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Local Strategic Niche Management (SNM): Unpacking Processes and Success Factors in Smart Energy Hub Development

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Summary

This research examines how three processes from Strategic Niche Management (SNM)—network building, articulation of visions and expectations, and learning processes—affect the success of the Smart Energy Hub (SEH) development at Hessenpoort. Success is measured by five indicators: project efficiency, team satisfaction, impact on customers, business success, and strategic potential. To investigate this, nine interviews were conducted, as well as documentation research and a participant observation. Data generated in this process was analysed and cross-checked throughout the study. Processes from SNM literature are based on the multi-level perspective, which explores how niche-level stakeholders collaborate to influence socio-technical regimes, as discussed by Geels and Schot (2007). The roles of various stakeholders are analysed, as well as their interests and their contributions to the SEH's success. It also tracks changes in the SEH network over time and how policy documents influenced the project's trajectory. The findings reveal a strong link between network building and project success and highlight the importance of knowledge building. Even though the articulation of visions and expectations was crucial, the stakeholders did not engage in the project for the same reasons. However, SEH at Hessenpoort formed a solution to the stakeholders' different individual challenges, resulting in some kind of shared visions nevertheless based on its usefulness. Overall, the research offers a detailed case study of SEH development in Hessenpoort, with a focus on stakeholder interactions. The discussion section critically reviews the research, summarizing key insights and the overall structure. The conclusion suggests recommendations for future studies on stakeholder cooperation, SEHs, or alternative energy systems.

Abbreviations

EMS	Energie Management Systeem
Groep-TO	Groeps Transportovereenkomst
HSMS	Hoog- en Middelspanningsstation
LAN	Landelijk Actieprogramma Netcongestie
NP RES	Natioanal Programma Regionale Energiestrategie
RWZI	Rioolwaterzuiveringsinstallatie
SEH	Smart Energy Hub
SZN	Smart Energy Hub regio Zwolle Noord
WDO Delta	Waterschap Drents Overijsselse Delta

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Chapter 1: Introduction

Background

The evolution of the public energy system in the Netherlands, thinking about energy provision politically and stakeholders engagement goes back for decades (Verbong 2001). Initially based on coal, the energy system underwent significant changes due to various external challenges. Geopolitical tensions and dependence on energy imports led the Dutch government, after WWII, to enhance domestic energy security by empowering local electricity producers (Ibid). A major shift occurred in 1953 when Minister Zijlstra promoted a self-regulating approach among stakeholders, reducing government intervention. In the 1960s, the energy sector transformed with the rise of natural gas and nuclear energy (Verbong and Geels, 2006). The government established Gasunie to monopolize gas exploitation and addressed the 1973 oil crisis by emphasizing environmental sustainability (Hesselmans et al., 2000). The Electricity Act of 1989 further liberalized the market, promoting competition and privatization (Oteman et al., 2017). This laid the groundwork for how public and private organizations would cooperate on energy supply in the future.

Recent years have seen a stronger focus on renewable energy, driven by the Energy Accord of 2014 and the Urgenda ruling of 2015 to pursue emissions reductions. The Paris Agreement and National Plan Energy and Climate 2021-2030 align Dutch policies with EU standards, promoting sustainability. This plan also introduced the concept of the Smart Energy Hubs (SEHs) as well as Regional Energy Strategy (RES) platforms, fostering stakeholder collaboration for a sustainable energy transition. In this process, grid congestion emerged as a major challenge in the Dutch energy transition, particularly for energy-intensive business parks (CBS 2021). SEHs were proposed as a solution, facilitating better energy regulation and congestion management for stakeholders (Hennig 2024). Although a definitive conceptualization of SEHs is still to be formulated, it generally involves local actors coordinating energy generation, conservation, conversion, and usage to meet collective needs (RVO 2023). The goal is to reduce reliance on the grid by moving more energy capacities closer to the user, allowing for more localized regulation of energy provision. Implementing smart grid solutions can improve efficiency and increase stakeholder engagement (Eladl et al., 2023). Developing SEHs therefore requires both technological innovations as well as strong collaboration among local stakeholders to effectively manage energy provision.

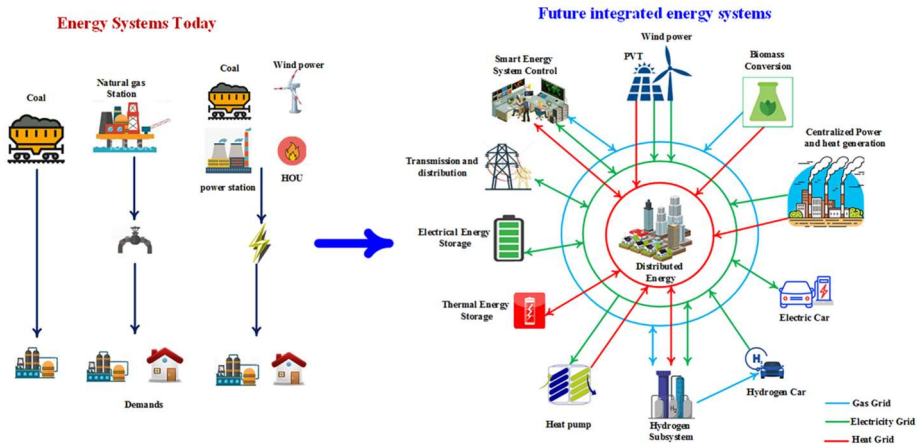

Figure 1: Smart Energy Hubs (Eladl et al. 2023)

Transitioning to a new system requires engaging stakeholders with diverse interests, which can be effectively examined using the strategic niche management (SNM) perspective (Hoppe & Miedema 2020). this approach focuses on understanding how stakeholders can best collaborate by emphasizing three key processes: network building, articulating visions and expectations, and fostering learning processes (Schot & Geels, 2008).

(Social) network building

Building social networks involves creating broad coalitions and engaging various actors to secure both material and immaterial resources, which helps gain commitment and facilitates interactions (Schot & Geels, 2008). The term 'social' here refers to the formation of networks that support technology adoption, stakeholder interactions, and resource provision (Rantala et al., 2020). National efforts to improve this include the National Program Regional Energy Strategy (NP RES), which assists local governments in developing energy strategies and has expanded its network to include various stakeholders and knowledge institutes (RES, 2022). These networks are vital for knowledge exchange, which is supported through events and other (in)formal ways of knowledge exchange. Building social networks and learning processes are therefore interconnected: networks facilitate knowledge sharing, and the need for knowledge can motivate stakeholders to create networks.

Articulating expectations and visions

The articulation of expectations and visions can enhance the "direction of learning processes, attracting attention to legitimate protection and nurturing" of the niches, as noted by Schot and Geels (2008). Nationally, the National Action Plan for Grid Congestion (LAN) exemplifies efforts to develop a shared vision among various stakeholders. For instance, the document describes three primary objectives: expediting grid extensions, optimizing grid efficiency, and enhancing flexible capacity (p. 3). Thus, this document serves as a model illustrating how expectations and visions can be documented at a national

level, laying the groundwork for collaborative efforts among stakeholders. However, since this document mainly addresses foundational strategies for addressing grid congestion at the national level, this paper will delve into the process of developing SEHs at the local level.

Learning processes

Learning processes are important for the success of niches because they help change cognitive frames and assumptions (Schot and Geels, 2008). Building SEHs requires creating knowledge to guide their development. Different initiatives, both profit-driven and not-for-profit, exist to support this. One such initiative is EIGEN, involving stakeholders from the energy sector, where knowledge is shared and created at a national level (eigen-energyhubs.nl, 2024). These include developers, those with problems to solve, future users, and energy providers, all contributing their expertise. EIGEN is developing a 'road map' (blauwdruk) to try out different ways to develop SEHs across the Netherlands. By testing these ideas, they aim to learn and improve the process of SEH development. This initiative demonstrates how stakeholders can collaborate nationally to enhance learning processes, not just by using existing data but by actively building upon it.

Geels and Schot (2008) outline how enhancing key processes through strategic niche management (SNM) can increase the likelihood of successfully integrating new projects into the socio-technical regime and making them mainstream, though this depends on context and scale, requiring in-depth research on stakeholders and the project itself.

Problem statement

This thesis focuses on the development of a Smart Energy Hub (SEH) at Hessenpoort. Across the Netherlands, various initiatives are exploring the potential of SEHs to improve energy provision. Scholars have studied the technical aspects of SEHs and the integration of multiple energy sources within a single system (Mohammadi et al. 2018; Bahrami and Scheikhi 2015). In the Dutch context, projects like EIGEN and policies like the LAN and NP RES are guiding SEH development. What is known therefore is much on the technical aspects of these systems, as well as some general steps that should be undertaken to structure the project. However, these approaches often create a broad, generalized plan that may not suit specific cases. Therefore, this thesis includes a detailed case study of Hessenpoort, emphasizing stakeholder collaboration at the project level. By examining this cooperation, the thesis adds to our understanding of how to successfully develop SEHs.

Research objective

The research question will therefore be focussing on how three processes occur at the local level, and how these have led to the success of the SEH at Hessenpoort. This level refers to the individual SEH, which can be further understood by examining local stakeholders and their involvement with these projects. The objective of this thesis is to explain how these three processes have led to the outcome of the SEH project at Hessenpoort, how they are interconnected, and what lessons can be learned from these approaches. To address this, the following research questions and sub-questions will guide the study:

> RQ: How have key processes as described in strategic niche management (SNM), namely network building, articulation of visions and learning processes, contributed to the successful outcome of the SEH project at Hessenpoort as defined through the five indicators by Shenhar and Dvir (2007)?

SQ1: To what extent can the SEH at Hessenpoort be considered a success?
SQ2: How have stakeholders approached network building in SEH development?
SQ3: How do stakeholders articulate their expectations and visions in SEH development?
SQ4: How do stakeholders shape learning processes in SEH development?

Relevance of the research

The concept of a Smart Energy Hub (SEH) has gained significant attention recently due to its potential to address grid congestion (Papadimitriou et al., 2023). SEHs offer various benefits, including technical improvements (better energy efficiency and system reliability), economic advantages (lower operating costs and reduced grid congestion), and environmental gains (decreased emissions by reducing reliance on fossil fuels). These benefits are crucial in tackling major societal issues like climate change, air pollution, and energy availability. Therefore, exploring the development of SEHs in depth is important for improving the Dutch energy system. Practically, this research can inform policymakers on designing effective SEH projects and provide stakeholders with insights into essential collaborations and strategies for successful SEH development. Although initiatives like EIGEN offer guidance, a detailed case study could reveal underlying dynamics and help refine development blueprints. This research can also contribute to the theory of Strategic Niche Management (SNM) by examining how innovations emerge at the local level and how SNM principles apply to contemporary concepts like SEHs. Given the need for diverse stakeholders, this study could shed light on how SNM can be effectively implemented. Personally, my interest in environmental issues, partly through by my work in consultancy and NGOs, drives my belief in the potential of SEHs to address environmental challenges through innovative and collaborative efforts. Through this research, I aim to contribute to the energy transition and promote a cleaner, safer future.

Chapter 2: Theoretical framework

Strategic niche management (SNM)

To gain deeper insights into the dynamics of technical development, scholars have expanded their theoretical framework by integrating socio-technical elements, a concept known as the multi-level perspective (Geels, 2002). This framework discusses innovation as a product of interactions among regimes, landscapes, and niches, emphasizing the interplay between these components.

Within this framework, a sociotechnical regime is defined as the collective norms within a specific community or established behavioural rules (Geels & Schot, 2007). In the context of SEHs, this refers to the dominant energy structures on which industrial parks depend, consisting of cooperation between energy providers, grid operators and energy users. The sociotechnical landscape includes the broader contextual factors influencing these regimes, such as political dynamics. As discussed in the background section, various levels of government are currently designing numerous sustainability policies. These policies can be seen as part of the sociotechnical landscape, providing the context within which SEHs are being developed.

Technological niches represent experimental and dynamic spaces where innovative concepts emerge, requiring actors to be distanced from market dynamics and competition (Geels & Schot, 2007). These niches can take the form of platforms where innovators collaborate to develop strategies for SEH development, such as the National Program Regional Energy Strategy (NP RES). It is crucial for stakeholders to work together in these niches, for example, by exchanging knowledge or ideas. Niches are primarily associated with the regional level, while regimes and landscapes are more closely linked to the national and supranational levels, respectively (Hoppe & Miedema, 2020). The governance structures set up to manage these dynamics are commonly referred to as strategic niche management (SNM).

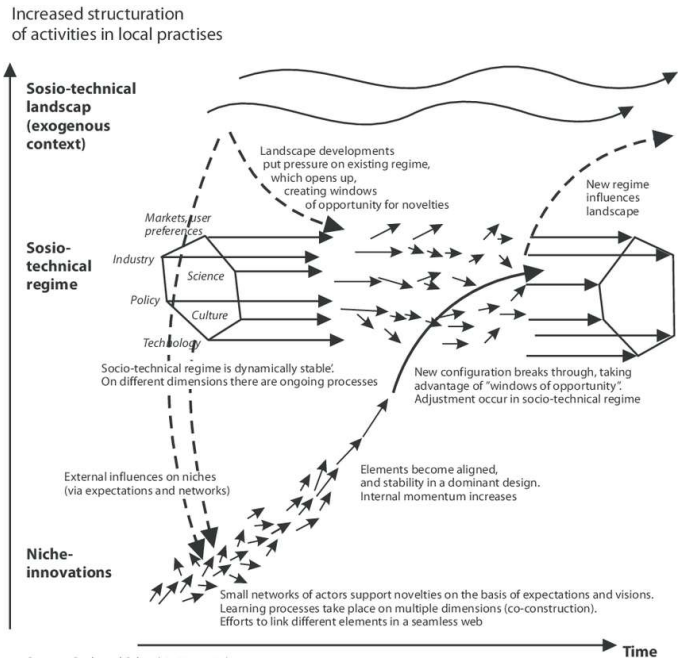

FIgure 2: The multi-level framework, where the niches are aiming to penetrate the socio-technical regimes by developing strategies (Geels and Schot 2007)

Niches have an important role in the realization of regime shifts (Schot & Geels, 2008). To be effective in their strategy, there needs to be some sort of interplay between them and the regimes and landscapes. Strategic niche management (SNM) on itself however is too limited to realize structural change (Stiles, 2020). Since it focusses on the niches itself, it does not adequately address the interrelatedness to the other socio-technical levels which is essential to understand how sociotechnical change is driven. Scholars have addressed therefore that it would benefit niches when taking a more holistic approach to driving change, expanding their scope to the other levels as well (Raven et al. 2010). Practically, this could mean not only looking at how the stakeholders in the niches are operating, but also to what external actors can have a role in driving this change. This would require a more holistic form of cooperation, in which the niches are not only engaging with each other but also with the actors in the sociotechnical regimes, and perhaps even the socio-technical landscape if this would contribute to the success of the strategy.

Determining the success of the project

To determine the success of the SEH at Hessenpoort, a framework can be adopted that addresses different aspects of the outcome of stakeholder cooperation. Assessing the outcome of a project allows for comparison between projects and can contribute to improved project management in the future. It is important to differentiate between short-term and long-term success (Jessen, 2011). In the short term, a project may exceed its budget and timeframe, which would be considered a failure in project management. However, in the long term, this same project might prove to be very successful, validating

the project's management framework. In the case of SEHs, which are relatively recent developments, the initial stages may not immediately appear successful if they exceed the set boundaries. Nonetheless, given their role in addressing significant societal issues like the energy transition and grid congestion, SEHs may prove to be highly successful in the long term, justifying the initial overuse of resources.

In evaluating project success, some authors use a multidimensional framework (Shenhar and Dvir, 2007). This framework encompasses five dimensions, or indicators, enabling assessments from various perspectives at different times. These indicators are project efficiency, team satisfaction, impact on customer, business success, and preparation for the future. With every dimension, the timeframe is increasing in length, with ‘project efficiency’ being the most short term indication of success and the ‘preparation for the future’ the longest.

Success Indicator 1: Project Efficiency

Project efficiency refers to the degree to which the project meets its objectives concerning time, cost, and functionality. This is the most immediate dimension and can be assessed during execution and immediately after project completion (Shenhar et al., 1997). In the context of SEHs, this dimension relates to the timeframe and costs dedicated to setting up such a system.

Success Indicator 2: Team Satisfaction

Team satisfaction concerns the project team's experience, including aspects such as morale and individual growth (Shenhar and Dvir, 2007). This dimension follows project efficiency and can be evaluated shortly after project completion. For SEHs, this includes the development stage's networks and whether the process has strengthened existing relationships.

Success Indicator 3: Impact on Customer

This dimension focuses on the customer's experience, particularly whether performance measures, functional requirements, and technical specifications are met (Shenhar et al., 1997). Most importantly, it measures whether the systems provide benefits for the user in terms of functionality, for example when it comes to technological solutions. In SEH projects, 'team satisfaction' and 'impact on customer' are closely linked, as the SEH is developed by stakeholders for stakeholders. Nevertheless, it could be argued that this dimension looks more at the utility of the system to the stakeholders, rather than their subjective experience of it.

Success Indicator 4: Business Success

Business success examines whether the project generates profits for its drivers, which can be economic or in terms of enhanced performance (Shenhar and Dvir, 2007). In SEH development, this dimension considers whether the SEH significantly improves stakeholders' energy management. It also evaluates the system's benefits to the organization in terms of energy or cost savings.

Success Indicator 5: Preparation for the Future

Preparation for the future assesses whether the project creates opportunities for future organizational growth, such as new markets, production lines, or technologies (Serrador and Turner, 2015). This is the most forward-looking dimension, evaluating the project's potential long-term benefits. In SEH development, it includes future expansion prospects and the broadening of the stakeholder network.

SNM processes

SQ1: network building

In their article, Schot and Geels (2011) describe network building as a method to gather resources from various actors and to integrate innovative ideas from external sources, which strengthens the entire network. This suggests that individuals creating networks within niches should focus on both the internal relationships between stakeholders and the external connections with other stakeholders. Research shows that dense networks, with close-knit connections, are better at exchanging resources and thus more likely to be innovative (Caniels and Romijn 2008). On the other hand, networks that are more loosely structured, allowing many actors to join, tend to be more successful because they can attract new ideas and external resources more effectively (Granovetter 1983). Which strategy to adopt is dependent on contextual factors. Therefore, both the internal and external environments of a network developing SEHs should be considered, and it is important to balance the dynamics between internal and external stakeholders.

Other authors have discussed how network building is related to the other two processes of strategic niche management (Caniels and Romijn 2008). In terms of network building and learning processes, strong networks enhance knowledge exchange because the organizations within them are aware of each other's information needs (Tyre and Hippel 1997). The link between network building and the articulation of expectations and visions is due to organizations working towards a common goal, which encourages new ideas and further strengthens the network, benefiting resource exchange. Network building is therefore interconnected with the other two aspects of strategic niche management, and they can reinforce each other if stakeholders invest in them.

SQ2: articulating expectations and visions

Regarding the articulation of expectations and visions, authors generally agree that this process unites multiple actors and motivates them to pursue a specific strategy. Elzen, Hoogma, and Schot (1996) identified three indicators to measure the effectiveness of these expectations and visions. First, the **robustness** of expectations and visions refers to the extent to which multiple actors across various sectors share them. A vision shared by a larger number of actors has a stronger foundation for executing

a niche strategy. Second, the **quality** of expectations and visions influences their ability to develop a successful strategy. This indicator depends on how well these expectations align with ongoing technical and sectoral innovations, which can enhance their credibility. Third, the **specificity** of expectations and visions is crucial, as more specifically formulated visions are more approachable and understandable, thereby attracting more stakeholders to join and support the initiative. Using these indicators helps determine if stakeholders involved in SEH development can construct effective expectations and visions for cooperation.

Other scholars describe this process as creating a common narrative (Boon et al. 2014). A well-constructed narrative attracts new actors to the network, bringing in additional resources and knowledge. Stakeholders or narratives can function as guiders in coalitions to achieve this change (Smith and Raven 2012; Turheim and Geels 2020). Narratives can activate and empower stakeholders by understanding the political discourse within socio-technical regimes and proposing renewed or improved alternatives. A central aspect of this approach is framing and re-framing reality. It involves addressing a specific challenge and proposing a solution from the niche's perspective. For SEHs, this means addressing the current reliance on fossil fuels and issues with grid congestion while promoting an alternative vision for energy provision. Moving the current frame towards a more sustainable and eco-friendly one, following the quality aspects previously discussed, is crucial. The success of such a frame largely depends on the willingness of the niche-based network of stakeholder to carry it out, and doing so is fundamental to whether or not the strategy will be successful in integrating into the socio-technical regime.

SQ3: learning processes

When researching the relevance of learning processes in strategic niche management, researchers emphasize the significance of both first-order learning (gathering information) and second-order learning (altering cognitive frames and assumptions) (Grin and Van de Graaf 1996; Schot and Geels 2008). Research also indicates that broad and open networks are more likely to engage in second-order learning because they include more outsiders who can introduce new ideas (Schot and Geels 2008). This highlights the dual responsibility of stakeholders in managing information within networks: sharing information internally and attracting external information. However, other scholars note that simply involving external stakeholders does not guarantee second-order learning (Harborne et al. 2007). They suggest that active learning within a network needs a driving force, such as a shared vision. This underscores the connection between the learning process and the development of expectations and visions. Expectations and visions can enhance learning processes by attracting external stakeholders who are motivated by a specific vision to join an innovation project.

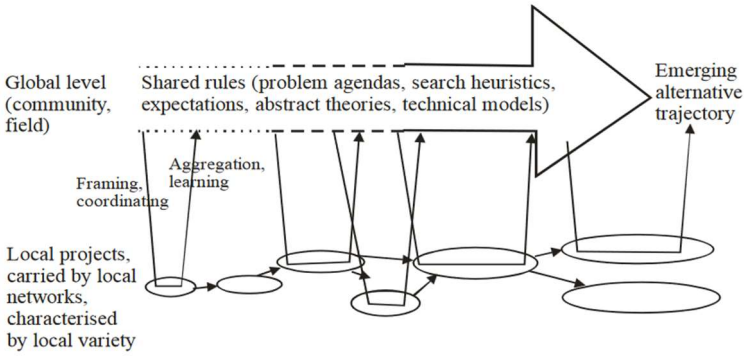

FIgure 3: Illustrates how learning is conducted by utilizing projects in harnessing knowledge, which in turn have an effect on the trajectory of the 'shared rules' (Geels and Raven (2006)

In SNM, there is a focus on 'social learning', where various actors interact to develop an alternative understanding of reality (Raven et al., 2010). This involves multiple local projects undertaken by different actors, which collectively shape a shared narrative of rules. The feedback from these diverse projects needs to be gathered and exchanged through platforms like conferences, workshops, technical journals, and newsletters. In the context of SEHs, these projects can encompass initiatives by individual stakeholders as well as ongoing specific projects. Experiences such as energy exchange, managing grid congestion, and sustainable energy generation methods are shared in this manner. Each stakeholder contributes unique knowledge, and integrating these insights enhances our understanding of how SEHs are successfully developed.

Conceptual framework

The illustration below depicts the application of strategic niche management (SNM) dynamics in analysing the success of SEHs in this study. This thesis examines the SEH project at Hessenpoort, assessing its success through five indicators discussed as part of the dependent variable. In exploring the independent variable, the thesis investigates how stakeholders at Hessenpoort have engaged in network building, articulated visions and expectations, and facilitated learning processes. The relationship between the independent and dependent variables thus focuses on how stakeholders applied strategic niche management theory and how these processes contributed to the success of the SEH at Hessenpoort, as indicated by these measures. This will provide insights into how these processes function, and how they contribute to SEH success.

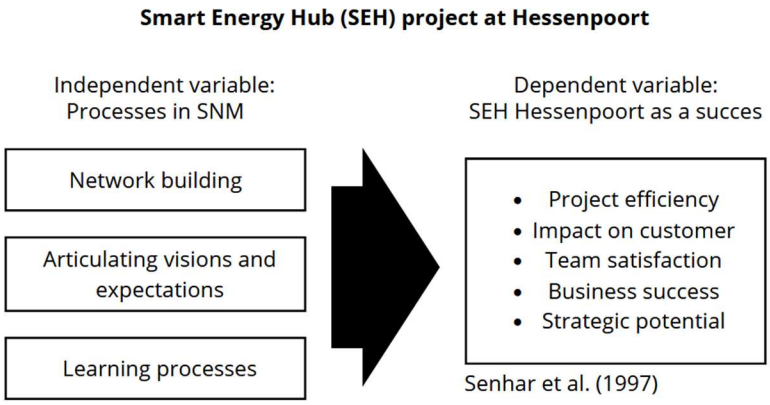

Figure 4: An illustration of the different concepts used in this research.

Conclusion theoretical framework

This chapter examines the theoretical framework underlying this study. By employing Strategic Niche Management (SNM) and its foundation in the multi-level perspective, the study enhances the understanding of socio-technical dynamics. Central to this approach is the examination of socio-technical niches, regimes, and landscapes, and their interactions which drive change when niches penetrate socio-technical regimes. SNM typically addresses how these niches organize themselves.

This study uses Shenhar and Dvir's (2007) theory to evaluate the success of the SEH at Hessenpoort, which is crucial for determining the relationships between various aspects. Shenhar and Dvir identified five dimensions of success: project efficiency, team satisfaction, customer impact, business success, and future preparation. These dimensions provide a comprehensive evaluation of the project's success from different perspectives and timescales.

Scholars assert that managing niches effectively involves succeeding in three key processes: network building, articulating expectations and visions, and learning. A broad, open network is generally better at attracting new information, while tight networks excel in exchanging knowledge. Articulating visions and expectations helps engage stakeholders. Learning, through first- or second-order learning, aids in developing strategies for change.

This study combines the five dimensions of success with SNM processes. According to the literature, successful execution of SNM processes is essential for a project's success. Understanding how these processes lead to the project's outcomes provides insights into how change is typically achieved. The methodology section will discuss the practical application of this approach within the context of the SEH at Hessenpoort.

Chapter 3: Methodology

The main goal of this research is to understand how the SEH project at Hessenpoort developed through collaboration among stakeholders. To do this, the study will use the SNM framework, which focuses on three important processes: building networks, articulating expectations and visions, and learning processes. The research question is: How have key processes as described in strategic niche management (SNM), namely network building, articulation of visions and learning processes, contributed to the successful outcome of the SEH project at Hessenpoort as defined through the five indicators by Shenhar and Dvir (2007)? This question aims to identify the key factors and conditions that lead to successful SEH development by examining these processes.

3.1 Research methodology

This thesis uses a single case study method focused on the Hessenpoort industrial park in Zwolle and adopts a qualitative approach. The research aims to understand how the SEH at Hessenpoort was developed through the perspectives of various stakeholders, including their views on learning processes and stakeholder engagement. A qualitative approach is more suitable here than a quantitative one, as it captures participants' interpretations and accommodates the unique nature of the SEH project in the Netherlands. Since this is one of the first of its kind, a quantitative approach would be less effective (Creswell & Creswell, 2023). Thus, a qualitative method allows for the exploration of new variables and insights, as existing theories have not yet been applied to this context.

The single case study approach is suitable for this research for several reasons. Yin (2009) explains that case studies aim "to illuminate a decision: why they were taken, how they were implemented, and with what result" (p. 12). The case of the SEH at Hessenpoort fits this approach because it is a contemporary phenomenon with unclear boundaries between the phenomenon and its context. A case study approach requires triangulation—gathering evidence from multiple sources—to provide greater detail, richness, and depth on the case (Flyvbjerg, 2008). This method is effective for exploring context-specific cases, making it well-suited for studying the SEH at Hessenpoort.

3.2 Case study chosen

The SEH project at Hessenpoort was chosen for several reasons. Firstly, it is one of the few successful examples in the Netherlands, making it valuable for studying challenges like grid congestion and sustainability. Understanding new projects like this can provide crucial insights as these challenges grow. Secondly, the project involves diverse stakeholders—businesses, governments, and grid operators—working together. Analysing their interactions can reveal how to successfully implement similar projects, making this knowledge broadly applicable. Thirdly, this case stood out among other successful projects in the Netherlands, like Schiphol Tradepark and SEH Tholen, because the

stakeholders were particularly enthusiastic about its potential to advance SEHs. Their strong interest led to quick responses to interview invitations and provided rich, detailed data, as they had invested significant time in the project and actively promoted it.

3.3 Data collection methods

To gain a deeper understanding of the SEH project at Hessenpoort, this research used triangulation to combine multiple data collection methods: documentation research, semi-structured interviews, and participant observation. Case studies are particularly suitable for utilizing multiple data collection methods (triangulation) because they enable investigation into a wide array of historical, attitudinal, and behavioural issues (Yin, 2007). First, documentation research was used. This involves reviewing relevant documents such as policy documents, news articles, and online publications. Through this method, interview and observation data can be checked and helps prepare for interviews by providing a well-informed perspective (Creswell & Creswell, 2023).

Second, interview data was gathered. Semi-structured interviews offer deeper insights into stakeholder experiences and interpretations of the SEH project. Interviews are guided by a prepared set of questions, which allows for systematic comparison and gathering of data related to key indicators. The questions in the interviews (appendix 3) were meant to steer the conversation, but depending on the topics that were addressed, the trajectory could be adjusted (semi-structured interviewing). Participants were selected using a snowball sampling strategy, resulting in 9 interviews: 2 from businesses at Hessenpoort, 3 from government bodies, 1 from a grid operator, and 3 experts on SEH development. This sample represents the key stakeholders involved in the project. These participants were based on their availability, but most importantly their relation to the case: all of them had first-hand knowledge of the case, or demonstrated knowledge about SEHs in general. Despite reaching out to many potential interviewees, most were unavailable due to being busy or already involved in other thesis projects. However, those who were able to participate were recommended by others who could not, highlighting their importance in the project and the network. This did not lead to a biased or one-sided selection of interview participants, as a representative group across different stakeholders participated. Their privacy was respected, and the findings were confirmed with the interviewees to ensure accuracy.

Third, a participant observation took place at the 'PVB Yearly Event Future-Proof Industry Parks' in Zwolle. This event, organized by the Sustainable Industry Park Programme (PVB) and OVH, provided context to the research by allowing the researcher to observe interactions and discussions about the SEH project in a relevant setting. This method adds depth to the interview data and enhanced understanding of stakeholder perspectives (Yin, 2007). This method also provided valuable context to interview findings by immersing the researcher in the environment where networks were formed, which is the Hessenpoort industry park.

Figure 5: On the left, an impression of the talks during the event: three experts with different backgrounds (government, NGO, Business) discussing implications of grid congestion.

3.4 Data analysis

The data collected through three methods underwent separate analyses, each with a unique approach (Creswell and Creswell 2023). First, for documentation, the focus was on identifying reliable sources, such as the organization's official website, and extracting relevant information that aligned with other data sources—this is known as triangulation. Different types of documents contributed in various ways: news articles provided a timeline of events, while policy documents offered insights into intentions and strategies. By critically examining these sources, a reliable ana lysis was achieved.

Second, the nine interviews were analysed through a process of transcribing, coding, and pattern recognition. All interview transcripts were combined into one document, and key points were coded and categorized using consistent colours. This allowed for identifying agreements and differing views among respondents, highlighting commonalities and differences in their perspectives. Representative quotes were selected to illustrate general trends discussed in the analysis section.

Lastly, participant observation was analysed using notes taken during meetings and events. Listening to attendees' concerns and their handling of SEH challenges provided a deep understanding of stakeholder operations. This method was particularly useful for contextual integration, helping to contextualize data from other sources. Additionally, the event provided new documentation, such as PowerPoint presentations, and facilitated in-person meetings with key project individuals. The observation also included informal conversations with people who could not join the interviews but attended the event. These were mainly people from the OVH and business representatives at Hessenpoort. These discussions provided new insights into the roles of these organizations, but they could not be formally recorded or analysed.

3.5 Strengths and weaknesses of this research

The strength of this research lies in its internal validity, which accurately measures the effect of the independent variable on the dependent variable. This is achieved through a triangulation process using three distinct data collection methods. These methods provide unique datasets that offer insights into the SEH pre-launch process at Hessenpoort, viewed through strategic niche management. Comparing these findings allows for a mix of subjective and objective data, with documentation offering context for interview and observation perspectives. This enhances our understanding of the SEH project.

To enhance the internal validity of the study, it is important to address certain challenges, as noted by Creswell and Creswell (2023). Careful selection of diverse interviewees is crucial to avoid bias, as inviting participants via email may attract those already supportive of SEHs. To mitigate this, the interview guide encourages critical reflection on SEH processes. Interviews will be conducted securely, mainly via Teams calls, and responses will be anonymized to ensure honesty.

The main limitation of this research is its external validity, which is typical in studies using a case study approach (Creswell and Creswell, 2023). This means the focus is primarily on understanding the specific dynamics of a particular case, rather than ensuring the findings can be applied to other cases in the Netherlands or elsewhere. In other words, the results may not be broadly applicable to other situations. However, because of the in-depth nature of this research, it may encourage other projects to adopt specific practices highlighted in the Hessenpoort case. Instead of studying multiple cases, focusing on a single case offers a variety of insights into these practices. Stakeholders from different cases are likely to find valuable lessons in this wide range of insights. It is important to consider the context in which this project took place so that observations can be understood within that framework. This approach not only strengthens the research's reliability but also enhances the understan how this case relates to others that are similar.

3.6 Operationalization table

The operationalization table, which can be found in appendix 1, aids in data analysis by using indicators to assign values to different variables. The indicators for both dependent variables (DV) and independent variables (IV) are based on the theoretical foundations discussed in Chapter 2. The table aims to clarify these variables by linking them to practical indicators for use in the analysis. Additionally, these variables align with the indicators of success defined by Shenhar and Dvir (2007) and the processes from SNM described by Schot and Geels (2008).

Chapter 4: Analysis

The following section will analyse data from documentation, interviews, and observation. This analysis will be divided into different sections. First, a timeline will outline key developments in the SEH project at Hessenpoort, highlighting crucial policy documents and other forms of documentation like news articles. Venn diagrams will illustrate the stakeholders involved during this period. The second part will focus on interview data, examining the SEH at Hessenpoort as a 'success' case and exploring it through the perspective of SNM to uncover and discuss underlying dynamics.

A more detailed overview of the different stakeholders and their interests is provided in Appendix 2. This section offers clarity on what drives each stakeholder and their reasons for engaging in the project.

4.1 Timeline SEH development at Hessenpoort

2016-2017 (phase 1)

The desire to make the Hessenpoort industrial park more sustainable has existed for years, with various initiatives and policies emerging to enhance it. In 2016, the province of Overijssel released its Omgevingsvisie, which outlines the provincial interest in different area types and characteristics, adding ambition and guidance (Provincie Overijssel, 2016). However, the document does not allocate much attention to 'sustainability' or 'energy', as none of the chapters are specifically dedicated to these topics. Instead, the discussion is introduced abstractly, leaving considerable room for further exploration.

At the same time, several organizations launched the 'Hessenpoort Natuurlijk!' initiative, aimed at increasing greenery in the area (Duurzaamdoor.nl, 2016). This initiative focused on enhancing biodiversity and greening the working environment. It was initiated by the Entrepreneurs' Association Hessenpoort (OVH) along with several NGOs (Ibid). The organization collaborated closely with the municipality to achieve its goals. Although this initiative was separate from later sustainable energy efforts, it demonstrated an early commitment to sustainability, with the OVH playing a central role and collaborating with governmental entities like the municipality.

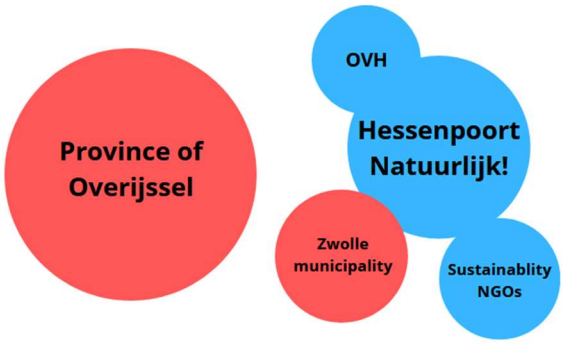

Figure 6: In phase 1, businesses under the OVH banner as well as NGOs work together to improve greenery in the Hessenpoort area. The province of Overijssel is developing its own sustainability strategy, separately.

2018 (phase 2)

During this period, the municipality of Zwolle clarified its sustainable energy ambitions in the policy document 'Plan van Aanpak 2018-2022: Zwolle geeft energie'. The municipality set a goal to reduce CO2 emissions by 25% by 2025, which necessitated measures across various sectors, including energy provision and generation. For businesses and industrial parks, the document demands that companies must implement energy-saving measures with a payback period of five years (Gemeente Zwolle, 2018). This policy is connected to increased efforts to develop solar fields. The document also emphasized the municipality's role in supporting businesses through information, advice, and encouragement (Ibid). Additionally, it stressed that the responsibility for these challenges extends beyond the municipality, requiring broad cooperation among various actors—big and small, organized and informal, professional and public—aimed at transitioning to more sustainable and affordable energy (Ibid). Driven by these policy documents, it appears that the NGOs withdrew from sustainability efforts. This likely happened because the new sustainability approach required comprehensive changes to the energy system, needing more government coordination rather than just increasing greenery. As a result, NGOs stopped participating.

The need to fundamentally rethink the Hessenpoort industrial park became a focus for the municipality within these policies. In 2018, the municipality released the 'Plan van Aanpak 2018: Duurzaamheid Hessenpoort', which specifically addressed issues related to energy provision and sustainability (Gemeente Zwolle, 2018). The document outlined opportunities and visions for the area, such as implementing collective systems and reducing energy costs. It also identified the key stakeholders necessary for realizing the plans and emphasized the importance of cooperation among them, noting that stakeholders varied in their understanding of sustainability (Ibid). This document also marked one of the first official mentions of the SEH project.

Figure 7: In the next phase, NGOs withdrew due to a new sustainability project at Hessenpoort. New participants joined, coordinated by the Zwolle municipality. Following the 'Plan van Aanpak: 2018-2022: Zwolle geeft energie' policies, a separate document focusing on Hessenpoort is being developed with businesses and grid operators.

2019 – 2022 (phase 3)

In 2019, the newly constructed solar park Zonneweide, with a generating capacity of 7.6 megawatts, raised concerns about grid congestion (zonneweidehessenpoort.nl, 2024; smartenergyhubs.eu, 2024). To address this issue, various businesses at the park formed the 'Cooperation Zonneweide Hessenpoort' and worked with the grid operator Enexis. They agreed to pilot a 'group transport agreement' (Groep-TO) to experiment with collective energy provision (Enexisgroep.nl, 2022). This approach focused on stakeholder cooperation to monitor energy usage according to agreed terms. Being granted pilot status by Enexis, the cooperation moved closer to realizing the SEH. The pilot not only offered potential savings on energy costs for businesses but also aimed to prevent public costs related to grid congestion (RVO, 2024). Implementing an SEH through a Groep-TO agreement could therefore be advantageous on multiple fronts.

To guide the development of the SEH at Hessenpoort and other similar projects, the province of Overijssel released the policy document 'Smart Energy Hubs 2021-2023: Uitvoeringsagenda'. This document outlines the goals for SEHs in Overijssel, which include making the Dutch energy system more sustainable, ensuring a reliable grid, and balancing supply and demand in the region (nieuweenergieoverijssel.nl, 2021). It specifies that SEHs should be completed by the end of 2023, when a fully operational SEH should be realized with multiple energy users joined. It also emphasized expected continual growth in the years following the realization. The province has taken a central role in this process, providing both area directors and resources to drive it forward. These area directors are tasked with consulting stakeholders, including local governments, businesses, and organizations like the OVH for the SEH at Hessenpoort.

The policy document also outlines how stakeholders should collaborate to enhance their learning processes. The province intends to make the knowledge gained from SEH projects widely accessible, noting that "every initiative, business, or industrial park aiming to integrate local energy supply and demand can benefit from the insights and experiences gained from these SEHs" (Ibid: p. 9). The goal is not only to generate valuable knowledge for the directly involved stakeholders but also to contribute to national and international knowledge on SEHs. Additionally, the document proposes a governance structure for the SEHs, including steering groups, executors, and expert groups, which will meet regularly to ensure effective collaboration (Ibid). This structure aims to clearly define roles and responsibilities while combining various areas of expertise to achieve the best results for the SEH.

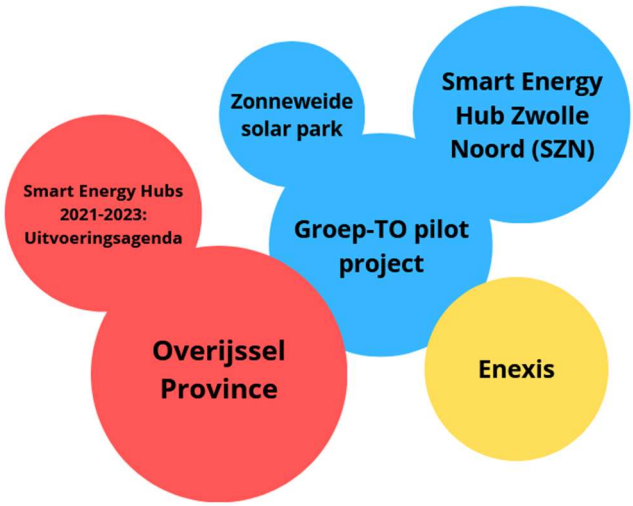

Figure 8: Due to a combination of policy documents on sustainable energy, solar panels, and grid congestion at Hessenpoort, the stakeholders are granted the Groep-TO pilot status. The goal is to establish a SEH at Hessenpoort through cooperation between businesses, government, and grid operators.

2023 – 2024 (phase 4)

In October 2023, the Smart Energy Hub (SEH) at Hessenpoort was officially launched. The project involved three businesses: Thiem (a social workplace), Zehnder (an air conditioning manufacturer), and Axxor (a cardboard honeycomb manufacturer). The SEH employs an ICT-based energy management system (EMS) to monitor and regulate the stakeholders' energy usage according to their agreements (oost.nl, 2023). The system is integrated with solar panels, batteries, and gas generators, which serve as backups in case of system failures. The Groep-TO agreement with the grid operator was essential for acquiring this system, as it provided the necessary permissions for the project. This agreement required the businesses to maintain their energy usage within specified limits (smartenergyhubs.eu, 2024). Typically, businesses negotiate energy usage agreements with the grid operator individually, and such Groep-TO agreements are generally not permitted. However, by being granted pilot status, the SEH at Hessenpoort was among the first to experiment with this approach.

Figures 9 and 10: On the left an aerial view of the industry park at Hessenpoort (Google.com 2024). On the right a shot from the official launch of the SEH in October 2023. Present are representatives from Zehnder, Axxor and Thiem (Nieuwe Energie Overijssel: 2023).

Shortly after the official launch of the SEH at Hessenpoort, the initiative was renamed to Ceurz (Cooperatieve Energie Uitwisseling Regio Zwolle Noord). This rebranding aimed to expand the initiative beyond the Hessenpoort industrial park and include other industries and stakeholders in the region. In May 2024, Ceurz held its first official member meeting, welcoming nine new organizations (LinkedIn, 2024). This development highlights how the SEH at Hessenpoort was the result of various government policies and was successfully launched through the collaboration of businesses, grid operators, and NGOs. However, many questions still remain regarding the frameworks, legislation, and ownership needed to effectively develop SEHs.

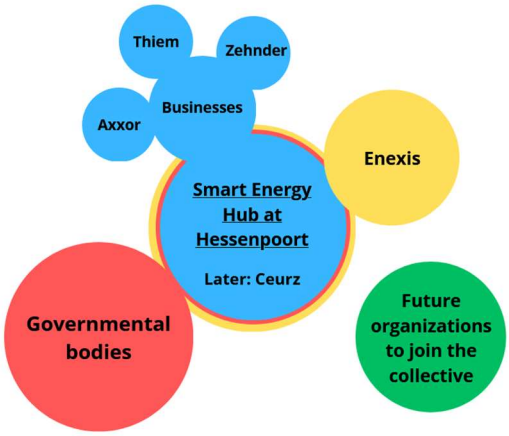

Figure 11: The SEH was officially launched in October 2023. As shown in the Venn diagram, businesses are now managing the project through agreements. Enexis remains involved as the grid operator and Groep-TO pilot initiator, while the municipality and province have taken a more reserved role. Future organizations, are mentioned, as Ceurz and its members are focusing on expanding their network.

4.2 Hessenpoort as a success

To assess the success of the SEH project, we can analyze various outcomes from both its development and its official launch in 2023. Shenhar and Dvir (2007) identify five indicators for evaluating project success: project efficiency, team satisfaction, customer impact, business success, and strategic potential. In the case of the Hessenpoort project, the customers and businesses are the same entities, as the organizations benefiting from the system also initiated and drove the project (nieuweenergieoverijssel.nl, 2024). This reflects a network governance approach, where stakeholders work collaboratively rather than following a top-down structure. However, the indicators of 'customer impact' and 'business success' will address different aspects of the project.

Project efficiency

According to Shenhar and Dvir (2007), project efficiency is assessed based on how well a project is completed within the set constraints of time, cost, and functionality. To evaluate the efficiency of the SEH project at Hessenpoort, we can examine three key aspects: adherence to the schedule, budget compliance, and functionality. As discussed, the project adhered to the schedule and met its functional goals, but budget compliance is difficult to determine due to insufficient financial data.

Firstly, regarding the schedule, the ‘Uitvoeringsagenda’ policy document from the Overijssel province set a plan to develop four SEHs, with Hessenpoort identified as the most promising. The Overijssel province effectively guided the development, and the SEH was successfully launched by the end of 2023, meeting the planned deadline.

Secondly, assessing budget compliance is challenging due to a lack of detailed financial documentation. According to a respondent (R8), most costs at launch were covered by the province and partially by the RVO, including funding for the EMS. Although it is difficult to verify if these funds remained within budget limits, it is clear that the province covered the majority of the costs up to the launch, rather than the individual businesses. However, due to insufficient documentation, it is difficult to make any statements on whether budget limits were being exceeded.

Lastly, concerning functionality, agreements were established among stakeholders and with the grid operator at the time of the SEH launch (oostnl.nl, 2023). These agreements laid a solid foundation for the Groep-TO project, enabling the EMS to start monitoring and regulating energy use as planned. At the time of the launch, these agreements ensured that the EMS met the required functionality standards.

> R4: “Then, you work towards the point when you can start to make agreements, and there are only a few examples where this has shown to have worked, among which Hessenpoort. (…) Then, you need to make agreements between the group and the grid operator. It is a legal construct: a contract. That is what you call a Groep-TO. (…) You need several things for that: a picture of what you are going to do, what the energy streams are and what the technological solutions are.”

This quote, as well as most of the other respondents, illustrates the processes towards such agreements. In this process, many things need to be considered, but by engaging in these negotiations the stakeholders were able to successfully secure the functionality of the SEH at the time of the launch.

Team satisfaction

According to Shenhar and Dvir (2007), team satisfaction involves assessing how the team members experienced the project, focusing on team morale and individual growth.

Regarding team morale for the SEH at Hessenpoort, feedback from the project team and external SEH experts was predominantly positive. Most respondents praised the strong collaboration among stakeholders. However, two respondents noted some challenges: one (R2) mentioned that Enexis was initially hesitant to participate in the Groep-TO project, while another (R6) discussed general concerns about grid operators' roles in SEHs. Despite these issues, the overall sentiment about team cooperation was favorable.

> R2: “We were already dealing with Enexis for a couple of years. At the moment that we wanted to connect to the grid, they said that this was not possible, because the grid was full. We said: that is not possible. It was a real pain. We went to court, and we won against Enexis.”

> R6: “The grid operator naturally has a large sense of responsibility for the trustworthiness of the energy supply. It is their reason for existence. So they do not feel like there is anyone else who can deal with that feeling better then they do. So they are really hesitant to give that control.

While most respondents praised the cooperation among stakeholders despite challenges like grid congestion and sustainability, two indicated that relations with grid operators were more strained. This suggests that the SEH project at Hessenpoort was successful, partly due to the mediation by the Overijssel province, which facilitated the Groep-TO pilot (phase 3) by ensuring that all parties were involved in its launch. Despite some tension as described in the quotes, the majority of respondents viewed the stakeholder cooperation positively. This means that for some organisations, they had difficulty with the grid operators individually, while the network overall were quite satisfied with the cooperation with the grid operator.

Regarding personal growth, most respondents did not directly address this aspect. However, they did describe learning processes, primarily related to collective knowledge building. This can also be understood as ‘social learning’, in line with Raven et al., (2010). One respondent (R4) specifically mentioned personal learning related to how stakeholders managed the transition, noting that different stakeholders experienced unique personal growth due to their varying interests. Given that the project was successfully launched, it can be inferred that the stakeholders underwent a significant phase of personal growth.

> R4: “As of now, we have learned a lot and things have become mainstream, but it used to be very unclear. But for businesses, grid operators, energy cooperations and municipalities there are different reasons to cooperate with this. But you are able to move in the same direction.”

Impact on customers

According to Shenhar and Dvir (2007), impact on customers refers to the benefits the system provides in terms of functionality and performance. For the SEH at Hessenpoort, the energy management system (EMS) is the key technological component that delivers its 'smart' capabilities. The EMS was successfully launched and became operational for the three businesses involved at the time of launch (phase 4). The system's implementation was supported by a negotiation process where stakeholders established how the EMS would function. Six out of nine respondents specifically mentioned the EMS, highlighting the importance of the agreements made to ensure its effective operation. Since the launch, these agreements have been in place, and ongoing collaboration will be essential, especially if new stakeholders join Ceurz.

> R4: “You are already entering the shadowy side of things we do not yet know. The pilot agreement is for a limited period, not for an unlimited period. During that period, stakeholders need to make agreements. So in the future… it is still a difficult question, because a new stakeholder will not receive connection with the grid operator. How do you deal with that? What do you do with a contract when someone leaves? Or if someone comes in return? That is still being thought out.”

This quote underlines the ongoing challenges and uncertainties that are related to the EMS’ operation as well as the agreements. Its success therefore is not fixed at a certain time, but needs continuous negotiation between stakeholders. In terms of impact on customers, the EMS is effectively enhancing energy provision for stakeholders by helping them meet their energy needs through the Groep-TO agreement. However, the success of this system relies on continuous negotiation among stakeholders to maintain the EMS's effectiveness, particularly as new participants join the collective.

Business success

According to Shenhar and Dvir (2007), business success is measured by whether a project has generated profits for its drivers. This can be assessed by examining energy savings and improvements in energy management capabilities. In the case of the SEH at Hessenpoort, only 2 out of 9 respondents specifically mentioned energy cost savings. This might be due to the project's recent development, with significant changes in energy costs not yet evident. However, those who did address energy costs noted that cooperation among businesses enables the sharing of energy provision costs, which lowers expenses for each stakeholder. This cost-sharing was likely established during the negotiation phase with Enexis (phase 3). The potential for further cost savings through negotiation remains, especially as new stakeholders join in the future.

> R1: “What is an advantage, of course, is that when you request a contract with three businesses, then its just the law of the large numbers. When you request more, or a bigger contract, then you have cheaper energy.”
>
> R2: “And Wehkamp is located on our terrain, and they are thinking of acquiring a large battery so they can maintain their logistical practices.”

Regarding improved energy management, 3 out of 9 respondents specifically noted that the EMS enhances their capability to monitor and analyze their energy use. The system collects data on individual stakeholders' energy consumption, which allows for better management of their energy usage. By providing valuable insights and requiring stakeholders to share their data, the EMS improves their ability to regulate energy use. Therefore, in terms of business success, the SEH and the EMS contribute both to cost savings and to a more effective management of energy usage for stakeholders.

Strategic potential

According to Shenhar and Dvir (2007), strategic potential refers to a project's ability to create future opportunities for organizations, such as new markets, production lines, or technologies. Indicators of this potential can include network expansion and contributions to the development of related projects. Regarding network expansion, Ceurz successfully attracted new stakeholders after the SEH's launch. As of May 2024, the collective held its first official member meeting and welcomed over nine new stakeholders. This expansion is partly due to some companies facing difficulties accessing the energy grid through traditional methods, thus seeking alternative connections like the SEH. In terms of further development, there is considerable interest in the results of the SEH project at Hessenpoort (observation 1). As outlined in the ‘Smart Energy Hubs 2021-2023: Uitvoeringsagenda’, the project enhances understanding of stakeholder dynamics in SEHs and has the potential to drive innovation in similar projects.

4.3 SNM processes in the SEH at Hessenpoort

4.3.1 Network building

In line with Schot and Geels (2011), this section examines how network building during the SEH development at Hessenpoort contributed to the project's success. Specifically, it explores how the network's breadth evolved over time. As illustrated in the timeline, the network around the SEH at Hessenpoort has expanded significantly. In phase 1, the focus was on the Hessenpoort Natuurlijk! initiative, with limited involvement from the municipality. Although this early effort demonstrated collaboration between the government and the OVH to promote sustainability, it was relatively informal compared to later partnerships. The NGOs involved in this phase could really contribute to the increase of greenery in the area, but lacked the holistic approach to contribute to a revision of the energy system. This is why they took more distance from the projects in later stages.

In phase 2, the network widened with the inclusion of grid operators, influenced by the ‘Plan van Aanpak 2018-2022: Zwolle geeft energie’ policy document. This document emphasized broad stakeholder engagement from the start, setting a precedent for future collaborations. In phase 3, the province took a more central role through the ‘Smart Energy Hubs 2021-2023: Uitvoeringsagenda’ policy document, which outlined specific directions for developing SEHs and identified key stakeholders. The province effectively aligned its sustainability goals with the grid operators' need to address grid congestion and the businesses' need for secure energy provision. Each stakeholder had distinct motivations, which encouraged their involvement in the project. Overall, the evolution of the network—from informal beginnings to a structured coalition with diverse stakeholders—played a crucial role in the SEH's success.

> R4: “The question is whether everyone has the same goal in mind and whether it is a problem if this is not the case. Look, ownership is very important. If nobody is concerned to do something it is like pulling a dead horse. But in the end, everyone has their own motivations to participate.”

This quote demonstrates that despite differing interests among stakeholders, they can still form an effective network. The goal of this network is to address various individual issues by working together on the SEH project. This collaborative approach was sufficient to establish a functional network. Additionally, new stakeholders can join if the SEH project offers solutions to their challenges and if they are willing to engage. Interviewees generally agree that new participants are welcome as long as they contribute resources and are committed to the SEH, even for different purposes. About 8 out of 9 respondents see the inclusion of new actors as a positive factor that enhances the project's success. This is evident in phase 2, where the municipality takes on more responsibility because of their sustainability goals, while NGOs from phase 1 have stepped back because their specific interest in improving greenery is not directly addressed by the SEH project.

Documentation supports this view, showing that as the province took a more guiding role through its area directors, additional organizations were involved to advance the Groep-TO pilot. This inclusion of diverse stakeholders also supported knowledge building, as it brought various areas of expertise into the project. Thus, the network around the SEH at Hessenpoort can be characterized as open and dynamic, effectively integrating different types of expertise and fostering ongoing learning and collaboration.

Figure 12: A yearly event organized by the Programme Sustainable Industry Parks (PVB) on June 20th 2024. The event illustrated the diversity in stakeholders involved with SEH development: governments, NGOs but mainly entrepreneurs and businesses participated to share knowledge and experiences.

4.3.2 Articulation of visions and expectations

In line with the work of Schot and Geels (2011) and Elzen, Hoogma, and Schot (1996), the articulation of visions and expectations is a key aspect of Strategic Niche Management (SNM). Evaluating these visions and expectations involves examining their robustness, quality, and specificity.

The concept of 'robustness' relates to how well actors share visions and expectations. Although the province, businesses, and grid operators had different reasons for joining the SEH project, this did not affect their participation. Only 2 out of 9 respondents specifically mentioned a shared vision of sustainability for the Hessenpoort industry park, but all respondents talked about their own interests and what the SEH could offer them. Businesses aimed to secure their energy supply, grid operators wanted to avoid grid congestion, and government bodies sought to enhance sustainability in their areas. Despite these differing motivations, the SEH project addressed all these challenges. This indicates that having a single, unified vision was less important than having a common goal that aligned with various interests. Therefore, while the vision of realizing the SEH was shared, it was pursued for different reasons, making it a robust vision with some qualifications.

This aspect ‘quality’ examines whether expectations align with real developments (Elzen, Hoogma, and Schot 1996). A notable challenge was Enexis's reluctance to fully commit, indicating a mismatch in visions between businesses and grid operators at that stage. Businesses were eager to develop the SEH, but needed grid operators' support. Initially, businesses feared they might be unable to connect to the grid due to congestion, a concern that materialized as grid congestion became a real problem. This issue motivated more organizations to join the SEH post-launch in 2023, transforming a theoretical threat into a reality.

> R2: “On one side, we do not really have the issue of congestion ourselves yet, in the sense that we cannot connect to the grid. In the new area at Hessenpoort however, where new lots are given out, the do feel the negative consequences. They can not be connected. It will be bigger, the whole connection problem.”

The specificity of the visions and expectation relates to the clarity of the visions and expectation (Elzen, Hoogma and Schot 1996). The policy documents by the Overijssel province clearly promote some visions and expectations, mainly related to sustainability and grid congestion. The SEH itself, as a project, was really vague in the beginning, and is arguably still vague at this point due to the lack of precedents.

> R4: “But it comes down to: when you want a solution, something would need to happen. But who takes initiative? (…) Which challenges, who takes which role, which solutions, what is needed for that? (…) Agreements among them, among stakeholders, businesses, cooperations. So: how are we going to divide the cake? What is there to divide?”

Clarity on how the SEH would eventually look like and what the impact of the Groep-TO would have on the energy grid for grid operators and businesses was not at all clear. However, it was the understanding by engaging in this pilot in phase 4 on the timeline, it could answer more questions on how such an SEH could be shaped. It was therefore not clear what the eventual goal would be, but the search itself turned out to be the goal.

4.3.3 Learning processes

In line with Schot and Geels (2011), understanding learning processes within SNM involves determining whether a project employs a first-order or second-order learning strategy. To assess this for the SEH at Hessenpoort, it is crucial to examine how stakeholders managed new information and whether it led to simple accumulation or resulted in significant shifts in their cognitive frameworks and assumptions. It should be noted that when talking about learning processes, the aim of the project is to better understand how to integrate local energy supply and demand, as laid down in the ‘Smart Energy Hubs 2021-2023: Uitvoeringsagenda’ policy document. This is the core idea behind SEHs in general, and also at the core of what the stakeholders wanted to achieve.

The data indicates that stakeholders were entering into uncharted territory with this pilot project. Initially, grid operator Enexis was hesitant but eventually granted pilot status, reflecting a process of information accumulation that could benefit future projects. Interviews revealed that stakeholders faced numerous unresolved questions about Groep-TO agreements and the broader applicability of SEHs. The SEH project’s outcomes are generating interest across the Netherlands, as other stakeholders seek insights for implementing SEHs in their own industry parks. The ‘Smart Energy Hubs 2021-2023: Uitvoeringsagenda’ specifically highlights the pilot's role in providing valuable insights for similar initiatives.

> R4: “There are different knowledge institutes that are also watching and developing things. Mooi EIGEN, this is also a place where knowledge is exchanged. They are working on a few models that can be used. (…) What you notice is that over the last three years, the topic of SEHs has really been hyped up. You would almost expect that it is a fully developed concept. In practice, this is not the case at all.”

This quote illustrates how other organizations are closely watching the developments at Hessenpoort, and are integrating it in their own projects. Even though there seems to be a lot of interest for knowledge on SEH development, the data for this also needs to be gathered. The Overijssel province employs area directors to gather and manage data for developing Smart Energy Hubs (SEHs) across the region. These directors oversee various processes, frequently meeting to share experiences and insights. For example, in phase 3, the province took charge of the project and used area directors to guide its direction. This collaboration forms a learning network where knowledge is accumulated from different areas and shared among directors. Since Overijssel is a provincial entity, the knowledge generated is specific to the region, making it highly relevant to local SEH projects.

Respondents noted that different types of learning occur depending on the stakeholders involved. Practical knowledge shared at the regional level helps address local SEH issues, while these insights also inform national policymakers who develop SEH frameworks. This process reflects second-order learning, combining hands-on experience with theoretical understanding to enhance both local and broader SEH implementation.

4.3.4 Conclusion

Examining how the three processes from the Strategic Niche Management (SNM) framework lead to the five outcome indicators defined by Shenhar and Dvir (2007) within the SEH project at Hessenpoort reveals that these processes collectively contributed to success across most indicators. Network building was crucial throughout this project. Early efforts in phase 1, the involvement of government bodies in phases 2 and 3, and the launch of Ceurz, which aims to integrate new stakeholders, all highlight the importance of network building in this process, despite different challenges. Regarding team satisfaction, there was some hesitation from the grid operator, but overall, interviewees were satisfied with the cooperation within the network. The EMS system benefited significantly from the network and member negotiations, which were vital for its launch and continued operation. Over time, various actors joined the project for different reasons, and their contributions were key to the SEH project's success. The network's open approach allowed for these diverse actors to participate and maintain cohesion despite their varying motivations.

Examining the articulation of visions and expectations reveals a close connection with network building in the SEH project at Hessenpoort. Network building was successful despite stakeholders having different visions on which problems the SEH would solve for them personally. The SEH project addressed individual problems of stakeholders, which helped maintain their commitment. For instance,

during phase 3, the reality of grid congestion heightened stakeholders' urgency to participate, as companies like Enexis recognized the need to address this issue for their own interests. This urgency contributed to the project's efficiency, with successful outcomes in terms of schedule and functionality, although budget compliance was difficult to assess. Additionally, the Groep-TO project's network aimed at knowledge building. This indicates that, beyond the successful realization of the SEH, the development of knowledge was also a key part of the SEH vision. In short, it shows that even through the stakeholders envisioned the same end result, this was based on their own personal challenge that the SEH was meant to resolve.

The learning processes were fundamental to the SEH project at Hessenpoort. The Groep-TO contract served as an experimental framework for both the grid operator and the provinces to test new types of contracts. The pilot attracted significant interest from various stakeholders across the Netherlands, highlighting its broader relevance. The province played an active role in accumulating knowledge from other projects to better understand how to realize SEHs. This attracted new participants, such as the grid operator, and contributed to the project’s strategic potential. In addition to generating general knowledge about SEHs, the project also provided insights into local energy regulation for the involved businesses individually, some of which described it as "entering uncharted territory." Thus, the pursuit of knowledge by multiple actors at various levels was an important motivator for those involved in the project.

Chapter 5: Discussion

The main goal of this thesis was to understand how three key processes from Strategic Niche Management (SNM) contributed to the success of the SEH project at Hessenpoort. These processes are network building, articulation of visions and expectations, and learning processes. The central research question was: How have key processes as described in strategic niche management (SNM), namely network building, articulation of visions and learning processes, contributed to the successful outcome of the SEH project at Hessenpoort as defined through the five indicators by Shenhar and Dvir (2007)? The analysis showed that while each of these processes influenced the project's success in different ways, they were also interdependent and worked together to be effective.

This research explores how Strategic Niche Management (SNM) theory and the Multi-Level Perspective (MLP) apply to what happens at the niche level when stakeholders try to influence existing socio-technical regimes. It highlights the interaction between regime stakeholders and niche players, particularly in the context of innovative projects like the SEH. Although provinces and grid operators are typically part of the regime, their significant interest in the project suggests they have a crucial role, rather than just being external influences. This case demonstrates that regime stakeholders are essential for the success of niche projects, and their role should be carefully examined when studying how such projects are realized.

The research confirmed some expected findings based on existing literature. For instance, network building was a crucial factor for project success, which aligns with the idea that having many involved actors makes this process essential. Learning processes also played a significant role, both in the success of the project and in encouraging stakeholders to join the network. However, a surprising discovery was how the SEH project at Hessenpoort, despite involving diverse interests and high stakes (such as energy provision and grid congestion), managed to collaborate effectively. Initially, it was anticipated that stakeholders might have varying interests, but the extent of their differing priorities was unexpected.

The theoretical framework included numerous indicators, both from Shenhar and Dvir’s (2007) success metrics and SNM processes, making it challenging to find a comprehensive relationship among them. As detailed in Appendix 1, addressing this complexity required careful formulation and breakdown of the indicators. In retrospect, it would have been valuable to extend the research beyond just the SEH project at Hessenpoort. For example, learning processes connected to how the project reached other stakeholders, as shown by the 'PVB Yearly Event Future-Proof Industry Parks' observed during the study. Including a broader context would allow for a deeper analysis of how knowledge and network-building efforts impact not just the SEH project but the wider environment in which it operates.

Chapter 6: Conclusion

This research demonstrates that Sustainable Energy Hubs (SEHs) can address societal issues such as grid congestion. Like other sustainability projects, SEHs require coordination among various interests to determine the best approach for the challenge at hand. The SEH at Hessenpoort exemplifies this possibility: through negotiation and cooperation, the project was able to succeed despite differing interests. Additionally, it highlights the need for further learning, particularly regarding the use of Groep-TO contracts and the collaboration between businesses to manage energy usage effectively.

Future research could delve into the broader knowledge-building efforts by stakeholders across the Netherlands and possibly beyond. Observing the wide interest in projects like the SEH at Hessenpoort has inspired many to reconsider how they manage energy in their own industry parks. Studying the role of agencies, forums, or events in these developments could provide valuable insights into their dynamics. Additionally, further research could examine the financial aspects of such projects: their costs and benefits. Understanding these economic factors is crucial for grasping the relationships between businesses involved in these projects. However, due to various constraints, these topics were beyond the scope of this research.

This thesis highlights the critical role of individual stakeholders in developing more sustainable energy systems and emphasizes the importance of negotiation in this process. It aims to enhance our understanding of Sustainable Energy Hubs (SEHs) and collective action in similar projects. The willingness of numerous people to invest time and resources in these challenging ventures offers hope that we can effectively combat global warming, reduce pollution, and achieve sustainability—benefiting both current and future stakeholders.

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Appendix 1

Success of the energy hub (DV)

Main variable: The success of Hessenpoort as an SEH

SV1: Project efficiency	
Properties	**Clarification**
Definition	Refers to the extent to which the project was completed successfully within the set frame in terms of time, cost and functionality.
Indicator	Whether the time schedule was adhered to Whether budget compliance was met Whether functional compliance was met
Data collection method	Interviews (data from stakeholder perspectives) Documentation (to determine the set goals as well as outcomes) Observation (additional experiences from stakeholders)
Question	**Time schedule** - How did the SEH project progress in relation to the set timeframe? **Budget compliance** - How did the SEH project progress in relation to the budget that had been set by stakeholders? **Functional compliance** - How did the SEH project progress in relation to the functional requirements?
Unit of measure	Time schedule: amount of time between estimated moment of completion versus the actual moment of completion at the time of the launch Budget compliance: estimated amount of resources versus actual amount of resources at the time of the launch Functional compliance: estimated functionalities versus actual functionalities at the time of the launch

SV2: Team satisfaction	
Properties	**Clarification**
Definition	Refers to how the team involved has experienced the project, relating to team morale or individual growth
Indicator	Whether team morale has improved within the process of the SEH development Whether the stakeholders have experienced improvement for their organization in some way as part of the project's development
Data collection method	Documentation (data on official statements by stakeholders) Interviews (data on subjective experiences by stakeholders)
Question	**Team morale** - How did the different stakeholders experience the cooperation with other stakeholders within the team? **Individual growth** - How has the project contributed to the organizations in terms of individual growth for their organization

Unit of measure	Team morale: number of interview respondents that looked favourably at cooperation with other stakeholders. Individual growth: number of interview respondents that experienced some kind of improvement within their organization as a result of the SEH's development

SV3: Impact on customers	
Properties	**Clarification**
Definition	It refers to how the systems provides benefits for the user in terms of functionality, for example when it comes to technological solutions.
Indicator	Whether the SEH meets performance measures Whether the functional requirements have been met when it comes to the usage of the SEH system
Data collection method	Interviews (to provide subjective data on the functionality of the system) Documentation (to provide official published data on the functionality)
Question	**Performance measure** - How effective is the SEH in improving the energy provision of stakeholders? **Functional requirements** - Does the SEH system do, what it was intended to do?
Unit of measure	Performance measure: number of respondents that expressed that the system is effective in improving energy provision Functional requirements: number of respondents that expressed that the SEH as a system functions as it was intended by the stakeholders

SV4: Business success	
Properties	**Clarification**
Definition	Refers to whether a certain project has resulted in profits for the drivers. Can be both economic profits, but also profit in terms of increased performance for drivers.
Indicator	Whether the stakeholders were able to save resources on energy costs Whether the stakeholders witnessed improved energy management within their organizations
Data collection method	Interviews (to understand the personal experiences of stakeholders) Documentation (statements by stakeholders' organizations)
Question	**Energy savings** - How did the SEH project have an effect on the energy saving costs of stakeholders? **Energy management** - How did the SEH project have an effect on the ability of stakeholders to manage energy use more effectively?
Unit of measure	Energy savings: number of respondents that expresses having saved costs as a result of the project Energy management: number of respondents that expresses have improved energy management quality

SV5: Strategic potential	
Properties	**Clarification**
Definition	This refers to whether the project will create opportunities in the future for the organizations. This can be by creating new markets, new production lines or new technologies. In the context of SEH at Hessenpoort: possible expansion of the system.
Indicator	Whether the development of a SEH at Hessenpoort leads to new participants joining in, expanding the network Whether the development of the SEH at Hessenpoort leads to further development of and knowledge building on SEHs in general
Data collection method	Interviews (data on subjective expectations for the future of SEHs and the SEH in Hessenpoort specifically) Observations (looking at how stakeholders express the future of the SEH) Documentation (on new participants joining in, as well as documented contributions of the SEH at Hessenpoort to knowledge building on SEHs
Question	**Expanding network** - How did the project lead to new stakeholders joining in the network? **Further development of SEHs** - What was the role of the SEH at Hessenpoort in the broader landscape of SEH development, and how did it contribute to it?
Unit of measure	Expanding network: number of new stakeholders that have joined since the launch Further development of SEHs: subjective expectations of interviewees on how the SEH at Hessenpoort contributed to our understanding of SEHs in general

Processes of SNM (IV)

Variable 1: Network building

SV 1.1: Width of the network	
Properties	**Clarification**
Definition	According to Schot and Geels (2011), the width of the network relates to how it deals with external and internal dynamics. This indicator would therefore look at whether where the network is on the spectrum from a tight, close network to a wide, loose network.
Indicator	Whether the network around the SEH at Hessenpoort, consisting of businesses, governments and grid operators, can be understood as a closed network, open network, or something in between.
Data collection method	Interviews (for subjective understandings of the network) Documentation (that reports about the stakeholders of the network) Observation (understanding how the stakeholders relate to the 'external actors)
Question	How does the network relate to new actors joining or contributing to the SEH at Hessenpoort? How are new stakeholders and their contributions received by the stakeholders within the network?
Unit of measure	Number of stakeholders in the network changing throughout time Number of interviewees expressing whether network is open, closed or something in between

Variable 2: Articulation of visions and expectations

SV 2.1: Robustness	
Properties	**Clarification**
Definition	The extent to which they are shared among actors (Elzen, Hoogma and Schot 1996)
Indicator	Whether existing visions and expectations are being shared among stakeholders among the stakeholders in the SEH network.
Data collection method	Interviews (to analyse the personal understanding of the visions and expectations) Documentation (to analyse laid down visions and expectations by stakeholders)
Question	How do stakeholders look at whether visions and expectations are being shared among the stakeholders within the network?
Unit of measure	Number of interviewees expressing the same visions and expectations Degree to which visions and expectations have been shared by other stakeholders, for example governments and grid operators, according to documentation (1-10)

SV 2.2: Quality	
Properties	**Clarification**
Definition	The extent to which expectations are met with real developments (Elzen, Hoogma and Schot 1996)
Indicator	Whether the expected direction of the project was being met with actual directions of the project
Data collection method	Interviews (to understand expectations by stakeholders) Documentation (to understand the evolving of visions and expectations)
Question	How was were the expectations of stakeholders being met with real developments within the network around SEHs?
Unit of measure	Number of interviewees expressing that their expectations were being met

SV 2.3: Specificity	
Properties	**Clarification**
Definition	Clarity of the visions and expectations formulated (Elzen, Hoogma and Schot 1996)
Indicator	Whether the stakeholders had a clear idea on what the general visions and expectations where that were existing within the network
Data collection method	Interviews (to understand whether visions and expectations are understandable to stakeholders)
Question	How did the stakeholders understand the visions and expectations that existed within the network around the SEH at Hessenpoort?
Unit of measure	Number of interviewees that describe specific visions and expectations that are shared broader within the network

Variable 3: Learning processes

SV 3.1: Learning type	
Properties	**Clarification**
Definition	Describes how the learning processes within the energy hub networks relate to first-order learning (information accumulation) and second-order learning (changes in cognitive frames and assumptions).
Indicator	Whether new knowledge in the network was being processes in a first-order learning process or second-order learning process
Data collection method	Interviews (to see how stakeholders have dealt with newly obtained knowledge) Documentation (to detect any formalized ways of incorporating newly obtained knowledge)
Question	How was newly obtained knowledge being implemented in business practice, and how did this relate to frames, beliefs and stakeholder engagement throughout the process?
Unit of measure	Number of interviewees who have expressed a first- or second-order learning strategy within the network around the SEH project.

Appendix 2

Name organization	Interests
Governments	**Generally, the governmental bodies did not have conflicting interests, but their approaches varied. The municipality balanced various local interests, while the province provided leadership through area directors. The national government, though not directly involved locally, focused on knowledge building at the national level through its agencies.**
Municipality of Zwolle	Their main interest was pursuing their sustainability target as laid down in various policy documents such as the 'Plan van Aanpak 2018-2022: Zwolle geeft energie' and the 'Plan van Aanpak 2018: Duurzaamheid Hessenpoort'. Also mediates between the various interests existing in the municipality.
Province of Overijssel	The organization is involved in several sustainable energy projects, including four SEHs as outlined in the 'Smart Energy Hubs 2021-2023: Implementation Agenda.' As its main interest was promoting innovative energy systems in the region, it plays an active leadership role through its area directors and the resources it has provided.
National government of the Netherlands (ministries, agencies)	The organization supports the development of Smart Energy Hubs across the Netherlands by promoting knowledge exchange and encouraging these projects through the Netherlands Enterprise Agency (RVO), and therefore through initiatives like EIGEN. The national government mainly focussed on knowledge building on SEHs.
Business actors	**Businesses involved with the SEH were primarily focused on maintaining their operations. They were interested in projects that ensured future energy supply, but they had limited resources to invest. This made the government a valuable partner.**
Individual businesses	For the SEH, companies like Thiem (a social enterprise), Zehnder (an air conditioning manufacturer), and Axxor (a cardboard honeycomb manufacturer) are mainly focused on their own operations and ensuring future energy supply. They are willing to participate in the project by contributing time, as it aligns with their interest in developing a sustainable energy grid.
Entrepeneurs' organization Hessenpoort (OVH)	The organization consists of businesses located at Hessenpoort and is deeply involved in the development of the Smart Energy Hub. Its main goal is to help these businesses create a suitable and high-quality work environment at the Hessenpoort industrial park.
Ceurz	The cooperative was renamed Ceurz (Cooperatieve Energie Uitwisseling Regio Zwolle Noord) shortly after launching the Smart Energy Hub in October 2023. This change aimed to reflect its broader focus beyond Hessenpoort, inviting new stakeholders. Their main goals were to attract new members and serve as a platform for collaboration on the SEH.
Zonneweide	A solar park was developed at Hessenpoort in 2019, which led to challenges like grid congestion. This issue was one of the reasons for starting the Smart Energy Hub project. The main goal of the project is to supply businesses at Hessenpoort with renewable energy and reduce their reliance on gas.
SZN	Smart Energy Hub Zwolle Noord (SZN) was the predecessor to Ceurz: it was the name of cooperation that aimed at developing the SEH at Hessenpoort. Its goal was to initiate the Groep-TO contract, and therefore realize the SEH
Grid operators	**The grid operators aim to secure energy provisions and use pilot projects like Groep-TO to test new methods. However, they are**

	cautious about fully transferring responsibility, as it may conflict with their primary interests.
Enexis	Enexis, the grid operator in Hessenpoort, partners with businesses to set energy usage limits. They are involved in the SEH project, granting Hessenpoort pilot status for a Groep-TO agreement, which lets businesses collectively manage energy usage. Enexis primarily aims to prevent grid congestion and develop innovative solutions.
TenneT	TenneT, the national grid operator, manages the country's main electricity transmission network. Although businesses don't directly contract with TenneT, the operator focuses on preventing grid congestion at the national level.
NGOs	**Early NGOs focused on sustainability but could not contribute much to the SEH development due to its inability to contribute resources to the project**
Hessenpoort Natuurlijk!	The organization, which includes various NGOs and the OVH at Hessenpoort, aimed to enhance sustainability at Hessenpoort by focusing on biodiversity and greenery. This initiative was an early example of different stakeholders collaborating to promote sustainability in the area.

Appendix 3

Interview guide Thesis 2024: Smart Energy Hub *Hessenpoort*

Jorn Topper | Urban Governance | ESSB and IHS | Dutch version

Opening

Hartelijk dank voor het deelnemen aan deze interviews. Deze scriptie richt zich op de ontwikkeling van Smart Energy Hubs, en dan specifiek op hoe de belanghebbenden hier samen aan werken. De case centraal in dit onderzoek is Smart Energy Hub Zwolle Noord, op het industriegebied Hessenpoort. In dit onderzoek zullen een aantal vragen worden voorgelegd aan vertegenwoordigers van verschillende belanghebbenden, om zo een beter beeld te krijgen van het samenwerkingsproces voorafgaand aan de lancering van de Smart Energy Hub.

De resultaten zullen volledig anoniem worden verwerkt in de uiteindelijke scriptie. Dit gebeurd in overleg met de deelnemers.

Interview

Persoonlijk voor de deelnemer:

- Op welke manier is uw organisatie betrokken bij het ontwikkelen van de Smart Energy Hub in de omgeving Hessenpoort?
- Wat zijn volgens u de belangrijkste spelers in dit proces geweest?
- Was er een specifieke organisatie of groep die hierbij het voortouw nam? Zo ja, welke?

Succes van de energy hub:

Aan de hand van uw eerste instinct:

- Hoe heeft het SEH project gepresteerd met betrekking tot de tijd, budget en functionele eisen die hieraan gesteld waren?
- Hoe was de tevredenheid van het team tijdens met betrekking tot de SEH, denkend aan persoonlijke groei van de deelnemers?
- Hoe heeft de SEH bijgedragen aan voordelen voor uw organisatie?
- In welke mate heeft de SEH bijgedragen aan energiekostenbesparing en verbeterd energiebeheer voor uw organisatie?
- Hoe heeft de SEH bijgedragen aan het aantrekken van nieuwe deelnemers tot het netwerk?

Bouwen van netwerken (*network building)*:

- Hoe werd er omgegaan met nieuwe belanghebbenden die zich wilde aansluiten?
- Hoe werd er intern kennis gedeeld? (Veel, of weinig, oppervlakkig)
- Is dit door de tijd heen veranderd? Zo ja, hoe?

Het articuleren van visies en verwachtingen

- Hoe werd gezamenlijk de visies en verwachtingen samengesteld?
- Kwamen deze ook uit, en op wat voor manier?
- In hoeverre waren dit duidelijke visies en verwachtingen?

Leerprocessen

- Hoe werd er omgegaan met kennis binnen het netwerk rondom de Smart Energy Hub?
- Hoe werd er nieuwe kennis uit ervaring verwerkt in het opzetten van de Smart Energy Hub?

Dank u voor het deelnemen aan het interview.