participation plans. Therefore, the setting of clear goals and targets is adamant in the successful deployment of the right assets, on the correct scale, with the proper target groups.

These goals are based around four themes; acceptance, quality of decision-making, support base, and ownership. For the first theme, acceptance, the emphasis is on informing and communication of the 'why' and 'how' of the RES. The ideal scale-level for this is municipal in order to reach citizens and local businesses. This goal becomes especially prominent if the energy transition is still a vague concept among the actors in the region.

The second goal, quality of decision-making, both in terms of the content of the RES and the decision-making process, puts the emphasis more on the inclusion of knowledge. In practice, this means including different knowledge institutes and other organized groups in order to gain experience and to come to solutions.

To get more support for the choices made in the RES, communication and co-production (in terms of knowledge sharing) are important. Having the support of directly involved organizations does not mean support among citizens. So, it is important, depending on the ambitions set out in the RES, that citizens get the opportunity to voice their concerns and opinions.

Ownership is another important aspect of participation in the RES. The idea here is that when citizens and other organized actors actively build towards the energy transition together, they are more supportive of the RES. They can initiate projects and become co-owners of energy generation facilities so that the benefits also flow towards them.

The PAW handles the gas phase-out for the built environment. The point of departure within this context is to come to an implementation plan to be used by network companies, energy providers, housing corporations, citizens organizations, energy cooperatives, and building and installation companies (PAW, 2021b). Five points play a central role in the participation on the neighborhood level. The first one is to design the process in cooperation with the stakeholders. It is important to set clear boundaries in terms of the possibilities to participate. The second

point is to give everyone an opportunity to participate. This reaches farther than just organizing meetings. One has to think about more ways to reach people by using, for example, existing social structures. Here it is also important to keep the different cultural backgrounds in mind that exist within a neighborhood. The third stipulates that everyone should be heard. Lowering communication barriers can help here by implementing clear contact points for citizens and organizations to reach. Building a good knowledge base is the fourth point, and the final point mentions supporting actors in the steps that need to be taken in order to transition away from gas (PAW, 2021b).

2.2 Case: Participation in the Neighborhood Twekkelerveld

In Twente, thus far only one project has been granted a subsidy of the PAW and is part of the national program. However, this does not mean that there is no activity regarding the gas phase-out in other municipalities. The choice for a part of the neighborhood Twekkelerveld in Enschede as study object has several reasons. Firstly, the neighborhood lies in close proximity to the University of Twente, making it an ideal case for practical reasons. Secondly, the project deviates from other gas phase out projects in terms of scale. The average project consists of roughly 500 houses that will participate (Gemeente Enschede, 2020), whereas the project in Twekkelerveld consists of 1200 houses. Furthermore, the types of houses in the neighborhood are diverse and the share of house ownership is roughly evenly divided between private owners and housing corporations. All these aspects make Twekkelerveld an interesting research object to dive deeper into stakeholder settings.

A project for the sustainable energy generation under the name ‘Enschede Wekt Op’ (Enschede generates) has been active since 2016. The municipality first applied for the national subsidy for the gas phase-out in Twekkelerveld in 2018. The process for the pilot in Twekkelerveld was and is supposed to serve as both a starting point for the rest of the city, and as a learning experience for the municipality and stakeholders involved. This decision was taken at the time, without the proper support from those stakeholders that would effectively feel the most of the coming transformation in the neighborhood, namely, the inhabitants. So, what actually happened is that the public was informed of the situation and the process and what steps were to be taken in the future, but without actually consulting inhabitants. Next to the lessons learned from the challenges with the need of proper support from citizens, Twekkelerveld was not

selected to be part of the first 27 pilot neighborhoods (Gemeente Enschede, 2020). The Ministry of Interior Affairs did not substantiate reasons why the subsidy was denied apart from mentioning that the subsidy budget of 85 million euros for a maximum of 20 neighborhoods was heavily oversubscribed (Borgerink, 2018).

In 2020, the pilot project of the gas phase-out in Twekkelerveld re-started. In July of 2020 at a public information event organized by the municipality, it became clear that the setup of the project did not benefit stakeholders. Or, more specifically, it did not seem to benefit the inhabitants of the neighborhood.

At this point, an external project manager had been brought in to facilitate the participation and communication of the stakeholders. In Enschede, the way that the municipality communicates and organizes participation is written in their Communication Vision 2020. In this document, the municipality acknowledges that communication is not just informing, but also listening and giving attention. The vision is translated to four topics; optimal information provision and service, dialogue and participation, be good and tell it, winning on the outside is to begin on the inside (Communicatievisie, 2020).

Providing the right information is important in communicating with citizens, organizations, and businesses. It stands at the basis of the ambitions of the municipality. In terms of participation, the municipality aims at open and transparent contact with inhabitants and other parties. The vision states that working on district level or neighborhood level helps to find connection to society and makes the municipality more approachable. 'Be good and tell it', is essentially showing what the municipality does. This part seems to be more focused on attracting talent and investments to the city. The last point in the vision is about the internal communication of the municipal organization. A lack of internal agreement and communication has implications for the 'outside', meaning the inhabitants, organizations, and businesses.

For the heating transition this means that citizens were included early on in the process. Kennispunt Twente, a regional knowledge institute, set out a survey in September 2020 to probe the opinions of inhabitants about the phase-out of gas. Next to this, information meetings were held where inhabitants could ask questions regarding the plans for the future. The heating transition vision of the city is set to be decided upon by the city council around the end of the summer in 2021. Beforehand, the public can deliver input.

Also, a new request towards the national program was submitted in 2020. The subsidy from the second round was not awarded, but plans were made to reflect on the standing of the project as it was at that moment and to look forward. Participation became a keyword in the project. ‘
At the time of writing, the project is still in its start-up phase. Currently, Enschede is focusing more on creating the proper support base among citizens and stakeholders and doing new research that explores the possibilities of phasing out gas. They have employed an external project manager that leads the team and takes care of the communication and participation between the involved parties. Together with these stakeholders, the plan is to build towards a new plan and possibly to enter in the third round of subsidy grants from the national program.

3. Theoretical Background

In this chapter, several theoretical perspectives are showcased that relate to participation models, stakeholder analysis models and network theory. Participation is an integral part of sustainable planning these days, backed by international agreements and institutions. It increases legitimacy and transparency of policies made and could result in a higher change of policy adoption. To properly guide the participation process for decision-making it is important to have an overview of the different stakeholders in a particular setting and their relationships. Network theory explains that these stakeholders can have different kinds of relations between each other, which tells something about the state of the network and the actors that operate within it.

3.1 Perspectives on participation

Participation refers to the overall inclusion of citizens and groups in the planning and decision-making process. A term that is often used in participatory research is 'stakeholder', which can be an individual, a group or organization affected by a proposed plan or project, or who can affect a project and the implementation of it (Lindenau & Böhler-Baedeker, 2014). Stakeholders can be groups with economic interests such as shop owners or local industry, but also groups representing public interests such as environmental or resident associations. Public involvement refers to the engagement of citizens specifically in the planning and decision-making process. While stakeholders often represent groups of a collective interest, citizens are individuals who do not necessarily share a collective interest or opinion. However, in the theoretical and practical distinctions are some blurred lines, as 'citizens can also be considered a large stakeholder group; citizens can belong to various sub-groups of stakeholders; and a stakeholder representative is at the same also a citizen.' (Lindenau & Böhler-Baedeker, 2014, p.348). So, participation in this research means stakeholder participation, which includes citizens.

Participation is encouraged by several international agreements. The 1998 Aarhus Convention, for example, says that citizens have the right to participate in a range of decisions where there may be an environmental impact. The convention goes on to state that non-governmental organizations can play a special role to promote involvement. Principle 10 of the Rio

Declaration on Environment and Development makes the assertion that ‘environmental issues are best handled with the participation of all concerned citizens’ (United Nations, 1992, p.2).

Participation in local government can take on several forms. One of the earliest models of participation has been developed by Arnstein (1969), who defines it by putting modes of participation on figurative steps of a ladder. The bottom of the ladder represents non-participation, the middle represents tokenism, where stakeholders are informed and consulted. And the top steps represent full and active involvement of stakeholders. Over the years, the ladder from Arnstein has been met with criticism. Carpentier (2016) mentions that Arnstein's ladder creates the illusion that participation can be categorized as easy cut-off points. ‘Even when several steps are distinguished, these discrete models still suggest fairly crude categorizations (e.g., power versus tokenism and non-participation) which do not always rest well with the complexities of participatory processes (Carpentier, 2016, p.76).
Thomas (1995) developed a ladder model from an administrative perspective. He describes five decision-making approaches that administrators can take. ‘At one extreme the public administrator makes autonomous decisions, without public involvement, and at the other extreme the public administrator makes the decision after full and broad consultation with the public’ (Callahan, 2007, p.1184).

The debate surrounding participation in the energy transition is very polarized. On one hand, there are groups that actively oppose the implementation of, for example, wind turbines. These ‘Not In My Backyard’ (NIMBY) groups and other action committees have shaped the debate over the years while hampering the transformation that is sometimes needed. On the other hand, researchers and politicians have described the successes of participation and civic engagement in favor of the transformation as constructive and oriented towards the common good (Radtke et al., 2020). Renn and Schweizer (2020) note that a major transition (such as the energy transition) cannot succeed without the support of major stakeholders in society. They focus on the deliberative perspective as a success factor for designing energy policy. ‘Since these issues can vary greatly, depending on the context and the history of the debate, a good understanding of all the circumstances (…) is a fundamental requirement in any effective involvement program.’ (Renn & Schweizer, 2020, p.63)

Fisher et al. (2020) view participation in energy transitions through the lens of stakeholder collaboration and state that ‘the inclusion of a broad and diverse range of stakeholders,

including citizens, is a key element of collaborative governance, and is especially significant in the success of these processes.' (Fisher et al., 2020, p.3).

Gustafsson et al. (2015) look at the energy planning in Swedish municipalities and add to this that participation is a way to enhance learning. The idea is that 'a collective process creates relationships, insight, coordinated action, and social change through learning (Gustafsson et al., 2015, p.4). The Swedish municipalities rely on stakeholders in the preparation of energy strategies to make up for the fact that they do not have much power over the local energy system. The same can be said for the municipality of Enschede, as it needs other stakeholders to come to sound energy strategies that have a higher chance of being implemented. 'Stakeholder participation will then be a means of identifying wider public concerns, sharing experiences and knowledge, and developing mutual knowledge about share problems and complex processes.' (Gustafsson et al., 2015, p. 5). As a side effect, these processes could influence stakeholders' ability to participate in a meaningful way and strengthen their willingness to participate in future energy practices.

Policy makers who want to implement and regulate sustainable development and the energy transition need to consider the trade-offs of choosing objectives to obtain and stakeholders to include. Different stakeholders may also have a multitude of - sometimes divergent - opinions on how the energy transition should be shaped. The task of these policy makers is then to incorporate these opinions into the implementation of the energy transition.

3.2 Perspectives on stakeholder analysis

Stakeholder analysis plays an important part in the development of sustainable energy policy. It is a popular approach to better understand the relationships and interests of the parties that are involved in decision-making. Some examples include understanding conflicts of interest to minimize them, increase quality of likelihood of policy implementation, understanding power dynamics to ensure fair representation, and assess feasibility of future policy options. But what is a stakeholder analysis? Who are relevant stakeholder categories? The section below shines a light on stakeholder analysis in the scientific community, by introducing some literature streams and introducing a typology to be further used for this research.

Throughout the years, several scholars have thought about stakeholder analysis in their work. A simple google search will lead down a path with many different meanings, mostly related to

conducting business and making investments. Freeman (1984) defines stakeholders as 'those who affect or are affected by a decision or action'. In project management, stakeholders are defined as 'individuals and organizations that are actively involved in the project or whose interest may be affected as a result of project execution or project completion' (Aaltonen, 2011, p.166). Stakeholders can be further divided into groups. One of the most commonly used divisions is to refer to internal stakeholders and external stakeholders. Internal stakeholders are those that are a formal member of the project and usually support the project. Moreover, they are often referred to as primary stakeholders and have a formal, official, or contractual relationship with an organization (Aaltonen, 2011). External stakeholders are not formal members of the project group but might be affected by or affect the project. They are sometimes referred to as secondary stakeholders and have no formal or contractual relationship with the project or organization. For this research, stakeholders will be defined as individuals or organizations that are connected through information exchange in the project.

Stakeholder analysis can basically be defined as generating information on the relevant actors. Gupta (1995, p.6) says that a stakeholder analysis is to 'identify and specify the stakeholders and their interests, domain and specificity; identify and describe the power relations between stakeholders and the firm, and among the stakeholders; incorporate the concepts of action and time'. Grimble and Wellard (1997, p.175) defined stakeholder analysis as 'a holistic approach or procedure for gaining an understanding of a system by means of identifying the key actors or stakeholders and assessing their respective interests in the system'. According to Reed et al. (2009) the process of stakeholder analysis is one that defines certain aspects of a social and natural phenomenon affected by a decision or action. Furthermore, it identifies individuals, groups of individuals or organizations who are affected by or can affect those parts of the phenomenon and it prioritizes these individuals and groups for involvement in the decision-making process.

Yang (2014) proposes two perspectives for stakeholder analysis; empiricism and rationalism. Empiricism states that knowledge can only be gained, if at all, through experience (i.e., experiences from a small 'core' group of stakeholders). 'This model assumes that the core stakeholders have exhaustive information about stakeholder expectations and the decision-makers are then able to make optimal decisions' (Yang, 2014, p.2). The advantages of the empirical school of thinking are: '(1) as long as core stakeholders meet, decisions can be made in a relatively short time; (2) for most conventional projects, core stakeholders can make wise

decisions based on their experiences.' (Yang, 2014, p.3). However, others think that this perspective of stakeholder analysis is too narrow. Crane and Livesey (2003) argue that the core group of stakeholders does not operate in a total vacuum but has its own set of independent stakeholders. Although the core group can have extensive experience in the field, it is still difficult to draw boundaries and identify the set of stakeholders simply through experience. Furthermore, a realistic stakeholder analysis can only be realized by adopting a perspective that recognizes the interplay within the communication process.

Compared to the empirical perspective, the rational perspective dictates that knowledge is gained independently of experience. It justifies the results by engaging almost all stakeholders. This is done by drawing three circles of stakeholders. The inner circle contains the stakeholders that the project team knows well, the second circle represents stakeholders that the project team is only familiar with, but the first circle does know. The third circle represents those stakeholders unfamiliar by the project team but known by the second and first circles. This concept can be used to identify stakeholders and is known as snowball sampling. 'As long as a complete picture of stakeholders' interrelationship is obtained, analysis can be conducted on which stakeholders or categories of stakeholders play more central roles and which are more peripheral by dissecting the structure of the relationship network.' (Yang, 2014, p.4). By dissecting the power structure, a better understanding can be developed on how stakeholders can influence the system and active changes in other stakeholders' opinions. This perspective also knows some weaknesses. The data collection for a robust analysis can be quite time consuming. Also, ethical issues could arise as stakeholders might not be willing to provide data because of privacy concerns.

For this research, the rational perspective of stakeholder analysis by Yang (2014) is taken and not only the core group, but almost all stakeholders are included to interpret the power structure.

3.2.1 Power and Interest

Stakeholders often organize themselves in groups to influence policy making and to have an impact on what happens in their environment. Having the power to influence is important for true participation to take place according to Arnstein (1969). Radaelli (1999) discusses how uncertainty and a lack of transparency in decision-making processes can provide opportunities for actors (such as representatives of research or those with administrative expertise) to rise to power over the 'logic' or mode of decision-making. For example, the transparency of decision-

making processes can become compromised by intense negotiations by different actors, acting to defend their policy arenas, or acting strategically to form networks and coalitions to increase their bargaining power (Juntti et al., 2009).

'Balancing stakeholder interests is a process of assessing, weighing and addressing the competing claims of those who have a stake in the actions of the organization.' (Reynolds et al., 2006, p.286). Ogden and Watson (1999) found in their research involving the British water supply industry, that expenses related to improving the customer service were negatively associated with the current profits, but positively correlated with shareholder returns, suggesting that this balancing act worked out for all the stakeholders involved.

Eden and Ackermann (1998) introduced a two-dimensional matrix and has been used in various research on renewable energy and energy planning (Guðlaugsson et al., 2020). A typical example of such a matrix can be seen in figure 2. This can lead to an overview of how stakeholders might be engaged.

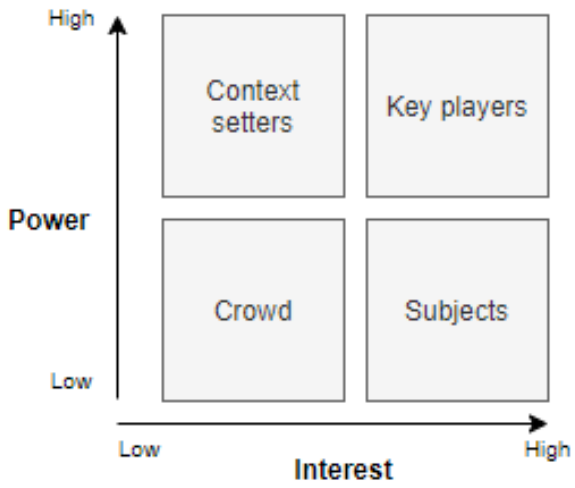

Figure 2. Example of power-interest matrix

Key players are those stakeholders that have a high influence and a high interest. Context setters are those stakeholders that have a relatively low interest but can have a high level of influence. The subjects are stakeholders that have a high interest in the matter at hand but have little power to influence processes. This could change if subjects form groups in order to increase their power. The crowd stakeholders have low power and low interest, so there is no immediate need to consider them in detail.

3.3 Perspectives on network theory

Over the years, network thinking has made its way into the social sciences where researchers have been interested in the spread of new ideas or behavior through social and communication networks (Oh & Monge, 2016). There are different types used in the scientific community. Two of the better-known theories are the strength of weak ties theory by Granovetter (1973) and the structural holes theory by Burt (1992).

The strength of weak ties (SWT) theory is organized as a set of premises and conclusions. The stronger the tie between two people, the more likely their social worlds will overlap (Borgatti & Halgin, 2011, p.1170). So, if A and B have a strong tie, and if B and C have a strong tie, the conclusion is then that there is a higher chance that there is at least a weak tie between A and C. This so-called transitivity is explained by Granovetter (1973) as the underlying causes of tie formation.
The second premise in the SWT theory is that bridging ties can be a source for new ideas. A bridging tie is a tie that links a person to someone that is not connected to any of his or her friends. The bridging tie can then introduce new information and other ideas to the person that do not already circulate in the 'bubble' of current friends. By combining the two premises, it can be concluded that weak ties have a higher chance of implementing new ideas and that strong ties are unlikely to bring in new information. Granovetter applies this in real life explanations of how people tend to hear about or get jobs through their acquaintances rather than their close friends. The theory can also be applied at the group level. Here, the argument is that communities with many strong ties have bubbles of strong cohesion and collaboration but the overall network cohesion is weak, whereas communities with many weak ties do not have strong local cohesion, but do have strong overall cohesion in the network.

The theory of structural holes (SH) by Burt (1992) is another well-known theory and it is concerned with ego networks, meaning the 'cloud of nodes surrounding a given node, along with all the ties among them' (Borgatti & Halgin, 2011, p.1171). To illustrate, figure 3 gives an overview of the ego network of node A and node B. In the figure, node A is more likely to come about with new information in comparison to node B's ego network based on the logic of strong and weak ties. As a result, node A might be able to perform better in any given setting. Moreover, since B's contacts are all connected with each other, the chance that B receives more

of the same information in comparison to A is higher. This can affect the performance of both nodes as A might be better informed and could be seen as the generator of new ideas.

The difference between the two theories is explained along various dimensions. Kilduff (2010) argues that Granovetter envisions a world in which people incidentally make connections, where Burt's theory poses a more strategic and instrumental view. Furthermore, Granovetter argues that the strength of a tie determines whether it is a bridge or not, but Burt sees the tie strength as a correlate of the underlying principle, which is redundancy (1992, p. 27). 'Thus, the difference is between preferring the distal cause (strength of ties), as Granovetter does, and the proximate cause (bridging ties), as Burt does.' (Borgatti & Halgin, 2011, p.1172).

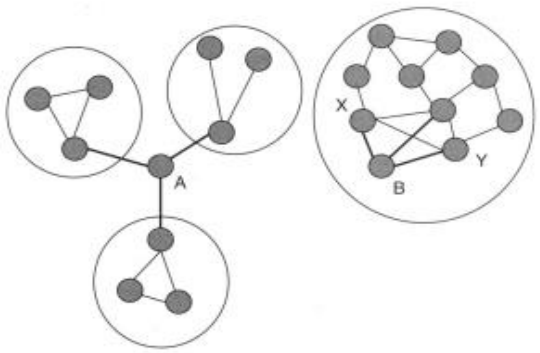

Figure 3. Ego network of node A and node B

3.3.1 Social capital

The ideas from Granovetter (1973) and Burt (1992) in a policy context leads to a discussion on social capital, or the value of the relationships, which influences how stakeholders participate and contribute to the decision-making process. Social capital has several definitions. Adler and Kwon (2002) define it as 'the goodwill available to individuals or groups. Its source lies in the structure and content of the actor's social relations. Its effects flow from the information, influence and solidarity it makes available to the actor' (p.23). Dekker and Uslaner (2001) define social capital as the value of social networks, bonding similar people and bridging between diverse people, with norms of reciprocity (Claridge, 2004). 'When people get together, they can do more than lone individuals can.' (Dekker & Uslaner, 2001, Abstract) In the scientific community, the distinction is often made between bonding social capital and bridging social capital. 'However, different forms of social capital may influence performance in different ways, with potential tradeoffs.' (Hamilton & Lubell, 2019, p.309). Bridging social

capital is the ability of stakeholders to get access to resources from other stakeholder groups. Broad and diverse relationships – indicating bridging social capital – have been associated with innovation as they provide stakeholders with new information and resources. 'Relationships associated with bridging social capital may be 'weak' in the sense that they do not require frequent interaction or substantial resource commitment from either party.' (Hamilton & Lubell, 2019, p.311). Overlapping relationships between stakeholders – indicating bonding social capital – help stakeholders engage in relationships that require trust. These 'strong' relationships are furthermore established by repeated interaction. 'Social capital is therefore important for understanding both the structure of networks, as well as their function'. (Hamilton & Lubell, 2019, p.309)

3.4 Hypotheses

The power-interest matrix gives an opportunity to further dive into the typology as presented above. The different actor groups represented in the typology (i.e., key players, context setters, crowd, and subjects) and how they operate is important to understand further relational ties and their social capital. It is expected that the stakeholders within the category groups have a relatively strong relationship among them and that they work together in trusting partnerships. This idea is represented in the following hypothesis:

> H1: Within the stakeholder groups there is high bonding social capital. (i.e., key players, context setters, crowd, subjects)

Key players are those stakeholders that have high power and high interest in the matter at hand. In the case of Twekkelerveld, these are likely to be policy makers, as within the political/social arena 'policy makers are the institutional stakeholders who put in place the rules, regulations, laws, and public policies that determine acceptable player behavior.' (Cummings & Doh, 2000, p.88). While high bonding social capital is expected within groups, between groups is the expectation that there is little interaction, following SWT theory. Establishing bridging social capital can have several benefits. It can increase the gathering of information, it can increase the ability to gain access to power, it can lead to better placement in the network and improve recognition of new opportunities (Adler & Kwon, 2002). Following Cummings and Doh

(2000), it is likely that the key players in the Twekkelerveld project determine the level of social capital and the ties between the groups. The second hypothesis follows as:

H2: Across groups, there is only bridging social capital if the key players establish it.

The next chapter discusses the methods that were employed for this study. Moreover, how to identify actors, the operationalization, data gathering, and data analysis are discussed.

4. Methodology

In this chapter, the steps that were taken in the research are discussed in the research design. Thereafter, the research methods and data collection of this research is explained, which presents how stakeholders are identified. And after that, how the stakeholders were differentiated and categorized. Finally, the method for measuring the relationships between stakeholders is explained. At the end of this chapter, the data analysis is presented.

4.1 Research design

To answer the research questions in this study, a research design needs to be made that describes the relevant steps taken.

A schematic overview of the steps taken in this case study can be seen in figure 4. The first step is connected to data gathering, the second step includes both data gathering and data analysis. The analysis of the data happens in the last part of the second step. The third step involves the outcomes. This schematic is adapted from the work of Reed et al. (2009) on doing a stakeholder analysis. The focus of this study is the neighborhood of Twekkelerveld in Enschede. The boundaries are then set in correspondence with the setting of the project (e.g., stakeholders involved in the project, inhabitants of the neighborhood etc.).

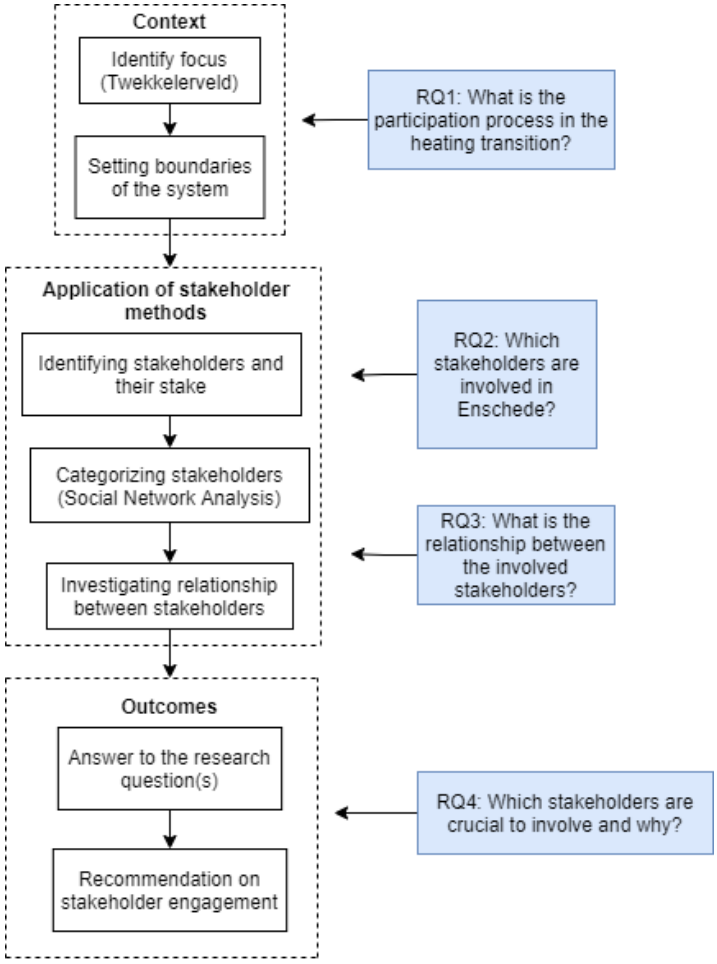

Figure 4. Research design

According to Borgatti and Halgin (2011) and Yang (2014), the definition of the network and its boundaries is an important first step in performing the analysis. But how does one make a selection? There is a concern that the wrong nodes may be chosen, or that nodes might be

excluded that should in fact be part of the analysis or include nodes that should be omitted. However, the choice of nodes should relate to the research question. It is important to differentiate between the types and not to mix them. For example, an organization is not the same as a committee, where several organizations are members of.

There are two fundamental types of network designs: whole network and personal network. In a personal network design, in the set of nodes focusses on and their ties to others, only the ties between the focal nodes and others are measured and not the ties among the 'other' nodes. This means that there are limited options to measure the network in terms of centrality. On the other hand, data-gathering is not as difficult and resource consuming.

A whole network can be seen as a set of ties among all the pairs of nodes in a given context. An example of this is looking at friendships among all members of an organization. The benefit of this design is that the researcher can make use of the full set of network measures (centrality measures). The downside is that the data-gathering can be quite time consuming and costly. Defining a whole network can be quite straightforward if you take the previous example of friendship in an organization. But where does it end? It is important to state the criteria for the boundary of the network. Possible criteria to consider can be looking at a specific group, a specific location, in a certain period of time, membership of an organization, or participation in a certain process.

The network for this study is based on the whole network as described above. Through the identification of stakeholders (snowball sampling), the network will expand with the stakeholders in the network. So, the nodes in the network will represent the stakeholders in the network. Moreover, the stakeholders are represented in the form of organizations; government, (local), housing corporations, knowledge institutions, and citizens organized in a platform. The relationships are defined as 'collaboration'. This is because the aim of the participation in both the RES and, eventually, the PAW, is for stakeholders to collaborate in order to come to decisions.

4.2 Research methods and data collection

Multiple research methods were used to set a first set of stakeholders to include in the survey, identify the stakeholders, categorize them and to find the (strength of their).

To identify the first set of stakeholders a preliminary document research is used. These were documents publicly available on the municipality website from council meetings, such as notes on the heating transition. (e.g., project manager for Twekkelerveld, possibly policy advisors responsible for energy transition topics within the municipality, other stakeholders that are identified). For the theoretical background of this thesis, scientific articles about participation, participation in local governments, stakeholder analysis, and policy making in energy transition projects were consulted.

In order to identify the stakeholders, a number of methods can be used as can be read in the theory chapter. According to Reed et al. (2009, p.1937), 'identifying stakeholders is usually an iterative process, during which additional stakeholders are added as the analysis continues, for example, using expert opinion, focus groups, semi structured interviews, snowball sampling, or a combination of these.' In this research, a combination of quantitative and qualitative methods was used to increase the reliability. As a quantitative method a survey was used and as a qualitative method semi-structured stakeholder interviews were used. To ensure that the survey was filled in by participants, they were asked to fill the survey out before the start of the interview. Next to making sure that participants filled out the survey, this also had the added benefit of participants being able to clarify some of the choices made in the survey for context.

The data is collected with a snowball sampling, which started with two employees from the municipality of Enschede. They were interviewed in order to gain knowledge about the project in general, but also to identify the stakeholders that these experts deem to be important to the process, starting a snowball process. 'As snowball sampling can be considered as a suitable technique to identify the widest range of actual and potential stakeholders' it was used in this study (Eskafi et al., 2019, p.221). The first interview took place with a neighborhood director responsible for the Northern district of Enschede. To start the snowball rolling, questions were asked about further contacts to participate in this study. The process of collecting data is slower, but it gives a good overview of the relational data. This research will include those stakeholders

that are interested but not involved or that should be involved according to stakeholders by asking key individuals for further referencing to other stakeholders.

Next to the data needed for the identification of stakeholders, the data was needed to differentiate and categorize them. To categorize the stakeholders, a power-interest matrix can be used. So, information is needed on the power and interest of stakeholders. This data was also collected with semi-structured interviews and a survey.

Identifying the stakeholders and categorizing them are important steps towards an understanding of the network of stakeholders. An understanding of the relationships between the stakeholders can further clarify the impact and importance of stakeholders or groups of stakeholders. The method chosen for this research is the so-called Social Network Analysis (SNA). SNA makes use of data matrices and data is usually gathered through interviews, questionnaires, or observations. SNA seems to be a good option as it not only captures the relationship, but also the strength of those relationships. 'Analysis of these matrices uncovers the structure of the stakeholder network, thus identifying which stakeholders are more central; which are marginal; and how stakeholders cluster together'. (Reed et al., 2009, p.1939).
SNA is linked to the rational perspective of stakeholder analysis. This network is defined as 'a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved.' (Mitchell, 1969, p.34). Furthermore, SNA could bring a better multilevel understanding of participatory structures and how these networks function. 'It can help researchers identify opportunities for the creation of social capital (bonding, bridging, and bracing) over a number of policy scales (…) This information can then be used to help community groups understand where opportunities lie for stronger, more productive means of multilevel collaboration.' (Holman, 2008, p.529). For the SNA, data about the relationships, collaborations and the strength of these collaborations was needed. This data was also collected with the survey and in the interviews.

4.2.1 Survey and interviews

To conduct the case study 7 semi-structured stakeholder interviews and 7 surveys were performed. The sampling of the research population which includes the respondent number (which correspond to the interview and survey number), organization name and the date of the interviews can be found in the table below.

Table 1. Interviewed participants

Respondent number	Organization	Function	Date of interview
1	Municipality	Neighborhood director Twekkelerveld	26-05-2021
2	Municipality	Project Leader	07-06-2021
3	Domijn	Project developer	15-06-2021
4	Ons Huis	Project developer	17-06-2021
5	De Woonplaats	Project developer	23-06-2021
6	Bewoners Platform Twekkelerveld (BEPT)	Manager	15-07-2021
7	Ennatuurlijk	Key Account Manager	20-07-2021

The survey consisted of four main questions. In the first question, the stakeholder was asked to indicate the interest that they have in the project. For this study, interest is defined as 'interests and concerns from the perspective of the organization in relation to the problem that is covered by the project'. Stakeholders could then check a box in an interactive document. The choices were based on a five-point Likert scale starting from the left, which indicated no interest whatsoever, and option located most right being highly interested.

In the second question, stakeholders had to indicate all other stakeholders that are involved in Twekkelerveld. During initial testing of the survey with one of the participants of this study, it became apparent that some of the concepts were not adequately explained and vague. In order to narrow down on essential stakeholders and to specify what was meant with 'involved' the definition became 'present during project meetings regarding Twekkelerveld aardgasvrij or influence one of the present parties during the project meetings'. On one hand, this definition introduced a description of the concept, and on the other hand it narrowed down the number of stakeholders included in the network, as the project is still in its development phase. If any stakeholders were missing on the list they could be added.

The third section handled the collaboration between stakeholders. As the project was in the beginning phase, the definition of collaboration was 'information exchange'. As it was expected not much other collaboration occurred between stakeholders involved in the project. Next to the indication of collaboration, participants were asked to indicate with whom they collaborated at least once a week. The reason for this is to be able to determine close collaborations and to determine possible important stakeholders in the project. By asking stakeholders with whom they collaborate, bridgers and bonders can be identified.
The fourth and final section of the survey contained the question about important stakeholders in the project. Importance here was defined as 'having influence on the decision-making process'. Participants were asked to indicate the importance of stakeholders on a five-point Likert scale to find out the level of importance. The scale ranged from 0 to 4, where 0 indicated no importance and 4 indicated highly important.

A full overview of the survey can be found in Appendix A. The survey was written in Dutch to accommodate the participants. The survey took a maximum of 10 minutes to fill to further limit barriers.

The semi-structured stakeholder interviews data was collected to provide context to the social network analysis data and find the more in-depth reasons behind the answers on the questions of the survey. So, the interview protocol followed the structure of questions as the survey and had a duration between 30 to 60 minutes. These interviews were also performed in Dutch to accommodate the participants and prevent a language barrier. The interview protocol can be found in Appendix B.

4.3 Data analysis

Identifying stakeholders is based on data from the interviews and survey. All parties who are named in the survey or interviews are identified. After that, the identified stakeholders were categorized according to the matrix groups. Key players are 1, context setters 2, subjects 3, and crowd 4. This is attribute data used for the network analysis.

Reputational data is gathered to operationalize the power dimension. To measure the interest dimension, a frequency count is used from the survey. The position of the stakeholders is

determined by the number that was given on a scale ranging from 1, no power/interest at all, up to 5, which is very interested/powerful. Since multiple stakeholders responded and gave different power-levels to others, the mean power-level was used.

The data analysis uses degree centrality, betweenness centrality and density measures.
In the star network (Figure 5), actor A has lots of opportunities to get resources. So, the more ties an actor has, the more power they have. Degree centrality measures thus the number of degrees an actor has. High in-degree indicates that the stakeholder is being contacted by others, and high out-degree means that the stakeholder is reaching out to others.

In betweenness centrality, actor A has a better position because it lies between other pairs of actors. For this thesis, Freeman degree and betweenness centrality is used. The density measures are used to measure the network data for the hypotheses.

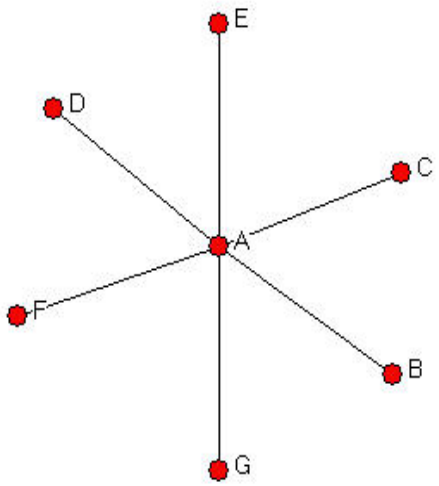

Figure 5. Star network

For the hypotheses, it is necessary to specify what is meant with bonding and bridging social capital. Social capital can be operationalized as collaboration; or in this case, information exchange. For H1, bonding social capital explains that there are only ties within groups. This is operationalized by looking at the density of ties within and across groups. Density is usually defined as the sum of the values of all ties divided by the number of possible ties.

Figure 6 below acts as a visual representation of the hypothesis.

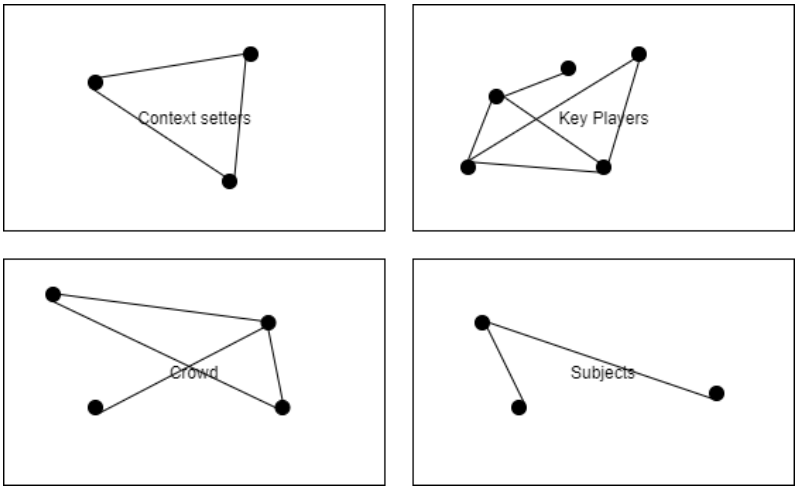

Figure 6. Visualization of H1

To test H2, bridging social capital is used by looking at information exchange. However, since key players' interactions with other groups are measured, a different coding is needed. 1 through 3 represent the context setters, subjects, and crowd. Numbers 4 through 9 are the individual key players. This time degree centrality measure is used to look at the exchange *between* the stakeholder groups. Key players match the hypothesis if they have a high mean degree centrality (density) towards more than one group. Figure 7 shows a visualization.

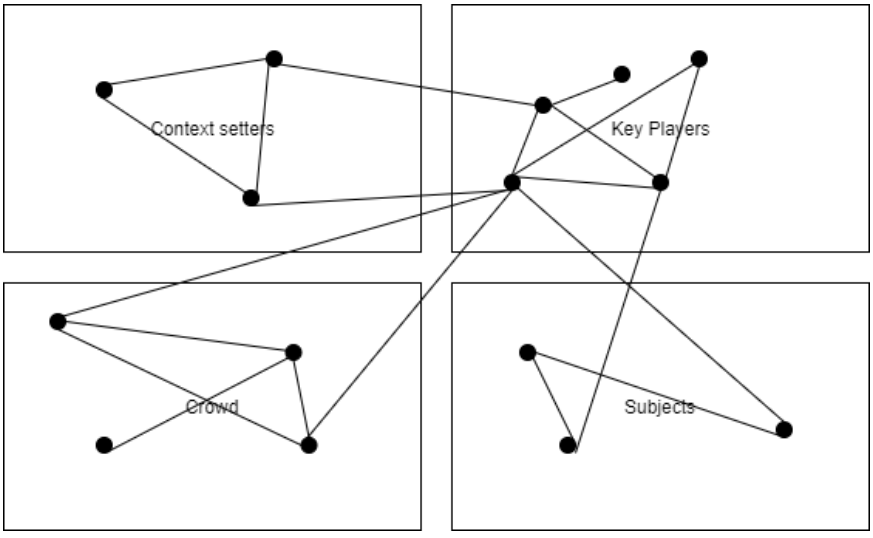

Figure 7. Visualization of H2

To determine what a 'crucial' stakeholder is, the SNA is used. The meaning of 'crucial' in this research is 'stakeholder(s) that has the most ties, or highest degree centrality scores, with other stakeholders' as it is likely that this stakeholder or group of stakeholders can influence decision-making the most.

To perform the SNA, the data is put in data processing software to interpret the results. For the data on stakeholders, Excel is used for storage. To process the relational data, SNA software UCINET version 6.730 is used.
Several methods in this research ensure the validity of the data. Firstly, the survey is based on another study (Metz & Ingold, 2014). Using 'proven methods' should increase the validity of the results. Secondly, the data gathering process was standardized by including semi-structured interviews, hoping to get reliable results. Furthermore, participants were given the same information before the start of an interview.

4.4 Ethics statement

To maintain scientific integrity and to comply with the principles of the privacy regulation, the ethics of doing research need to be discussed with regards to data management. Before starting, the research was submitted to the ethics committee of the University of Twente to test whether certain conditions were met. The data that was collected through interviews was handled in a manner that is on par with the standards. Meaning, before the start of the interview, permission was asked if the interview can be recorded. This was for the purpose of transcribing the conversation for analysis to come to results, and to prove that the data is not fabricated or falsified in the process. It is unlikely that vulnerable interviewees were interviewed in this study. The data that was collected was not stored on online databases, as these might be compromised. Finally, personally identifiable data of persons that participated in this research were anonymized in order to comply with General Data Protection Regulation.

5. Results

In this chapter the results of the data collection and analysis are presented. Firstly, the stakeholders that are involved in the Twekkelerveld project are identified and described. After that, the relationships between the stakeholders are explored, with the use of the power-interest matrix, the density and centrality.

5.1 Stakeholders of heating transition in Enschede

This section presents the different types of stakeholders that are involved in the project. A top-down approach will be taken here, beginning with the government (national to regional). Then moving on to knowledge institutes, housing corporations, societal organizations, and, finally, citizen groups.

5.1.1 Government

Depending on the stakeholder, the national government with their national program PAW is part of the project in Twekkelerveld. Strictly looking at the phase of the project 2021, the national government has no influence on the project in Twekkelerveld (Interviewee 3). A one-sided relationship exists between the citizens' platform and the national program PAW in the form of information exchange. If the project gets the subsidy, it is possible for the national government to become more directly involved in terms of financial support. But for now, the PAW mostly serves as a knowledge platform.

From the local perspective, the municipality of Enschede is involved as a governmental actor. The roles they currently have in the project is to facilitate the information exchange between stakeholders, making plans for the neighborhood, and the eventual decision-making. In terms of the entire energy transition, the municipality bears more responsibility. According to interviewee 3, 'The municipality takes on a very clear directing role in the whole transition (…) they are more on the path of phasing-out natural gas.'

The eventual decision on the how and the what of the heating transition in Twekkelerveld (and the rest of Enschede) has to be made by the city council, where a group of elected representatives act like a parliament. They set the framework that dictates the daily management

of the municipality. ‘The city council has to approve the neighborhood plans and also the transition vision for the entire city (…) to put it bluntly: they call the shots.’ (Interviewee 3).

5.1.2 Knowledge institutes

The knowledge institute that is mostly involved in the project is Tauw. This is a European environmental consultancy operating in several disciplines related to sustainability. As an external actor, they are only connected to the project in terms of the technical feasibility research that is ongoing at the time of writing. Gadella is an engineering consultancy that has connections with the citizens platform.

5.1.3. Housing corporations

In terms of housing, Twekkelerveld consists of approximately 45% privately owned, 10% private renters, and 45% owned by housing corporations. The housing corporations are bound to the ‘Woningwet 2015’ (housing law), which stipulates that they are responsible for affordable housing for people with lower incomes. There are three corporations in the neighborhood. Domijn has about 1200 houses, De Woonplaats also possesses about 1200 houses, and Ons Huis has a small part of the houses. These corporations are actively involved in the Twekkelerveld project, and also work together on other aspects within the neighborhood.

5.1.4 Energy network operators

Energy network operators are indicated to be part of the network of information exchange. However, in reality, they are absent from the discussion in the project in its current state. Ennatuurlijk is already active in setting up and maintaining heating networks in Enschede. Enexis is responsible in the region for gas network maintenance. Both of these parties are involved in the making of the transition vision for heating in the city. However, they are not actively involved in Twekkelerveld at the time of writing. This might change in the future, depending on the solution that is chosen for the gas phase-out.

5.1.5 Societal organizations

There are five societal organizations mentioned by stakeholders that are part of the network. These organizations focus mostly on the participation of citizens in several projects around Enschede. Firstly, Alifa is specialized in social aspects of participation (e.g., social inclusion, providing youth workers, organizing events for elderly people). Secondly, Eurus is an organization that specializes in citizen participation on a wide range of topics. This also includes the energy transition. They act as a mediating party and position themselves between the municipality and the citizens in order to work together towards a participation track that fits the transition of the neighborhoods/villages.

Thirdly, the Participatiecoalitie is a support organization for citizen participation in the energy transition. They offer knowledge and practical advice on citizen participation and local ownership of energy projects. Fourthly, NMO (Nature and Environment Overijssel) also gives advice on citizen participation, also in a broader context of nature-related projects. Fifthly, Enschede Energie is a local energy cooperative that mostly deals with solar panel projects (planning, implementing, managing).

5.1.6 Citizens

Finally, but certainly not the least important, are the citizens of Twekkelerveld. Citizens are important to include in the process of the transition as they are the stakeholder that will feel and see the most of the energy transition. In Twekkelerveld, citizens were left out of the conversation in the beginning of the project. Since the restart, the opinion of the citizens became more prominent. One of the ways that the opinions of citizens are heard is through the citizens platform. The citizens platform keeps connections with the municipality, housing corporations, neighborhood committees, and others.

Regarding Twekkelerveld, groups of ‘front runners’ were formed that acted as representatives of smaller areas within the neighborhood. Around a dozen of these teams are the eyes and ears of the neighborhood in order to monitor opinions.

5.1.7 Visualization of involved stakeholders network

In the survey, the participants indicated which other stakeholders are involved in the project. This resulted in a network of involved stakeholders as shown in Figure 8.

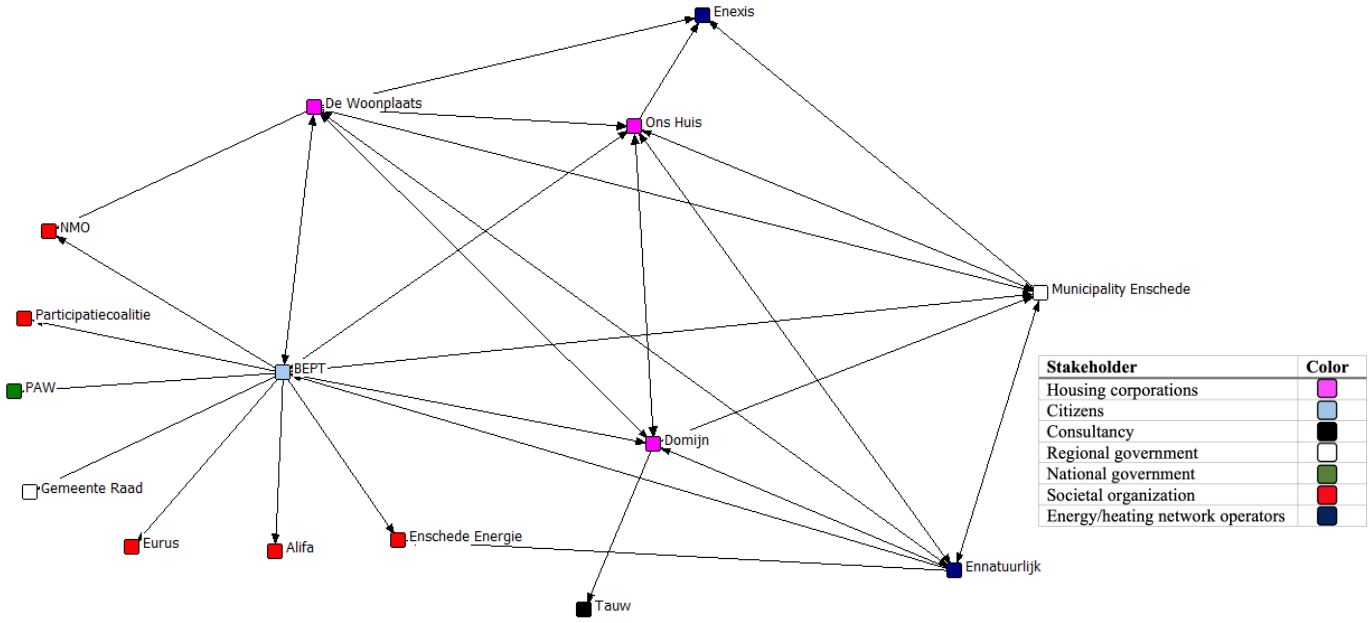

Figure 8. Network of involved stakeholders

5.1.8 Stakeholders that should be involved

In the interviews with several stakeholders, the question was asked if any other stakeholders should be involved in the project that are left out right now. Two types of stakeholders were mentioned by a couple of stakeholders (interviewee 3,4). The first one is schools. In Twekkelerveld, there are several schools ranging from elementary to vocational college. Schools can play a role in the education of the transition, not only towards children, but also adults, as parents might be influenced by the opinion of children. 'Information, knowledge sharing, and learning programs. Children nowadays are already thinking differently about climate than we did. Your generation will handle climate affairs differently from my generation.' (Interviewee 3).

A second possible stakeholder mentioned are the businesses in Twekkelerveld. How they will be included in the heating transition is not clear at this point in the project. The likely cause is that they are not formally represented in a group. One interviewee mentions that 'they have to take steps in order to be more sustainable, but the question is if that will be part of the

neighborhood plans. At this point they are not represented at all and the municipality gave notice that they do not know how to approach them.' (Interviewee 3).

5.2 The relationship between the stakeholders

This section shows the relationships between the identified stakeholders of the network. Figure 9 below displays the network of the identified stakeholders that exchange information with each other. So, this figure shows who has a relationship with each other.

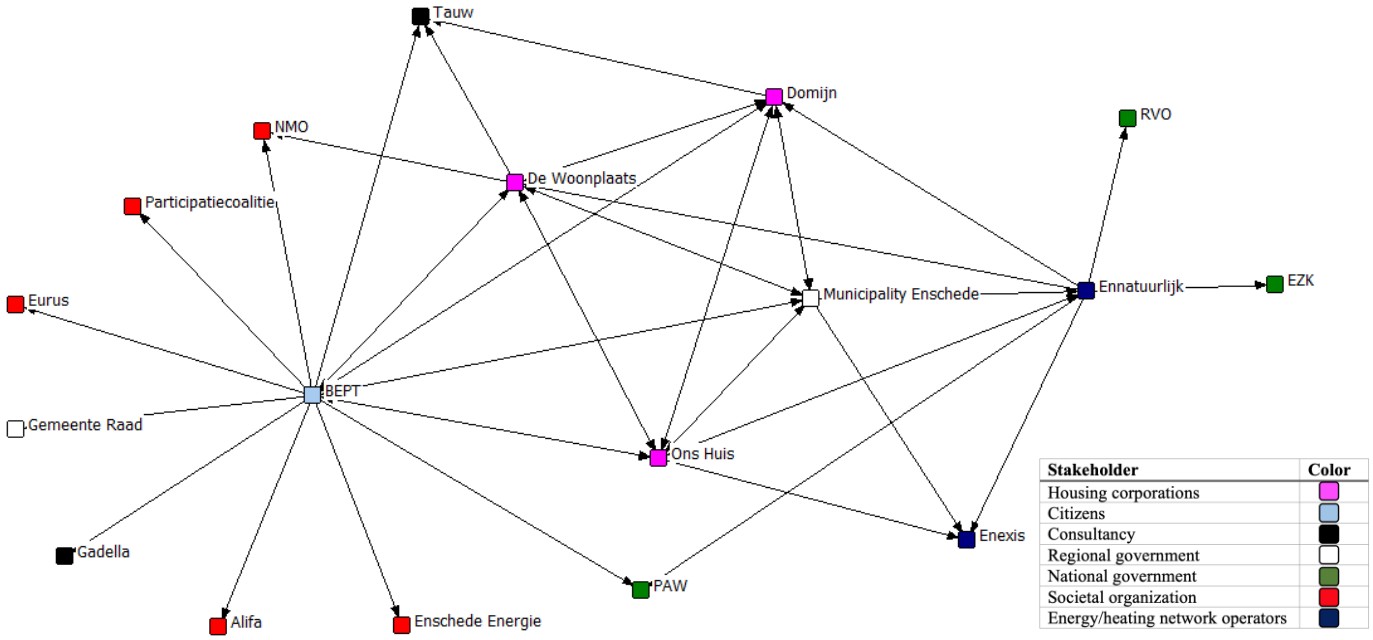

Figure 9. Network of information exchange

Comparing Figures 8 and 9, some immediate differences can be spotted. Firstly, different number of stakeholders are present in each network. The simple explanation for this is that there are more stakeholders that exchange information with each other in comparison to the involvement in the project itself. This is the case for Gadella, Ministry of Economic Affairs and Climate (EZK), and Rijksdienst voor Ondernemend Nederland (RVO). This is not a surprise, as it is not uncommon for individual stakeholders to share knowledge with each other. Secondly, there is no presence of national government stakeholders in the project, while there is information exchange occurring between some involved stakeholders and the national government. The explanation for this is that Ennatuurlijk operates on a national scale and thus naturally keeps in touch with the national government. In terms of the Twekkelerveld project, the national government does not have a role, yet, as it is still in a start-up phase. Figure 10

shows a high out-degree centrality for Ennatuurlijk, which can be explained by the fact they are a heating network operator already active in Enschede.

		1	2	3	4
		OutDegree	InDegree	NrmOutDeg	NrmInDeg
5	BEPT	13.000	4.000	76.471	23.529
1	Ennatuurlijk	8.000	2.000	47.059	11.765
6	Municipality Enschede	6.000	5.000	35.294	29.412
3	De Woonplaats	6.000	5.000	35.294	29.412
7	Ons Huis	6.000	5.000	35.294	29.412
4	Domijn	5.000	5.000	29.412	29.412
2	Enexis	0.000	3.000	0.000	17.647
8	Enschede Energie	0.000	1.000	0.000	5.882
9	Tauw	0.000	3.000	0.000	17.647
10	NMO	0.000	2.000	0.000	11.765
11	Alifa	0.000	1.000	0.000	5.882
12	Eurus	0.000	1.000	0.000	5.882
13	PAW	0.000	2.000	0.000	11.765
14	Gemeente Raad	0.000	1.000	0.000	5.882
15	EZK	0.000	1.000	0.000	5.882
16	RVO	0.000	1.000	0.000	5.882
17	Gadella	0.000	1.000	0.000	5.882
18	Participatiecoalitie	0.000	1.000	0.000	5.882

DESCRIPTIVE STATISTICS

		1	2	3	4
		OutDegree	InDegree	NrmOutDeg	NrmInDeg
1	Mean	2.444	2.444	14.379	14.379
2	Std Dev	3.789	1.606	22.289	9.449
3	Sum	44.000	44.000	258.824	258.824
4	Variance	14.358	2.580	496.817	89.282
5	SSQ	366.000	154.000	12664.359	5328.720
6	MCSSQ	258.444	46.444	8942.714	1607.074
7	Euc Norm	19.131	12.410	112.536	72.998
8	Minimum	0.000	1.000	0.000	5.882
9	Maximum	13.000	5.000	76.471	29.412
10	N of Obs	18.000	18.000	18.000	18.000

Network Centralization (Outdegree) = 65.744%
Network Centralization (Indegree) = 15.917%

Figure 10. Freeman degree centrality and graph centralization of Twekkelerveld information network

The citizens platform is very active in the practice of exchanging information, as they have the highest number of ties with other actors in the network and thus may be regarded as the most influential. Furthermore, the citizens platform exchanges information with a wide range of different types of stakeholders. This indicates that, at least in terms of information exchange, the citizens are supposedly well informed or they have at least the options to acquire a lot of information. One of the obstacles is the uncertainty surrounding the project. An interviewee mentions ‘I followed several webinars and came in contact with others that shared this view. If you have clear goals and know what needs to be done, then people can say no that’s not for me.’ (Interviewee 6).

The housing corporations have about the same levels of in- and out-degree. Outside the scope of Twekkelerveld, they largely share the same objectives in terms of sustainability. One interviewee mentions ‘At the moment, we have a good relationship among the corporations up to the point where we do these kinds of projects together if possible.’ (Interviewee 3) and ‘it’s very open. Data is shared’ (Interviewee 4). All three have been working on making their houses future-proof, some have been working on this since the 1980s already. Their goals differ from those of the municipality, namely, instead of focusing on natural gas free neighborhoods, the corporations look at the larger, overarching goal of being CO2 neutral by 2050.
These different goals sometimes clash with each other. An interviewee mentions in this regard ‘The municipality is for natural gas free, the corporations not so much. As a large real estate owner, the national government appointed us as a starting point for the natural gas phase out (…) The municipality has more interest in the natural gas phase-out, so we said: we’ll go along, up to a certain point.’ (Interviewee 3).

Because a healthy business case is what many stakeholders mention as a large obstacle in the whole transition. ‘I haven’t seen a single healthy business case for the heating transition of existing neighborhoods, nowhere in the country.’ (Interviewee 2). One of the biggest lessons here is that more monetary instruments are needed, either subsidies or certain benefits for sustainable measures. This development directly opposes the promises made by the national government to make the heating transition ‘housing costs neutral’. The average 1930s house needs about 30-40.000-euro investments to make it ready for the gas phase-out. The people are supposed to earn this back over the years, but that’s not happening right now. As long as these conditions are not met, the transition will remain in a lower gear. (Interviewee 7).

There are also several actors that are influential in the actual decision-making process, but don’t have a prominent position in the network. Most notable is the role of the city council in the Twekkelerveld project. This stakeholder is mentioned by multiple others as having an influential position, but not being directly involved (interviewee 3, 4, 6). When it comes down to it, the city council makes a decision, which can have significant influence on the entire project. ‘The role of the council became apparent when they made a statement surrounding Twekkelerveld.’, interviewee 3 mentions. ‘Once they realized they got the approach all wrong, with the citizens, with the techniques, with the business case, they said; no further. They approved a re-start of the project where the firsts steps could be made and a neighborhood vision could be made. But if nothing comes out of this, it stops.’.

Enexis is another stakeholder which can have an influence in the decision-making process but is not directly involved in the project. One of the explanations for this is that the current state of the project does not require direct input from Enexis, as they are the gas/energy grid operator. Once more is known about the actual plans for the neighborhood, they can become important, as they have to do the physical work in the streets. (Interviewee 3,5)
Ennatuurlijk is mentioned by other stakeholders as being involved in the project and a party that is included in the information exchange network, but this comes with a side note. They are the only heating network party operating in Enschede, so they will have to be involved eventually. However, they are not part of the structural meetings in the Twekkelerveld project. (Interviewee 7)

5.2.1 Power-Interest matrix

The power-interest matrix was filled in by using the survey that was sent to the participants. However, the construction of the matrix comes with several side-notes that explain it further. First of all, the survey data alone was not sufficient to fully make use of the power-interest matrix. Not every actor could be reached in time to be included in the results. Therefore, some of the stakeholders had to be positioned in the matrix solely based on what other stakeholders thought about their position and from the in-depth reasoning given during interviews with several stakeholders.

Looking at Figure 11, the stakeholders have a place in the power-interest matrix. The 'key players' in Twekkelerveld are also the stakeholders that are part of the structural meetings. The municipality indicated a slightly lower interest in the project, which is likely explained by the phase that the project is currently in. The housing corporations together with the citizens platform are on the same power- and interest-level. An interesting stakeholder also part of the key players is Ennatuurlijk. They were mostly indicated to be important by other stakeholders in the network. However, they are not directly involved and only will be when the choice is made for Twekkelerveld to use the heating network in Enschede (Interviewee 7).
The 'subjects' are those that should be kept informed, have high interest, but are not very powerful in terms of decision-making. The interest-level of Tauw, the Participatiecoalitie and NMO had to be informed by the interviews with other stakeholders. Tauw, being the main consultancy, is expected to have a reasonably high level of interest in the project. NMO and the

Participatiecoalitie are also expected to have similar interest in the project, as they inform on participation of citizens.

The ‘crowd’, those with relative low interest and power, consists mostly of societal organizations. The interesting stakeholder here is PAW, as they are not involved in the project, yet they appear to have some power regarding the decision-making process. It should be noted that the scores given for PAW have a high variety, so opinions on PAW’s power are not uniform.

The ‘context setters’, those with power but having little direct interest, consist of the city council of Enschede and Enexis. Again, these stakeholders had to be positioned based on the scores given by other stakeholders and by context of the interviews. The city council takes a very high position when it comes to power, as they are the ones who make the final decisions. Their interest-level is set as neutral, as they likely deal with many other topics regarding the city and thus have no special interest in the project itself. Enexis is indicated to have high power, but only if the project moves beyond the phase that it is currently in.

All stakeholders have at least a little power in terms of decision-making. This could indicate that the involved parties are not just part of the process to ‘check a box on a participation list’, but are there because they can help make a difference and are perceived by the rest of the network to have some importance. Then again, missing data entries could sketch a different picture compared to the situation in practice.

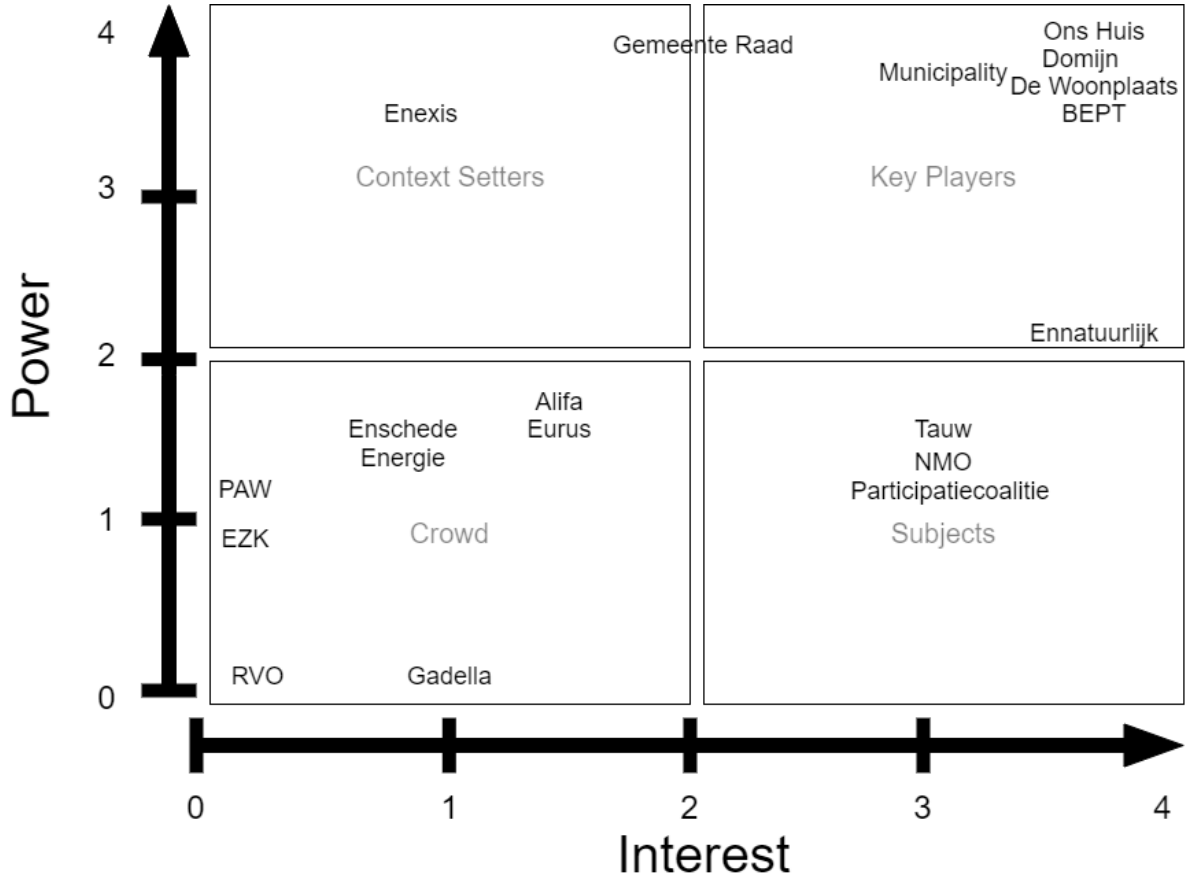

Figure 11. Power-interest matrix of stakeholders in Twekkelerveld

5.3 Testing the hypotheses

To show bonding social capital, the density within and between the stakeholder groups is displayed in Figure 12.

```
                                  1     1 1   1 1   1 1 1 1
                    1 6 3 4 5 7   2 4   9 0 8   1 3 8 5 2 7 6
                    E M D D B O   E G   T N P   A P E E E G R
                   ---------------------------------------------
 1         Ennatuurlijk |   1 1 1   1 | 1   |       |   1   1     1 | Number of ties
 6 Municipality Enschede | 1   1 1 1 1 | 1   |       |               |
 3        De Woonplaats |   1   1 1 1 |     | 1 1   |               |          1  2  3  4
 4               Domijn |   1 1 1 1 1 |     | 1     |               |          -- -- -- --
 5                 BEPT |   1 1 1   1 |   1 | 1 1 1 | 1 1 1   1 1   |       1 26  4  6  8
 7           Ons Huis | 1 1 1 1 1   | 1   |       |               |       2  0  0  0  0
                   ---------------------------------------------       3  0  0  0  0
 2              Enexis |             |     |       |               |       4  0  0  0  0
14        Gemeente Raad |             |     |       |               |
                   ---------------------------------------------  4 rows, 4 columns, 1 levels.
 9               Tauw |             |     |       |               |
10               NMO |             |     |       |               | Density of ties
18  Participatiecoalitie |             |     |       |               |
                   ---------------------------------------------              1     2     3     4
11               Alifa |             |     |       |               |          ----- ----- ----- -----
13                PAW |             |     |       |               |       1 0.867 0.333 0.333 0.190
 8     Enschede Energie |             |     |       |               |       2     0     0     0     0
15                EZK |             |     |       |               |       3     0     0     0     0
12              Eurus |             |     |       |               |       4     0     0     0     0
17            Gadella |             |     |       |               |
16               RVO |             |     |       |               |  4 rows, 4 columns, 1 levels.
                   ---------------------------------------------

Standard Deviations within blocks

             1      2      3      4
             1      2      3      4
        ------ ------ ------ ------
   1  1  0.3399 0.4714 0.4714 0.3927
   2  2  0.0000 0.0000 0.0000 0.0000
   3  3  0.0000 0.0000 0.0000 0.0000
   4  4  0.0000 0.0000 0.0000 0.0000
```

Figure 12. Density of four groups in Twekkelerveld information exchange network

The blocked matrix shows the values of the connections between each group of stakeholders. In block 1,1 the density is 0.867, meaning that out of the 26 possible directed ties among stakeholders 1, 6, 3, 4, 5, and 7, 22 are actually present. The within group densities differ quite a lot looking at the different groups. The key players (group 1) have a very high density among themselves. This is further supported by the interview data, stating a high-level of cooperation and information exchange among the stakeholders in the key player category. These results should be interpreted with caution. What is interesting to see is that there are no ties among the stakeholders in the other categories. The foremost reason for this is that the data for the stakeholders in other categories is missing, making it hard to attach hard conclusions to these results.

For now, the results mean that H1 should be rejected as there is no high bonding social capital within the groups of stakeholders.

H2 suggests that there is only bridging social capital if the key player category of stakeholders establishes it. Figure 13 shows the betweenness centrality scores of the stakeholders in the information exchange network.

		1	2
		Betweenness	nBetweenness
5	BEPT	35.167	12.929
1	Ennatuurlijk	11.000	4.044
6	Municipality Enschede	7.750	2.849
7	Ons Huis	7.750	2.849
3	De Woonplaats	5.417	1.991
4	Domijn	2.917	1.072
2	Enexis	0.000	0.000
8	Enschede Energie	0.000	0.000
9	Tauw	0.000	0.000
10	NMO	0.000	0.000
11	Alifa	0.000	0.000
12	Eurus	0.000	0.000
13	PAW	0.000	0.000
14	Gemeente Raad	0.000	0.000
15	EZK	0.000	0.000
16	RVO	0.000	0.000
17	Gadella	0.000	0.000
18	Participatiecoalitie	0.000	0.000

DESCRIPTIVE STATISTICS FOR EACH MEASURE

		1	2
		Betweenness	nBetweenness
1	Mean	3.889	1.430
2	Std Dev	8.311	3.056
3	Sum	70.000	25.735
4	Variance	69.080	9.337
5	SSQ	1515.667	204.864
6	MCSSQ	1243.445	168.069
7	Euc Norm	38.932	14.313
8	Minimum	0.000	0.000
9	Maximum	35.167	12.929
10	N of Obs	18.000	18.000

Network Centralization Index = 12.18%

Figure 13. Freeman node betweenness for Twekkelerveld information exchange network

The figure shows that there is a lot of contrast in stakeholder betweenness, ranging from 0 to 35.17. There is also a bit of variation, with a standard deviation of 8.2 relative to a mean

betweenness of 3.9. But the overall network centralization is not that high. The stakeholders categorized in the key player group appear to have all the power in the network. Interestingly, the citizens platform has the most 'power' in the network. Even though there is little structural power and there is not much betweenness power in the system, this fact could still be important for the network. The fact that the citizens platform has a high betweenness score is further supported by interview data, where other stakeholders have mentioned that 'the citizens platform is part of the structural meetings, so they hear exactly what the municipality and housing corporations are talking about.' (Interviewee 3).

The results of the betweenness centrality scores only show half of the story. It does not tell anything about the connections between the different groups of categories in the power-interest matrix. Figure 14 below gives insight into the connections between the four groups from the power-interest matrix.

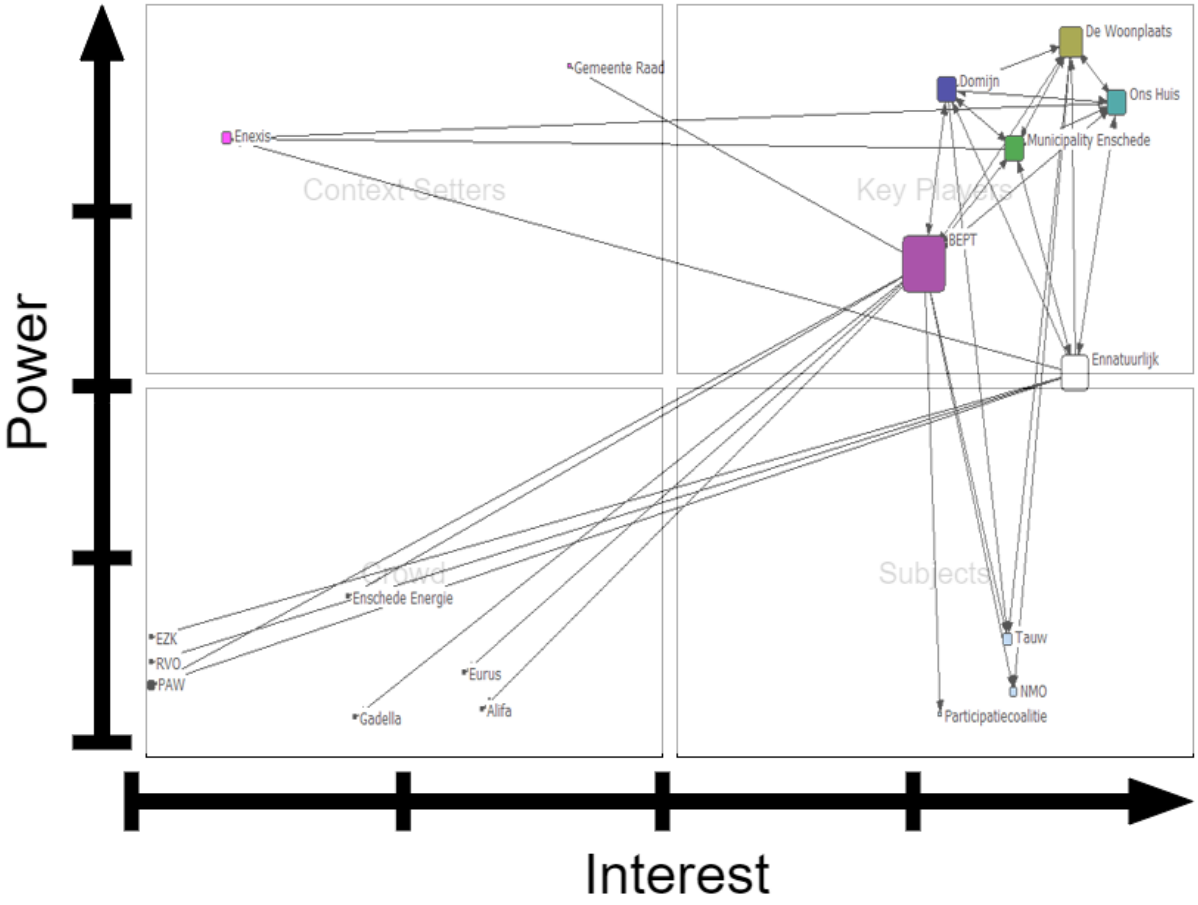

Figure 14. Visualization of connections between four groups, node size set by degree centrality score

What is interesting is that only the key player groups have connections among them, whereas the rest of the stakeholder groups share no connections among them.

Below in the figures the density of the four stakeholder groups is shown. Here the information exchange network is again examined. An attribute or partition was used to divide the key players, context setters, subjects, and crowd so the amount of connection within and between groups is made clear.

```
Column
Block Old Code       Members:
----- --------   ---------------
    1        1    Enexis Gemeente Raad
    2        2    Tauw NMO Participatiecoalitie
    3        3    Enschede Energie Alifa Eurus PAW EZK RVO Gadella
    4        4    Ennatuurlijk
    5        5    Municipality Enschede
    6        6    De Woonplaats
    7        7    Domijn
    8        8    BEPT
    9        9    Ons Huis
```

		1 4 G	2 E	1 0 N	8 P	9 T	1 3 P	1 2 E	8 E	6 R	5 1 E	1 A	7 G	1 E	6 M	3 D	4 D	5 B	7 O
14	Gemeente Raad																		
2	Enexis																		
10	NMO																		
18	Participatiecoalitie																		
9	Tauw																		
13	PAW																		
12	Eurus																		
8	Enschede Energie																		
16	RVO																		
15	EZK																		
11	Alifa																		
17	Gadella																		
1	Ennatuurlijk	1					1			1	1			1	1	1		1	
6	Municipality Enschede	1												1		1	1	1	1
3	De Woonplaats			1	1										1		1	1	1
4	Domijn				1										1	1	1	1	1
5	BEPT	1		1	1	1	1	1	1		1	1			1	1	1		1
7	Ons Huis	1												1	1	1	1	1	

Density / average value within blocks

		1 1	2 2	3 3	4 4	5 5	6 6	7 7	8 8	9 9
1	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	4	0.5000	0.0000	0.4286		1.0000	1.0000	1.0000	0.0000	1.0000
5	5	0.5000	0.0000	0.0000	1.0000		1.0000	1.0000	1.0000	1.0000
6	6	0.0000	0.6667	0.0000	0.0000	1.0000		1.0000	1.0000	1.0000
7	7	0.0000	0.3333	0.0000	0.0000	1.0000	1.0000		1.0000	1.0000
8	8	0.5000	1.0000	0.7143	0.0000	1.0000	1.0000	1.0000		1.0000
9	9	0.5000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	

Standard Deviations within blocks

		1	2	3	4	5	6	7	8	9
		1	2	3	4	5	6	7	8	9
1	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	4	0.5000	0.0000	0.4949		0.0000	0.0000	0.0000	0.0000	0.0000
5	5	0.5000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000
6	6	0.0000	0.4714	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000
7	7	0.0000	0.4714	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000
8	8	0.5000	0.0000	0.4518	0.0000	0.0000	0.0000	0.0000		0.0000
9	9	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Figure 15. Density of four stakeholder groups in Twekkelerveld information exchange network

The numbers confirm what the picture in figure 14 already shows. The key players have quite dense in and out ties to one another, and to some extent also to other subgroups. There is a fit to H2 if a key player has a high density towards more than one of the other groups. The one that stands out most in this regard is the citizen's platform, which has ties to all three other groups and thus fits the hypothesis. Based on these results, H2 is rejected.

5.4 Crucial stakeholders to involve

There are several stakeholders that are important to involve in the project. First one is the municipality of Enschede. The national government has put the responsibility of the energy transition on the RES, meaning that municipalities are largely responsible for the strategy specific to their region. Furthermore, the municipality was asked by the key player stakeholders to take the leading role in the project as they are the ones pushing for the phase-out of gas in houses and have more experience in bringing stakeholders together. More importantly, the municipality has the power to make policies and decisions around the project.

The housing corporations are a crucial stakeholder to involve, because of the share of houses that they own in the neighborhood. Furthermore, data shows a high level of degree centrality, as they are part of the structural meetings regarding Twekkelerveld.

Another important stakeholder is the citizens platform. A lack of representation from citizens in the initial project proved to be detrimental in the backlash experienced by the municipality. Current data also suggests that the citizen's platform is an important stakeholder in bridging social capital, making connections with many other stakeholders from different groups,

according to the power-interest matrix. Interviewee 3 mentioned that the involvement of the citizen's platform has been a curse and a blessing. On one hand, citizens need information on what is going to happen with their neighborhood and having them present during meetings is important to get firsthand knowledge. On the other hand, if the platform is highly critical of plans or if they pull too much of the coordination towards them, they might slow down processes. Interviewee 3 mentioned that critical thinkers are necessary in these kinds of projects, but too much influence can lead to complications in the greater process.

The city council of Enschede is also an important stakeholder to involve. They are the ones that make a decision regarding the project. However, their connection to the project is currently weak. Figure 13 shows a connection from the citizens platform towards the city council, recognizing the importance of that stakeholder. Members are expected to have a wide range of knowledge concerning the matters they decide upon. But to know everything is impossible, so the citizen's platform is actively seeking contact with members to convey the experience of citizens in the neighborhood. (Interviewee 6).

Finally, an important stakeholder is PAW. Most of the stakeholders indicate that PAW is not directly involved and has no real power to influence decision-making. However, analysis using Key Player 1.45 in UCINET offers a different perspective. Within the information exchange network, PAW reaches 100% (18 nodes), meaning that they are well-connected but also non-redundant. Another reason PAW seems important is that their subsidy is needed to get a healthy business case. Nearly all interviewed stakeholders mention money to be a big obstacle to move forward (interviewee 1, 2, 3, 4, 5, 6). Getting selected as a pilot neighborhood could thus fill this gap. Currently, PAW functions as an information hub.

6. Discussion

In this chapter, I discuss the answers on each sub-question, put the results in perspective of other studies that focus on local-level participation using similar methods and discuss striking or unexpected results. Thereafter I reflect on this research and describe its limitations and strengths.

One of the most important aspects of the participation process in the heating transition is to include relevant stakeholders as soon as possible in the entire transition track. Both PAW and RES are clear on that matter, indicating early citizen inclusion to be crucial in a successful participation track. Plans should be transparent about project contents, timeline, and consequences (both physical and non-physical) to accommodate inhabitants and to lower the risks of opposition. Furthermore, stakeholders should enjoy an open communicative environment that ensures clarity for everyone involved. It is confirmed by interviewee 3, 4, 6 and 7 that open communication can decrease unclarities. The participation process should then adapt to what the context requires, which can be different in every neighborhood, city, and region. Celino & Concilio (2011) argue that while public authorities practice the use of participatory decision-making, most decisions in environmental policy are often characterized by conflict and tension. They go on to conclude that negotiations with an explorative approach are effective to the problem at hand. This is also one of the lessons learned from the first attempt to phase-out gas in Twekkelerveld. Looking at the total time line of getting Twekkelerveld off of gas, it is clear that 'just beginning' is not the right way to go about it. Before the re-launch of the project, the municipality had decided to appoint Twekkelerveld to be the first neighborhood phasing-out gas, almost completely without the involvement of the inhabitants. A large part of the reason why progress was met with backlash is because the inhabitants of the neighborhood were merely informed, and not consulted. Citizen participation thus proves to be an important facet in these kinds of projects. The results from the network analysis further support the importance of citizen participation, as the citizens platform is indicated to have a reasonable power position, with many ties towards other stakeholders.

In that sense, the municipality has learned their lesson and embraced the input from stakeholders and citizens more. The re-launch of the project seems to symbolize a rekindled relationship between the citizens/stakeholders and government by including the former from

the start. As the proverb goes: “if you want to go fast, go alone; If you want to go far, go together”.

This leads to the stakeholders which are involved in Twekkelerveld. The stakeholder groups which are involved according to the data are: the government, knowledge institutes, housing corporations, energy network operators, societal organizations, and citizens. However, this is not truly the case, as energy network operators are not actually involved. They become involved once an actual decision has been reached on the alternative for gas. It is striking that these stakeholders have quite a high power position according to this research, while they do not have a high interest right now, as can be seen in the power-interest matrix. This can also be explained by the fact that they have to change their energy network when the phase-out of gas starts. Another interesting and unexpected result is that the PAW has relatively little power indicated on the matrix, while at the same time, the gas phase-out seems to be dependent on the funding provided by PAW. The low power could be explained by the fact that Enschede has no subsidy granted from the PAW right now.

The amount of information exchange differs from stakeholder to stakeholder. A stakeholder that has many information exchanges is the citizens' platform. This is supported by the results of the centrality scores. It is interesting to see that the citizens' platform has a high out-degree, while it has a quite low in-degree. This means that it maintains their connection actively, while other people do not connect with the platform so often. This can be explained by the fact that the citizens' platform is very interested in participation by the process (interviewee 7). Another striking point is that the information exchange is mostly between the stakeholders which are key players according to the power-interest matrix. The key players are the citizens platform, housing corporations, the municipality, and one energy network operator. The key players are also the crucial players to be involved, because they have the most knowledge, power and influence on the decision-making process. Striking is that all key players except the municipality (city council) only have ‘soft’ power, because the city council is the final decision maker in this process, but the key players with 'soft’ power are detrimental to the process, as in the first attempt of the gas phase-out. That the citizens platform is the most important stakeholder with ‘soft’ power was expected. This is also in line with the recommended participation process in the heating transition of the RES and PAW (PAW, 2021b). They advise municipalities to actively involve stakeholders and especially citizens. Secondly, and contrary to what one would expect, this study found that the city council is the ‘hard’ power but they do

not have the time and capacity to build a relationship with all stakeholders. The citizens platform recognizes this fact and actively reaches out. This case showed us that the citizens participation is crucial and that the city council has improved this the second attempt to phase-out gas. Stakeholders that only have an in-degree and no out-degree are those that could not be reached to answer the survey. So, data only exists based on the indications of other stakeholders that did answer the survey.
Keeping contact with those that have the knowledge, the thought of being unaware or unknowledgeable is kept at a minimum and might give a party an advantage in influencing the network. This is also mentioned by Hanneman & Riddle (2020). The position of the citizens platform is a typical example of a star network. 'Actors who have more ties have greater opportunities because they have choices. This autonomy makes them less dependent on any specific other actor, and hence more powerful.' (Hanneman & Riddle, 2020)

As for the hypotheses, while there is data available to at least be able to steer a discussion in a direction, it is hard to absolutely accept or reject them. The output for H1 is partly inconclusive. It shows high bonding social capital within the key player group, but since there is no data on the other groups, it is hard to accept the hypothesis based on one group alone. H2 suggests the key players are responsible for bridging social capital. The output from the UCINET analyses indicates that not all stakeholders were surveyed, and the initial betweenness centrality shows only results for the key player group. This could be explained by the fact that a lack of data on the rest of the stakeholder groups results in a skewed image of the network. Meaning that there are connections among other stakeholder groups, but they were simply not measured. Another explanation for the lack of connections among other groups is that they are simply individual parties operating with a certain key player and have no need to connect with others in the stakeholder group. For example, Gadella has a connection with the citizens platform in order to function as a second opinion for the technical feasibility research going on. So, it would be weird to have a connection for them with organizations such as Eurus and Alifa that handle participation processes.
Does this mean H2 has to be rejected? It is hard to say whether there are any connections among the groups as there is no data coming from the groups other than key players. For these reasons, it seems that H2 has to be rejected. At the same time, Figure 14 shows that key players are responsible for making connections across groups. The citizens platform is especially bridging stakeholder groups with each other. Furthermore, within the context of the project, it is unlikely that stakeholders in the groups of context setters, subjects, and crowd are connected with each

other. For the key players, being part of the structural meetings regarding the natural gas phase-out, it is logical to have a high level of density.

The challenges because of the small sample of this research leads to the limitations and strengths of the results. The small sample is a result of the snowball method in combination with the timeframe of this thesis. As snowball sampling means adding more stakeholders to the list after almost every new participant, only a limited number of stakeholders could be contacted within the scope and timeframe of the thesis. The project in its current state might also only contain a small number of stakeholders and as the project matures, the pool of stakeholders grows with it. However, the smaller group of stakeholders would decrease the reliability of the rejection of the hypotheses, but not seems to heavily influence the other results, because the group of key players is expected to remain the same, even if the project continues to expand. The housing corporations simply for owning a high share of the houses in the neighborhood, the citizens for their continued participation in the project, and the municipality for the policy- and decision-making. The data gathering process chosen for this research also led to some challenges. From the start, it was not clear what kind of stakeholders would be part of the Twekkelerveld project and who those stakeholders were. So, this meant it was hard to find a 'correct' starting point.

Another limitation which also indicates the relevance of this research is the limited evidence available on local-level phase-out of gas, as there are only a handful of other studies that focus on the gas phase-out in neighborhoods. The majority of these studies are written in Dutch, by Dutch organizations, which also results in a limited comparison of the results of this study to another study. However, since the gas phase-out is becoming more urgent, it will not take long for others to take interest and it is more and more important to fill this knowledge gap in literature. This study could be expanded by future research that includes more stakeholders in the analysis, such as the ones proposed by interviewed stakeholders (schools, businesses). Another interesting angle would be to look into neighborhoods that receive the national funding and become part of PAW's pilots in order to take the monetary instruments into account in the analysis. With more time available, this study can also be expanded by including a comparison with a neighborhood that received the national funding and to analyze the network of stakeholders to see if there are differences or similarities in the setting of the network. These future studies would add to the knowledge on participation specifically for these projects.

7. Conclusion

This thesis set out to answer the main research question: '*How do interactions among stakeholders shape their ability to contribute to the decision-making process in the phase-out of natural gas?*

The analysis has revealed that interaction among stakeholders shapes their ability to contribute to the decision-making process by having high power and interest. The results showed that it is not necessary to have 'hard' power to contribute to the decision-making process, because 4 out of 5 key players are organizations with 'soft' power. This research showed that having many relationships and connections increase the power of an organization. Striking is that the organization with the 'hard' power, namely the city council, is not the party with the most connection, but is partly informed by the party with the most relationships, namely the citizens platform.

Next, to collaboration and building relationships with stakeholders to increase your power to contribute in the decision-making process, it is from the 'hard' power side important to give stakeholders the chance to participate and contribute in this process. The first attempt of the municipality of Enschede failed by a lack of participation of the citizens. Contrary to what one would expect, this study found that the city council has the 'hard' power but they do not have the time and capacity to build a relationship with all stakeholders. The participation of stakeholders in this decision-making process is facilitated by the project members of the municipality who report and update the city council about the process.

As a final statement it should be said that whatever the outcome is of the gas phase-out in terms of alternatives, a decision should be made sooner rather than later. The recently published climate report by the Intergovernmental Panel on Climate Change (IPCC) shows that the scientific community is more determined about humanity's share in global warming than before. Politicians used strong language in support and many showed to be worried. And there are choices to be made, but these choices have to be made now and not in ten years.

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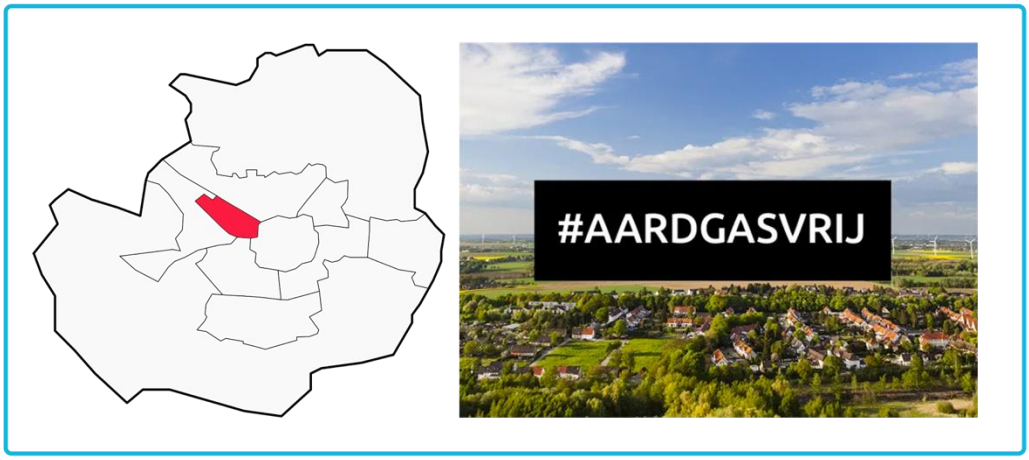
Appendices

Appendix A: Survey

Vragenlijst onderzoek ‘Twekkelerveld aardgasvrij’



Deze vragenlijst maakt onderdeel uit van het onderzoek over het project Twekkelerveld aardgasvrij. Het doel is om verschillende stakeholders te identificeren binnen het netwerk van het project Twekkelerveld aardgasvrij om te onderzoeken hoe de netwerksetting het beslissingsproces beïnvloed. Hierbij heb ik uw hulp nodig om het onderzoek te laten slagen.

Deze vragenlijst bestaat uit 4 vragen in totaal en zal u de kans geven om de perspectieven van uw organisatie te verduidelijken over:

A. De mate van interesse vanuit uw organisatie naar het project Twekkelerveld aardgasvrij
B. Participerende stakeholders binnen het project Twekkelerveld aardgasvrij
C. Samenwerkingsverbanden vanuit uw organisatie met andere organisaties in het project Twekkelerveld aardgasvrij
D. Belangrijke stakeholders binnen het project Twekkelerveld aardgasvrij

De vragenlijst zal niet langer dan **10 minuten** van uw tijd in beslag nemen. Op verzoek zal ik aan het einde van het onderzoeksproces de resultaten van het onderzoek met u delen. Graag zie ik uw reactie tegemoet door de ingevulde vragenlijst uiterlijk **17 juni 2021** naar het volgende mailadres te sturen: **m.c.morskieft@student.utwente.nl**
Dit is tevens het correspondentieadres voor dit onderzoek.

A. De mate van interesse vanuit uw organisatie naar het project Twekkelerveld aardgasvrij

Interesse*: interesse en zorgen vanuit de stakeholder in relatie tot het probleem dat het project aankaart.*

U kunt uw keuze aankruisen op de schaal die hieronder staat afgebeeld door op 1 van de vakjes te klikken.

Helemaal niet geïnteresseerd		*Neutraal*		*Zeer geïnteresseerd*
☐	☐	☐	☐	☐

B. Stakeholders in het project Twekkelerveld aardgasvrij

Er zijn verschillende stakeholders betrokken bij het project Twekkelerveld aardgasvrij (2020-nu). De volgende tabel laat een aantal stakeholders zien die *mogelijk* betrokken zijn bij het project.

Betrokken: *welke stakeholders zijn aanwezig bij vergaderingen over Twekkelerveld aardgasvrij?*

Kruis de stakeholders aan die betrokken zijn bij het project Twekkelerveld aardgasvrij vanuit het oogpunt van uw organisatie.
Als er stakeholders zijn die niet op de lijst staan kunt u die onderaan de lijst invullen.

Stakeholders	Betrokken bij project
Ministerie van Economische Zaken en Klimaat	☐
RVO Rijksdienst voor Ondernemend Nederland	☐
Nationaal Programma Regionale Energiestrategie	☐
ECW Expertise Centrum Warmte	☐
PAW Programma Aardgasvrije Wijken	☐
Milieu Centraal	☐
Ennatuurlijk	☐
Enexis	☐
De Woonplaats	☐
Domijn	☐
Bewonersplatform	☐

Tauw	☐
Enschede Energie	☐
Alifa	☐
Eurus	☐
NMO (Natuur en Milieu Overijssel)	☐
Gemeente Enschede	☐
Ons Huis	☐
Gemeenteraad	☐

Hieronder kunt u de nog missende stakeholders noteren:

C. Samenwerkingsverbanden vanuit uw organisatie met andere organisaties in het project Twekkelerveld aardgasvrij

De volgende tabel bevat dezelfde stakeholders als in deel B.

Samenwerking: Met welke stakeholders vindt informatie-uitwisseling plaats?
Samenwerking wil niet zeggen dat dezelfde meningen worden gedeeld.

1.1. Kruis hierin alle stakeholders aan met wie uw organisatie samenwerkt binnen het project Twekkelerveld aardgasvrij (2020-nu).

1.2. Kruis de actoren aan met wie er minstens 1 keer per week informatie wordt uitgewisseld.

Deze vraag is van belang om te begrijpen hoe het stakeholder netwerk in elkaar zit. Eventueel persoonlijk identificeerbare data worden geanonimiseerd.
Als er stakeholders missen uit de lijst, voeg deze dan onderaan toe in het daarvoor bestemde tekst vak en zet een ‘x’ achter de stakeholder als er nauw mee wordt samengewerkt.

Stakeholders	Samenwerking	Minstens 1 keer per week
Ministerie van Economische Zaken en Klimaat	☐	☐
RVO Rijksdienst voor Ondernemend Nederland	☐	☐
Nationaal Programma Regionale Energiestrategie	☐	☐
ECW Expertise Centrum Warmte	☐	☐
PAW Programma Aardgasvrije Wijken	☐	☐
Milieu Centraal	☐	☐
Ennatuurlijk	☐	☐
Enexis	☐	☐

De Woonplaats	☐	☐
Domijn	☐	☐
Bewonersplatform	☐	☐
Tauw	☐	☐
Enschede Energie	☐	☐
Alifa	☐	☐
Eurus	☐	☐
NMO (Natuur en Milieu Overijssel)	☐	☐
Gemeente Enschede	☐	☐
Ons Huis	☐	☐
Gemeenteraad	☐	☐

Hieronder kunt u de missende stakeholders noteren:

D. Belangrijke stakeholders binnen het project Twekkelerveld aardgasvrij

De volgende tabel laat dezelfde stakeholders zien als in de voorgaande vragen.

Kruis alle stakeholders aan in de tabel die belangrijk zijn binnen het project Twekkelerveld aardgasvrij. Geef de mate hierbij aan op een schaal van 0 tot 4.

Belangrijk: Welke stakeholders hebben invloed op het beslissingsproces, en in welke mate?

Als er stakeholders in de lijst missen, voeg deze toe in het daarvoor bestemde tekst vak en zet een nummer achter de stakeholder om de mate van belang aan te geven.

Stakeholders	Belangrijk binnen project				
	0	1	2	3	4
Ministerie van Economische Zaken en Klimaat	☐	☐	☐	☐	☐
RVO Rijksdienst voor Ondernemend Nederland	☐	☐	☐	☐	☐
Nationaal Programma Regionale Energiestrategie	☐	☐	☐	☐	☐
ECW Expertise Centrum Warmte	☐	☐	☐	☐	☐
PAW Programma Aardgasvrije Wijken	☐	☐	☐	☐	☐
Milieu Centraal	☐	☐	☐	☐	☐
Ennatuurlijk	☐	☐	☐	☐	☐
Enexis	☐	☐	☐	☐	☐
De Woonplaats	☐	☐	☐	☐	☐
Domijn	☐	☐	☐	☐	☐
Bewonersplatform	☐	☐	☐	☐	☐
Tauw	☐	☐	☐	☐	☐

Enschede Energie	☐	☐	☐	☐	☐
Alifa	☐	☐	☐	☐	☐
Eurus	☐	☐	☐	☐	☐
NMO (Natuur en Milieu Overijssel)	☐	☐	☐	☐	☐
Gemeente Enschede	☐	☐	☐	☐	☐
Ons Huis	☐	☐	☐	☐	☐
Gemeenteraad	☐	☐	☐	☐	☐

Hieronder kunt u de missende stakeholders noteren:

Appendix B: Interview protocol

Doel van het interview: inzicht krijgen in de huidige stakeholders van het Twekkelerveld aardgasvrij project.

Soorten vragen: open en gesloten

Thema's: project, stakeholders, power-interest

Concepten:

- Invloed: de mate van een stakeholder om het beslissingsproces van het project Twekkelerveld aardgasvrij te beïnvloeden
- Interesse: de impact van het project Twekkelerveld aardgasvrij op de stakeholder, zowel positief als negatief

Project Twekkelerveld context vragen:

1. Zou je jezelf kunnen introduceren?

2. Wat is precies de rol van (organisatie) binnen het project?

3. Hoe belangrijk vindt (organisatie) de energietransitie?

4. Wat doet (organisatie) nog meer aan verduurzaming?

5. Wat is het grootste obstakel voor (organisatie) bij het project Twekkelerveld aardgasvrij?

Vragenlijst:

1. Allereerst, zijn er nog vragen over het invullen van de vragenlijst?

A. Interesse
    a. Kun je deze keuze verder uitleggen?
B. Participerende stakeholders

    a. Zijn er nog andere actoren waarvan je denkt dat ze er ook betrokken bij moeten worden die nu niet gerepresenteerd zijn?

C. Samenwerkingsverbanden
    a. Welke informatie wordt er met ….. uitgewisseld?
    b. Met wie heeft (organisatie) het vaakst contact?
    c. En met wie het minst?
    d. Waarom is er geen wekelijks contact met….. ?
    e. Wat zou er moeten gebeuren om deze stakeholders meer te betrekken?

D. Belangrijke stakeholders
    a. Je hebt een aantal stakeholders aangekruist die niet direct betrokken zijn bij het project, waarom zijn ze dan toch van belang voor Twekkelerveld aardgasvrij?
    b. Zijn er stakeholders die belangrijk zijn, maar nu niet worden gerepresenteerd binnen het project?