The Collaboration between Distribution System Operators and Local Governments for the effective expansion of the electricity grid in the Netherlands

A study of the impact of the collaboration between distribution system operators and local governments on the renewable energy transition

Word count: 21.737

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Acknowledgement

This thesis is the last product I will produce as a student. From here onwards, I will look back happily and proudly at my student years. I see myself as lucky, considering the amazing support around me in the form of my friends, family, supervisors, professors and fellow students.

I would like to give special thanks to my supervisor Shaun Smith, who supervised my thesis amazingly. Also special thanks to Rachel who helped me shape my thesis and was always open for a discussion about my results.

Furthermore, I would like to thank all members of the 'werkgroep gebouwde omgeving' and, in general, Netbeheer Nederland for their help in arranging the interviews and for giving me the opportunity to write this thesis for them, whilst also giving me an amazing experience in the world of the grid operators.

Lastly, I would like to thank Sara for the amazing support this past half year.

Abstract

This thesis analyses the collaborative relationship between Distribution System Operators (DSOs) and local governments in the Netherlands. To reduce greenhouse gas emissions, the energy transition asks for the electrification of current energy systems. This electrification is shown due to the rapid increase of Distributed Energy Resources (DER), which also increases the demand for electricity. However, the current electricity grids do not have sufficient transport capacity yet, potentially halting the energy transition. The expansion of the electricity grid is a substantial spatial task as it significantly impacts public space. Especially at a neighbourhood level, grids have to be expanded. The DSOs implemented the 'neighbourhood-orientated approach' in which, through standardized processes, medium-voltage substations (essential elements in the grid expansion) are implemented in bulks per neighbourhood. This approach requires intensive collaboration with local governments.

The main question of this thesis is therefore:

"To what extent and how does the collaboration between distribution system operators and local governments shape the expansion/adjustments of the energy grid in relation to the renewable energy transition in the Netherlands?"

Data is collected by interviewing 26 key informants of the DSOs and the local governments. These key informants are directly involved in the collaborative process surrounding the grid expansion and the finding of space for the necessary infrastructures. Here, a multi-stakeholder perspective approach has been chosen to capture both sides of the collaborative process.

The most important findings relate to the key issues present in the collaboration. DSOs and local governments have conflicting interests: DSOs prioritize speed and standardisation (one-fit solutions), while local governments seek integrated, context-dependent solutions. However, these conflicting interests appear primarily in neighbourhoods with limited public space. In this context, DSOs and local governments should engage in more integrated collaborative approaches, balancing interests in public space and making trade-offs.

Engaging in an integrated collaborative form asks for a change in the organisation of both actors, organizational-wise and capacity-wise. DSOs, for example, to effectively collaborate with local governments, should adopt a spatial planning-related role beyond their traditional technical role.

The role of data/information is essential for an effective integrated collaborative approach. Providing insight into the number of medium-voltage substations, potential locations for the stations, and the order of the neighbourhoods in which the infrastructure will be implemented,

creates input for an effective decision-making process and the making of trade-offs of interests in public space.

In conclusion, collaboration between DSOs and local governments significantly impacts the expansion of the electricity grid and, therefore, directly impacts the renewable energy transition. If both actors operate siloed from each other, the collaboration will halter the expansion and, therefore, also halter the renewable energy transition. By implementing an integrated collaborative structure, critical issues in the collaboration can be overcome. Central here is the acknowledgement of each other's interests and the alignment of interests to balance speed and local context-based solutions.

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1. Introduction

In 2015, countries worldwide signed the Paris Agreement, in which it was agreed to limit the global temperature rise to a maximum of 1,5 degrees Celsius (United Nations, n.d.). As a result, global efforts have been made to decarbonise our energy systems through the renewable energy transition. As a means to reduce carbon emissions, the energy transition asks for a shift from the use of carbon-based energy sources to renewable energy sources (Chen et al., 2019). In this shift, the increased electrification of our energy systems is necessary (Battaglini et al., 2012). This electrification is visible through the increase of Distributed Energy Resources in energy system, such as solar panels, heat pumps and batteries (Damsgaard et al., 2015).

The role of electricity grids cannot be overlooked in a (global) energy system where electricity will have a more dominant place. The International Energy Agency (IEA) (2023) describes the critical function of electricity grids as the backbone of energy systems as the grids transport and distribute the electricity. However, multiple challenges are also connected to the electricity grids: As more (renewable) Distributed Energy Resources are being implemented, electricity grids must be expanded. This expansion is equal to the doubling of the already existing grid. Furthermore, investments in renewable energy have doubled since 2010. However, global grid investments have not changed (remaining at 300 billion per year). As queues for grid connection for large renewable energy projects are increasing, the lack of investment in the electricity grids delays the energy transition (International Energy Agency, 2023). This brings a two-sided perspective on electricity grids. Electric grids are the backbone of a successful energy transition; at the same time, they are also at risk of becoming the energy transition bottlenecks due to insufficient transport and distribution capacity (International Energy Agency, 2023).

When focusing on the Netherlands, problems surrounding the electricity grids also surfaced, putting pressure on the energy transition. Through the implementation of DER's grid-related challenges occur such as voltage profile alterations, bi-directional electricity and grid congestion (Haque et al., 2014). The Minister of Economics & Climate (2023) states that the energy transition in the Netherlands happens at such a pace that the electricity grid cannot keep up and that electricity grid-related challenges, specifically grid congestion, are the biggest challenges to the energy transition in the Netherlands. These challenges must be solved to ensure a stable and consistent electricity grid (Johansson et al., 2020; Haque et al., 2014).

Expanding/strengthening the electricity grid is stated as one of the most important solutions (Ministry of Economics and Climate, 2022). The expansion has to happen on a high-voltage grid owned by the Transmission System Operator (TSO) and medium- to lower-voltage grids owned by the Distribution System Operators (DSO). The TSO is responsible for transporting high-voltage electricity through the Netherlands, while the DSOs convert this electricity to

lower voltages and distribute it through lower voltage grids to the end-users on a neighbourhood level (Netbeheer Nederland, 2019).

This research aims to address challenges surrounding the expansion of low-voltage grids at the neighbourhood level. Expanding and strengthening the low-voltage electricity grid is a substantial socio-spatial task that implies broader and more intense collaboration between the DSOs and local governments. Between the present and 2035, more than fifty thousand medium-voltage substations must be implemented by the DSOs on a neighbourhood level (equal to 800 football fields), of which most in densely urbanised areas with scarce public space (Netbeheer Nederland, 2023a; Netbeheer Nederland, 2023b). Due to the time pressure and the quantity of the still-to-be-implemented infrastructure, the DSOs have adopted a neighbourhood-orientated approach which aims to implement the medium-voltage substations (and cables) per neighbourhood through a standardised process (Netbeheer Nederland, 2023a). Priority is given to speed and standardisation, giving limited space for solutions considering the local context of the specific neighbourhoods. Furthermore, in the context of the neighbourhood-level approach, local governments should also, in collaboration with the DSOs, have decided where space is available in a neighbourhood for the medium-voltage substations (Netbeheer Nederland, 2023a).

Finding space in neighbourhoods is one of the most significant issues that local governments and DSOs face and is, on one side, connected to the dense context of the Dutch landscape and, on the other hand, connected to the fact that other actors also require space (for example, climate resilience measures) (Scholten et al., 2023). This asks for precise coordination between the DSOs and local governments. A strong collaboration is essential to make agreements about the reservation of space and the spatial implications of the necessary infrastructures (Scholten et al., 2023). This highlights the nature of the grid expansion. Next to it being a technical challenge, it also translates into a spatial challenge.

A critical theoretical approach to spatial planning is collaborative governance, which partly discusses the importance of discursive processes in which all relevant stakeholders have a voice and examines how outcomes are based on mutual agreements between stakeholders. Conversely, conflicts can arise when multiple stakeholders have opposing stakes (Forester, 1982; Healey, 1999; Healey, 2003; Lane, 2005; Westin, 2021). In light of collaboration, sectoral decision-making (silo-thinking) and the lack of reflection on interrelations between different actors in the urban area hinder collaboration and finding potential synergies/opportunities between actors (Covarrubias et al., 2019).

Furthermore, literature on regional grid operators and spatial planning is scarce. There is, however, literature that focuses on the changing role of DSOs as grid challenges increasingly

occur. In this changing role, DSOs have to switch from a form of operating which is traditionally technical and maintenance-oriented towards the proactive management of grid congestion and implementation of new grids (Prado et al., 2019; Uzum et al., 2024; Lavrijssen & Edens, 2019).

Therefore, the main aim of this research is to analyse the collaborative relationship between DSOs and local governments in the context of the allocation of space for medium-voltage substations in the context of the neighbourhood-orientated approach and how this collaborative relationship shapes the energy grid expansion/adjustment. In addition, the focus will also be on the potentially changing role of the DSOs in light of the collaboration between DSOs and local governments. Furthermore, by examining the dynamics in the collaborative relationship, opportunities that can improve the collaboration can be formulated to facilitate the energy grid expansion/adjustment whilst also taking into account local governments' (spatial planning) interests. This results in the following lead question:

"To what extent and how does the collaboration between distribution system operators and local governments shape the expansion/adjustments of the energy grid in relation to the renewable energy transition in the Netherlands?"

Multiple sub-questions have been developed to answer this research question. First, the focus is on the actual collaboration between the local governments and the DSOs: *What are the critical issues that shape the collaboration between DSOs and the local governments?* Second, the scope will be on the overall influence of the collaboration on local energy transition planning and how this differs per type of local government: *How do the collaborative dynamics between DSOs and local governments affect local energy transition planning in the Netherlands and does that differ between different types of local governments (i.e. small/big, urban/rural)?* Next, as the collaboration intensifies and the DSOs operate more proactively, it is essential to identify the changing way of operating of the DSOs: *How has the role of DSOs changed in terms of spatial planning?* The last sub-question will focus on improving the collaboration: *How can the collaboration between DSOs and local governments be improved?*

Reading guide

In Chapter Two, the literature review is presented, followed by the theoretical framework in Chapter 3. Then, in chapter 4, the conceptual framework is introduced. Chapter 5 will explain the methodological steps taken in this research. The 6th chapter presents the results and the discussion. Lastly, chapter 7 presents the conclusion, followed by the limitations in chapter 8.

2. Literature Review

The following chapter presents the scientific debates on infrastructures and the energy transition, spatial planning and collaborative governance. Last, a short overview of the current literature on regional grid operators is given.

2.1 Infrastructural Transformations and Energy Transitions

The energy transition plays a crucial role in reducing global greenhouse gas emissions. However, this is also a big challenge for energy infrastructures/grids as they have to be adjusted/transformed to be suited for an increase in renewable energy sources (Schnidrig et al., 2023). Infrastructures are interrelated sociotechnical systems that enable, sustain and enhance urban living conditions by providing energy, water, waste, mobility and/or communication services. Infrastructural transformation is described as the process of making physical and/or organisational changes to these systems to create sustainable and resilient cities (Monstadt et al., 2022). These changes often occur slowly, focusing on intermittent, reversible, dyssynchronous and incremental processes. This pace is necessary as infrastructures need the ability to be adjusted to react to unexpected changing circumstances and challenges over time. These transformations go beyond technical innovation and can be described as social, cultural and political challenges next to a techno-economic challenge (Monstadt et al., 2022).

In addition, Farntzeskaki and Loorback (2010) and Bolton and Foxon (2015) also refer to infrastructures and infrastructural transformation as a complex interplay involving multiple actors (users, planners and/or owners and regulators) with diverse objectives, recourses and strategies to achieve their objectives. Supporting this argument, Bolton and Foxon (2015) argue that a shift in how infrastructural systems are understood from solely technical to socio-technical systems is necessary.

Energy transition as a spatial challenge

When shifting the discussion from infrastructures to the more general concept of the energy transition, the same line of arguments is given. Urban energy transitions are complex phenomena beyond solely technocratic processes (Rutherford & Coutard, 2014; Sillak et al., 2021; Bouw et al., 2022). Instead, energy transitions show how technologies, regulations, and governance aspects intersect with diverse local contexts that all have different energy needs (Rutherford & Coutard, 2014). The authors argue that transition plans should always be assessed as plurally and heterogeneous due to the sheer diversity of different urban contexts. A successful urban energy transition, therefore, requires a deeper understanding of context-specific conditions. Lastly, Sillak et al. (2021) state that transition paths need to be created and

recreated through intensive collaboration with governments, energy companies/utility organisations and local communities.

The importance of space/local context in energy transitions is also highlighted by Bridge et al. (2013). When assessing transitions, the main focus is often on the temporal aspect of a transition, that is, seeing a transition as a process of change over time (Bridge et al., 2013). However, the authors state that a transition, especially the energy transition, should also be looked at through spatial dimensions. Here, the authors call for future research on how energy transitions are spatially-constituted. Spatial constitution refers to the fact that a transition is shaped by spatial factors, such as the influence of spatial/geographical factors on the energy transition (location, landscape and spatial differentiation) (Bridge et al., 2013).

Importance of space in (urban) transitions

Additionally, Duivenvoorden et al. (2021) discuss the impact of the energy transition on public space whilst also connecting it to governance aspects to manage the spatial impact of the energy transition. They state that major transitions, of which the energy transition is one, often require changes in public space as public space is used to provide essential infrastructures such as roads and energy infrastructure (Duivenvoorden et al., 2021). However, the current approach towards managing multiple transitions (energy transitions, mobility, climate adaptation-related transitions) that impact public space, according to Duivenvoorden et al. (2021), is fragmented. This fragmentation forms an institutional constraint in the potential of solving future challenges. Duivenvoorden et al. (2021) argue for a transdisciplinary approach involving collaboration with various stakeholders involved in public space management. This also includes investing in synergy between different policy sectors involved in public space management.

Governance in infrastructural transformation

Bolton and Foxon (2015) examined governance challenges surrounding the transformation of (energy) infrastructures, specifically electricity and heat distribution networks. The authors also argue that an infrastructural transition is a coevolutionary process in which multiple interactions with technology, institutions, end-users, business aspects, and the environment (i.e. society, economy and ecological environment) take place. Lastly, the main conclusion is that new governance strategies are necessary to address governance challenges regarding infrastructure system renewal, transition, and building and establishment. System renewal, in this sense, refers to implementing improvements to the current system in order to, for example, enhance performance, whilst system transitions imply a significant transformation of a system, rethinking the fundamental principles. System building and establishment is concerned with creating new systems and the growth, expansion and establishment of these new systems.

Path dependency and lock-ins

A last discussion concerning renewable energy transitions is concerned with path dependency. The above literature highlights the importance of infrastructural transformations in the energy transition and its impact on space. Monstadt et al., 2022 refer to path dependency and lock-in as a process in which past developments constrain future developments, leading to outcomes that are difficult to reverse. Eitan and Hekkert (2023) argue that concepts such as path dependency also occur in the renewable energy transition, referring to renewable energy lock-ins. Firstly, through renewable energy lock-ins, established/dominant renewable energy systems can block the implementation of other alternative and promising renewable energy systems. Secondly, lock-in mechanisms can hinder the implementation of decentralisation. This means that locked-in renewable energy systems tend to steer decision-making processes towards large-scale centralised projects instead of decentralised projects, whilst decentralised projects can create benefits concerning flexibility and resource diversity (Eitan and Hekkert, 2023).

2.2 Governance and Spatial Planning

As explained in the above section, infrastructure transformations and the energy transition are processes that cannot be assessed only from a technical perspective but involve a variety of stakeholders who have to collaborate. At the same time, the spatial impact of the energy transition cannot be ignored. This brings a second approach to the energy transition/infrastructural transformation, which is collaborative/integrative governance and collaborative spatial panning.

Collaboration is a complex phenomenon and can be explained as the fundament of multiple approaches to resolve conflicts between different actors in, for example, environmental conflicts (Rice & McCool, 2021). Collaboration, as presented by Rice and McCool (2021), implies that fair and suitable solutions can be found for specific challenges through negotiation processes. These negotiation processes are often structured so that multiple actors collaborate towards a shared goal/vision.

Communicative Planning Theory

A critical theory in spatial planning that focuses on intensive collaboration is communicative planning theory. Communicative planning theory is a lens that can be used to identify the different perspectives, goals and potential conflicts through deliberative processes. Communicative planning theory (also referred to as collaborative planning theory) focuses on the importance of dialogue, argumentation and discourse in planning processes. It recognises that (urban) planning and decision-making are complex and multifaceted as diverse stakeholders often have conflicting interests (Lane, 2005).

Communicative planning came forward as a reaction aimed at the epistemological base of modernist planning. Modernist planning was known for its instrumental rationale as the main rationality in planning (Westin, 2021). Instead, the communicative planning approach is based on Habermas' notion of communicative rationality (McGuirk, 2001). The notion of communicative rationality looks at intersubjective deliberation and argumentation to create reasoning instead of only using instrumental rationality. Knowledge is not generated through (scientific) systematic understanding but through the communication and exchange of different perspectives, understandings and knowledge based on the specific culture and morals of the stakeholders/participants (Mattila, 2020; McGuirk, 2001).

Through collaboration, the communicative planning approach tries to create a richer understanding and awareness of local social relations and conflicts so approaches to solve those conflicts can emerge. This involves planning models that focus on interactive processes, discursive processes, conflict mediation and consensus-building (Healey, 1999; Healey, 2003). Forester (1982) looks at communicative planning as a way to counteract communicative distortions in planning processes while critiquing the power relations visible in top-down planning processes.

Collaborative and Integrated Governance

Governance was traditionally connected to the state/governments and decisions made by these actors towards the regulation of public affairs. Currently, governance goes beyond the state/government and includes a broader scope, including civil society and the market. In this sense, governance is a comprehensive concept that focuses on inclusive decision-making processes between multiple actors to handle common affairs. Understanding the interactions between these actors is essential for effective decision-making (Nuissl & Heinrichs, 2011). Obeng-Odoom (2012) describes urban governance as the coordination, regulation, or steering of affairs between actors, between specific sectors or in a city.

Collaborative governance focuses on the collaboration aspects of solving complex challenges. Wang and Ran (2021) highlight collaborative governance as the engagement of non-state stakeholders in a collective decision-making process. Collaborative governance aims to find through deliberation, consensus building and conflict resolution a shared goal (Wang & Rand, 2021).

Integrated urban governance aims to integrate urban policies and institutions and seeks to connect stakeholders from different sectors to solve complex urban challenges (Rode, 2018). Ioan-Franc et al. (2015) explain the essence of integrated governance as a form of collaboration consisting of multiple stakeholders and sectors to solve urban challenges. Important in

collaboration is the formation of coherence, synergies, and transparency in the decision-making process to create integration/synergies between interdisciplinary policy sectors.

Combining Governance and Spatial Planning

Literature about spatial planning highlights the importance of collaboration between stakeholders. Albrechts (2004) described the importance of involving multiple stakeholders in spatial planning. The author argues that a shift in spatial planning approaches is necessary to solve complex issues. This shift highlights the more active involvement of stakeholders in the decision-making process, looking at finding shared interests, relevant knowledge and joint definitions. In other words, combining collaborative/integrated governance principles with spatial planning is essential in solving increasingly complex problems (Albrechts, 2004).

2.3 Changing roles of the DSOs

The emergence of distributed energy resources in the electricity power sector shapes the new role of DSOs as new responsibilities emerge. Lavrijsen & Edens (2019) observed how the technical and societal context is changing for the DSOs, forcing them to reinvent themselves. This reinvention can be described as the DSOs needing to operate proactively to allow smarter, more flexible and sustainable energy systems. Uzum et al. (2024) also reflect on the changing role of DSOs due to the changing energy landscape. The significant points of change are the increasing responsibility of the integration of DER in the energy system, the increasing responsibilities in terms of congestion management and the active management of ensuring a reliable and qualitatively high electricity grid (Uzum et al., 2024). Furthermore, DSOs are often connected to path dependency as their physical assets (such as the energy grids) are capital-intensive objects with long lifetimes. In addition, DSOs are typically organisations with highly structured organisational routines, which makes short-term organisational changes challenging (Johansson et al., 2020).

3. Theoretical framework

Two theoretical frameworks are used to analyze the collaborative relationship between DSOs and local governments. First, the integrative collaborative governance framework is described. Next, the adaptive policy-making process is introduced.

3.1 Integrated Collaborative Governance Framework

Emerson, Nabatchi, and Balogh (2011) developed a collaborative governance framework, which is presented in Figure 1. The framework aims to conceptualize the basic elements of cross-boundary governance/collaboration. It consists of multiple dimensions/elements: the system context, the collaborative governance regime, and the collaborative dynamics and actions (including impacts and adaptation).

System Context

Emerson et al. (2011) describe the system context as a three-dimensional space in which collaborative governance takes place. The system context influences the collaborative governance regime through political, environmental, legal and socio-economic influences. In the system context, drivers (based on the influences) originate and drive the need for collaboration between multiple actors. Drivers are, for example, uncertainty and interdependency: an acknowledgement that actors need to collaborate due to their dependence (mutual reliance) and the increasing complexity and uncertainty of wicked problems, driving the need for collaboration.

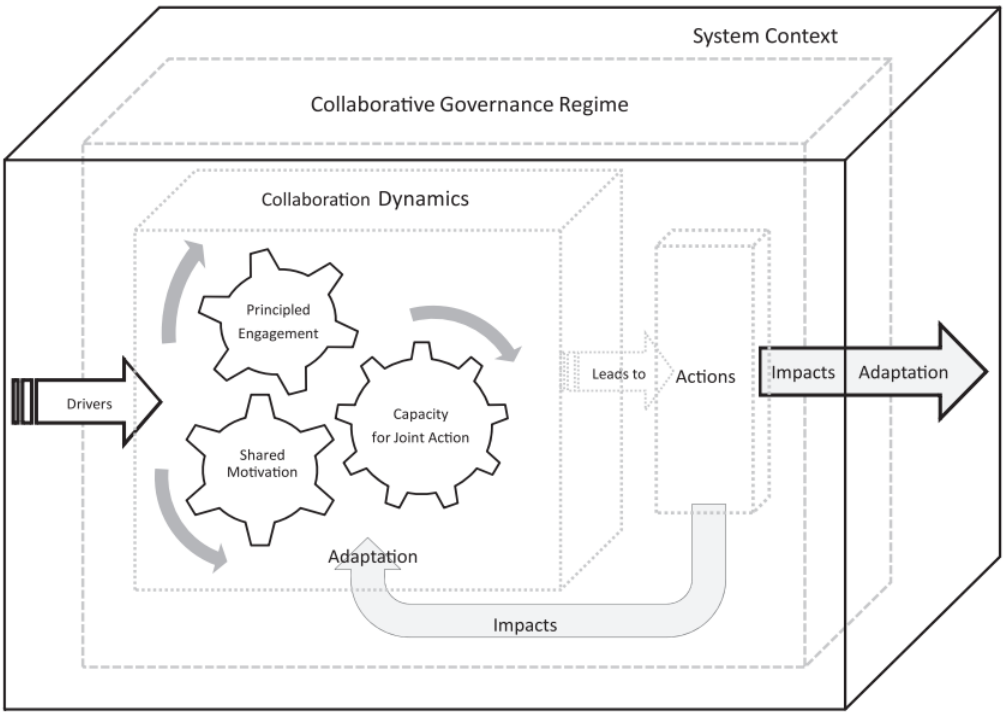

Figure 1: Collaborative Governance Framework. From. An Integrative Framework for Collaborative Governance (P. 6), by Emerson, K., Nabatchi, T., & Balogh, S. 2011. Oxford University Press. Copyright 2011 by Oxford University Press.

Collaborative governance regime

The collaborative governance regime presents the predominant form of collaborative conduct, decision-making, and activity. It consists of two important elements: the collaborative dynamics and the concept of 'action'. The collaborative dynamics describe how the process surrounding the collaboration should take place and consist of the dynamics: Principled Engagement, Shared Motivation and Capacity for Joint Action. The interaction between these dynamics is cyclical, meaning that the interaction is not linear but rather constantly repeating. Principled engagement stimulates shared motivation, whilst shared motivation also stimulates principled engagement. The capacity for joint action is developed over time and is a result of the interactions of shared motivation and principled engagement. The capacity for joint actions stimulates again the dynamics of shared motivation and principled engagement. Actions refer to the direct outcome of collaborative processes, such as new policy or law-making. The section below will explain the collaborative dynamics.

Principled engagement

Principled engagement consists of four process elements: discovery, definition, deliberation and determination. Discovery and definition focus on the identification of shared interests, risks, values, and relevant information, as well as on defining common objectives and expectations for each other. Deliberation is the process surrounding effective communication. This encompasses the skilful advocacy of interests and effective conflict resolutions. Within the deliberation element, constructive conversations and honest disagreements should be present. Determination is the result of principled engagement and leads, for example, to procedural decisions and substantive determinations (agenda setting, reaching action agreements, etc.).

Shared motivation

Principled engagement focused on processes in collaboration. Shared motivation, instead, looks at the relational and interpersonal aspects. Through principled engagement, collaboration takes place, and over time, trust gets built. Here, the collaborating actors show each other that they are predictable, reasonable and dependable. This forms the basis of the creation of a form of shared understanding (respecting each other's perspectives and disagreements) and legitimacy (credibility and trustworthiness of the other actor). Lastly, with a sense of trust, mutual understanding and legitimacy, commitment is reached. This highlights the willingness of actors to cross sectoral/organisational/jurisdictional borders to commit and stay committed to the collaboration.

Capacity for joint action

Capacity for Joint Action is an essential element of the collaboration. It can be explained as the elements necessary to ensure the ability of actors to continue to collaborate. In this sense, they are more of a supportive character. The first sub-dynamic is connected to procedural and institutional arrangements. This refers to the formulation of protocols and structures that manage the collaboration between actors. The protocols and structures are defined both intra- and interorganizational. Another supportive aspect is leadership. Leadership is essential in a collaborative relationship as it functions as an important driver to stimulate collaboration. Leadership can be, among others, in the form of a facilitator/project leader. The last two elements, knowledge and recourses, are closely connected. Knowledge is an important resource in decision-making. In the context of this framework, knowledge is the generation of new shared knowledge (originating from differing sectors/specialisations) that ensures effective collaboration. Recourses are defined as supportive elements such as money, time, organisational assistance and, for example, expertise.

Action, Impacts & adaptation

The collaboration leads to action. Action refers to the collective efforts and initiatives the collaborating actors undertake to achieve shared goals and address common challenges. Impacts refer to the results of the action and are focused on the physical, environmental and social areas in the system context, which are 'results on the ground'. Furthermore, impacts can be short-term or long-term. Adaptation refers to the potential transformative change that collaborative governance has. Through collaboration, solutions for challenges can be found. At the same time, new solutions can reveal new challenges and opportunities that influence/change the system context. Indirectly, the collaborative governance regime can also be altered due to changes in the system context, therefore influencing the drivers that influence the collaborative governance regime.

The collaborative governance framework has multiple (complex) elements that are connected. For this research, the most critical aspects of the framework are the collaborative dynamics, as these shape the way collaboration can take place. Furthermore, the framework does mention elements of evaluation (impact and adaptation if the desired impact is not reached). However, this research will focus on how the collaboration between DSOs and local governments takes place and how it can be improved. Therefore, the 'evaluation phase' is a significant element of this research and needs further explanation. The following section will focus on the evaluative phases of policy creation and implementation.

3.2 Adaptive Policy Creation

The collaborative governance framework explains how collaboration takes place. In essence, it can be used to analyse multiple collaborative relationships. In this research, the framework will be used to analyse the collaboration in the context of the 'neighbourhood-orientated approach', which asks for collaboration between DSOs and local governments. The need for collaboration is high in the DSO's developed policy of the neighbourhood-oriëntated approach. This research is, therefore, put in the context of the policy implementation/evaluation phase. This asks for literature about policy creation and evaluation.

Walker and Cave (2001) explain the dynamics/steps of adaptive policy and refer to the four different stages of an adaptive policy-making process. First, 'stage-setting' specifies and discusses the most relevant objectives, potential constraints, and available policy options. In this stage, a definition is given to success (regarding the desired objectives and the acceptable constraints). The second stage, '*the assembly of the basic policy',* specifies more intensively in terms of promising policy and the formulation of conditions that have to be met for the policy to succeed. The third stage is the process of '*Specifying the rest of the policy*'. This means that the remaining policy elements, beyond the basic element of the policy, are specified.

The last stage is the actual policy implementation. In the implementation phase, the evaluation also occurs. In earlier phases, signposts have been developed. Conditions for the policy's success are transformed into signposts so that monitoring/measuring of the policy is made possible. In other words, signposts can be seen as indicators/markers/variables to measure the success of a policy. An essential element in the signposts is the identification of triggers. As particular signpost variables/indicators show a risk of undesired outcomes of a policy, this is a 'trigger' for action.

Actions can be either defensive or corrective. Defensive actions are measures implemented to prevent risks and safeguard the policy. The focus is on preserving the policy and reducing the risks as much as possible. These measures are proactive and implemented based on potential risks that might occur. Corrective actions are reactive measures that aim to solve problems that have already occurred during the policy implementation. The goal of corrective actions is to realign/correct the policy towards the desired goal. When both corrective or defensive actions do not have the desired effect, the policy has to be re-assessed. This can mean that the policy process has to be restarted.

Combining the collaborative governance framework and Adaptive Policy

This chapter introduced two frameworks/processes that will be used to analyse the collaborative relationship between the DSOs and local governments. First, the collaborative governance framework, the collaborative dynamics are relevant. By using collaborative dynamics, the DSOs and local governments' collaboration can be analysed in the context of the neighbourhood-orientated approach, and possible shortcomings/improvements in the collaborative process can be identified. Furthermore, the policy evaluation aspects, and mainly the concepts of triggers and defensive and corrective actions, are used to target concrete elements in the DSOs' policy and in collaboration with local governments that are considered corrective or defensive actions or where corrective or defensive actions could be desired.

4. Conceptual Framework

The following chapter will discuss the conceptual framework (figure 2) based on the theoretical framework presented in Chapter 3. The conceptual framework displays the dynamics of collaboration between DSOs and local governments and the evaluative element in the collaboration based on the policy implementation phase (see paragraph 3.2).

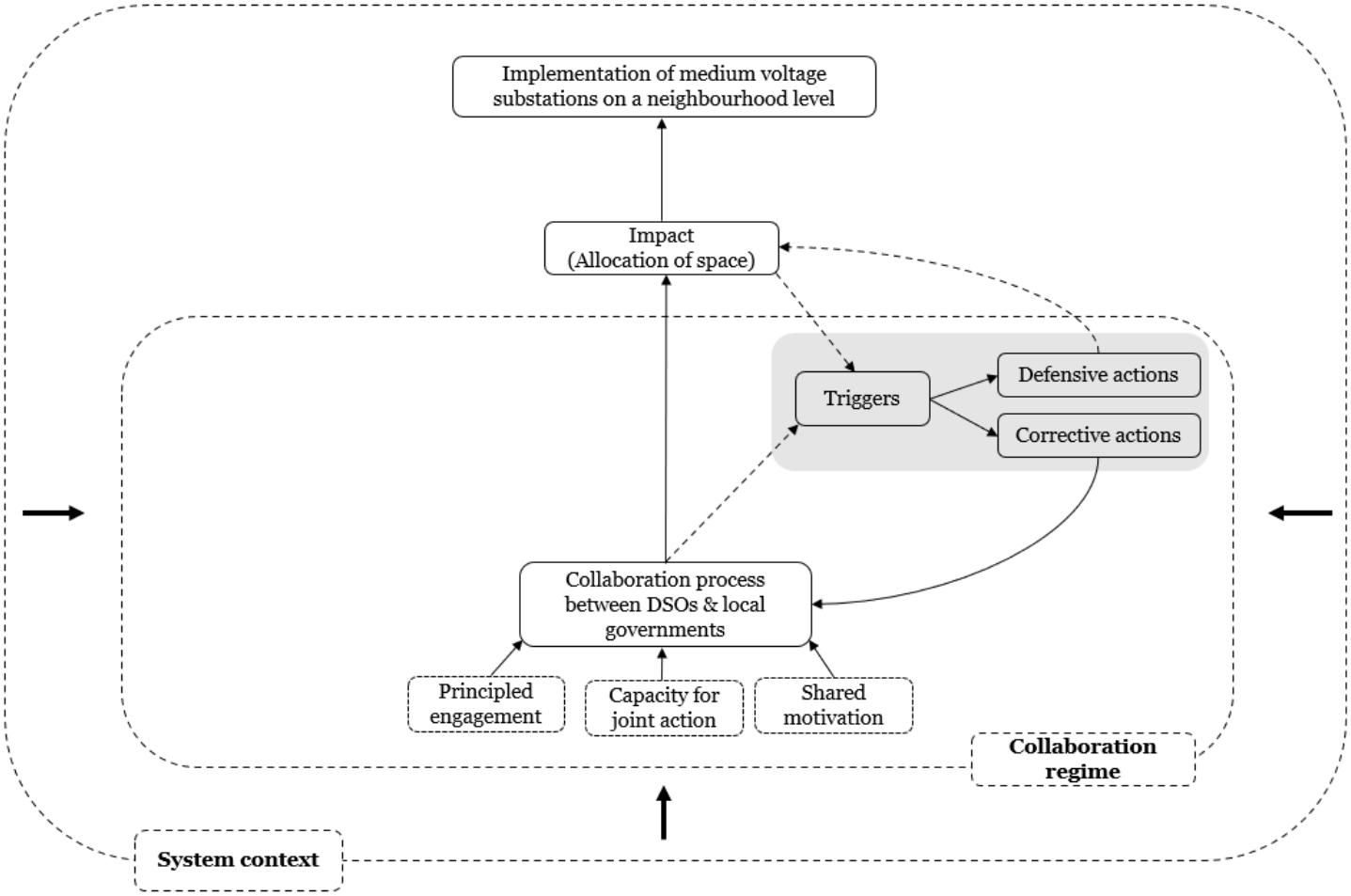

Figure 2: Conceptual framework.

The dashed line on the outside represents the *system context*. Within the *system context*, external factors/challenges influence the collaboration regime. These could be political influences (for example, societal pressure/demand for action by the public in terms of climate change), historically developed collaborative culture (for example, siloed departments that fail to work together) and institutional influences (for example, the need for collaboration due to law-making). In the context of this research, an influence from the system context would be the increase in decentralised energy sources (solar panels, heat pumps, etc.) due to ambitions set to achieve the energy transition. Furthermore, these external factors are often the reason why new forms of collaboration are necessary due to the complex nature of these external factors. These factors/challenges are represented by the outer black arrows. The *collaboration regime* is represented by the second dashed line. The collaboration regime is, in its most simple form, the dominant form of collaboration. The dominant form of collaboration is shaped by the external factors coming from the system context but also shaped by the collaborative dynamics: *Principled Engagement, Capacity for Joint Action* and *Shared Motivation*. The dynamics shape how the collaboration takes place and if it will lead to change. The collaboration between local government and DSOs leads to *Impact*. *Impact* has been defined as the successful allocation/reservation of space for medium voltage substations. The successful allocation of space leads to *the implementation of medium voltage substations* on a neighbourhood level.

Within the conceptual framework, a grey square is also present that shows the following elements: '*triggers*', '*defensive actions*' and '*corrective actions*'. In this grey square, the evaluative processes take place. When the collaboration between DSOs and local governments takes place, there is a possibility that the collaboration does not reach the desired action/impact. When the collaboration does not reach the desired impact, *Triggers* are identified, which lead, based on the causes of the triggers, to the implementation of *defensive* or *corrective actions*. In the case of defensive actions (proactive actions), if these actions are successful, they lead to the successful allocation of space for medium voltage substations. When defensive actions are insufficient or even halter the collaboration, corrective actions (reactive) are implemented to improve the collaboration.

5. Methodology

This chapter describes and explains the methods used to answer the main question. First, the research design is described overall. Second, the focus is on data collection and the specific cases that have been selected. Third, an explanation of how the collected data will be analysed is given. This section also operationalises the theoretical concepts.

5.1 Research Design

This research aims to analyse the collaborative relationship between DSOs and local governments. This way, the following research question and sub-questions can be answered:

"To what extent and how does the collaboration between distribution system operators and local governments shape the expansion/adjustments of the energy grid in relation to the renewable energy transition in the Netherlands?"

- What are the critical issues that shape the collaboration between DSOs and the local governments?
- How do the collaborative dynamics between DSOs and local governments affect local energy transition planning in the Netherlands and does that differ between different types of local governments (i.e. small/big, urban/rural)?
- How has the role of DSOs changed in terms of spatial planning?
- How can the collaboration between DSOs and local governments be improved?

A qualitative analysis has been chosen to analyse the collaborative dynamics/relationship between local governments and the DSOs. A qualitative approach allows for a better understanding and meaning of the experiences of the involved actors (Fossey et al., 2002). Data has been collected through semi-structured key-informant interviews with both DSOs and representatives of local governments. All stakeholders interviewed were actors involved in the collaboration processes between DSOs and local governments (to find space for medium-voltage substations). The multi-stakeholder perspective allows for the exploration of how different stakeholders (with different roles) look at specific topics. This allows for capturing the reality and experiences of the key actors who are highly involved in the specific work field (Salman et al., 2021; Bedaf et al., 2017). The data is analysed based on the combined (theoretical) framework of the collaborative dynamics (collaborative governance framework) and the evaluative phase of adaptive policy creation (Emerson et al., 2011; Walker & Cave., 2001), whilst also focusing on thematic aspects.

5.2 Data Collection

Interviews were conducted with key informants who have diverse roles in collaborative processes. By interviewing diverse roles, multiple perspectives can be collected. The

collaboration, in practice, also takes place between multiple actors who have their own roles and approach the collaboration from that role. This way, the collected data reflects the reality of the collaboration. Based on four explorative interviews with representatives of Enexis, Liander and Stedin, the most relevant key informants have been identified. The Netherlands knows in total six DSOs. However, the choice to specifically focus on the three biggest is based on the fact that the other three (smaller) DSOs, in terms of electricity distribution, operate in a total of 19 municipalities, whilst Enexis, Liander, and Stedin together operate in 323 municipalities. In total, 9 interviews were conducted with key informants of the DSOs.

16 interviews were conducted with key informants from 9 local governments. The local governments have been divided into 'small municipalities', 'middle big municipalities' and 'big municipalities'. This division is made to give an extra dimension while analysing the data, as the sizes of municipalities can influence how the collaboration with DSOs takes place. For example, big municipalities might have enough resources concerning the dedication to collaboration; however, due to the size, it might be more challenging to reach a consensus between all the different key departments in the municipality. Smaller municipalities might have a more flexible approach towards reaching a consensus but don't have the resources to dedicate to an extensive collaboration process with the DSOs. The criteria for what are considered 'small', 'middle-big', and 'big' municipalities are taken directly from the definition used by the Ministry of Social Affairs and Employment (2019): 'Small' (maximum of 50.000 residents), 'Middle' (between 50.000 and 100.000 residents) and 'Big' (more than 100.000 residents).

Furthermore, the level of urbanity has also been taken into account. Urbanity, as described by the Central Bureau of Statistics (n.d.), can be defined through the average address density per square kilometre: Non-urban (average address density of fewer than 500 addresses per square kilometre), Minimal-urban (average address density between 500 and 1000 addresses per square kilometre), Middle-urban (average address density between 1000 and 1500 addresses per square kilometre), High-urban (average address density between 1500 and 2500 addresses per square kilometre) and Very high urban (average address density more than 2500 addresses per square kilometre).

Table 1 provides an overview of the local governments interviewed based on their size and level of urbanity.

Table 1: Overview of local governments and their level of urbanity

Level of urbanity	**Amount of municipalities**	**Sizes of local governments**
Minimal-urban	1	Small

Middle-urban	3	Small, middle, middle,
High-urban	3	Small, big, big
Very high urban	2	Big, big

Interviews

In total, 26 key informants from both the DSOs and the local governments were interviewed. Table 2 below gives an overview of the interviews and a description of the roles of the key informants.

Table 2: Overview of interviews conducted and function of interviewees

Role(s)	**Interviewees**
Local governments	
Policy employee/project manager sustainability/energy transition *Definition: Policy employees/project managers' sustainability/energy transition are less connected to the actual collaboration to find space but often function as the first contact person for the DSOs in the specific local government. This collaboration often took place on the higher/ strategic level.*	4
Civil Engineer *Definition: Concerned with the feasibility of implementing the infrastructure, especially the infrastructure implemented under the surface.*	2
Policy employee Spatial Planning *Definition: Responsible for spatial planning in the municipality and are directly involved in finding space or developing policy that influences the finding of space.*	6
Project manager grid congestion/electricity grid/energy systems *Definition: Directly responsible for the smooth implementation of the necessary infrastructure whilst also taking into account the interests of the local government.*	5
Total	17
DSOs	
Account managers, employee land acquisition *Definition: responsible for sustaining good relationships with the local governments. Communicating/collaborating with local governments to find space and negotiate about the type of ownership of ground, which is necessary for the infrastructure.*	5
Engineer *Definition: Responsible for technical aspects of the grid. Calculates which locations for medium-voltage substations are best in terms of optimal functioning of the electricity grids. Also, directly involved in the collaboration with the local governments.*	1

Key-account managers *Definition: Collaboration on a strategic level. Communication of the upcoming challenges/long-term planning surrounding the electricity grid and the amount of necessary infrastructure.*	3
Total interviews DSO	9
Total DSOs and Local governments	26

5.3 Data Analysis

The interviews have been analysed based on the combined theoretical framework of the collaborative governance framework and the implementation phase of the adaptive policy framework (Emerson et al., 2011; Walker & Cave., 2001). The conceptual framework (figure 2) shows multiple elements. However, for the specific analyses of the interviews, the focus was on (but not exclusively on) two areas of the conceptual framework: The collaboration regime, the 'Collaboration process between DSOs & local governments' and the 'Evaluative aspects' (triggers, defensive actions & corrective actions).

The collaborative dynamics (principled engagement, Capacity for joint Action, and shared motivation) have been used to examine the collaborative relationship. Furthermore, the evaluative aspect is used to see what actions can be taken to improve the collaboration between local governments and DSOs while keeping the collaboration's original goal. Table 3 describes how the elements presented in the conceptual framework are measured.

Table 3: Operationalized theoretical variables

	Measuring
System Context	Questions are formulated that aim to identify the past and current forms of the collaborative relationship between the DSOs and the local governments. Attention is given to what (political, environmental, etc.) factors influenced the transition from the past to the new form.
Collaboration Regime	Questions are formulated to capture how the collaboration takes place and what the desired form of collaboration is for both the DSOs and local governments.
Impact (allocation of public space)	No applicable measurement.
Implementation of medium voltage substations	No applicable measurement
Principled Engagement (Discovery, Definition, Deliberation and Determination)	Questions will be asked that focus on how the collaboration can be improved in the context of the neighbourhood-orientated approach. These questions are aimed at identifying conflicting interests in the collaborative process. Both actors can give their perspectives on collaborative agreements, the ways these agreements are made and the deliberative processes connected to them.
Shared Motivation (mutual trust, mutual understanding, legitimacy, commitment)	Shared motivation focuses on the relational and interpersonal aspects of the collaborative process. The questions have a high level of reflection, allowing the participants to reflect on how they experience the collaboration with each other.
Capacity for Joint Action (procedural and institutional arrangements, leadership, knowledge and recourses)	The capacity for joint action encompasses the supporting aspects that ensure long-term collaboration (resources, procedural arrangements, etc.). This dynamic will be measured through evaluative questions that force the participants to think about how the collaboration can be improved.

Triggers	Triggers are identified through questions about barriers in the collaboration.
Defensive actions	Questions are asked about how to improve the collaboration. These questions will help to identify the potential defensive actions.
Corrective actions	Questions are asked about the desired form of collaboration of both actors. This will give insight into potential corrective actions that can improve the collaboration.

The interviews were partly conducted face-to-face and partly through video-calling platforms. Questions were prepared on a topic list; however, due to the semi-structured character of the interviews, the room was given to explore within the interviews. The topic relied on evaluative questions, giving the respondents room to think about what the other actors can improve in the collaboration whilst also questioning what they themselves can improve. In Appendix 1, the topic lists used to interview both the DSOs and local governments have been added. Lastly, all interviews have been anonymised.

6. Results

This chapter presents and examines the perspectives of the key stakeholders interviewed. First, the focus is on the collaborative regime and the system context. Second, the collaborative dynamics are used to analyse the key themes in the collaboration between the DSOs and the local governments, and critical issues are identified. Next, the policy evaluation mechanisms are used to identify defensive actions and corrective actions to give insight into which measures were/are taken by the DSOs or local governments to improve/halter the collaboration. Lastly, the focus is on how the influence of the size of local governments impacts collaboration.

6.1 Collaborative Regime & System Context

The local governments and DSOs need to collaborate to successfully expand/adjust the electricity grid on a neighbourhood level. The current and desired collaboration takes place in the collaboration/collaborative regime. It is essential to understand both the current collaborative regime and the desired collaborative regime. The comprised roles and responsibilities of the DSOs are as follows: non-discriminatory provision of connections of energy producers and consumers to the electricity and gas grid so that the energy market can function, the maintenance of the electricity and gas grids with attention to safety and the avoidance of malfunctions ensuring transport security, and the on-time and cost-efficient expansion of the electricity and gas grid (Netbeheer Nederland, 2019). In terms of accountability, the DSOs are accountable to the Authority of Consumers and the Market (ACM), the regulator of the DSOs. The ACM checks the DSOs in terms of performance relative to each other, ensuring an efficient operation of the DSOs (Netbeheer Nederland, 2019).

The responsibilities and core tasks of the DSOs tend to be of reactive and technical character. The reactive character of the DSOs is also reflected in the current/past form of operating of the DSOs. A reactive form of operating refers to the functioning of a DSO, which focuses on maintaining the existing grid, and only when voltage problems occur, adjustments are made to solve the problems. Multiple respondents representing the DSOs also referred to the reactive character in their operations. They explained that in the past, the DSOs would look at where voltage problems occurred and then contact the local government to explain that a new medium-voltage substation was necessary (DSO-B, personal communication, March 28, 2024).

Conversely, local governments have a diverse role in collaborating with the DSOs in the current/past collaborative regime for energy transitions. First, local governments are responsible for spatial planning. In this sense, spatial planning refers to the balanced allocation of functions (such as utilities, housing, etc.) to locations within the municipal borders. Second, local governments have a directive/leading role in the heat transition within the built environment, given to them by the national government, which is inherently connected to the

electricity grid. Thirdly, local governments are the only institutions that have the authority (locally) to plan the below-surface infrastructure (cables, sewers, etc.). Fourthly, local governments are responsible for permit licensing in terms of the design and implementation of the medium-voltage sub-stations (Boerkamp, 2023).

The past form of collaboration between DSOs and local governments consisted of the DSOs informing the local governments about necessary maintenance adjustments to the grid. This often meant that one or two sub-stations had to be implemented. Location propositions would then be sent to the specific local government. The specific local government would internally discuss if the location(s) proposed are sufficient in terms of location, impact on local residents, and impact on space. After this process, a location would be appointed (DSO-C, personal communication, April 17, 2024). The collaborative regime, therefore, consists of a collaboration in which the DSO mainly operates reactively and from a technical perspective, whilst the local government is responsible and has authority for/over spatial planning procedures and permit licensing. This clearly distinguishes the responsibilities and roles of the local governments and the DSOs.

This form of operation, with clear distinctions in the roles and responsibilities of both DSOs and local governments, is changing. An important factor that drives this change is the energy transition. On a political level, the need to reduce greenhouse gas emissions, in line with the Dutch Climate Agreement, asks for a transformation of the carbon-based energy system to a renewable (electricity-based) energy system. However, without expanding/strengthening the current grid, there will not be enough transport capacity to facilitate the energy transition. Expanding the electricity grid is such a substantive spatial task that the reactive form of operation by the DSOs is no longer effective. The DSOs must operate proactively, almost having to implement a second electricity grid next to the existing grid (DSO-A, personal communication, April 17, 2024).

Knowing the urgency of expanding the electricity grid, the DSOs have introduced the neighbourhood-orientated approach, which aims to standardise the process of finding space for medium-voltage substations. Furthermore, the medium-voltage substations should be implemented in bulks per neighbourhood. DSO-A describes how changing from a reactive character to a pro-active character is also new for the DSOs, and whilst the neighbourhood-orientated approach has started, they are still learning:

"There are a few roads we have to walk. One of those roads is making sure everybody is connected to the electricity grid. Also, when problems occur on the electricity grid we solve them. At the same time, we need to walk another road and that the implementation of a new grid from the start, before grid problems even occur. In this, we also need to prioritise.

There are a lot of things we still have to think about, how we will develop, and how we will learn and experience things" (DSO-A, personal communication, April 17, 2024).

Local governments also need to adjust to the proactive character of the DSOs. For the neighbourhood-orientated approach to be successful, local governments must also reorganise themselves. Instead of processing the medium-voltage substations one by one through siloed municipal departments, local governments need to collectively process the stations' locations per neighbourhood in one go. Processing the stations is an activity in which different departments, such as greenery, mobility, etc., make trade-offs with each other and with the DSOs to find space for the medium-voltage substations (DSO-B, personal communication, April 12, 2024).

The DSOs and local governments stated that transitioning to this new collaborative relationship is challenging. The DSO-A mentioned that:

"*This is for the grid operator, a big internal switch. We go from reactive and maintenance orientated on demand to having to plan into the future and proactively implement new grids. This should also bring a cultural change in the organisation, or maybe even a very big cultural change."* (DSO-A, personal communication, May 10, 2024)

From the local government's side, it also asks for a change in how they operate and in terms of capacity: Sometimes local governments do not commit to collaborating with the DSOs until they have arranged the right amount of capacity (DSO-B, personal communication, March 28, 2024). Looking from an operational perspective, local governments have to shift from 'assembly' like work (handling the stations individually per department) to project-based work, processing the stations per neighbourhood in one go. This also asks for better alignment between the relevant departments regarding collaboration and a feeling of urgency (DSO-C, personal communication, April 17, 2024).

Although the responsibilities of both sides don't change per se, the collaboration will intensify as the need to expand the electricity grid is high. For DSOs, pro-activity also means the adoption of a directive role, actively guiding collaborative processes to find space for the medium-voltage substations. In this sense, local governments and DSOs transition towards an integrative form of collaborating instead of having clear, distinctive roles. Both actors, however, still face organisational challenges (capacity & ways of operating).

6.2 Key Themes in the Collaborative Dynamics

Based on the interviews, multiple themes have been identified as relevant to the collaborative relationship between local governments and DSOs. These themes are concerned with potential key issues to the collaboration. After discussing each theme, a reflection is presented on how the specific theme connects with the relevant collaborative dynamics. The following themes are discussed: The siloed approach of the DSOs, Spatial Perspectives, Flexibility in complex areas, Information/knowledge conflicts and, lastly, effective collaboration constructions.

6.2.1 The Siloed Approach of the DSOs

Multiple interviews with local governments revealed that the siloed 'spatial approach' of the Distribution System Operators is seen as a barrier to collaboration. The siloed spatial approach refers to the DSOs' attitude towards the neighbourhood-orientated approach. The DSOs prefer avoiding linking with other utility companies/organisations, for example, when having to implement their infrastructure in a neighbourhood. DSO-B mentioned that having to link up with other utility companies will slow down the process of expanding the grid as more time will have to be spent on coordination and planning mismatches can occur between the DSOs and other utility organisations (DSO-B, personal communication, April 12, 2024). DSO-B referred to the siloed approach as 'solo-unless' (solo-tenzij). 'Unless' refers to whether the other utility organisations' planning fits in the DSO's planning.

When zooming in on the perspective of the local governments, criticism towards the siloed approach came forward from both the smaller local governments and the bigger local governments. Small-municipality-A referred, for example, to the demanding attitude of the DSO:

"*Is a sensitive topic, well at least at the Department of Public Space Management. Because they had the feeling as if all of a sudden DSO-A demands something of them with that solo-unless mentality. From our perspective, we would like more opportunities for participation and coordination, at least that's how I understood it.*" (Small-municipality-A, personal communication, April 23, 2024).

This same municipality described that within the Department of Management of Public Space, the sense was that control/responsibility for the public space was being taken away by the DSO:

"*Yes, they (Department of Management of Public Space) are responsible for the public space, and they like to have that control. If DSO-A then comes with the statement that they will go solo-unless, then that control is being taken away, which creates resistance*" (Small-municipality-A, personal communication, April 23, 2024).

The above quote shows that the siloed approach of the DSOs can create an uneven power influence between the local governments and DSOs. Small-municipality-A felt like the control

of public space was taken away by the DSOs due to the dominant position concerning 'going solo'.

Closely connected with the feeling of an uneven collaboration form is the feeling of a one-sided communication stream in planning. Small-municipality-B gave a clear statement of the overall feeling when collaborating:

"*The communication has to come from both parties. Now we have the feeling that DSO-A communicates the planning to us, but that can change then again multiple times, and I feel like from the municipal perspective that we also have the desire to be allowed to give input*" (Small-municipality-B, personal communication, April 15, 2024).

The bigger local governments also referred to the 'solo-unless' mentality as problematic. Big-municipality-G, for example, mentioned that if the DSO operates solo, the whole city will be under constant construction:

"*Solo won't happen because then every street will be open every day in municipality X. There is so much stuff under the ground that has to be replaced*." (Big-municipality-G, personal communication, May 8, 2024).

The second aspect connected to the DSOs' siloed approach concerns planning. The local governments need accurate planning developed by the DSOs. Accurate planning consists of an estimation of the amount of medium-voltage substations per neighbourhood, the potential locations of the stations per neighbourhood, and insight into the order in which neighbourhoods will be developed and when. With a clear understanding of the planning, local governments can align other utility projects with the DSOs. Local governments understand that DSOs prioritise speed but still aim to reduce nuisance for residents as much as possible. For example, small-municipality-B explained that following the DSOs plans would mean local residents face construction twice in a short period (Small-municipality-B, personal communication, April 15, 2024).

Perspectives of DSOs on the siloed approach

From the DSOs' perspective, the siloed approach is essential to achieving the desired speed to expand the electricity grid. Linking up with other utility organizations can increase the construction time by 4 to 10 times (DSO-A, personal communication, June 11, 2024). The solo-unless approach does give (limited) room for linking up if the other organisations can adjust their planning to that of the DSOs. DSO-B described the position of the DSOs in the following quote:

"Solo-unless means that, in general, we will go solo. But if there is an opportunity for another utility company to join, and it fits in our agenda, then we are willing to collaborate,

but this is with high exception. We now have the mandate to decide if we want to link up with other utility companies. It used to be the municipality that would take the lead and decide when certain construction takes place. But now we (DSO-B) want to take this lead because we have to ensure speed and therefore it is essential that we take the decisions"
(DSO-B, personal communication, March 28, 2024).

To summarise, the DSOs prefer a siloed approach to implement the medium-voltage substations so that speed can be prioritised. Local governments find this unfavourable as it will be a nuisance for residents. Even more, the siloed approach can create tension as, to a certain extent, the directive role over public space is taken away from the local governments. Also, certain local governments are experiencing the collaboration as one-sided, with a dominant position taken by the DSOs.

Reflecting on the collaborative dynamics

When reflecting on the siloed approach using collaborative dynamics, it can be connected with the dynamics of principled engagement and shared motivation. There are apparent mismatches in interests, which will be discussed below.

Principled Engagement

The essence of principled engagement is the finding of shared interests and the definition of expectations/key tasks (Emerson et al., 2011). Both the DSOs and local governments have differing interests in terms of the implementation of the medium-voltage substations. The DSOs have a siloed approach, which also translates to the solo-unless mentality. Their main interest is speed. The local governments generally reacted negatively towards the siloed approach as it does not serve the interests of the local governments who want to avoid streets having to be opened up multiple times per year, creating a nuisance to local residents.

Shared Motivation

The dynamic of shared motivation is concerned with the interpersonal and relational aspects of collaboration (Emerson et al., 2011). When there is a lack of principled engagement, shared motivation is also influenced negatively. An important finding that fits in the framing of shared motivation is the dominant position of the DSOs that some local governments experience. The first step in creating shared motivation is mutual trust. Within mutual trust, reasonability is an essential element (Emerson et al., 2011). With the dominant position the DSOs take, the local governments can experience the DSOs as unreasonable. The same applies to the siloed approach/solo-unless mentality. The findings showed that the solo-unless mentality created tension within local governments as they experienced it as if their responsibility was taken away.

6.2.2 Spatial Perspective

A recurring theme in the interviews with the local governments was the 'spatial perspective' of DSOs. Multiple local governments have stated that it would be helpful if the DSOs tried to move away from a solely technical perspective, consider the spatial environment, and adopt a spatial perspective.

Spatial thinking means that in the more complex areas, where multiple interests in public space clash with each other, trade-offs have to be made. The DSOs will be asked to actively participate in making these trade-offs. This asks for a collaborative form in which both the DSOs and local governments look for solutions that fit the common good, meaning that sometimes both actors let (partly) go of their interests (making trade-offs) to find the middle ground (Big-municipality E, personal communication, April 24, 2024). Big-municipality-E mentioned the following about 'Spatial thinking':

"Until not that long ago, implementing medium-voltage-sub-stations was just an asset thing for the DSO, and they mainly did replacement jobs; now you can see how it turned into a spatial planning challenge in which the DSO also have to collaborate with us increasingly more. They might have to think also in a spatial way in, for example, well, right now, when they propose a design for the grid, it is just very technical. Normally, the DSO expects us to be the 'spatial' counterbalance of their technical perspective. I'm not saying that we should do each other's work, but we are getting closer to each other in terms of roles, and that means we should talk about it. We should anticipate this, and that will probably take more time." (Big-municipality-E, personal communication, April 24, 2024).

When asking big-municipality-E, what it would mean for the planning processes if the DSOs would contribute from a spatial perspective, the following answer was given:

"What we will see is that we will invite the grid operators to think with us. They should also start thinking ahead and be in line with municipal challenges. You can see this as a situation where the municipality has multiple sectoral challenges, of which most are the responsibility of the municipality with each their own policy workers. We ask the grid operators to think with us about their role in the process of making trade-offs. They will be more and more present in the process of making trade-offs. I think then, the collaboration will go even more smoothly. However, grid operators have not yet organised this way" (Big-municipality-E, personal communication, April 24, 2024).

The sentiment concerning the 'spatial' perspective came forward in other interviews with the bigger municipalities. For example, Big-municipality-D stated, when asked about barriers surrounding the finding of locations for sub-stations, that:

"*They (DSO-B) are not used to looking at locations with spatial glasses. For example, a location (for a substation) in front of a resident's window—c'mon, you couldn't see yourself that this is not a good place? However, the more we collaborate, the better the location propositions become, so I do think it is just a matter of time*" (Big-municipality-D, personal communication, April 19, 2024).

In the same interview, big-municipality-D mentioned that the sectoral perspective of DSO-B also came forward in the collaboration when both sides were discussing the conditions for the spatial implications of the medium-voltage substations:

"And now DSO-B describes from their perspective what the municipality has to do and then also a little bit what the DSO's responsibilities are. But they were describing things like technique and safety are always leading, really from a DSO's perspective. We denied this proposal and stated that we want a collaboration agreement in which we (municipality) can also put our interests" (Big-municipality-D, personal communication, April 19, 2024).

Small-municipality-F also stated that when collaborating with DSO-B, the overall feeling was that DSO-B looks from a sectoral point of view whilst neglecting other spatial aspects:

"DSO-B looks very much from the DSO perspective, and that is for them number one. I understand that grid congestion is a big challenge we all have to deal with, but they (DSO-B) really do not think about what the residents might think of it or how they can make it look pretty in the neighbourhood or something. They don't care, to say it straight to the point" (Small-municipality-F, personal communication, April 30, 2024).

Medium-municipality-C also noticed that the view can differ depending on with whom from DSO-B they collaborate. Here, medium-municipality-C refers to a difference in mentality between employees of DSO-B:

"I (municipality) have noticed a split within DSO-B in terms of the employees that really think from the technical perspective and the other employees that think more from a broader societal perspective" (Medium-municipality-C, personal communication, May 7, 2024).

Big-municipality-H had a similar experience and mentioned that the success of DSO-C looking beyond their technical perspective depends on the person with whom they collaborate. Some representatives of the DSO think in line with the local governments, whilst others stay in their own technical role. At the same time, Big-municipality-H acknowledges that it works the same the other way around. Furthermore, that the most essential element is discussing each other's interests to make trade-offs so beneficial outcomes can be found (Big-municipality H, personal communication, June 6, 2024).

To summarise, the local governments spoke about the desire of the DSOs to adopt a spatial perspective when collaborating to find space for medium-voltage substations. This does not mean that the DSOs should let go of their technical perspective, but it does mean that the roles of the DSO and the local governments are growing towards each other. With many different interests and ambitions in the public space, of which the DSOs are one, now the DSOs also have to think about how their interests match with other interests in the public space. This also implies that the DSOs might shift towards a way of operating in which they, with the local governments, think about making trade-offs between the different interests in public space.

Reflecting on the collaborative dynamics

The theme 'Spatial Perspectives' shows strong links with the dynamics of principled engagement, shared motivation and capacity for joint action.

Principled Engagement

As the collaboration between local governments and DSOs intensifies, the local governments desire the DSOs to look beyond their technical perspective. Currently, the local governments experience the DSOs as putting their interest up front. An excellent example of a barrier concerning principled engagement is the experience of Big-municipality-D, in which the DSO proposed a collaboration agreement. The collaboration agreement is a form of a determinative result in which weighed interests of both actors should be represented. However, the agreement was mainly written from the perspective of the DSO. Furthermore, if DSOs and local governments grow closer to each other regarding their role, the sub-dynamics of principled engagement must be assessed, especially in terms of defining tasks and expectations and anchoring these in collaborative agreements (determinations). An equal representation of interests in these determinations is essential.

Shared motivation

The level of openness towards the spatial perspective can differ per representative of the DSOs, which seems to be an aspect that fits in the relational/interpersonal characteristic of shared motivation. When in collaboration, the mentality of representatives towards adopting a spatial perspective differs; it is hard to create a form of reasonability and predictability due to the difficulty of collaborating with representatives with whom you do not share the same views.

However, if the DSOs and local governments grow closer together in terms of their role, the shared motivation can increase significantly from both sides. For example, if the DSOs show that they are also trying to think from the same perspective as the local governments, and actively participate in making trade-offs, this can create positive impulses to the collaboration. It shows that both actors are reasonable and predictable, which in itself increases, according to Emerson et al. (2011), the other elements of shared motivation.

Capacity for Joint Action

With the DSOs potentially adjusting their role and also adopting a spatially connected role, it does ask for an increase in recourses/organisational change. It means that the DSOs need to let go of their technical role, which, internally, can be a challenge. DSO-A described that, in general, the implementation of the neighbourhood-orientated approach already asked for the switch in the organization due to the transition to a proactive form of operating (DSO-A, personal communication, May 10, 2024). This means that to support the collaboration, DSOs have to reorganise themselves towards the spatial role, but at the same time, a need for recourses can also occur as employees also need to adopt this 'spatial thinking'.

6.2.3 Flexibility in Complex Areas

The general sentiment in the interviews was that locations will be found for most of the medium-voltage substations. However, friction can occur when space has to be found in areas where there is limited public space, such as densely populated neighbourhoods or (historic) city/village centres. All four big local governments stated that, in complex areas, they expect flexibility from the DSOs when it comes to customising the medium-voltage substations (a form of context-based solutions). In addition, all four local governments are starting or are in the middle of formulating implementation frameworks that describe how the medium-voltage substations should be implemented based on the local context. Big-municipality E, for example, is developing implementation criteria that are based on the density of the areas in which the stations have to be implemented (Big-municipality E, personal communication, April 24, 2024).

This finding also came forward in smaller municipalities. For example, medium-municipality-C stated that they, in the future, will see a struggle concerning where to find space within the village centres (multiple villages are within one municipality) (Medium-municipality-C, personal communication, May 7, 2024).

Local governments frequently mentioned the word 'flexibility'. Flexibility refers to the need for DSOs to let go, to a certain extent, of their standpoint in terms of standardisation. The overall approach of the DSOs is to, through standardised processes, implement the necessary infrastructure in one go per neighbourhood. This preference for speed leaves almost no room for the customisation of sub-stations. An example of local customisation is an indoor medium-voltage substation (using space in existing building stock). However, local governments, in general, have mentioned that the desire for customisation is high, mainly in more complex urban contexts where available space is limited. Medium-municipality-C mentioned, for example, that:

*"We have noticed that, in the past 10 years, it is very hard to implement the sub-station without a form of customisation. There is so little public space that fulfils the criteria in terms of square meters that DSO-B wants. You cannot just make a simple set of rules and deal with every situation the same way" (*Medium-municipality-C, personal communication, May 7, 2024).

In that same interview, medium municipality C stated that:

"*The biggest obstacle is the lack of public space. For now, looking at what will already be implemented hasn't been that bad. But when the focus is on the village centre of X, I wouldn't know where to find space for sub-stations. We prefer something indoors, or below*

the surface. Everything but those loose cubes in public space in our historical centre " (Medium-municipality-C, personal communication, May 7, 2024).

Big municipality-G stated that they are in the middle of the process of creating an agreement on what to do when clashes are connected to the design of the substations. Furthermore, big-municipality-G mentioned if the DSOs choose speed over taking into account the local context, especially in the historical city centre, clashes can occur in the collaboration:

"The easiest for DSO-C would be to present us a menu card with the message that only these types of sub-stations can be chosen. That would be the quickest. However that will clash with our interests because there are not the most pretty sub-stations. The current sub-stations create resistance, and the municipality knows that, we want the aesthetics of the public space to be nice. To keep the aesthetics of the historic city centre alive. Not on every corner one of those paperbusses (a paperbus is a type of sub-station). That bring you to another point. Cant we implement them under the surface? Or other implementation criteria would be to implement the stations indoors. But this costs more money, and a lot more time. If its up to DSO-C, just put them on the street so they can reach it easy for maintenance" (Big-municipality-G, personal communication, May 8, 2024).

One last important aspect is the newness of the challenge. At the moment, multiple pilot projects have been completed. However, these projects were done in spacious neighbourhoods, whilst the more difficult neighbourhoods still need to come. Big-municipality-D stated, for example:

"*right now we have chosen the neighbourhoods of which I am quite optimistic that the collaboration will go well. But we also did a pilot in a more complex neighbourhood, neighbourhood-X, a typical pre-war neighbourhood with little public space. This is where clashes occur, and we think: How can you even propose this?*" (Big-Municipality-D, personal communication, April 29, 2024).

When summarized, local governments need flexibility in terms of local customisation in more complex areas where public space is limited. Furthermore, the local governments are already developing frameworks/policies that set criteria for how the stations should be implemented based on the local context. Essentially, this is a question of standardisation (speed) versus customisation. This need for flexibility does pose a threat to reaching the speed the DSOs desire, as it can take significantly more time (and money).

Reflecting on collaborative dynamics

The need for flexibility of the local governments and their efforts to develop implementation criteria can be linked with all three of the collaborative dynamics.

Principled Engagement

The main concern of local governments is the areas with limited public space. They expect flexibility (with regards to customisation) of the DSOs when implementing the medium-voltage substations, as this way, the stations can be implemented more effectively in terms of aesthetics/impact on the local (living) environment). When reflecting using the dynamic of principled engagement, it shows that the DSOs and local governments have conflicting interests in areas with limited public space: standardisation versus customisation. Both actors understand that flexibility is sometimes necessary and that trade-offs must be made to advance the electricity grid expansion. The result of principled engagement should be a form of agreement concerning the collaboration in which both interests are represented. Currently, the four big municipalities are in the process of developing and discussing it with the DSOs 'implementation' criteria. In these criteria, it is essential that, according to Emerson et al. (2011), both interests are represented, and a clear definition of expectations is agreed upon to avoid clashing policies of both the DSOs and local governments.

Shared Motivation

Both actors will collaborate intensively to expand the electricity grid. This makes it essential that trust is high. On a relational level, both sides should be willing to make trade-offs to keep the collaborative relationship positive (Emerson et al., 2011). This means that sometimes the DSO should allow customisation, but local governments should accept that in certain situations, standardisation is the only way to go (reasonability). If both actors show a form of reasonability, this can also create a form of predictability between both actors. The dynamics in the collaboration become more predictable as both sides know of each other that they are sometimes willing to let go of their perspectives in order to advance the collaboration, also showing their dependability. However, if one of both actors presents itself as inflexible, not willing to make adjustments in terms of flexibility, this can lead to stagnation of collaboration (Emerson et al., 2011).

Capacity for Joint Action

A last finding concerning the complexity of areas with limited public space concerns pilot projects of the neighbourhood-oriented approach. Multiple local governments mentioned that the current neighbourhoods that have been 'tested' are the more spacious neighbourhoods, whilst the more complex neighbourhoods have not yet been 'tested'. A relevant sub-dynamic of capacity for joint action is the generation of shared knowledge as it informs/supports shared decision-making (Emerson et al., 2011). It is essential for the DSOs and local governments to

also focus on complex (dense) neighbourhoods in order to generate new knowledge/data that can be used to make future collaborations more effective in these complex areas (Emerson et al., 2011).

6.2.4 Information/Knowledge Conflict

A recurring finding from the perspectives of the DSOs and the local governments is the role of information and knowledge. This is two-sided: the first side is from the perspective of the local governments, who want a concrete description of the number of medium-voltage substations and potential locations per neighbourhood. The second side is from the perspective of the DSOs, who stated that there can be a gap in knowledge about energy infrastructures when collaborating with local government representatives.

Big-municipality-D stated the following when discussing barriers in terms of information about the medium-voltage substations.

"*We have noticed that we really need predictability from all sides. Predictability, in this sense, means that the municipality knows what options are available in terms of the aesthetics of the medium-voltage substations. But also the predictability of where the stations are going to be implemented. Can DSO-B provide insight into the locations? Can they show us how many stations are necessary per neighbourhood? This way, we can make a long-term strategy so we can reserve space for those stations*" (Big-municipality-D, personal communication, April 29, 2024)

Simultaneously, smaller municipalities also stated a demand for concrete planning in terms of numbers and locations for the stations, as well as in terms of the broader plans of the DSOs. Medium-municipality-C stated that:

"*We want to develop neighbourhood X this year. And we hope that DSO-B can give us a multi-year plan. About which neighbourhoods they will develop and when. We have already made multi-year plans for our other challenges. Like road replacements, sewer replacements, etc. And we hope to coordinate these plans so the road only has to be opened once"* (Medium-municipality-C, personal communication, May 7, 2024).

The DSOs cannot yet give accurate information to the local governments as there is still a high level of uncertainty, making it so that the amount of medium-voltage substations can change over time (DSO-A, personal communication, April 17, 2024). This is where interdependability also comes into play. The DSOs calculate how much transportcapacity might be necessary in the future. However, here, they are also dependent on the plans of local governments in the energy transition, making it harder to give local governments a trustworthy estimation of the amount of medium-voltage substations when local governments also do not have clear plans yet (DSO-A, personal communication, April 17, 2024). DSO-A gave a good description of the current status of information sharing when reflecting on the local government's desire for more accurate estimations:

"Yes, that is the high-level design that we need in every neighbourhood. But, the high level design only gets created when there is a formal contract, so within the last two years before we start. And it is understandable, because in 10 years everything can differ again. So, what we share is always the most recent information. This is good information, but it is maybe 70% of the truth." (DSO-A, personal communication, April 17, 2024)

The second aspect concerns a knowledge gap between local government representatives and DSOs. The knowledge gap refers to the level of understanding from the local government's side of how the electricity grid works/functions. This gap can create situations where the DSOs have to explain that the local government's propositions about spatial implementation/customisation are technically not feasible. For example, DSO-A mentioned that:

"We have experienced, in collaboration with municipality x, that the knowledge of certain representatives from the local government is so limited, and these are mainly landscape architects, and they would say. Let's implement a tree there, and we, as DSO-A, then would say, but that's impossible. The tree cannot be implemented there" (DSO-A, personal communication, April 25, 2024).

The DSOs do not expect the exact same level of technical knowledge from the governmental perspective; however, some knowledge about how the electricity grid works is desired. With the knowledge level of local governments and DSOs closer, the process of finding locations can be more effective:

"It (the project manager from municipal side) should be someone that has at least some knowledge about cables and grids. So not somebody that never did anything with cables and grids. You need somebody that knows how it works in the utility world, that can explain the arguments from both perspectives (perspective of the DSO and the local government)" (DSO-A, personal communication, April 25, 2024).

To summarise, it is essential for both sides to receive timely, concrete information. For the local governments, this means insight into the number of substations per neighbourhood and where they will be located. For the DSOs, it means information about the local government's future plans for the energy transition. This shows a high dependency, as when both actors can deliver this information, collaboration can take place more effectively.

Reflecting on the collaborative dynamics

Information and knowledge conflicts fit within the dynamic of Capacity for Joint action as it functions as a supporting 'recourse'. Supportive highlights the contribution knowledge/information can give to the effectiveness of the collaboration.

Capacity for Joint Action

When looking at the findings concerning information, it is clear that local governments miss information that can help them coordinate the implementation of the medium-voltage substations with other utility plans. Although the DSOs want to give the right information, they also depend on the choices of the local governments in terms of the energy transition. Here, both actors should collaborate and generate new knowledge that, according to Emerson et al. (2011), consists of the perspectives of all participants. By generating this new (shared) knowledge, more concrete estimations for the amount of medium-voltage substations can be generated, and more insight into potential locations can be given. This, in return, will influence other dynamics, such as principled engagement, because the more information local governments have about the locations and amount of the medium-voltage substations, the easier the local governments can prepare for the implementation. Potentially, this can decrease the tension concerning the 'solo-unless' approach, as local governments have a better idea of what is ahead and, therefore, can coordinate other utility projects more efficiently.

Shifting to the knowledge gap between the local governments and DSO representatives, it seems like the more the collaboration intensifies, the more the knowledge necessary to support the collaboration becomes specialised (i.e. knowledge about grids). This highlights the importance of the constant generation of new knowledge. Emerson et al. (2011) also state that often, in long-term collaboration, knowledge gets increasingly more complex and specialized. DSOs experience a lack of knowledge about energy infrastructures from the local government's side. The question is, however, how can this specialised knowledge about energy grids be transmitted to local governments to create effective collaboration?

6.2.5 Effective Collaboration Constructions

The DSOs experience barriers when collaborating with local governments. First, certain local governments are not organised efficiently yet, as the relevant municipal departments still assess medium-voltage substation locations individually. The DSOs would like the local governments to adopt a project-based approach in which the departments together asses the locations to ensure efficiency and speed:

"They (local governments) don't see it as project-based work. We would call the local government, say we need a new substation, and someone would start working on it. And the location for the station would be there when it would be there. And now we are going to say: No, we need to have locations now! We need a rhythm to get to the locations. And here we see it is very difficult because the other people (local governments) with whom we are collaborating, those are not the people that work project-based." (DSO-C, personal communication, April 17, 2024)

Simultaneously, the DSOs noticed a disconnection between departments in local governments concerning interests. For example, the Department of Energy Transition understands the urgency of the grid expansion, but other departments concerned with space allocation do not:

"We notice that the interests within a municipality are not equal. The urgency of the energy transition is being felt in the departments where the plans have to be realized. However, there are fewer departments where procedures have to be followed for the spatial design of the energy transition." (DSO-B, personal communication, March 28, 2024)

All three DSOs have stated that, for them, the most effective form of collaboration is through an integrated structure where representatives of the relevant departments of local governments and representatives of the DSOs sit face-to-face to discuss the potential locations. The key here is that the interests of all actors can be shared, understood and used to make trade-offs. DSO-B referred to this process as the 'interests-table' (belangentafel) and explained the process as follows:

"*I think the ideal method is that in a single conversation where every stakeholder or every interested party within a municipality sits at the table, we can have a conversation with each other, where we can say, okay, this is the choice that has to be made. We're not going to end this conversation until this choice is made. So there must be a very clear time frame that the location is clear, so that we say: 'okay, we can say that we have chosen a location within a month, because in two weeks these appointments are scheduled with the municipality in which that location is clearly defined. becomes.' That is one. The second aspect is that there is someone within the municipality who ultimately has a mandate to*

make a decision. So not that every department can say something itself and therefore has an influence, which means that you always remain in the middle, but that ultimately, there is one person within the municipality who can make a decision across all those departments as to what will be applied on all those departments." (DSO-B, personal communication, April 12, 2024).

Having such a collaborative approach, which DSO-B refers to as the 'Belangentafel' (interest table), helps spread the urgency and importance of expanding and adjusting the energy grid and also gives more depth into why the local governments and DSOs make choices. DSO-A and C, although not referring to it as the 'belangentafel', refer to similar collaboration constructions as very effective. The effectiveness of this collaborative structure was captured well by DSO-B, who stated the following:

"*It has been a super interesting process. It starts with that people (representatives of the local governments) don't have the slightest idea of why we even want to implement a station (the medium-voltage substations) at a specific location and why it is not possible to implement it in the middle of a field. By having conversations with the involved group (from the municipality), you become almost colleagues instead of having 'us versus them' dynamics. In this conversation, you get to know each other's interests and perspectives, and you learn more from each other every time you meet up. Then you don't have to explain why specific locations are not possible, And this way, the process will improve. Of course, it will not always be as easy as how we describe it now, but at least the approach in the collaboration is based on each other's interests and perspectives instead of a 'you can't' or 'you are not allowed' mentality"* (DSO-B, personal communication, April 12, 2024).

This form of collaboration was perceived well by the local governments; medium-municipality-c, small-municipality-F and big-municipality-D mentioned that it worked effectively in terms of discussing each other perspectives and creating mutual understanding for the interests of the DSO. At the same time, on an interpersonal level, the collaboration is perceived as pleasant and constructive. Medium-municipality-C reflected specifically on the forming of mutual understanding between different interests:

"*We sit with more colleagues around the table. The discussion now takes place not only in my own head, but also between colleagues. This way, we also got an understanding of the interest the DSO has, that it is not as simple as just placing a cube (referring to a substation), but that there are also cables that need to connect to it. There are more criteria than just that cube"* (Medium-municipality-C, personal communication, May 7, 2024).

Although this desired form of collaboration has proven to be effective, there is a critical note that should be mentioned. Having a collaborative structure, as described, asks for an increase

in the use of resources. Recourses, in this sense, mean having enough employees who are able to invest time in such a collaborative form. For example, DSO-B mentioned that local governments are currently struggling with a capacity shortage. DSO-A stated that it is important for local governments to invest in arranging capacity so that the integrated collaboration structure happens more effectively (DSO-B, personal communication, March 28, 2024; DSO-A, personal communication, May 10, 2024).

To summarise, the DSOs have a clear view of their desired form of collaboration with the local governments. The focus is an integrated collaborative approach where different local government departments are present and interests are discussed face-to-face. Local governments experience this as a pleasant collaboration form but also struggle to invest in such a collaborative form due to a shortage in capacity.

Reflecting on the collaborative dynamics

The desired form of collaboration of the DSOs has been proven effective as local governments find a pleasant way of working. The desired form of collaboration has connections with the Capacity for joint Action dynamic, especially with the sub-dynamic 'procedural and institutional arrangements'.

Capacity for Joint Action

The sub-dynamic 'procedural and institutional arrangements' explains the importance of process protocols and organisational structures essential to manage collaborative interactions over time, especially for longer, complex collaborative relations (Emerson et al., 2011). The collaborative relationship between DSOs and local governments will intensify, making explicit organisational structures/protocols essential. The integrated approach to the collaboration shows that the DSOs and local governments are developing procedural arrangements that will help them manage how the collaboration can take place. A second sub-dynamic is that of recourses; whilst the integrated collaborative form has potential, a lack of recourses (lack of capacity) can stand in the way. Furthermore, the DSOs highlighted the importance of a project leader-type role on the local government side. This means that at least one person has the dedicated task to focus on the neighbourhood-oriëntated approach. However, here again, the statement was made that local governments often cannot invest in such a collaborative form.

The following section summarises the above findings whilst also relating them to collaborative dynamics. In table 4 below, the different themes have been categorised within the collaborative dynamics. Each theme represents key issues within the current form of collaboration.

Table 4: Overview of key themes categorized per collaborative dynamic

Principled Engagement	Shared Motivation	Capacity for Joint Action
• The siloed approach of the DSOs • Spatial Perspective • Flexibility in complex areas	• The siloed approach of the DSOs • Spatial Perspective • Flexibility in complex areas	• Spatial Perspective • Flexibility in complex areas • Information/knowledge conflict • Effective collaborative constructions

The most prominent issue is the siloed approach of the DSOs. This siloed approach comes forward in the solo-unless mentality but also in the general opinions of local governments about the often sectoral approach the DSOs use when collaborating. This translates to 'principled engagement' principles in which interests should be discussed to develop agreements for further collaboration. However, the interests mainly clash as the DSOs desire speed, while local governments often need local-context-based solutions. Here, the themes of 'spatial perspectives' and 'flexibility in complex areas' are also relevant, as this shows again clashing interests in how the infrastructure should be implemented per neighbourhood. In return, assessing these themes correctly will translate to the development of shared motivation, as both actors recognise a form of reasonability. However, if it is the other way around, and both actors are not open to each other's interests, shared motivation will be low, resulting in a strained collaboration.

In addition, the supportive aspects are presented within the principle of 'capacity for joint action'. Here, overlap is again present. When interested in terms of 'flexibility' and 'spatial perspectives' are being actively assessed in the principled engagement, it also means that capacity/recourses are necessary for the DSOs to invest in such a collaborative form. For example, if DSOs are going to adopt a more 'spatial' role, knowledge about spatial planning is necessary. Also, to fully capture the issues that can arise in collaboration in more complex local contexts, new knowledge has to be generated through more pilot projects in those complex contexts.

The last two themes (information/knowledge conflicts and effective collaborative constructions) highlight the importance of sharing information to improve collaboration. For the DSOs, this means the sharing of concrete concerning the amount and locations of medium-voltage substations, but for local governments, it means more insight into their long-term plans concerning the energy transition. This also shows their interdependency. Lastly, the integrated collaborative approach (interest table) is shown to be very effective in balancing the interests of both actors but does ask for organisational improvements. Local governments must invest in such a collaborative form by increasing capacity (manpower) and reorganising themselves within their organisation. This implies better collaboration between different departments within a local government and appointing project leaders (capacity).

6.3 Policy Evaluation

Paragraph 5.2 introduced multiple themes that can be considered barriers to the collaboration between local governments and DSOs. This graph will reflect on the barriers by identifying the defensive and/or corrective actions already implemented or actions that both actors would like to see implemented. The main collaboration between the DSOs and local governments takes place in the context of the neighbourhood-orientated approach. This is still a very new approach and, therefore, still in the earlier phases. However, defensive/corrective actions can still be identified. It has to be stated that certain actions cannot be exclusively categorised under defensive actions or corrective actions; instead, they consist of elements of both types of actions.

Defensive actions

With the siloed approach (and the solo-unless approach), the DSOs aim to protect the interest of speed in the neighbourhood-orientated approach. This is a defensive action implemented by the DSOs to ensure no delays occur due to having to link up with other utility organisations. However, the local governments see this form of operation as a barrier. The DSO-A stated, however, that the level of resistance is often based on how the DSOs communicate that they want to go solo. The DSOs are thinking of how to communicate with the local governments to 'soften' the landing of the solo-unless approach, reducing the resistance as much as possible (DSO-A, personal communication, June 11, 2024). This is an additional defensive action to ensure the interests of the DSOs are protected in terms of speed. Simultaneously, this form of communication also shares connections with corrective actions, as it can be seen as a reaction to the resistance of local governments that the DSOs have experienced while collaborating in the context of the neighbourhood approach concerning 'going solo'.

Furthermore, focusing on the themes of 'flexibility in complex areas', both local governments and the DSOs have implemented defensive actions. First, the DSOs, again ensuring speed, stated that standardisation is necessary and, therefore, give limited room for customisation. This is a defensive action as it tries to mitigate risk (delays) as much as possible. However, local governments are implementing defensive actions with the opposite character. By formulating implementation criteria, especially for more complex areas, the local governments want to reduce the impact of the stations on the public pace as much as possible. These can be considered defensive actions as both actors proactively try to mitigate risk before the intense collaboration starts. Both actors identified the risks early on and are now developing defensive actions in their policies to mitigate the risks.

Corrective actions

An essential corrective action to improve the collaboration significantly is the implementation of the integrated collaborative form 'interest table' by the DSOs. Although this was a reaction to the collaboration before the neighbourhood-orientated approach was implemented, it still serves as a practical adjustment to policy. In essence, the integrated approach aims to collect all relevant departments of the specific local governments and actors of the DSO to discuss locations for medium-voltage substations and conflicting interests and eventually decide what locations are chosen. This form of operating is a clear improvement compared to earlier ways of operating, where locations for stations were handled individually per department.

A second corrective action is concerned with data-driven collaboration. The DSOs have been increasingly using geographical information systems to improve collaboration. Multiple local governments stated that they highly desire data/information on the DSOs (amount of stations and potential locations). At the same time, the DSOs acknowledged that they could improve in providing the local governments with data concerning stations (DSO-A, personal communication, April 17, 2024). Even though it is still difficult for the DSOs to deliver accurate data, the use of geographical information systems improves collaboration. For example, through digital maps, in which potential locations are mapped, both the DSOs and local governments can discuss interests more effectively. DSO-C stated that using these digital tools gives more insight into where there is room for trade-offs (DSO-C, personal communication, May 6, 2024). The use of digital tools also makes the integrated collaboration approach more effective, as, while sitting face-to-face, local maps are presented on which potential locations are presented. This makes it possible to discuss on the spot the extent to which the locations can be altered for effective implementation.

Distinguishing Corrective and Defensive actions

When trying to categorise the themes under corrective or defensive actions, it seems there is a lot of overlap. The distinction between defensive and corrective actions is as follows: defensive actions are implemented proactively to prevent issues from occurring. Corrective actions are reactive measures (responses) to problems identified during, for example, the decision-making process. The neighbourhood-orientated approach is still new. A lot of policy choices are based on shortcomings in the 'past' form of collaboration. In this context, it can be stated that most of the actions are corrective reactions to these shortcomings. However, at the same time, as the 'new' form of collaboration is based on one specific policy, the neighbourhood-orientated approach, it seems that most actions are of a defensive character, in which the DSO upfront tries to mitigate risks as much as possible (based on past experience). In order to make a clearer distinction, more time is needed in the collaboration.

To summarise, in paragraph 6.2, the main triggers (key issues in the collaboration) are presented. This paragraph reflects on these triggers by presenting the defensive and corrective actions of both actors. The defensive actions mainly protect the interests of the individual actor (speed versus customisation). However, the corrective actions (integrated collaborative approach and data-driven collaboration) seem to focus on trying to make trade-offs between both actors to find a 'common' solution. Such an integrated collaborative approach has the potential to improve collaboration with the DSOs significantly, as it can potentially increase the understanding of each other's interests.

6.4 Comparing the Different Sizes of Local Governments

During the data collection, local governments of different sizes were interviewed to analyse if there are any differences in how the collaboration takes place between the DSOs and local governments. This paragraph reflects on the findings connected to the sizes of local governments and their level of urbanization.

Influence of difference sizes on the collaboration

The first clear finding concerns with whom the interviews were conducted. All four interviews with the big local governments were conducted with representatives that specifically had a function connected to solving the complexities surrounding the electricity grid. They were assigned as the main director who collaborates with the DSO. This finding is in contrast with the interviews conducted with the medium-big-municipalities and the small municipalities. Here, the interviews were conducted with employees who, next to other responsibilities, were also partly involved in the collaboration with the DSOs. This shows possibly a difference concerning capacity. The big local government had more capacity to employ one person with the specific task of managing the grid expansion, whilst the smaller local governments might have less capacity to invest in the collaboration.

Another finding connected to the above is the knowledge surrounding the challenge of the electricity grid expansion. When asking the big municipalities about their familiarity with and opinion of the DSO's neighbourhood-orientated approach, all four could easily answer the question while also giving opinions. Furthermore, the representatives of the big municipalities provided feedback on the neighbourhood-orientated approach without the interviewer asking for it. When interviewing the medium-big and small municipalities, with exceptions, an introduction was often necessary to explain the essence of the neighbourhood-orientated approach of the DSO. It has to be stated that the medium-sized and small municipalities were aware of the (spatial) challenge surrounding the electricity grid expansion; however, there was a clear difference in knowledge.

Additionally, the big municipalities were all in the process of formulating spatial implementation criteria for the medium-voltage substations. This shows the very proactive character of these big municipalities. This proactivity seemed less present when talking with the medium-big and small municipalities. Here, it was not the case that they were not thinking at all about spatial implementation criteria, but they were less explicit.

Different answers were given when asked what differentiates the bigger municipalities from the smaller ones. Big-municipality-G stated, for example:

> "*Yes, a small municipality may not have enough capacity to really have a clear opinion about. Wel, this is not allowed, this is allowed. Yes it might be a bit faster there, yes, if you*

say so, do it or not. Like, hey, what are you doing here? That's not possible" (Big-municipality-G, personal communication, May 6, 2024).

Furthermore, when asking big-municipality D how they look at the difference in sizes and why it seems like the bigger municipalities have a stronger collaborative position, the following statement was given:

"Well, I have a feeling that the DSO is more flexible for us because we are a big municipality. Investing in the relationship with us is also in favor of the DSO because of the size of the challenge. And I also kind of sense this when having conversations with DSO-B, that they won't put in that effort for smaller municipalities. And I also question if employees of smaller municipalities already have so much on their plate with other work that it is hard for them to try and emphasise with how the DSO thinks and through that way try and find the flexibility" (Big-municipality-D, personal communication, April 29, 2024).

In the interviews, the smaller municipalities have not explicitly stated that they are being treated differently than bigger municipalities. There were, however, statements that connect to the view presented in the above quote. Small-municipality-F mentioned how inflexible DSO-B was when talking about what the DSO could improve in the collaboration:

"*I think they can really improve in terms of flexibility of what the municipality wants. Instead, they just want to implement the medium-voltage substations. What we want in this municipality is a broader approach to solving grind congestion, so not only medium-voltage substations but also smart-energy solutions. And DSO-B just is like, No! We want to do the neighbourhood-orientated approach and implement the infrastructure. But this way, the municipality does not have a negotiation position anymore. I hope there will still be some flexibility instead of the DSO just saying: 'This is what we want'. Hopefully, they will also start listening to what is going on within the municipality*." (Small-municipality-F, personal communication, April 30, 2024).

Also, small-municipality-B had comments about the dominant character of DSO-A in the collaboration and mentioned:

"*There should be communication both ways. Right now, I have the feeling that DSO-A has the planning and communicates it with us, but then it changes 10 times. We as a municipality also want to give input to the planning*" (Small-municipality B, personal communication, April 15, 2024).

It is important to bring nuance to the influence of the size of the municipalities. Although the above-discussed findings imply a clear difference in how municipalities are treated, when discussing the findings with DSO-A, they did not agree with the statement that collaboration happens less smoothly with smaller municipalities. She stated that there are actually a lot of small municipalities with whom she collaborates that are making a lot of progress and could function as an example for other municipalities (DSO-A, personal communication, May 10, 2024).

A last finding concerning the influence of size shows that smaller local governments tend to be more patient in seeing what the DSOs are planning. In other words, the smaller municipalities tend to be more patient and wait for the DSO to come up with a plan for the implementation of the medium-voltage substations. For example, Medium-municipality-I, after informing that the DSOs are dependent on the plans of the local governments to make a more concrete planning, stated that:

"*But isn't this a chicken and egg story then? They (DSO-A) should have their 'stuff' in order. Then, a municipality has more options, and we can say that we also want electric solutions, but now that is not possible because the electricity grid is completely overworked. Then, they (DSO-B) should not come to us with the question of whether we already know what we want. They (DSO-B) should just put a good working cable in the ground! That's also how you can look at it. Now the responsibility is given to the municipality even though the future is so uncertain. Last year, we were still forced to take a heat pump*" (Medium-municipality I, personal communication, June 3, 2024).

Simultaneously, DSO-B refers to the patient character of some municipalities as a barrier to the effective implementation of the neighbourhood-orientated approach whilst also mentioning the shortage of workforce within local governments:

"Yes, they get woken up. But a lot of municipalities have a shortage of staff. They do not have enough employees. Then they start postponing. What you then see is that when they develop neighbourhood plans, they say: 'Oh, the first ten years, we will only do something with insulation and after, we will think a bit more. Other municipalities state that they have finished their spatial visions in 2030. Yes, if this is the case, it will be very hard." (DSO-A, personal communication, April 17, 2024).

The above findings do show the difference in collaboration dynamics between different sizes of local governments. The smaller local governments experience the DSOs as less flexible. However, this might have to do with the fact that smaller local governments have less capacity

to counter the dominant approach of the DSOs. The bigger local governments seem to have more capacity and therefore there is more balance in the collaboration.

Comparing the level of Urbanism between local governments

Lastly, when focusing on the level of urbanism, the following findings are of interest: The four bigger local governments (all considered high urban/very high urban) stated that, in general, the collaboration gets complex when the neighbourhoods get more dense. However, this same finding applies to smaller local governments, which are, in general, less urbanized but still have dense, complex neighbourhoods. Medium-municipality-C (medium urban) described, for example, that the main worry is finding space in the densely occupied areas (Medium-municipality C, personal communication, May 7, 2024). Small-municipality-A (also medium urban) also described that in some areas within the municipality, there are too many interests in public space, which makes it difficult for the DSOs to operate solo (Small-municipality A, personal communication, April 23, 2024). These findings show that every local government has, to a certain extent, more complex neighbourhoods that will also ask for a more intensive collaboration.

To summarise, bigger local governments seem to spend more energy on being the spatial counterparts of the DSOs by formulating policies about the spatial implementation of medium-voltage substations. Smaller municipalities tend to be more patient and wait for what the DSOs are planning. At the same time, some findings refer to the fact that the DSOs present themselves as less flexible to smaller municipalities and more flexible to the bigger municipalities. It is clear that the bigger local governments also have more capacity to implement recourses (such as manpower) to fully dedicate to the collaboration, while the smaller local governments don't. Furthermore, a lower level of urbanism does not equal an easier expansion of the electricity grid, as even less urbanised local governments still have complex and dense areas with limited public space.

6.5 Discussion

The collaboration between DSOs and local governments is increasing in the context of the neighbourhood-orientated approach. This poses challenges for both the local governments and the DSOs in terms of their collaborative relationship. To summarise the main challenges: First, DSOs and local governments can have conflicting interests in expanding the electricity grid. Where the DSOs prefer speed/standardisation, the local governments expect, to a certain extent, customization options/local context solutions. Second, in the collaboration, the DSOs seem to take a dominant position (i.e., solo-unless mentality, only allowing standardization, etc.), which is seen as a barrier by the local governments. Third, it seems like the most complex collaboration occurs in densely urbanised areas with little public space. In this context, local governments and DSOs' roles come closer together (spatial thinking). Fourth, both actors experience barriers in terms of organization in collaboration (reorganisation, shortage of capacity, etc.). These barriers currently are an obstacle to the implementation of an integrative, collaborative approach. Fifth and lastly, the role of information/data is essential in order to improve collaboration.

In addition, the sizes of local governments have an influence on the collaboration as it seems that the bigger local governments have the capacity to invest in the collaboration more. Simioultaniusly, based on the interviews with the local governments, there is a sentiment that the DSOs present themselves as more flexible towards the bigger local governments. At the same time, the more dense/complex areas are, the more friction between DSOs and local government can occur. These dense and complex areas are present in the bigger local governments, but also in the smaller local governments.

It is important to put these findings in the broader discussion of the renewable energy transition and spatial planning. This will be done through reflecting on three questions related to the sub-questions and the main question.

1. *The changing role of the DSOs and its impact on the energy transition*

Traditionally, when implementing infrastructure, the DSOs had a technical perspective, while the local governments functioned as the 'spatial' counterparts. The findings show that the DSOs are taking an increasingly prominent position in public space due to the sheer size of the challenge of expanding the electricity grid.

This challenge pushes the DSOs to operate proactively with and beyond their traditional reactive form of operations. Even more, the challenge surrounding the grid expansion brings newer questions concerning the reliability of the grid:

> *"We experience that we are not only a grid operator anymore, but way more. And yes, maintaining the grid is still an extremely important task, but developing the grids and*

making sure we have transport capacity has become even more important. So only maintaining is not enough anymore. In the past, our main focus was trying to avoid and repair disruptions, but the question now is if that's still the goal. Or should we maybe lower our reliability so that the energy transition will be possible" (DSO-B, personal communication, March 28, 2024).

In line with the literature about DSOs and their changing role, the DSOs operate proactively (Lavrijsen & Edens, 2019; Uzum et al., 2024). Implementing the neighbourhood-orientated approach is an example of this proactive as the DSOs actively want to expand the grid (DSO-B, Personal communication, March 28, 2024).

However, with this proactive way of operating, the main concern remains the DSOs' inflexibility, especially in more complex local contexts. The impact on public space, which is accompanied by the expansion of the grid, shows that the energy transition is not only a technical challenge but also translates into a spatial challenge. The DSOs take a prominent position in public space. However, the question is whether, with the prominent position, the siloed (inflexible) mentality is still effective when crossing sectoral borders (from technical to spatial), as due to the size of the challenge, local governments cannot function as the balanced spatial counterpart.

The desires of local governments for a collaborative form in which the DSOs try and implement 'spatial thinking' shows that the DSOs, with their proactive role, also adopt tasks connected to spatial planning. Yet, as the neighbourhood-orientated approach shows, and the local governments state, the DSOs keep functioning still siloed and sectoral.

Literature shows the increasing connection between governance and spatial planning. The main line of argument is that decision-making processes surrounding complex spatial challenges are effectively assessed when there is a form of integrated collaboration between different stakeholders (Albrechts, 2004; Rode, 2018; Wang & Ran, 2021). Literature about urban energy transitions also shows that a homogenous (one fit) solution in the energy transition is ineffective as every urban area is shaped differently and, therefore, has different needs based on the local context (Rutherford & Coutard, 2014; Sillak et al., 2021; Bouw et al., 2022). It seems the DSOs are doing the opposite of these normative assumptions, putting their interests at the centre and operating from their technical perspective. In essence, the neighbourhood-orientated approach (standardisation) is a policy that implies a one-fit solution for every local government in the Netherlands.

The grid expansion challenge will occur in increasingly complex local contexts, highlighting the importance of acknowledging that the energy transition translates into a spatial challenge. Assessing this spatial challenge requires a collaborative form beyond siloed thinking. This

potentially changes the role of the DSOs, forcing them to adopt spatial planning-like tasks. Currently, it seems that the use of the integrative collaborative approach (interest table) is already a practical step towards a form of 'spatial' thinking. In this collaborative approach, the DSOs actively engage in the making of trade-offs in public space.

The last impact is connected to the different sizes of local governments. If indeed the DSOs present themselves as more flexible towards bigger local governments, the danger arises that the smaller local governments will be exposed to a dominant DSO. Given the high need for capacity, small local governments might also lag behind in the energy transition as they potentially fail to create the right amount of capacity on time. The main argument is that the neighbourhood-orientated approach asks for an intensive collaboration. This intensive collaboration can be filled in better by the big local governments compared to the smaller local governments. This might show a bigger issue: if the desired collaboration asks for such an increase in capacity, where will that capacity come from? What if smaller local governments are not able to find this capacity? Big-municipality-G reflected on this and that that for themselves, it is already an issue to arrange the capacity let alone for smaller local governments:

"We don't get budgeting from the national government to arrange the capacity. Let alone how small local governments should arrange this capacity. I think there should some support." (Big-minicipality G, personal communication, April 29, 2024).

This brings an important argument to light. Literature shows the importance of local context-based solutions in energy transition planning. The findings show that smaller local governments can struggle to absorb the dominant collaborative approach of the DSOs. This can imply that the capacity to effectively collaborate is one of the most essential elements for the local energy transition planning and that local governments who cannot invest in the collaboration can potentially fall behind in the energy transition.

2. *Broader challenges in the energy transition*

As the role of the DSOs is subjected to change and both actors are intensifying their collaboration, both actors are experiencing multiple challenges.

First, local governments see the energy transition as a part of broader challenges. The DSOs are one of many actors that demand public space. Now that it is clear that the energy transition has transformed into a spatial challenge, local governments also need to reorganise themselves. First, capacity-wise, local governments are struggling. In order to fully commit to the grid expansion challenge, sufficient capacity (employees, supporting mechanisms) is necessary. This shows a broader problem as spatial challenges get increasingly more complex, responsible actors struggle due to a shortage of capacity.

Second, local governments might also undergo change. The main frustration of the DSOs is that local governments are not yet organised in an effective way to engage in collaboration. Locations for sub-stations are still assessed separately per department. Instead, local governments should work integrally among the different departments and asses with the DSOs the potential locations. This shows that even within the local governments, there is a form of siloed operating present (DSO-B, personal communication, Apil 12, 2024).

For the DSOs, in light of their changing role, the challenges are visible in the organisation. As the DSOs operated for years reactively and from a technical perspective, this has changed. Being proactive also means the efficient use of resources. DSOs have a limited number of technical employees who have knowledge about electricity grid expansion. This also explains their focus on standardisation and speed (DSO-A, personal communication, May 10, 2024.

This introduces the following argument. The successful implementation of the energy transition seems highly dependent on the collaboration between local governments and DSOs. Both actors are highly dependent on each other, and without a strong collaboration, the electricity grid cannot function sufficiently to serve the energy transition. However, the successful collaboration is dependent on three essential aspects:

1. The DSOs' ability to work more integrally with the local governments (referring also to the ‘spatial thinking’)
2. The ability of a local government to reorganise itself (internally) to form a more integral collaboration between relevant departments.
3. The availability of the right resources/capacity to support the necessary collaborative changes for both the local governments and DSOs.

To conclude, although the three aspects are simplified, they clearly describe the broader challenge of the energy transition. It is not just a matter of one actor collaborating with another actor. The energy transition also encompasses inter-organizational changes/challenges to deal with the increasing complexities of conflicting interests in public space.

3. Implications for other utility organisations

Moving away from the grid challenges and the energy transition, the relevant question is how the increasing complexity of spatial challenges will transform the way of operating/collaborating in other sectors (utility).

To start this argument with an example: In April 2024, multiple Dutch newspapers described the potential unavailability of drinking water in the near future. And, very similar to the problems the DSOs are experiencing, water utility companies even had to deny new connections to the drinking water grid. To make sure the drinking water utility companies can

keep up with the demand for drinking water, new extraction locations have to be implemented (Wolters, 2024).

In a way, this challenge is similar to the challenges that DSOs face. However, what happens if every actor/utility organisation faces external challenges and needs increasing demand in public space? If every utility organisation wants to operate the same way as the DSOs operate, it would mean that every utility organisation functions siloed. In this context, the collaborative relationship between the DSOs and local governments shows the importance of collaborative and integral approaches to spatial planning and governance. Furthermore, as the need for collaboration will grow linear with the increasing complexities of (urban) challenges, an increase can occur in 'sectoral border crossing'. The DSOs and local governments are good examples of how the 'spatial planning sector' and the 'technical sector', with a limit, cross this sectoral border.

The above argument falls in line with the literature concerning integrated/collaborative governance in which the need for integrated/collaborative governance approaches is highlighted concerning (urban) complex challenges (Ioan-Franc et al., 2015; Rode, 2018; Wang & Ran, 2021). Both the DSOs and local governments show that an integrated collaborative approach is necessary to expand the electricity grid in more complex local contexts.

7. Conclusion

This research aimed to analyse the collaborative relationship between DSOs and local governments in light of the electricity grid expansion on a neighbourhood level. As the Netherlands is in the middle of the renewable energy transition, an increase in Distributed Energy Resources has also increased the demand for transport capacity of the electricity grids (Scholten et al., 2023). Currently, the transport capacity of the electricity grids is insufficient, putting the energy transition on a halt. The DSOs stand for a substantial spatial task as they are responsible for expanding the electricity grid on a neighbourhood level. In order to ensure speed, the DSOs implemented the neighbourhood-oriëntated approach, which aims to expand the electricity grid per neighbourhood in a standardised manner. In the neighbourhoods, a significant amount of infrastructure has to be implemented, with the medium-voltage substations being the objects impacting public space. The space for these stations has to be found in often densely neighbourhoods where public space is scarce, making it a complex spatial task (Netbeheer Nederland, 2023).

The neighbourhood-orientated approach requires intensifying the collaboration between DSOs and local governments to effectively allocate space, and expand the electricity grid. It is in light of the intensification of this collaboration that the following central question will be assessed:

"To what extent and how does the collaboration between distribution system operators and local governments shape the expansion/adjustments of the energy grid in relation to the renewable energy transition in the Netherlands?"

Multiple sub-questions have been developed to answer the central question. Below, these sub-questions are assessed. After, the focus is on the main question.

Critical issues in the collaboration

The first sub-question focuses on identifying the critical issues that shape the collaboration between DSOs and local governments. The DSOs, through the neighbourhood-orientated approach, prioritise speed and standardisation. In this approach, the DSOs adopted a siloed and technical character. This conflicts with the interests of the local governments, which prefer an integrated approach in which other interests can be balanced with the interests of the DSOs.

Furthermore, the second aspect is connected to data and information. The DSOs need insight into choices concerning the energy transition from the local governments so that they can give an estimation of the planning (amount of stations, potential locations, order of neighbourhoods). Often, the local governments do not have this information yet. At the same time, local governments spoke about their desire for more data concerning the planning. This shows the importance of a data-driven collaboration.

The last issue is connected to organisational aspects. Both the DSOs and local governments need to reorganise themselves to collaborate. For the DSOs, this means switching from a technical reactive organisation to a proactive organization that also thinks with the local government about other interests in public space. Local governments, in their turn, also have to reorganize themselves to adjust to the proactive form of the DSOs. This means a better alignment between different departments within a local government is necessary. This way, different departments will also function more integrated together. In addition, both actors struggle capacity-wise due to a shortage of employees, making a full commitment to the collaboration a challenge.

Collaboration and its impact on local energy transition planning

The second sub-question answers how the collaboration between DSOs and local governments affects local energy transition planning in the Netherlands. Furthermore, a second aspect of this question focuses on the influence of the sizes of municipalities and their level of urbanity/rural.

The most essential spatial task of the DSOs and local governments is to find space for the stations in dense, complex areas. The overall sentiment given was that space will be found in less dense areas, and the collaboration will go smoothly. In complex local contexts, the standardised approach of the DSOs will create tension. In line with theory, energy transition plans often depend on local spatial contexts, making one-fit solutions undesirable. However, the standardised approach of the DSOs implies a one-fit solution. From the perspective of the local governments, there is a high need for flexibility in the complex local contexts to ensure better linkage with other interests in public space. This flexibility will, however, increase the time needed to expand the electricity grid. In other words, if local governments or the DSOs are open to each other's interests and are willing to make trade-offs, the making of energy transition plans becomes dimensioned to the local context but will increase the time necessary to expand the electricity grid. Alternatively, standardization/speed is the primary approach, implementing a one-fit solution and ignoring the local contexts.

This sub-question's second aspect concerns the different sizes and levels of urbanism per local government. The sentiment is given that the DSOs might present themselves as being more flexible to larger local governments while keeping a dominant approach when collaborating with smaller local governments. Furthermore, bigger local governments have more capacity to invest in a strong collaboration with the DSOs, compared to the smaller local governments. When reflecting on the level of urbanization, it seems that the bigger the local government, the higher the level of urbanization is. However, the collaboration does not per se become more complex when one municipality is considered 'urban' and the other 'rural'. The complexity of the collaboration is dependent on the local context. All big local governments are considered

‘very high urban’ or ‘urban’. Yet, they implied that collaboration is going fine in less dense neighbourhoods. In smaller local governments, some neighbourhoods have less public space, increasing the complexity of the collaboration also.

Taking the above into account, it seems like capacity is the deciding factor that influences how a local government can absorb the dominant collaborative position of the DSOs. Smaller local governments often have less capacity than bigger local governments, causing the collaboration to become unbalanced.

The Changing Role of the DSOs

As the collaboration between the DSOs and local governments intensifies, this might also imply a change in the role of the DSOs compared to their traditional technical role. Therefore, the third sub-question seeks to analyze how the role of the DSOs has changed in terms of spatial planning aspects.

The DSOs transitioned from a technical reactive way of operating to a proactive way of operating. Where traditionally, the DSOs were concerned with maintaining the electricity grid, they now have to implement almost a second electricity grid in a short time period. The DSOs, in this sense, have to actively collaborate with the local governments to successfully implement the grid. Due to the size of the grid expansion challenge, local governments cannot function anymore as the spatial planning counterpart of the technical orientated DSOs. However, as the DSOs claim a dominant position in public space, local governments highlight the importance of a DSO that also thinks spatially. This spatial thinking is, in essence, a new role the DSOs will have to adopt, especially in the complex local contexts. Spatial thinking highlights the proactive collaboration of the DSOs in making trade-offs, balancing their own interests with other interests in public space. Where first local governments were responsible for the balanced weighing of interests, the DSOs are now asked to actively contribute to finding the best solution. This implies a change from their traditional way of operating. Although the DSOs will still operate from their sectoral background, they will engage more in spatial planning practices, such as contributing to making trade-offs.

Improving the collaboration

The last sub-question concerns how to improve collaboration. Both actors know that they are dependent on each other. One of the most important improvements, which has partly already been implemented, is the integrated collaborative structure. In this structure, different municipal interests are weighed against the interests of the DSOs. This is a collaborative form in which the stakeholders sit face-to-face and discuss each other's interests while making definite choices concerning locations for medium-voltage substations. To support this form of collaboration, however, (coming back to a key issue) data/information is of high importance.

By using digital tools to present relevant data (number of stations, potential locations, etc.), discussions about locations occur more effectively. Both the local governments and the DSOs should actively engage with each other to generate this data/information. The integrated collaborative approach also reflects the changing role of the DSOs towards the engagement with spatial planning activities.

In conclusion

It is clear that the expansion of the electricity grid is dependent on the collaboration between the DSOs and local governments. This collaboration still has issues that need to be addressed to expand the electricity grid successfully. Both actors are faced with a substantial spatial task in terms of finding space for the necessary infrastructure, especially in neighbourhoods where public space is scarce. Currently, the collaboration can be described as the DSOs adopting a siloed approach and technical perspective when the local governments desire a more integrated collaborative approach. The key issues here are the conflicting interests between the DSOs and the local governments (speed versus local- context-based customisation). The expansion of the electricity grid is a technical issue but also translates to a spatial planning issue. This also means that the DSOs will be increasingly involved in spatial planning-like tasks with the local governments. The complexity of the collaboration will differ based on the specific neighbourhood. In these complex neighbourhoods, collaboration influences the successful expansion of the energy grid the most, as both actors will need to make trade-offs to find room for solutions that fit within the local context whilst also considering the interests of the DSOs and the local governments. If no integrated collaborative approach is applied, both actors won't be able to collaborate effectively, delaying the expansion of the electricity grid and, therefore, the energy transition as a whole. In addition, supporting factors in the form of capacity, information/data, and organisational structures are essential in the collaboration. Both actors struggle with a shortage in capacity, a need for more information and data, and intra/inter-organizational challenges.

Collaboration in the context of the neighbourhood-orientated approach is still new. However, these first findings show the importance of a collaboration in which both actors are represented equally, both actors are open to each other's interests, and both actors are able to let go of their sectoral perspectives.

8. Limitations

The last section presents the study's limitations and gives recommendations for further research. The limitations of the research are connected to the methodological aspects (the size of the sample of local governments) and empirical limits due to the newness of the neighbourhood-oriëntated approach.

Sampling

In total, 26 key informants have been interviewed, of which 17 are representatives of in total 9 local governments. The Netherlands consists of 342 local governments, meaning that the sample is rather small. This makes it harder to generalize the findings over the whole of the Netherlands.

Also, the initial approach was to conduct interviews with local governments that experienced the collaboration as bad. However, while trying to reach out to these local governments, often, they were not open for an interview. Therefore, to still collect data, the criteria had to be loosened, meaning that the local governments interviewed, where the local governments in which the collaboration is experienced positively. Nonetheless, even in the more positive collaborative relationships, key issues still surfaced.

Empirical limits

When focusing on the empirical data collected, the newness of the neighbourhood-orientated approach is a limit. With exceptions there, most of the local governments interviewed had not started with the actual implementation of infrastructure and were mostly in the phase of introducing the challenge and concept-plannings concerning the necessary infrastructure per neighbourhood.

Furthermore, although this research aimed to compare the different sizes of local governments and their level of urbanism, the analyses were limited due to the early phases of the neighbourhood approach. This means that the influence of size/urbanism of local governments is based on how the collaboration is experienced by the collaborating actors instead of the mapping of actual physical aspects per neighbourhood.

Recommendations for further research

In future research in order to capture more in-depth findings, case studies should be done on specific local governments with differing contexts (rural/urban, big/small). This way, the more detailed collaborative processes can be captured. In addition, as multiple pilot projects are being conducted, future research should focus on these pilot projects to potentially develop normative frameworks that can help improve future collaborations.

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Appendix 1: Topic lists

Topic-lijst voor netbeheerders (X = Liander, Stedin or Enexis)

- Welke rol heeft u in het samenwerkingsproces met lokale overheden om ruimte te vinden voor stations op buurtniveau?

- Wat is uw mening over de effectiviteit van de buurtaanpak kijkend naar het vinden van ruimte voor stations?

- Welke veranderingen heeft u ervaren, kijkend naar het vinden van ruimte voor stations, in de samenwerking met lokale overheden in vergelijking met het verleden? (verleden = voor de uitdagingen rondom net congestie)

- Hoe vindt de huidige manier van samenwerken met lokale overheden plaats op het gebied van het vinden van ruimte op buurtniveau voor stations?

- Hoe zou u de samenwerking willen hebben/wat is uw ideale vorm van samenwerken, kijkend naar het vinden van ruimte voor stations?

- Kijkend naar de huidige manier van samenwerken en de door u beschreven ideale manier van samenwerken, wat is er nodig om uw ideale manier van samenwerken te bereiken?

- Welke barrières kunt u identificeren, in het samenwerkingsproces, die de transitie van de huidige manier van samenwerken naar uw ideale manier van samenwerken, in de weg kunnen zitten?

- Waar kunnen de lokale overheden een verbeteringsslag maken om het samenwerkingsproces te verbeteren?

- Wat denkt u wat lokale overheden verwachten van **X** om de samenwerking te verbeteren ten aanzien van het vinden van ruimte voor stations op buurtniveau?

- Wat zou **X** kunnen verbeteren in het samenwerkingsproces met lokale overheden zodat er ruimte kan worden gevonden/aangewezen voor stations?

Topic list voor DSOs (X = Liander, Stedin or Enexis)

- What is your role in the collaborative process with local governments in the context of the neighbourhood-orientated approach?

- What is your opinion about the effectiveness of the neighbourhood-orientated approach?

- What changes have you experienced when looking at finding space for infrastructures in the collaborative processes with local governments compared to the past? (past = before energy grid challenges arose)

- How does the current form of collaboration concerning finding space for infrastructure, take place?

- What is your desired form of collaboration with local governments to find space for infrastructure?

- Looking at the current form of collaboration and your described desired form of collaboration, what has to change to reach your desired form of collaboration?

- Which barriers can you identify that stand in the way of reaching your desired form of collaboration?

- Where in the collaborative process do you think local governments can improve themselves?

- What do you think local governments expect from X in terms of improving the collaborative processes

- What do you think X can do internally to improve the collaborative processes?

Topic-lijst voor lokale overheden (X = specifieke gemeente) (Y=specifieke netbeheerder)

- Welke rol heeft de u in de samenwerking met **Y**, kijkend naar het vinden van ruimte voor stations op buurtniveau?

- Wat is uw mening over de buurtaanpak van de netbeheerders?

- Hoe ervaart u de samenwerking met **Y** kijkend naar de buurtaanpak van de netbeheerders?

- Welke veranderingen heeft u ervaren kijkend naar de samenwerking met **Y** om ruimte te vinden voor stations in vergelijking met het verleden (verleden = voor de uitdagingen i.v.m. net congestie etc.)?

- Hoe vindt de huidige manier van samenwerking met **Y** plaats op het gebied van het vinden van ruimte voor stations?

- Wat is uw ideale vorm van samenwerken met Y kijkend naar het vinden van ruimte voor stations op buurtniveau?

- Kijkend naar de huidige manier van samenwerken en de door u beschreven ideale vorm van samenwerken, wat denkt u dat er nodig is om de ideale vorm te bereiken?

- Welke barrières kunt u bedenken die in de weg kunnen staan in de transitie van de huidige manier van samenwerken naar de door u beschreven vorm van samenwerken?

- Waar kan **Y** naar uw idee een verbeteringsslag maken om het samenwerkingsproces te verbeteren ten behoeven van het vinden van ruimte voor stations?

- Wat denkt u wat **Y** verwacht van u/**X** om de samenwerking te verbeteren ten aanzien van het vinden van ruimte voor stations?

- Wat zou u/**X** kunnen verbeteren in het samenwerkingsproces met **Y**, zodat er ruimte kan worden gevonden/aangewezen voor stations op buurtniveau? (voorzichtig vragen)

Topic list for local governments (X = specific municipality) (Y = specific DSO)

- What role do you have in the collaborative process with Y, in the neighbourhood-orientated approach?
- What is your opinion about the neighbourhood-orientated approach?
- How do you experience the collaboration with Y looking at the neighbourhood-orientated approach?
- What changes have you experienced looking at the collaboration with Y to find space for medium-voltage substations compared with the past? (past = before energy grid related challenges)

- How does the current form of collaboration with Y take place in the context of finding space for infrastructures?
- What would be your ideal form of collaboration with Y looking at finding space for infrastructures?
- Looking at the current form of collaboration and your described desired form of collaboration, what has to change to reach your desired form of collaboration?
- Which barriers can you identify that stand in the way of reaching your desired form of collaboration?

- Where in the collaborative process, to find space for infrastructures, do you think Y can improve itself?
- What do you think X expects from Y in terms of improving the collaborative processes?
- What do you think X can do internally to improve the collaborative processes with local governments?