Master's thesis – master Innovation Sciences

Experimentation in Mission-oriented Innovation policy: natural gas free districts

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Abstract

This thesis focuses on the contribution of district level experiments to the Dutch national mission of the transition towards a natural gas free built environment in the Netherlands. In Mission-oriented Innovation Policy, using experiments is emphasized, but a clear description of the desired contribution of these experiments or guidelines to design such an experiment are lacking. Therefore, it is studied which factors contribute to the internal success (achieving the goal of a focal experiment) and external success (the broader, general impact of an experiment) of experiments that are dedicated to this Dutch mission. These factors are divided over four categories, being multi-stakeholder interaction, niche-regime relationship, network and resources. To study these factors and the contribution of the experiments to the mission, 12 experiments that are part of four different experimental programs are studied by conducting interviews and reading local reports. Additionally, newspaper articles and governmental reports are analyzed. It is found that factors that stimulate internal success or different types of external success may contradict each other. Therefore, it is recommended that policy makers choose which type of success they want to achieve before starting an experimental program or policy, to be able to implement a corresponding policy design. Specific policy recommendations that correspond to the chosen type of desired success are provided.

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Introduction

With the Netherlands being one of the countries ratifying the Paris agreement, the national government is tasked with translating the corresponding international goals, like keeping the increase in global average temperature below 2 °C above pre-industrial levels, into national policies. For several goals, mission-oriented innovation policy (MIP) approach is chosen as a policy framework (Keijzer, 2019), with a mission being defined as '*an urgent strategic goal that requires transformative systems change directed towards overcoming a wicked societal problem*' (Hekkert, Janssen, Wesseling, & Negro, 2020). This type of innovation policy has been chosen as the Dutch government expects it to enhance the collective approach of societal challenges while being able to profit from emerging economic chances (Keijzer, 2019; Ministerie van Economische Zaken en Klimaat, 2019b). MIP has been used increasingly over the last decade to approach societal problems, extending the focus of innovation policy from the rate of economic growth to its direction by targeting specific challenges (Mazzucato, 2017).

Policies makers turn to scientists for strategic recommendations regarding MIP (Mazzucato, 2018b). Despite a lack of empirical papers, some favorable aspects of the formulation and implementation of a mission are identified. For example, missions can be set on a national or international level (Wanzenböck & Frenken, 2020), but typically require insights and input from a broad range of actors and sectors (Mazzucato, 2017). Regarding the formulation of a mission, it is considered important that a mission is clearly defined, bounded by a specific timeframe and comprising a portfolio of multiple R&D or innovation projects (Mazzucato, 2017, 2018b). Concerning policy implementation, a decentralized implementation of national goals (Mazzucato, 2017), or implementation at a regional level (Wanzenböck & Frenken, 2020) is recommended. Additionally, while a direction might be set top-down, bottom-up experimentation processes should be engaged to cope with the uncertainty of innovation and to galvanize the resulting growth (Mazzucato, 2017).

This experimentalism is considered a key feature of mission-driven policies and organizations (Kattel & Mazzucato, 2018). However, Kattel and Mazzucato (2018) do not clearly explain what such experiments should contribute to the mission. Foray (2018) also highlights the experimental nature of mission oriental policies. He considers transformative activities as experiments. Robinson & Mazzucato (2019) explain how policy mixes in MIP focus on achieving bottom-up experimentation, to explore and catalyze new sources of value and growth by creating new forms of public private partnerships. However, they do not focus on how these experiments should be designed. Mazzucato (2018b) also emphasizes the importance of bottom-up solutions and experimentation, which should contribute to the overall success of MIP. Some concrete expected results of such bottom-up processes are mentioned, being the ability to think outside the box and therefore come up with new solutions, learning lessons that should be collected, building dynamic capabilities and bringing in new expertise that contributes to the missions. However, again it is not explained how these experiments should be designed and how these aspects concretely contribute to achieving the mission. Schot, Ghosh, Kivimaa, Ramirez and Torrens (2020) do explain what types of transformative outcomes can be targeted when applying experimental policy engagement in policies like MIP, and how policies can contribute to these outcomes, however, their focus is on policy making for the niche level in general. Therefore, their two case studies focus on influential developments of the niche on the national level, without focusing on individual experiments that did or did not contribute to achieving a certain mission. This kind of empirical papers at the level of the experiment that focus on the contribution of small scale experiments to a mission have not been found.

While using experiments is clearly emphasized in MIP literature, literature on experiments shows that experiments do not always accomplish their expected outcome (Torrens, Schot, Raven, & Johnstone, 2019; Turnheim, Kivimaa, & Berkhout, 2018). Their success or wider impact seems to be

influenced by several factors, for example the historical and spatial context of an experiment (Torrens et al., 2019), its embeddedness (Turnheim et al., 2018) or the institutional learning and absorptive capacity of the government (Kattel & Mazzucato, 2018). Remarkably, setting a specific goal is also identified as a factor that positively influences the chance of success of an experiment (Turnheim et al., 2018), so being part of a mission should support the experimental process. Therefore, the relation between a mission and experiments is mutual, in which contributing to a mission among other factors should increase the chances of success of an experiment, while having experiments contributes to the chances of success of a mission.

To describe the possible contribution of an experiment to a mission, two ways of being successful as an experiment are to be considered; *internally*, when an experiment achieves its main ambition for the focal area, or *externally*, when an experiment has a wider impact and contributes to system wide change (Turnheim et al., 2018). If an experiment is only internally successful, this means that it supports the implementation of a (national) mission by incorporating it at a specific focal area without offering additional value to other areas. An externally successful experiment might for example provide deepening lessons about the mission and its implementation strategies, tools for scaling up or possibilities for repeating the experiment. The Dutch government expects that small scale experiments in their mission programs provide possibilities for scaling up (Rijksoverheid et al., 2020). Despite these expectations, empirical papers about the contribution of small scale experiments to achieving a certain mission when MIP is applied, are lacking. Therefore, this thesis focuses on explaining how experiments actually do or do not contribute to achieving a mission.

In order to meet the Paris agreement, the use of fossil fuels needs to be (Verkuijl, Piggot, Lazarus, Asselt, & Erickson, 2018). Therefore, the Dutch government aims for 'A built environment in which natural gas does not play a role anymore', in its 'Missions for Top sectors and Innovation Policy'-program (Ministerie van Economische Zaken en Klimaat, 2019b). In this aim, the built environment consists of all dwellings, government buildings, educational institutions, and industry buildings and its involved market actors (Klimaatakkoord, 2019) To achieve this, the corresponding mission focuses on making 200.000 houses per year independent of natural gas before 2030 (Ministerie van Economische Zaken en Klimaat, 2019b), which should lead to 7 million natural gas free houses and 1 million natural gas free other buildings in 2050 (Klimaatakkoord, 2019). Since a gas bubble has been discovered in the Netherlands in 1959, heating infrastructure and industrial processes are designed around the existence of low calorific Dutch gas (GasTerra, 2019). Therefore, 40% of the Dutch primary energy demand has become gas-dependent, which means that the gas-paradigm has nested within the veins of the heating systems for Dutch houses and industry (GasTerra, 2019). Consequently, the formulated mission calls for systemic change.

To achieve this mission, a decentralized approach is used, meaning that municipalities are responsible for operationalizing this target per district (Van Lier, n.d.). On the national level, public funds have been used to start an experimental program that should provide insights in the conditions that are required for the transformation of 200.000 houses per year (Blekemolen, Sanders, & Van der Zwan, 2019; Knops, 2020; Van Elburg, De Coo, & Van der Veen, 2018). Besides, governments on the provincial level ("'Wijk van de Toekomst' - Gelders Energieakkoord," n.d.), and the municipality level (Gemeente Groningen, n.d.) started formulating and implementing experimental programs. All projects decided to create experimental natural gas free districts, which should create learning experiences for the further diffusion of natural gas free districts.

Thus, experiments are used as a policy instrument to achieve the mission of a natural gas free built environment. No empirical papers are found that study the contribution of small scale experiments to achieve a specific mission when MIP is applied. Therefore, the outcome of these experiments in terms of their contribution to the national mission are hard to predict. Additionally, theoretical insights in favorable approaches for moving beyond spatially bounded experiments

towards a valuable contribution to the accomplishment of a national mission are missing, so evidence-based principles cannot be applied. To fill this theoretical gap, in this thesis the following research question is answered:

"*Which factors contribute to the internal and external success of an experimental district in the context of the Dutch mission to make the built environment independent of natural gas?'*

To answer this question, in the next section literature on MIP and experiments is used to identify factors that influence internal and external success, thereby contributing to the implementation of natural gas free districts by starting with a single district or even by creating valuable lessons for other districts and possibilities for scaling up. This is followed by a description of the methods for data collection and data analysis. The identified factors from literature are used as a conceptual framework for analyzing interview data, governmental (policy) document and newspaper articles. In the fourth section the results and analysis are presented. This thesis thereafter is concluded by conclusions, a discussion and recommendations for policy and further research.

Theory

This research focuses on explaining how experiments do or do not contribute to MIP. Therefore, this section starts with providing an overview of MIP theories, followed by a more elaborated description of literature on experiments. MIP theories are used in this thesis as a framework in which the results about experiments are incorporated. Literature on experiments is used to create insight in possible factors that influence the contribution of an experiment to accomplishing a mission. This section ends with a comparison of both parts of literature.

Mission oriented innovation policy

MIP is innovation policy that is not primarily focused on economic growth, but also on its direction by targeting specific challenges (Mazzucato, 2017). This policy has been applied from at least the 1960s and 1970s, when strong technological missions were defined (Wanzenböck, Wesseling, Frenken, Hekkert, & Weber, 2019). However, over the last decade, MIP started focusing increasingly on societal problems instead of technological missions, resulting in more complexity as the problems that need to be solved and the desired outcome of the mission process tend to be less clear (Mazzucato, 2017; Wanzenböck et al., 2019). Some other characteristics of current missions are explained in this paragraph.

Firstly, a pro-active, market shaping approach is required from the government, different from the market fixing approach that was argued for in neo-classical economics (Mazzucato, 2017). This is in line with Mowery, Nelson, & Martin (2010), who argue that strong government technology policy is needed to find solutions for climate chance. Another contrast with technological missions is that current societal missions show longer time frames and are of greater breath (Foray, Mowery, & Nelson, 2012). This is also emphasized by Mazzucato (2017), stating that insights and inputs from different sectors are needed and that system-wide change over may different sectors should be created. Also, a portfolio of multiple different technologies should be supported (Foray et al., 2012; Mazzucato, 2017), and solutions in the areas of institutions and behavior are to be considered (Foray et al., 2012; Wanzenböck et al., 2019). However, despite this greater breath of current MIP, a mission should remain concrete enough to be translated into specific problems that need to be solved, to be able to continuously and dynamically evaluate the progress towards the mission (Mazzucato, 2016, 2018a).

Another difference between former technological missions and current societal missions, is that these missions cannot be solved by using only public funding; private funds and efforts are needed too (Foray et al., 2012) . Foray et al. (2012) emphasize the need of demand-side policies to create incentives for private actors to invest and be involved in the formulated mission. Mowery et al. (2010) support this, mentioning that the success of former mission-oriented programs in the U.S. and U.K. has been explained by the strong demand by potential users for the technologies that were supported by these programs. Moreover, demand-side policies are useful to accelerate the adoption of new technologies (Foray et al., 2012). However, Boon & Edler (2018) find that this type of policy is often neglected and therefore call for policy makers to analyze both the supply and demand side when identifying systemic problems in an innovation process.

The involvement of both public and private actors is also emphasized in experiments in MIP. Kattel and Mazzucato (2018) highlight the importance of bottom-up experimentation across several types of public and private actors. These experiments should provide knowledge about the most suitable policy in a certain environment (Mazzucato, 2016). However, literature on experiments independently from MIP point to the fact that papers on how experiments can be designed and diffused are lacking, and little attention has been paid in literature to the contribution of experiments to the transition towards climate-resilient societies (Turnheim et al., 2018). Therefore, insights from other strands of literature concerning experiments in innovation policy are discussed in the next

section, to identify factors that possibly influence the impact of an experiment on accomplishing a mission.

Experiments

Small scale experiments, like the district level experiments that are used in the mission of a natural gas free built environment, are used for differing purposes, for instance when there is uncertainty about problems and solutions (Van den Bosch & Rotmans, 2008), or to foster learning in situations when it is not sure which approach is best or when no single actor can impose its solution on the other actors (Turnheim et al., 2018). The view on learning from experiments ranges from simple 'testing' policies or technologies to internalizing new ways of thinking, doing, acting and knowing (Turnheim et al., 2018). To achieve the mission of a transition towards a natural gas free built environment, the Dutch government as well decided to use experiments. In the following paragraphs, the role of experiments in transitions is described, followed by an explanation of potential success factors in experimenting and the impact of the context of an experiment.

Transition experiments

Much research has been done on experiments in the context of the energy transition (Bulkeley, 2013; Dietz, Brouwer, & Weterings, 2008; Raven, Van den Bosch, & Weterings, 2010; Rotmans, Loorbach, & Kemp, 2007; Torrens et al., 2019; Van den Heiligenberg, Heimeriks, Hekkert, & Van Oort, 2017). While this research focuses on the occurrence, context and up scaling of urban experiments (Bulkeley, 2013; Dijk, De Kraker, & Hommels, 2018; Torrens et al., 2019), the design of transition experiments (Dietz et al., 2008; Raven et al., 2010; Van den Heiligenberg et al., 2017), or the (policy) context of experiments (Rotmans et al., 2007), no research has been found that studies the impact of small scale experiments on a mission while applying MIP. Therefore, this thesis studies the impact of experiments on the mission of a natural gas free built environment in the Netherlands.

Within the research on transitions, the concept 'transition experiments' is used to characterize small-scale experiments with a high potential to contribute to transitions (Van den Bosch & Rotmans, 2008)**.** These experiments are defined as 'an innovation project with a societal challenge as a starting point for learning aimed at contributing to a transition.' (Van den Bosch & Rotmans, 2008, p. 13). Thereby, the transition experiment deviates from the regime, which is the dominant way in which societal needs are fulfilled. The experiments take place within the niche, and interact with the landscape, which is the broader societal context that cannot directly be influenced (Van den Bosch & Rotmans, 2008).

The mission of the Dutch government regarding a natural gas free built environment requires a transition from natural gas towards alternative solutions, for which small scale transition experiments are used. These experiments indeed have a societal challenge as starting point: a natural gas free built environment. But, while potentially contributing to this transition, lessons from experiments are not always transformed into more general outcomes (Raven et al., 2010; Turnheim et al., 2018). Some theoretical insights need to be considered to increase the value of experiments.

Success of experiments

Experiments can be successful in two dimensions: internally and externally. Internal success regards the extent to which the experiment realizes its main ambition, for example testing an innovative approach or developing new insights or knowledge (Turnheim et al., 2018). External success considers the ways in which the output of experiments result in more lasting change within the policy regime, for example by leading to changes in visions, rules or standards (Turnheim et al., 2018). Therefore, the experiment must be embedded in its context, for which for which Raven et al. (Raven et al., 2010)

propose three processes: scaling up, deepening, and broadening. Scaling up refers to embedding an experiment in the existing structures of an incumbent regime, deepening to learning as much as possible from the focal transition experiment and broadening to repeating the experiment in an adjusted form in a different context (Raven et al., 2010). More specifically, scaling up is about embedding new culture, practices and structure of the experiment at the level of the societal system (Van den Bosch & Rotmans, 2008). This implies that sustainable practices that are initially unusual, become the mainstream practice. Learning in deepening processes includes both local and general shifts in culture, practices, and structures. This means that it is about learning in a local context how to fulfill a societal need in a deviant way. However, contradicting to scaling up, it has little dominance over the regime as it often comprising local and relatively immature lessons. Broadening includes both repeating a transition experiment in different context or linking it to other functions and domains. This process implies further variation of the experiment by broadening the objective of the experiment, or by using best practices in other contexts. Interaction between experiments therefore is determining the presence of processes of broadening (Van den Bosch & Rotmans, 2008). Over all, the conditions for internal and external success may be opposites, which is called the Pilot Paradox. In the next paragraphs, these conditions are described by dividing the work of multiple scholars in four categories: multi-stakeholder interaction, niche-regime relationship, network, and resources.

The interaction between stakeholders influences both the internal and external success of the experiment. Stakeholders in an experiment should have possibilities for social learning by being open to new perspectives and being able to reflect on their beliefs to achieve internal success (Turnheim et al., 2018). In this learning process, a broad group of stakeholders should be involved (Kemp, Schot, & Hoogma, 1998; Raven et al., 2010), considering a broad range of topics, for example technical, economic, and social aspects of the experiment (Raven et al., 2010). Geels, Berkhout and Van Vuuren (2016) also emphasize the importance of a broad group stakeholders for energy transitions in general, as a broad coalition is required for the cocreation of new objectives, practices and technologies, which is critical for social acceptance. As a lack of social acceptance could be a powerful barrier to the achievement of renewable energy targets (Wüstenhagen, Wolsink, & Bürer, 2007), legitimacy and social acceptance are factors that should be considered by policy makers (Geels et al., 2016; Wüstenhagen et al., 2007)**.** Wüstenhagen et al. (2007) discuss three levels of social acceptance: social political acceptance as the most general level, which can be divided over market acceptance (amongst investors, firms and consumers) and community acceptance, which is mostly based on justice and trust (Wüstenhagen et al., 2007).

Regarding external success, Van den Bosch and Rotmans (2008) consider an open mindset of stakeholders to be important. They describe the influence of the competences of involved project participants on deepening, broadening and scaling up, explaining how stakeholders should have an open mind and willingness to learn, be able to look beyond the borders of their own disciplines, and able to communicate the results of the projects to others. Bos and Brown (2012) add to the required characteristics of stakeholders for external success that so called 'champions' should be involved, which they define as key individuals within the experimental process. These 'emergent leaders' are mostly driven by intrinsic motivation and commitment, rather than formal employment responsibilities. They are most prominent in setting direction, and create legitimacy by defining an desired outcome as soon as possible.

Secondly, the relationship between the niche and the regime influences both internal and external success. Regarding internal success, the experiment must be a safe place at sufficient distance of established practices of the policy regime. A local government must be able to adjust the goal of the experimental project to their situation (Turnheim et al., 2018). On the opposite, to achieve external success, the experiment and the parent organizations must be at sufficient proximity, and the experiment outcomes must be of some congruence with the standard operating procedures (Turnheim

et al., 2018). This is in line with Van den Bosch and Rotmans (2008) who mention that experiments, that take place within the niche, should align with some mainstream practices within the regime. They also explain that the local power of the niche should exceed the power of the regime, to be able to change the regime, which can be achieved by for example creating an infrastructure for the niche technologies, or by connecting to developments in the landscape. Bos and Brown (2012) highlight the importance of the reputation of the involved individuals for the experimental process, as it motivates potential partners to support and recommend the newly developed governance structure to create both power for the niche and social acceptance. Accordingly, Turnheim et al. (2018) and Dijk et al. (2018) state that the experiment should be relevant, reliable, representative and useful in the perception of agents for areas that are not part of an experiment but are targeted by the mission. Turnheim et al. (2018) add that the potential receiving organizations must be able to easily link the outcomes to present problems and agendas of receiving organizations to make it possible for the regime to take over niche developments (Turnheim et al., 2018).

Thirdly, networks could concern internal networks, between the actors that are involved in an experiment, or external networks, between various experiments and regime actors. The networks within experiments are discussed in multiple stakeholder interaction, focusing on social learning as a result of the diversity and character of involved actors. External networks need to be open and flexible, to provide knowledge, and support broadening and replication of the experiment (Bos & Brown, 2012). Therefore, these networks again need to be broad. It supports processes of broadening and deepening if a network consists of both niche and regime actors, and actors from several expertises (Schot et al., 2020). To share knowledge before and during the experiment, a bridging organization can be helpful (Bos & Brown, 2012; Schot et al., 2020)**.** Brugge and Fevolden (2019) highlight the importance of coordination of experience sharing and mutual learning, as a lack of coordination may increase long term costs and limit the effects of ongoing initiatives within the regime.

Lastly, experiments need sufficient resources. To achieve internal success, experiments need sufficient knowledge and information, and financial capital (Turnheim et al., 2018). To be externally successful, a need of science and research, financial capital, time, and creative space is needed (Bos & Brown, 2012). Space allows unconventional processes of thinking, learning and reflecting by providing time and financial resources to take risks (Bos & Brown, 2012). It also allows for the implementation of creative technological solutions.

Context of experiments

In literature, some context aspects are identified that influence the desired design of the experiment and experimental programs: the social, ecological, political and temporal dynamics of an experiment (Turnheim et al., 2018), and its institutional embeddedness (Raven et al., 2010; Turnheim et al., 2018) Additionally, a clearly formulated desired outcome or direction for the experiment improves its chances of success (Bos & Brown, 2012). As a government influence the direction of innovation in MIP, they might be picking potential winners in early phases, decreasing technological variety (Hekkert et al., 2020). Conesa (1998) already mentioned that a government should consider technological variety when initiating experiments in mission-oriented policies to prevent a lock-in. Accordingly, the need for experimentation with alternative solutions (Kattel & Mazzucato, 2018) or having multiple decentralized parallel experiments over different technological trajectories (Conesa, 1998) before committing to a particular system design is emphasized. To do so, Brugge and Fevolden (Brugge & Fevolden, 2019) highlight the importance of good coordination between local projects to avoid increasing costs and decreasing effectiveness. Therefore, the context of experiments and variety in experimental programs is taken into account when discussing both internal and external success.

MIP and experiments

Experiments are implemented as policy instrument in MIP (Kattel & Mazzucato, 2018). Successful MIP is expected to set direction top-down, while enabling bottom-up experimentation and learning (Mazzucato, 2017). This is a mutual relationship: an ex-ante desired outcome (having a societal challenge or mission as starting point) improves the chances of success of experiments (Bos & Brown, 2012; Dijk et al., 2018). Experiments are considered to possibly be a useful ingredient for learning about outcomes, possible impacts and potential for uptake of a solution (Wanzenbock et al., 2019), or to contribute to transitions (Van den Bosch & Rotmans, 2008). However, literature on experiments indicates that an experiment does not automatically provide situations for learning. They possibly only achieve implementation of a proposed solution within the scale of the experiment, if they are internally successful. A broader impact can be achieved if an experiment is externally successful, by broadening, deepening or scaling-up the experiment.

In the previously described literature on experiments, four categories of factors are described, being multi-stakeholder interaction, niche-regime relationship, network and resources. These categories all consist of influencing factors, which are summarized in table 1. While concrete guidelines for experiments are missing in MIP literature, some factors that would stimulate internal or external success of experiments are related to MIP literature. No factors that stimulate internal or external success are found that would contradict MIP, neither have MIP aspects been found that contradict the success of experiments. An overview of factors and their relation to MIP are found in table 1.

Category:	*Internal success of experiments:*	*External success of experiments:*	*MIP literature:*
Multi stakeholder interactions	Social acceptance		
	Open reflection processes		Continuous evaluation
	Broad group of stakeholders	Broad group of stakeholders	Public and private actors
	Broad range of topics discussed	Open mindset	Focus not only on technological change, but also on behavioral and institutional change
	Social learning	Willingness to learn	
		Presence of champions	Proactive government
Niche-regime relationship		Proximity to regime	
		Alignment with regime	
		Power of the niche	
		Reputation of individuals	
		Relevant, reliable and representative to others	Mission should be translated into specific problems Demand side policies
	Distance from regime		
	Success influenced by context	Success influenced by context	
	Societal challenge is starting point	Societal challenge is starting point	Aim to approach societal challenge
	Multiple parallel experiments	Multiple parallel experiments	Portfolio of different technologies
Network	Diverse network needed		Public and private actors
	Social learning		
		Bridging organization	Coordinated projects
		Open and flexible network	
Resources	Financial resources	Financial space	Public and private funds
	Science/research	Knowledge	Multiple R&D projects
		Creative space	Portfolio of solutions
		Time space	Decentralized, bottom up experiments

Table 1: Concepts that are covered in both MIP and experiments literature.

Conceptual framework

In this thesis, internal and external success are used as dimensions to describe the contribution of an experiment to a mission. In literature, several factors are identified that influence internal and/or external success. These factors are used to develop the research design, which is described in the methods section. An overview of these factors can be found in figure 2.

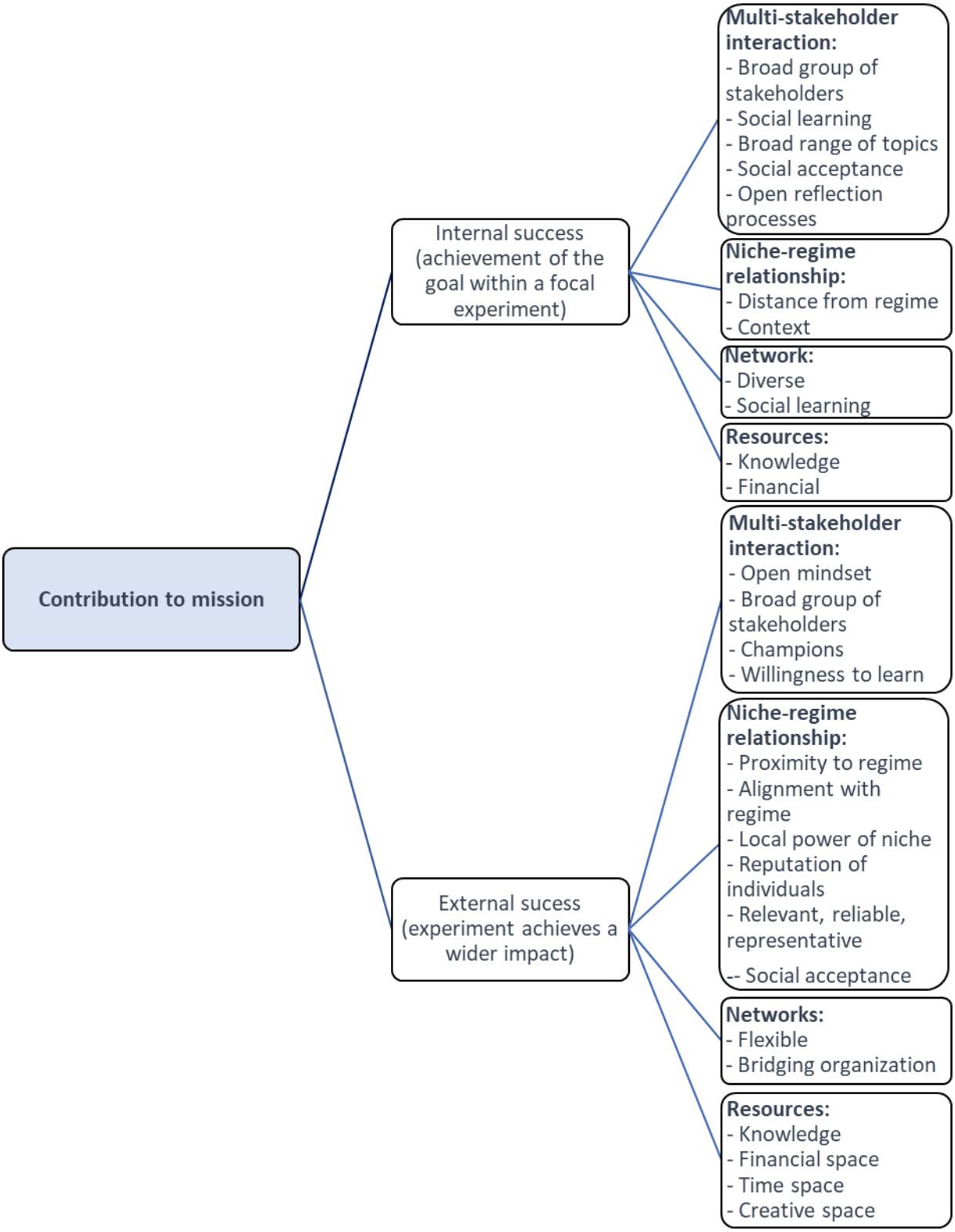

Figure 1: Overview of factors influencing internal and external success.

Method

In this section is explained which method is used to answer the research question and why this method is most suitable. A case study approach has been chosen as this enables in-depth study of how and why several experiments do or do not contribute to a mission and how this differs amongst the experiments. Therefore, this section starts with a description of the connection between the mission, experimental programs and districts. The description of these experimental programs is concluded by an explanation of the method for case selection, and followed by the introduction of the dependent and independent variables that are derived from the theory section. The section is closed by the method for data collection and analysis of the variables.

Case description

The Dutch built environment has committed to the mission of making 7 million houses and 1 million buildings independent of natural gas before the end of 2050 Klimaatakkoord, 2019). The government uses experiments for this mission to learn how a district focused approach can be designed and scaled-up, by means of local, collective and institutional learning processes (Knops, 2020).This aim for both internal success (design of a district focus approach) and external success (expanding a district focused approach) led to the choice for these experiments as a case for this thesis. As can be seen in figure 2, four experimental programs are connected to this mission, being the Programma Aardgasvrije Wijken (PAW, Program Natural Gas Free Districts), Green Deal #212 'Aardgasvrije Wijken', Wijk van de Toekomst (District of the Future), and Wijkenergieplannen (District Energy Plans). All of these programs are devoted to the transition towards a natural gas free built environment and apply a district focused approach, but they broadly differ in three dimensions: 1) the amount of experimental districts that is involved, 2) the level of parental organization, 3) the learning goals (see table 2). The amount of districts and the connection between those districts and the mission is displayed in figure 2.

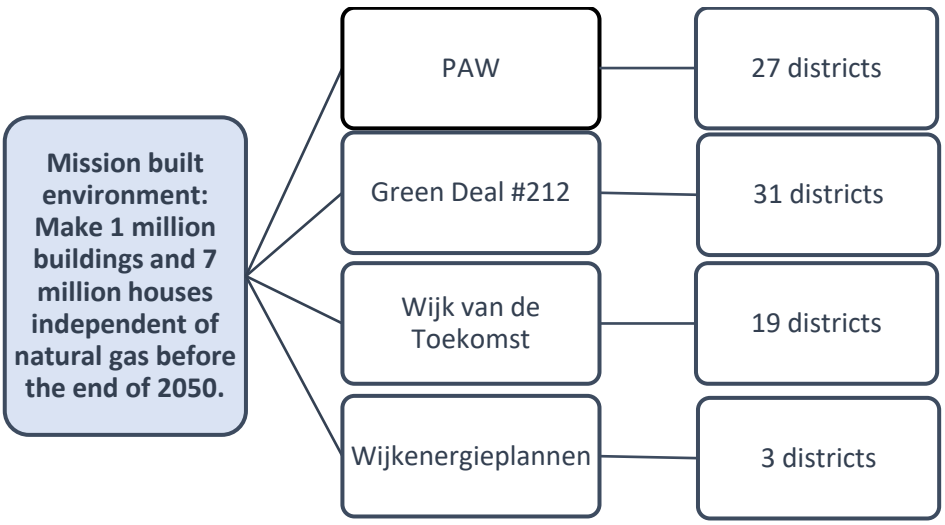

Figure 2: Relation between the national mission of the built environment and the experimental districts.

	Programma aardgasvrije wijken	*Green Deal #212*	*Wijk van de Toekomst*	*Wijkenergieplannen*
Amount of districts:	27	31	19	3
Level of parental organization:	National government	National government	Province (Gelderland)	Municipality (Groningen)
Learning goals:	Learn to design and scale-up the district focused approach.	Accelerating the transition to natural gas free districts and adjusting legislation, finance constructions and responsibilities and competencies.	Accelerating the transition to natural gas free districts by implementing a district focused approach. Developing affordable solutions and motivating other districts.	Obtaining knowledge and experience that can be applied to the transition of other districts in the municipality.

Table 2: The involved amount of districts, level of parental organization and learning goals of the four experimental programs (RVO, 2017.; "'Wijk van de Toekomst' - Gelders Energieakkoord," n.d.; Knops, 2020).

As this thesis focuses on explaining the contribution of the experiments themselves, cases will be selected at the district level as this is the level of the experiments. To be able to select districts for explorative, in depth analysis, an overview of the districts is created in which three dimensions are included: the used technology, the amount of buildings in the experiment and the type of ownership (particular/corporation) that is most present in the experiment. These dimensions are expected to have the largest impact on the design of the experiments, thereby covering the diversity in experiments. An overview of possible types of districts can be found in table 3; an overview of these dimensions for all experimental districts in the four programs can be found in appendix 1. These dimensions are mostly described based on the district websites of the projects; if information was lacking, the dataset 'Core numbers districts and neighborhoods 2019' of Centraal Bureau voor de Statistiek (Centraal Bureau voor de Statistiek, 2019) is used. A purposive sampling strategy is used to select 12 districts that cover all possible combinations of characteristics to create insights about the contribution of the experiments in differing circumstances. These 12 districts are equitably divided over the four experimental programs. An overview of the selected districts can be found in Table 4**.**

Dimension:	*Score:*
Technology	Individual approach: if a solution is chosen per house. Collective approach: if a collective solution is chosen for the full experiment.
Amount of houses	Small: if the district is among the smallest 33% of all experimental districts. Medium: if the district size is between 33% and 66% of all districts. Large: if the district is among the biggest 33% of districts.
Ownership	Particular: if more than the average share of the houses is privately owned. Corporation: if more than the average share of the houses is owned by a corporation.

Table 3: Dimensions that are used to group the experimental districts.

Municipality:	*District:*	*Amount of houses*	*Score - amount of houses*	*Technology:*	*Score - Technology*	*Ownership*	*Score – ownership*	*Program*
Culemborg	Lanxmeer	300	Small	District heating with heat pump	Collective		Particular	Green Deal & Wijk van de Toekomst
Assen	Lariks West	428	Small	Natural gas free (not clearly specified)	Individual	57% privately-owned houses, 43%rental houses, 25% housing corporation	Particular	PAW
Tilburg	Quirijnstok	433	Small	All Electric	Collective		Corporation	PAW
Ermelo	West Midden	500	Small	Owner's choice	Individual		Corporation	Wijk van de Toekomst
Sliedrecht	Sliedrecht-Oost	600	Medium	District heating	Collective	50% privately-owned houses 48% rental houses 38% housing corporation	Particular	PAW
Amsterdam	Van Der Pekbuurt	827	Medium	District heating	Collective	7% privately-owned houses,	Corporation	PAW, Green Deal

						92% rental houses, 86% housing corporation		
Woerden	Schilderkwartier	900	Medium	Individual	Individual	51% particular, 4% particular rent, 45% housing corporation	Particular	Green Deal
Groningen	Reitdiep	918	Medium	All electric	Individual & collective	12% rent, 86% particular	Corporation	Wijkenergieplannen
Arnhem	West (Lombok Heijenoord Klingelbeek)	2870	Large	District heating (research phase)	Collective		Particular	Wijk van de Toekomst
Delft	Voorhof Oost	8400	Large	District heating (open)	Collective	49% housing corporation	Particular	Green Deal
Rotterdam	Pendrecht	1900	Large	Residual heat from industry (District heating)	Collective	30% privately-owned houses 69% rental houses 56% housing corporation	Corporation	PAW & Green Deal
Zoetermeer	Palenstein	3000	Large	District heating; Thermal energy storage	Individual	24% particular, 2% particular rent, 74% corporation	Corporation	PAW & Green Deal
Ermelo	West Midden	500	Small	Own choice	Individual		Corporation	Wijk van de Toekomst

Table 4: Overview of the selected districts.

Dependent and independent variables

In the theory section is explained how the contribution of experiments consists of two dimensions: internal success and external success. Internal success focuses on achieving the goal within an experiment, while external success comprises whether approaches and strategies from individual experiments can be expanded. To explain the contribution of experiments to a mission, in this thesis these two dimensions of success of experiments are used as dependent variables.

In literature, several factors are found to influence the internal and/or external success of an experiment. These factors are grouped in four categories: multi-stakeholder interaction, niche-regime relationship, network and resources. An overview of these factors and their relationship with internal or external success can be found in figure 1. The factors are used as independent variables, but possible new factors are taken into account as well. How data considering these independent and dependent variables is collected and analyzed, is explained in the next paragraph.

Data collection and data analysis

Data collection for this research consists of collecting reports and conducting interviews. For all selected Wijk van de Toekomst, Green Deal and Wijkenergieplannen experiments, two stakeholders are interviewed. In case only one interviewee was available, other complementary data have been used (see table 5). For all PAW experiments, one interview was conducted and corresponding reflexive monitor reports were analyzed. Additionally, of every experimental program, one program leader is interviewed, leading to a total amount of 18 interviews (see table 6) and some program related complementary data (table 5). Interviews are semi-structured to be able to compare interviews between one another while giving interviewees freedom to follow their own notions of what they think is important about the topic. The interview guide[1] is based on the independent variables, but also leaves space for complementary factors. The interviews have been conducted in Dutch, as this is the working language in all programs. Interviewees have been asked whether they agree that the thesis provides an overview of the municipalities or experimental program and the type organization of the interviewee (municipality/housing corporation/electricity company etc.), without including their names. Interviewees received the results concerning their specific case for validation and approval.

Reference:	*Source:*
NP11, NP197	Series of newspaper NRC about the transition in Ermelo-West
PM1	Project monitor Assen
PM2	Project monitor Tilburg
PM3	Project monitor Amsterdam
PM4	Project monitor Zoetermeer
PM5	Project monitor Sliedrecht
PP1	Project plan Rotterdam
WO1	Presentation 'Energy transition & Schilderskwartier', 6 september 2019
WO2	Newsletter Schilderskwartier, September 2018
WO3	'Woerdense Wijkaanpaak', information flyer about alternatives for natural gas in Schilderskwartier, April 2018

Table 5: Overview of used complementary case data.

[1] See appendix 3

Reference:	*Municipality/organization:*	*Program:*
GRI1	Groningen, program leader	Wijkenergieplannen
GRI2	Groningen, citizen organization	Wijkenergieplannen
PI1	Assen, municipality	PAW
PI2	Tilburg, municipality	PAW
PI3	Amsterdam, network operator	PAW
PI4	Zoetermeer, municipality	PAW
PI5	Sliedrecht, municipality (2 interviewees)	PAW
PI6	Rotterdam, municipality	PAW
GI1	Delft, municipality	Green Deal
GI2	Delft & Zoetermeer, housing corporation	Green Deal, PAW
GI3	Woerden, citizen organization	Green Deal
WI1	Arnhem, citizen organization	Wijken van de Toekomst
WI2	Ermelo, municipality	Wijken van de Toekomst
WI3	Arnhem, municipality	Wijken van de Toekomst
WI4	Culemborg, municipality (2 interviewees)	Wijken van de Toekomst
PL1	Program leader	Green Deal
PL2	Program leader	PAW
PL3	Program leader	Wijken van de Toekomst

Table 6: Overview of interviewees.

This thesis focuses on explaining the impact of experiments on missions. In literature on experiments, it has already been stated that experiments are useful tools to achieve a mission, while it has not been explained why and how. As an abductive research approach is suitable to refine existing theories instead of inventing new ones or confirming existing ones (Dubois & Gadde, 2002), this approach is used in this thesis. The research is started with existing theoretical concepts to explain both internal and external success. The interviews are analyzed using a-priori coding, in which the independent variables are used as codes[2], for which the QSR Nvivo qualitative data analysis toolkit is used. The interviews and analyses are incorporated within the context of MIP of the Dutch government. Statements of interviewees are triangulated by comparing them to the plans and reports of the specific experiment or program they relate to.

To fill descriptive and conceptual gaps in case data, newspaper articles and governmental letters and documents are analyzed as well. These documents are collected by looking for 'aardgasvrije wijken' (natural gas free districts) and 'Wijk van de Toekomst' (district of the future) on site:tweedekamer.nl and Nexis Uni. On Nexis Uni, only newspapers articles are selected. Only documents that are published after 1-1-2017 are used, as the agenda setting of the experimental programs did not start before 2017. Also, documents must contain the term 'Aardgas*' to be included. An overview of available data can be found in table 7. These data is checked for double articles and articles that do not discuss the experimental districts. These articles are removed from the dataset, thereafter the relevant articles are analyzed by applying the a-priori coding scheme. This coding scheme was designed to both highlight previous literature findings and also identify themes from the interviews, newspaper articles and governmental documents. Based on the identified factors that would influence internal or external success of experiments, relevant themes are generated. All data was analyzed based on careful reading and interpreting which statements fit the a-priori codes. After this first round of coding, the analysis is refined by applying a more grounded approach within the

[2] See appendix 4

coded items to keep the explanation of the effect of the independent variables as close as possible to the actual terminology that was used by interviewees, journalists and authors.

Search engine:	*Search terms:*	*Amount of results:*	*Relevant results:*
Google – site:tweedekamer.nl	"Aardgasvrije wijken"	70	44
Google – site:tweedekamer.nl	"Wijk van de Toekomst"	1	1
Nexis Uni	"Aardgasvrije wijken"	262	169
Nexis Uni	"Wijk van de Toekomst"	27	27

Table 7: Overview of available data.

More specifically, internal success is analyzed by asking the interviewees from the experimental districts how they perceived the presence of the independent variables regarding internal success and by asking open questions about what factors did hinder or accelerate the experiment. Attention has also been given to the contribution of the experimental programs and the contexts of the experiments. Also, progress reports and local newspapers are analyzed to get a more objective overview of the influence of these factors.

External success is analyzed by asking the interviewees from the experimental districts how they perceived the presence of the independent variables regarding external success, whether they have shared knowledge both with other municipalities or program leaders, and how they obtained their own knowledge. Again, attention has also been given to the contribution of the experimental programs and the contexts of the experiments. Processes of deepening, broadening and scaling up are analyzed using the recommendations of Van den Bosch and Rotmans (2008). Therefore, deepening is analyzed by asking what change actors want to achieve and what is learnt so far. Processes of broadening are analyzed by looking into linkages with other experiments and niches, and with other applications. Scaling up is analyzed by looking at changes in thinking, practices and the awareness of actors. Governmental documents and newspaper articles are used to provide an overview of knowledge sharing events and objectives, and to provide information about the opinions on and approaches for natural gas free districts.

The analysis of internal and external success together indicate whether and how the experimental districts are providing opportunities for implementing a natural gas free district and whether and how knowledge, approaches and results are shared and adopted. This together provides an answer whether these experiments support the transition towards a natural gas free built environment by providing valuable insights, knowledge and experience or not, and thereby answers the research question.

Research quality

The research quality of this thesis is determined based on measures of external reliability, internal validity and external validity.

External reliability refers to the degree to which a study can be replicated (Bryman & Bell, 2015) and is ensured by accurately following indicators for broadening, deepening and scaling up as proposed by Van den Bosch and Rotmans (2008) **.** Also, the coding scheme that has been derived from theory is carefully followed to guarantee a systemic and replicable analysis.

Internal validity regards whether or not there is a good match between the observations of a researcher and the theoretical ideas that are developed (Bryman & Bell, 2015). To ensure internal validity, observations were triangulated two times: 1) by conducting multiple interviews per case; 2) by using both interviews and online documents. External validity considers the degree to which

findings can be generalized (Bryman & Bell, 2015). As only one mission in a single country is researched, the external validity of this research is rather limited. However, the results regarding the contribution of experiments to MIP could be tested by applying this research to other missions. Also, the results of this thesis could be generalized to other experimental districts within the same mission, because it has been chosen to select a wide variety of different experiments to create a representative sample.

Results

In this section is explained how the identified independent variables influence the internal and external success of the independent programs, and thereby the contribution of the experiments to the mission of natural gas free Dutch built environment. First the context of the mission and the programs are outlined, followed by a description of the possible technological solutions that are implemented in the experiments. The section is concluded by explaining the factors that influence the internal and external success of the experiments. This description is structured based on the four dimensions that are described in the theory section: multi-stakeholder interaction, niche-regime relationship, resources, and network.

Context

Despite the fact that all of the experimental programs concern the transition towards a natural gas free built environment, the designs of the programs and the experiments differ on some dimensions. As these differences relate to the independent variables, they are outlined in this paragraph.

Design of experimental programs

Starting with PAW, this program aims for exploring conditions to transform 200.000 existing houses into natural gas free houses per year[3]. Municipalities could apply themselves for PAW, after which 27 districts were selected for the first round. This selection was based on diversity in applicable technologies and district characteristics, thereby focusing on technological variety. PAW also based its selection on diversity in geographical location, the possibilities to quickly start the execution within the experiment and the quality of the application. Indicators for quality that have been used are social acceptance, integration with other challenges, embedding within municipality or province policy, sustainability of the solution, and social acceptance among municipal civil servants, inhabitants and other stakeholders[4]. PAW is focused on collecting, exchanging and disclosing knowledge[5], and offers a learning network and subsidies to cover the unprofitable top during all phases of the process.

Wijk van de Toekomst, like PAW, also focuses on existing districts. They also explicitly focus on the creation of social acceptance and learning how to approach this transition[6]. Wijk van de Toekomst is organized rather bottom up: It is possible to apply for Wijk van de Toekomst as a citizen initiative, company or municipality[7]. After application, the program leaders and the applicant will have some intake conversations to discuss whether the program suits the experiment or not. Wijk van de Toekomst stimulates diversity among districts, but it is not a hard requirement. The program offers both a central learning network with all other participants, and more small scale communities of practice. Besides, it offers subsidies that cover half of the costs that are involved in creating the plan for the transition in the experiment, while expecting the municipality to pay the other halve of the process[8]. The program also provides support when moving on to the execution phase.

On a national level, the goal of the Green Deal has been to obtain knowledge about natural gas free districts, to work on unclarities in regulation and to involve inhabitants in the transition ("Aardgasvrije wijken | Greendeals," n.d.), in which a network of frontrunners together should provide these insights[9]. The program preceded PAW. Both new housings estates and existing districts are involved. It was required from participating municipalities that they would have chosen a district to

[3] GO1, GO36
[4] GO36
[5] GO36
[6] NP8
[7] PL3
[8] PL3
[9] PL1

start with already, and that they would be willing to openly announce that they would start working on this district[10].The Green Deal has not been connected to any subsidies, but focused on the creation of a network of frontrunners and relevant events[11].

Finally, on the municipality level, Groningen uses its Wijkenergieplannen to gain experience with the transition by starting in three districts. These experiences should provide lessons for other districts (Gemeente Groningen, n.d.). The districts have been selected rather top down, based on diversity in applicable technologies and district characteristics[12], which supporter their aim of providing lessons to other districts. The program demonstrates flexibility in its subsidies; it tries to financially support the experiments as much as possible to make sure that a feasible plan is created[13].

To compile, while all programs contribute to the transition towards a natural gas free built environment, they differ in the application procedure. While PAW and Wijkenergieplannen actively select districts based on required characteristics and (technological) variety, the Green Deal and Wijk van de Toekomst discuss with applicants whether or not the program and the district are a match. Also, the amount of offered subsidies range from no subsidies offered to offering the full unprofitable top. Therefore, the amount of subsidies depend on the specific experiment designs. These characteristics are used to elaborate table 3 from the method section:

	Programma aardgasvrije wijken (Program Natural Gas Free Districts)	*Green Deal #212*	*Wijk van de Toekomst (District of the Future)*	*Wijkenergieplannen (District energy plans)*
Amount of districts:	27	31	19	3
Level of parental organization:	National government	National government	Province (Gelderland)	Municipality (Groningen)
Learning goals:	Learn to design and scale-up the district focused approach.	Accelerating the transition to natural gas free districts and adjusting legislation, finance constructions and responsibilities and competencies.	Accelerating the transition to natural gas free districts by implementing a district focused approach. Developing affordable solutions and motivating other districts.	Obtaining knowledge and experience that can be applied to the transition of other districts in the municipality.
Type of districts:	Existing	Existing & New	Existing	Existing
Application:	Selection (variety), application by municipality	Intake, application by municipality, company, or	Intake, application by municipality,	Top-down selection (variety)

[10] PL1
[11] PL1
[12] GO36, GO4, NP136, NP142, GRI1, GRI2
[13] GRI1, GRI2

		government department	company, or citizens	
Contribution	Subsidies (unprofitable top) and network	Network	50% subsidies, network	Subsidies (unprofitable top/extra research), network

Table 8: Characteristics of the experimental programs.

Goal setting

Municipalities can join the programs that contribute to the Dutch mission to make 7 million houses and 1 million other buildings independent of natural gas before 2050. When joining these programs, municipalities select an experimental district for which they set a more specific goals. Most municipalities focus on a specific amount of houses to be natural gas free before a certain moment[14]; goals are set between 2023 and 2035. The realization of the goals depends on the owners of the houses[15], therefore it might take longer to achieve individual all electric solutions as the transition is dependent on the participation of all individual house owners in this case[16]. Some involved actors explain that they have other priorities than achieving their specific goal, they aim for an accurate process[17], or keep the cost of living equal for inhabitants[18]. Goals for an experiment are mostly related to the goal on municipality level. These goals are mostly focused on being energy neutral before a specific year (ranging from 2030 to 2045)[19], however, some municipalities also focus on being climate neutral[20]. So, while all experiment districts aim to contribute to the Dutch mission of 7 million natural gas free houses and 1 million other buildings in 2050, a more specific, short term goal is set on the experiment level.

Technological options

The chosen technology is a prominent factor in determining the costs of an experiment. Broadly speaking, municipalities can choose between individual technological solutions, collective technological solutions, and sustainable gasses like biogas. An overview of possible technological solutions can be found in figure 3.

The first option, individual solutions, requires an analysis of the most suitable solution per house. Thereby, two functions of heat need to be taken into account: the availability of hot tap water, and heating a house. By using a pellet stove or a heat pump, both functions can be covered at once. Another option is using infrared panels for heating; however, to also have hot tap water, these panels should be combined with a thermodynamic heat pump (Gemeente Tytsjerksteradiel, 2018). In every case, houses need to be very well isolated, electric cooking should be used, and solar energy needs to be used to cover the high demand of electricity.

The basis of collective solutions always is district heating, but the heat source is dependent on the local situation. In general, four alternatives are distinguished: a geothermal source, heat cold storage, collective heat pumps and residual heat. A geothermal source, as the experimental district in Delft has been planning to use, is not always available, therefore this is not possible for all municipalities. The same goes for residual heat: to provide a whole district with heat, a great amount is needed which is not provided by all industry actors. The experimental district in Rotterdam is able

[14] GI2, GO30, GRI1, GRI2, PP1, NP143
[15] PI4, GI1, GRI1
[16] GRI1
[17] GI2
[18] NP128
[19] NP159, NP126, NP110, NP157, NP45, WI2
[20] WI2, GRI1

to use this type of heat, as the harbor in Rotterdam provides enough heat for a large area. Collective heat pumps, as used in Culemborg, and heat cold storage can be used for a small scale heating network or for districts with more than 50 houses that are not compact enough for a large district heating network (Agentschap NL, n.d.; Gemeente Middelburg, n.d.), or to broaden a heating network with a few extra streets.

Besides choosing the source, a municipality would also have to choose between closed and open district heating, and the most suitable temperature of the heating network must be chosen. Open district heating uses heat of multiple providers, while closed district heating is bounded to a single provider. Currently, open district heating is only limitedly used, which is mostly due to legal challenges (Schilling, Nikdel & De Boer, 2017). The temperature in a district heating network also can be varied: both high and lower temperatures can be used. The choice for a temperature depends on the energy efficiency of the houses: the better the isolation and efficiency of a house, the lower the temperature can be. These temperatures can also be downgraded over time, however, this is a costly operation[21].

Lastly, in PAW 1 out of 27 involved districts uses green gas (PAW, n.d.).In this case, the gas network does not necessarily have to be adjusted, however, the amount of green gas that is available is scarce. Therefore, it is only considered a suitable solution for older houses that cannot easily be prepared for all electric solutions, or in rural areas where sufficient resources for the production of green gas are available (Interprovinciaal Overleg, VNG, & Unie van Waterschappen, 2020).

Currently, collective solutions are most prominently represented in the experimental programs, which is caused by the fact that individual solutions tend to be more expensive at the moment[22]. Some municipalities still have to choose for individual solutions, as their districts are not suitable for a collective solution. This can be caused by the absence of a heat source, as is the case in Assen, or a low density of houses which makes district heating less feasible (Gemeente Tytsjerksteradiel, 2018).

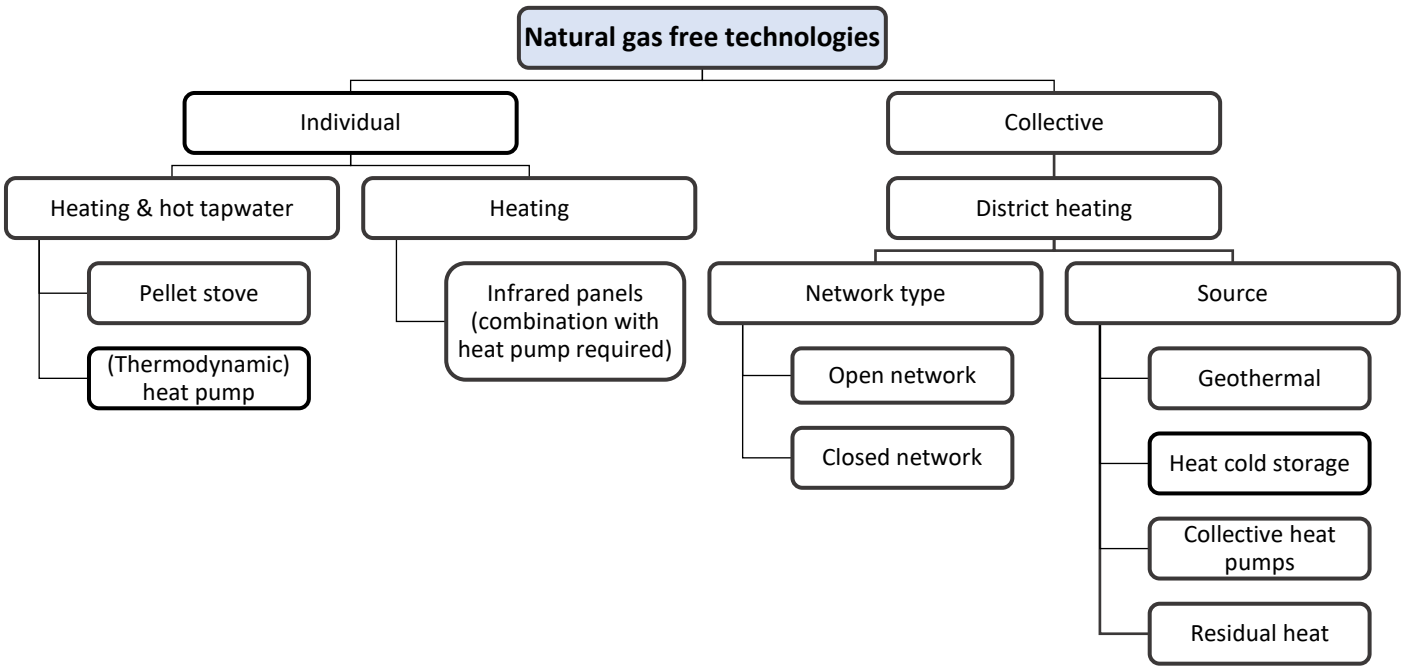

Figure 3: Overview of natural gas free technological solutions.

[21] GI2
[22] PL1

Determinants of internal and external success:

The factors that are found to influence internal and external success of the experiment can be found in table 9. In this section, these factors are explained. The categories that are described in the theory section (multi-stakeholder interaction, niche-regime relationship, network and resources) are used to structure the findings.

	Internal Success	External success		
		Broadening Repeating the experiment in an adjusted form in a different context.	*Deepening* Learning as much as possible from the focal transition experiment.	*Scaling up* Embedding an experiment in the existing structures of an incumbent regime.
Multi-stakeholder interaction	+ Municipal civil servants and housing corporations bring energy and ambition into the project, which fastens the project. - Multiple disciplines and organizations needed to manage different aspects of the process, but differing processes among these organizations slow down the process -Participation of inhabitants is costly and time consuming. + Listening to critical input from inhabitants increases societal acceptance of the projects. +/- Involving inhabitants from the start of the project and providing a clear plan creates social acceptance, while this may turn into rejection of the whole experiment when their plans are not executed.	+ Some actors are involved in multiple projects, which naturally creates an exchange of information between the projects. + Actors choose technologies that can be easily expanded, as they are working towards a natural gas free municipality.	+ Municipalities acknowledge that the experiments are useful learning processes, and therefore try to learn as much as possible through continuous reflection. +/-: Social political background in district influences willingness to experiment.	+/-: local initiatives depend heavily on municipalities, therefore they determine the pace of the process within the municipality. Enthusiastic civil servants (who are intrinsically motivated to be frontrunners) increase the pace by actively implementing natural gas free technologies, while more conservative ones decrease it.

Niche-regime relationship	- More support from the national government considering the goals of the energy transition would create power for the niche and thereby improve the chances of success within the districts. - Uncertainty considering developments in the regime and landscape makes it difficult to make long term plans. - Gas free solution is not always improving the situation of inhabitants, which decreases niche power and social acceptance. + By including topics in the projects that are not energy related, project teams increase the motivation of inhabitants.	+/- Programs select very diverse districts to generate relevant lessons for many different districts, however, context still differs too much to create general lessons.	- Because of pressure from the regime, some municipalities are scared are of making mistakes, leading to less freedom to experiment with risky situations. + Techno-economic analysis creates rationales for specific policies.	- More support from the national government considering the goals of the energy transition would increase the power of the niche, creating more familiarity and acceptance amongst inhabitants with a natural gas free districts. +/- Results of a project influences social acceptance in municipalities that are geographically close.
Network	+ Good connections between stakeholders before the start of the project increases the pace within the project.	+ Most districts are actively involved in learning programs. + Geographical proximity increases quality of communities of practice. + Program leaders support municipalities with sharing knowledge. + Independent project leaders improve connection between districts. + Other municipalities provide valuable lessons for own policies.	+ Municipalities that work on comparable cases organize meetings to discuss the case. + Reflection documents of municipalities are disclosed to provide knowledge to other municipalities.	- Lack of incentive for frontrunners to share knowledge with starting municipalities. - Municipalities do not have a shared goal, which would possibly increase the pace of scaling up. - Context differs too much between municipalities; therefore it is hard to provide general lessons about the process.

		- Process dependent on network within a municipality, decreasing possibilities for broadening.		
Resources	- Technological pressure forces municipalities to hurry, leading to a less accurate process. - It is hard to create a clear business case, leading to uncertainty among investors and inhabitants. + Subsidies create motivation to join programs. + Enough knowledge available. - Some municipalities need more flexibility regarding regulation and making mistakes, as rules and consequences now hinder the progress.	- Research is needed to create and promote the plan, however, it is more expensive than expected resulting in the need for extra money. - Not enough (resources for) human capital to work in more experiments. - Experiment model too expensive for broadening, therefore, it may become faster in other districts, but will not be cheaper.	+ Municipalities take time to work on challenges and adjust plans after research processes. - Delay is not appreciated by all involved actors. + Financial flexibility leads to more opportunities for research. + Subsidies create motivation to join programs and therefore be involved in learning programs. - Some technological options are not possible due to regulation, which decreases opportunities to test such systems. + PAW gives enough space to deviate from the plan.	- It is hard to create a clear business case, leading to uncertainty among investors. + Technological characteristics of districts create windows of opportunities for starting and elaborating an experiment. - Municipalities must offer a gas network to every household.

Table 9: Overview of factors influencing internal and external success.

Multi-stakeholder interaction

Municipalities are key actors in the experiments, as they are responsible for the transition in their places. It is remarkable how most municipalities that are involved in all programs are dedicated to be frontrunners in the transition[23], which is found to improve the pace of the experiment project[24]. Some municipal civil servants also acknowledge that the experiments are about learning, and therefore they aim for continuous reflection to learn as much as possible[25], which creates a process of deepening. Frontrunner municipalities often also are motivated to start new experiments[26], to broaden (elements of) their processes. If possible, municipalities choose technologies that can be easily broadened[27]. In districts with a majority of houses of the housing corporation, the active involvement of the housing corporation motivates inhabitants, which increases the pace of the project[28]. When a housing corporation, network operator or project leader is involved in other municipalities with an experiment project as well, they are have been able to share knowledge about the process in the project teams, which naturally creates a process of broadening[29]. However, this has one drawback: when organizations are involved in multiple projects, it may become too intensive or expensive for them to participate in all experiments at the same time[30], resulting in less potential for internal success in these districts and a slowing down of the broadening process.

Within the projects, multiple disciplines and organizations are needed[31].The differences in the internal processes of those organizations may cause delays[32]. To make sure that all organizations stay involved and work towards the same goal, contract can be used[33], or independent project leaders can be hired[34]. Wijk van de Toekomst always expects its districts to hire a project leader, and this type of delay is not reported by these districts. It also limits the delay when people are involved that have the right to make decisions for their organization[35].

In the districts, inhabitants also influence the internal success of the projects[36]. In most districts, they are directly represented by an inhabitants group or during events[37]. However, multiple municipalities explain how motivating inhabitants and collaborating with them is a time consuming and expensive process[38], that may take more time than was calculated when making the project plan[39]. 4 out of 7 municipalities that work with collective technologies report this problem, while only 1 out of 5 of the municipalities that work with individual technologies mention it. This may be because people experience more autonomy with individual solutions, or because districts with individual technologies often are not as far as collective technologies. The social economic and political background also influenced the required amount of communication and convincing[40]. Highly educated people that vote for more pro-sustainability parties are experienced to be more likely to be willing to

[23] PI2, GI2, PL1, PM1, PM2, PM4, WI1, WI3, GRI1, RI2, WI4
[24] PL1, PL2
[25] WI2, PI6
[26] GI1, PI1, PI2, WI4
[27] GI1, GO43, NP45, NP126
[28] GI2, WI2, PI3, NP197
[29] GI2, GO5, PI4, GI2, WI3, PI3, WI4, WO1
[30] GI2, PI4
[31] PI1, PI3, PL2, GI2, PI2, NP48, NP52, NP129, NP131, NP142, NP176, NP190, NP196, WO1
[32] GI1, PI2, PM3
[33] GI2, PI4, PM3, WI3
[34] WI3, GR1, PM3, PL3
[35] GI2, PI3
[36] GO4, GO6, GR1, PI3, PM1, PM5, WI1, WI2, PM2
[37] GO4, GO6, PM1, PM2, PM5, WI1, WI2
[38] PI2, PI5, PM2, PM5, WI4, WI2
[39] PI5
[40]WI1, WI4, WI3

get rid of natural gas, while people that are voting more conservatively and having less income and education are more likely to be against the transition, and thereby causing delays.

Niche-regime relationship

Social acceptance of the transition towards a natural gas free society is considered a condition for internal success[41]. The niche, in this case the natural gas free houses in the districts, need support to develop and scale up. Municipalities are mostly concerned about the social acceptance among inhabitants. All Wijk van de Toekomst-interviewees are positive about social acceptance among inhabitants, which may be caused by the requirement of Wijk van de Toekomst that inhabitants are involved from the beginning of the subscription[42]. Some municipalities call for more support from the national government considering technological solutions and the importance of the transition[43], which would make it easier to start or accelerate the experiment. Currently, municipalities experience uncertainty regarding regime and landscape developments, which makes it more difficult to make long term policies[44]. Due to the corona crisis as a landscape development, a lack of (resources for) human capital and a changing economy are identified as causes of uncertainty[45]. This uncertainty reduces social acceptance and thereby the power of the niche.

Creating power for the niche can be impeded as it may be difficult to promote the proposed niche technology for a natural gas free district. These technologies do not always improve the situation of inhabitants[46]. It may not improve living comfort, or even be temporally more expensive than natural gas. To overcome this, internal success is promoted by listening to critical input from inhabitants. This creates awareness and understanding, which improves social acceptance. Therefore, municipalities try to involve them as soon as possible in the process, while the technology and costs are still quite uncertain. By also listening to other problems that inhabitants experience in the districts and including them in the experiment, social acceptance is improved[47]. Controversially this may harm the process, as municipalities might not be able to implement the ideas of inhabitants which decreases social acceptance as inhabitants are disappointed in the project leaders[48]. Indirectly, this also influences external success. Because of these consequences of uncertainty, some municipalities are scared of making mistakes which leads to less freedom to experiment with new or risky situations[49]. This constrains the processes of deepening. To overcome uncertainty and create a rationale for certain technological or financial solutions, most municipalities hire research agencies to conduct analysis considering the possible solutions[50], which stimulates learning from the situation within a specific district and increases chances for internal success by improving societal acceptance. However, in one municipality, the inhabitants did not fully trust the commercial agency that provided the advice and wanted to choose their own partners[51].

External success is also influenced by the results of others. To convince regime actors (e.g. inhabitants of districts that are not yet natural gas free, or municipalities that are not actively involved)

[41] GI2, PL1, GO6, PL2, WI1, WI2, WI3, WI4, PI5, NP11, NP30, NP62, NP73, NP76, NP77, NP100, NP106, NP119, NP130, NP133, NP147, NP148, NP157, NP166, NP169, NP176
[42] WI1, WI2, WI3, WI4
[43] GO6, PM5, GRI1, PI2, NP32, NP52
[44] PI1, PI2, PI3, PM1, GO4, GO6, PL1, PL2, GRI2
[45] PI5, WI4
[46] GRI1, PM5, WI4, N7, NP25, NP166, NP177, NP190
[47] GO1, PP1, PM3, GO6, PI1, PI2, PI4, WI1
[48] GRI1, WI4, PI2, WO1, WO2
[49] NP69
[50] GI1, GI2, GRI1, PI4, PM3, WI2, WI3, PI5, GRI2, NP4, NP10, NP20 NP34, NP65, NP66, NP67, NP96, NP119, NP156, NP172, WO1
[51] GRI2

from the usefulness of the sustainable district, results of others are used[52]. This may influence the process both positively and negatively: negative results in other municipalities nearby create distrust[53], while positive experiences create enthusiasm to accelerate the process. The fact that both regime and fellow niche actors do not consider all results and policies of other municipalities relevant is found to decrease this effect. Most interviewees mention that the context of other municipalities or even other districts within the municipalities differs too much from their current situation. Therefore, they find it hard to really replicate what is done in other municipalities[54]. Some districts did actually use best practices from other districts[55], thereby broadening these policy aspects.

Network

Both the connections within and outside the experiment are influencing its success. A strong network is desired, because of the complexity of the challenge[56]. If the stakeholders already know each other before the start of the experiment because they worked together at other experiments, this accelerates the process within the experiment[57], thereby increasing the chances of an internally successful experiment. The involvement of independent project leaders also smoothens the process as they are able to explain the required steps[58]. Considering external success, this may create a barrier. When the effects of policies within the experiment are dependent of the group of stakeholders that work in the district, possibilities to replicate the process are decreased as it can never be the same group in all districts[59]. So, while a familiar group of stakeholders promotes internal success, it is found to decrease the external success as other groups are not expected to create the same results and thereby not able to use best practices.

To support municipalities to share knowledge amongst each other, program leaders organize events and publish reflection reports of municipalities. While most municipalities are actively involved in such events[60], it is indicated that the relevance of events is not always clear as contexts differ too much to share general lessons that are useful for other municipalities[61]. In general, municipalities choose lessons that are relevant for their specific situation, thereby broadening practices of other municipalities. Municipalities that are involved in networks with fellow municipalities that are geographically closer are found to experience more in depth learning, which helps them to use best practices of other municipalities[62]. Remarkably, this has not been mentioned by interviewees from Wijkenergieplannen. While they report the usefulness of close relationships with their program leader at municipality and province actors[63], connections with other districts are not actively created. Also municipalities that created a network with others that face similar problems and challenges deepen the knowledge about these challenges and use each other's best practices[64].

Additionally, the phase of development within a district influences the effectiveness of learning between the municipalities[65]. It is found that frontrunners do not join network events about

[52] PI4, PL2, PL3, PM2, PM4, WI2
[53] WI1
[54] WI2, WI3, WI4, GI1, GO33, GO6, PI3, PI4, PM1, PM3, NP47, NP110, NP135, NP146
[55] GI2, GO6, PI3, PI4
[56] NP34, NP51, WO3
[57] GI2, PI4, NP189
[58] WI3, GR1, PM3, PL3
[59] WI4
[60] GI1, GO30, GO35, PI1, PI4, PL3, PM4, WI2, WI3
[61] WI2, WI3, WI4, GI1, GO33, GO6, PI3, PI4, PM3
[62] PL2, PI1, PL3, PI5, GI2
[63] GRI1, GRI2
[64] GO35, PI1, PI2, PL1, PL3
[65] GRI1, PL3, WI2

topics that are about starting a experiment, while they possess the valuable experiences that starters need. Therefore, one of the program leaders thinks about incentives for frontrunners to keep sharing their knowledge[66], and another one also starts requiring a vision on upscaling and sharing knowledge before subsidies can be allocated[67].

Resources

The availability of resources has proven to be influencing both the internal and external success of the experiment districts in different dimensions. Firstly, the technological dimension forces municipalities to scale up, as in some districts, the gas networks must be replaced. As a gas network is only replaced once in 30 or 40 years, it is not feasible for municipalities to create a new gas network while being aware of the fact that before 2050 the whole built environment should get rid of natural gas. Therefore, they aim to only look into alternative solutions[68], which results in alternative niche technologies being included in regular plans and in incentives to join programs or elaborate the heating network of another district. . Regulation is a drawback for this development: currently a municipality is obliged to provide a gas network to every household. This also provides an incentive to join programs or to elaborate the heating network of another district. However, the time limit that they will have in this case also forces them to hurry, leaving less space for an extensive process, which reduces deepening possibilities[69]. At the same time, when a municipality has a heating network and sufficient sources, municipalities do not feel like having other options to consider than to use this heating network and these sources. Additionally, they feel bounded to the owner of the source, as there is a lack in the offerings of heat sources[70]. This is also caused by regulation that currently works against some new technological options, for example the 'open district heating network' where the network can be connected to various sources instead of being dependent on one contracted source owner. To protect heat providers from unprofitable business cases, the government decided that one provider can deliver heat in a certain geographic area. However, this prevents the development of open district heating, which would better fit in some municipalities. By applying open district heating, inhabitants are protected from a monopolist provider and the heat source can be adjusted over time if a more sustainable source becomes available[71] .

Secondly, a clear business case is needed for investors and inhabitants to support the project[72]. Inhabitants may not have enough financial resources to support the execution of the plans[73]. As there is uncertainty among municipalities (see 'Niche-regime relationship'), it is difficult for municipalities to create this business case. Therefore, interviewees state that financial aspects are the biggest challenge of the internal process. The needed research and process of creating social acceptance is more expensive than they expected[74]. This is constraining the progress within the district, but provides an incentive to municipalities to join in the programs as these offer subsidies, which automatically involves the municipalities in the network and learning events[75] . The program leader of the Green

[66] PL3
[67] PL2
[68] GI1, WI2, PI5, PI1, PI6
[69] GO6
[70] GI1
[71] GI1, PI1
[72] GO6, GI1, GI2, PI3 PI4, PL1, PL2, PM1, PM3 PM5, WI2
[73] GI1, GO6, PI4, PL1, PL2, PM1, PM5, WI2, WO3, NP6, NP76, NP157
[74] GI2, PM4, WI2
[75] GI2, PI1, PL2, PL3

Deal also found that municipal actors needed knowledge and therefore wanted to join the program as it was the first national program that offered learning networks and events[76].

Thirdly, municipalities take enough time to work on challenges, unless technological pressure forces them to hurry[77]. They eventually adjust plans during the process if research or inhabitants provide a better solution[78] . This both positively and negatively influences internal success: while the better option may cause an increase of social acceptance, not all stakeholders can appreciate the eventual delay[79] . When municipalities keep reconsidering the plan for their experiments by means of research and discussion, a process of deepening is started.

However, some municipalities are pessimistic about upscaling. They report a lack of (resources for) human capital for this transition[80], but moreover, the ways that they use for the experiment districts are too intensive and expensive or time consuming to broaden without new subsidies[81] . They do not expect the processes to become cheaper, but mostly do think that they would be able to do it faster another time. Additionally, as in Wijk van de Toekomst the municipality has to contribute 50% of the costs, for some municipalities it might be too expensive to join the program with multiple districts[82].

Overview and relations:

In this section, factors influencing internal and external success are summarized. An overview of the relation between these factors can be found in figure 3.

Regarding internal success, several factors are found to be promoting the process in the districts. Firstly, the presence of frontrunners that are intrinsically motivated accelerate the process within the experiment. It stimulates the pace in the district even more if the stakeholders already knew each other before they start working in the experiment. Also, actors that are involved in multiple experiments improve the pace in the experiment, as they bring in knowledge from other districts and might already know each other. Further, the socio-economic and political characteristics within the district either stimulate or hinder the progress within the experiment: a highly educated, sustainability-oriented group of inhabitants are more willing to experiment and to collaborate with the municipality in the process than a group of inhabitants with lower education and income.

Additionally, niche-regime interaction influences the internal success. To increase niche power, some municipalities call for the national government to more actively support the chosen technologies. Resistance amongst inhabitants occurs because the alternative technologies do not automatically improve the situation of users, which makes it hard to promote them among the people. However, as social acceptance is essential for internal success, inhabitants must be convinced of the need and method for a natural gas free district. Therefore, most municipalities involve inhabitants as soon as possible, which broadens the group of stakeholders. Starting the experiment with an analysis of multiple technological and financial solutions may help to provide a rationale for the chosen policy and thereby to create more power for the niche over the regime.

Further, the availability of sufficient resources is a condition for the internal success of the experiments. As the experiments are too expensive for municipalities and inhabitants, government subsidies are needed to successfully finish them. These also helped to create a clear business case,

[76] PL1
[77] GI2, PI1, GI1, GO3, GO4
[78] GI1, GI2
[79] GI1
[80] GI1, PL2, PI3, PM3, NP57, NP136
[81] NP32, WI2, WI3, PI2, PI4, PI5, WO3,
[82] WI1, NP134

which is needed to convince inhabitants and the national government of the feasibility of the project, to gather national subsidies and social acceptance.

Regarding external success, a process of *broadening* is created by having actors involved in the experiment that are also involved in some other experiments. They shared lessons between different experiments. However, to have this process of broadening, similarities in the various districts are needed to be able to share relevant lessons among each other. But while frontrunners were improving the chances for internal success, they found a lack of relevance in other districts as they are not as far and therefore do not actively connect to these municipalities, which prevented them from sharing lessons with each other (see figure 4). Also, the influence of different socio-economic and political characteristics causes that districts were not easily comparable, which keeps municipalities from sharing and using lessons amongst each other or applying their own experiences to other districts within the municipalities. Technologies can be distinguished in terms of a) alternatives that are relatively easy to broaden, which are mostly the collective technologies like district heating, and b) technologies that are more difficult to broaden, like individual all electric solutions. A gas network that needs maintenance or replacement created an incentive to broaden existing solutions or start a new experiment.

To create a process of *deepening*, experiments need sufficient space for experimenting in time, budget and creativity. This contradicts with the need for a clear business case for subsidies and clarity for inhabitants to create social acceptance (see figure 4). It also creates a difference in experiment conditions and context between experiments that have or do not have this space available, constraining a process of broadening. To learn even more lessons about a specific situation, multiple experiments approach the deepening process together. Municipalities that build networks with others that were geographically close and in the same phase of the experiment, reported more usefulness of these networks and learning processes. Frontrunners reported that these networks mostly were not relevant to them, as shared lessons had not been relevant or new to them.

Lastly, to achieve a process of *upscaling*, an experiment must have a design that would fit the regime. This can be accomplished by working with conditions that are also achievable in regular situations, which is inconsistent with the need for subsidies to achieve internal success, as municipalities explain that experiment designs are too expensive to scale, which creates a reputation of expensive solutions. However, if the experiments would not receive these subsidies, it would be impossible to some of them to be internal successful. Also, a technological need for a renewed new heat provision network puts pressure on a municipality to start using niche technologies as it is not profitable to again implement a gas network while the built environment should be free of natural gas before 2050. Upscaling is also supported by positive results and enthusiasm, which can be created by frontrunners who successfully finish experiments and share results amongst inhabitants (see figure 5). However, this effect can also work the other way around in case of negative results.

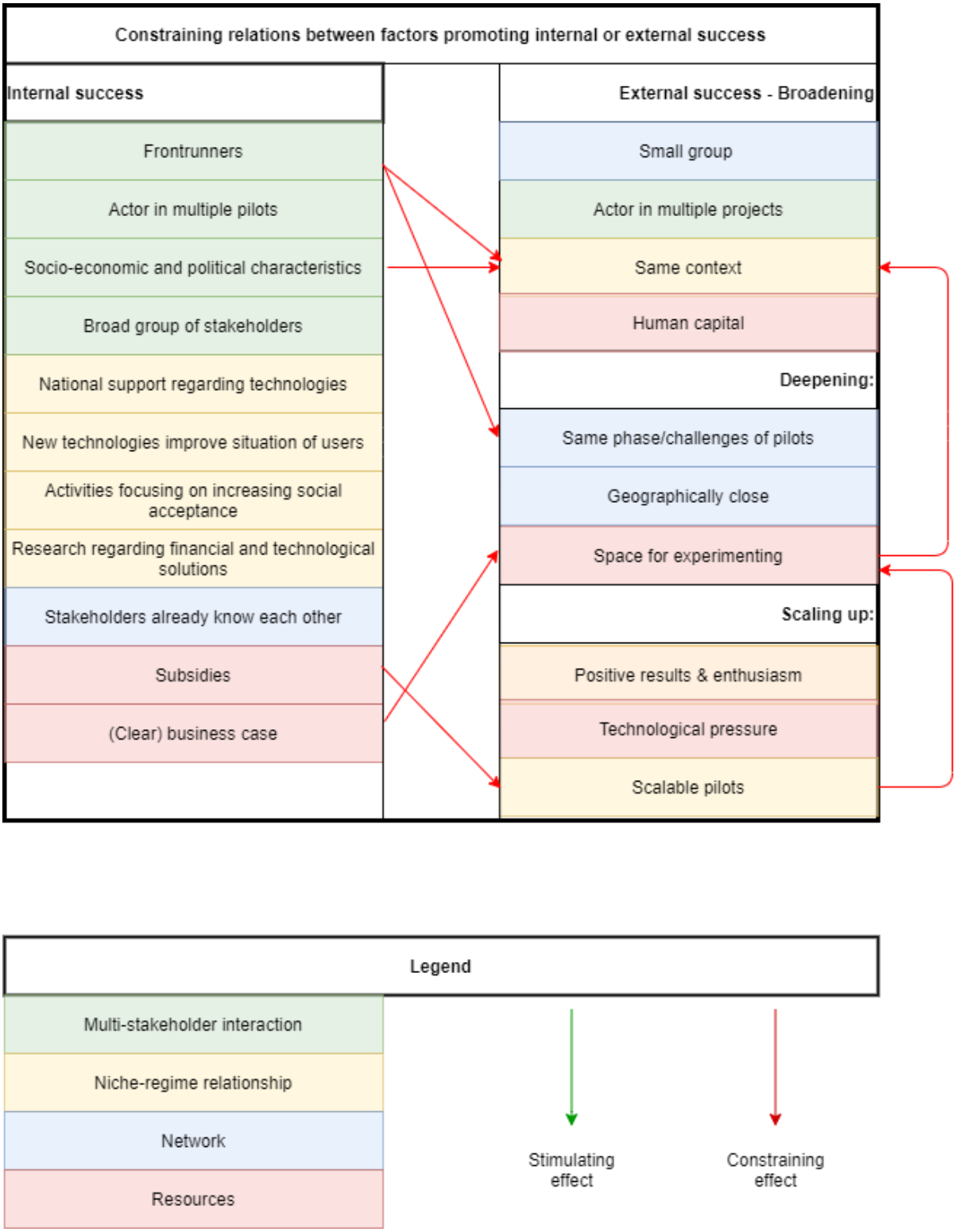

Figure 4: Constraining relations between factors promoting internal or external success.

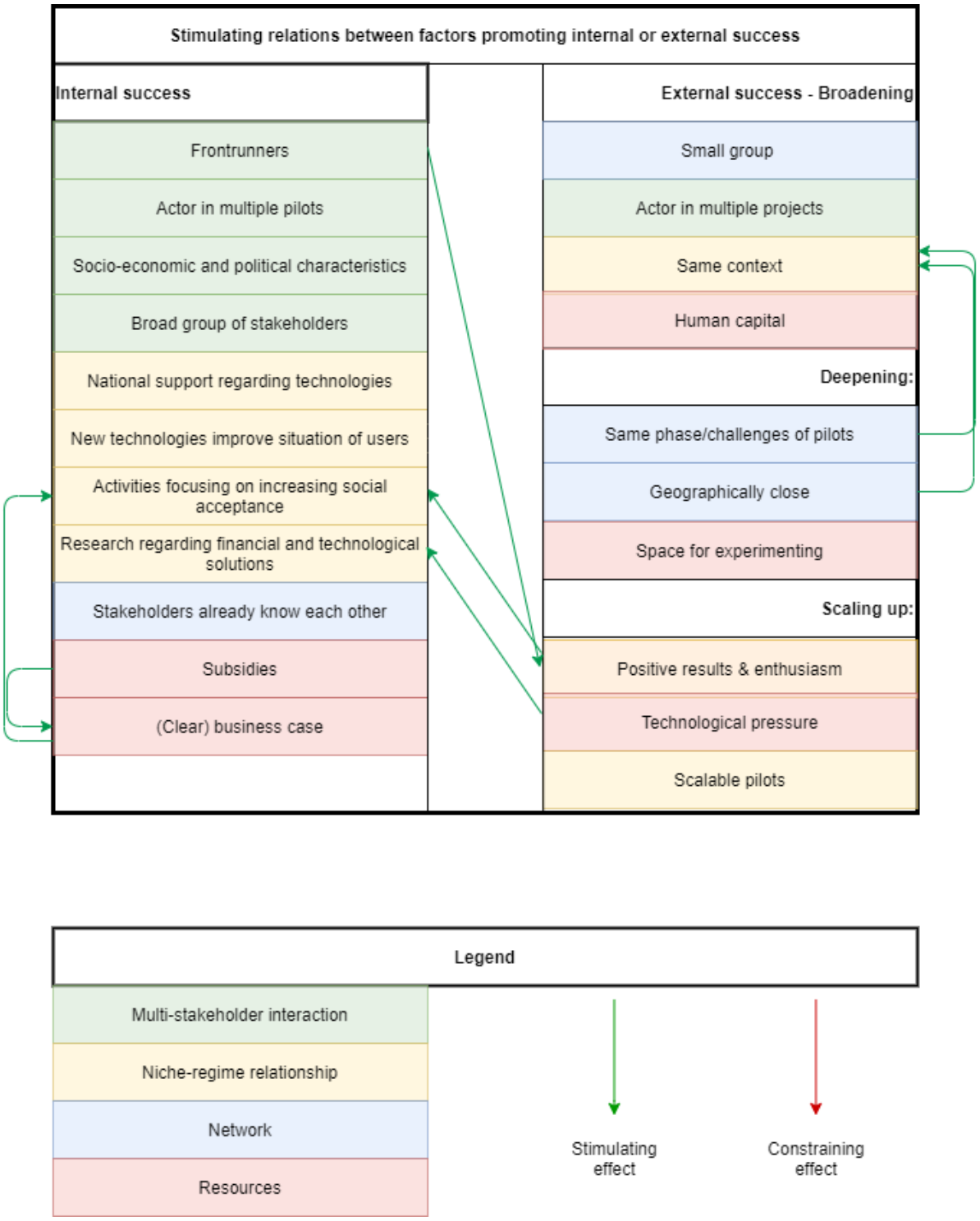

Figure 5: Stimulating relationships between factors promoting internal or external success.

Conclusion

This thesis raises the research question "*Which factors contribute to the internal and external success of an experimental district in the context of the Dutch mission to make the built environment independent of natural gas?'*. 12 experimental districts that are working towards this mission are studied. These districts are all part of one an experimental program that contributes to the mission by creating a network or providing extra subsidies. To answer the research question, the factors influencing internal and external success of an experimental district firstly are discussed separately, which is concluded by a general answer to the research question. An overview of these factors can be found in table 9.

Internal success

Internal success is achieved when the goals that are set within the experiments are accomplished. In terms of the mission of a natural gas free built environment, internal success means that one district, the experiment districts, has become independent of natural gas. Several factors are found to influence the internal success of an experiment; an overview of these factors can be found in table 9. .

It is essential for internal success that multiple disciplines and organizations are involved in the experiment, as the transition is a complex process. The experiment is accelerated when the stakeholders are well connected due to having collaborated before. The drawback of this broad group of stakeholders is that different organizations all have their own decision making processes, which causes a barrier for internal success. Besides the presence of a broad group of stakeholders, the attitude of stakeholders is also influencing internal success. The pace in the experiment is increased by municipal civil servants and housing corporations that aim to be frontrunners, and by inhabitants that agree with the working method in the experiment. The social acceptance of inhabitants is improved by involving them from the start of the experiment, however, social acceptance decreases if inhabitants are invited to propose solutions which are rejected by experiment leaders. By also including topics other than natural gas that are important to inhabitants, enthusiasm among inhabitants is created. This also helps to create an improving situation for inhabitants at the end of the experiment, which improves the power of the niche over the regime. Improvements for inhabitants can be decreased living costs or more comfortable districts. Power of the niche would also be improved by more governmental support regarding goals and technologies. As the process of creating social acceptance is a complex process, this often resulted in a more time consuming and costly experiment than was expected at the start of the experiment.

Besides the complexity of social acceptance, other factors are also complicating the estimation of the costs of the experiment. These factors are both the landscape and regime developments. However, certainty about the costs of the experiment is needed to convince inhabitants and stakeholders or investors of the feasibility of the experiment. To make sure that expected unprofitable tops are covered, municipalities therefore turn to the experimental programs to apply for subsidies. As the internal success is priority to most municipality actors because they want to be frontrunners, these subsidies are the most prominent motivation for them to join the programs. A positive side effect of joining the program, is the network that is created in the programs. Therefore, this factor influences both internal and external success.

External success

External success is achieved if an experiment results in more lasting change within the policy regime. In the context of a mission this means that the experiment also has a broader contribution to achieving the mission. The results of this research show that internal success and external success are closely related. External success can be divided in three processes: broadening, deepening and scaling up.

Broadening is about repeating (best practices of) the experiment in an another context, deepening refers to learning as much as possible from the foal transition experiment and scaling up to embedding an experiment in the existing structures of an incumbent regime. The factors that influence these processes are summarized in table 9, relations between factors are displayed in figure 4 and 5.

A process of *broadening* automatically occurs when actors are involved in multiple experiments. They started using lessons from other experiments when starting a new experiment. Sometimes, technologies are chosen that can easily be elaborated in districts nearby, which promotes a process of broadening. Program leaders aim for relevant lessons for as many non-participating districts as possible, by selecting a diverse set of experiments. However, both sharing an adopting lessons is hindered by the differences between phases of the experiments and differences between the actual contexts and groups of stakeholders in the experiments. For frontrunners, it is not perceived relevant to share their knowledge with other starting districts. On the opposite, starting districts perceive their own context unique and therefore find it hard to adopt relevant lessons from frontrunners. By actively creating networks in which other experiments are involved that are geographically close or dealing with the same challenges, stakeholders improve the relevance of lessons from other districts. It is also acknowledged that some relevant general lessons are offered during the program, that can be used in adjusted form in multiple districts. Nonetheless, it remains difficult to create valuable best practices for districts that are participating in a program, as the designs are too intensive and expensive to execute without subsidies. Moreover, a lack of human capital creates barriers for applying the design of an experiment on a larger scale, as the required amount of technical personnel is not.

A process of *deepening* is aimed for by stakeholders that acknowledge that experiments are useful learning processes. They try to learn as much as possible, and by connecting to experiments that are dealing with the same challenges, they are applying a broader perspective on these challenges. Program leaders also play an important role in this process by disclosing reflective documents and organizing learning events. On the opposite, in depth learning processes are constraint by the required certainty about plans and solutions. This results in municipalities that are actively avoiding failure, and thereby risky learning processes. The positive side of this non-risk taking behaviors is that thorough research is done before policies are implemented, creating in depth lessons about technological and financial solutions in specific cases. In general, more freedom is experienced for a broader scope of research in districts with highly educated people that are willing to experiment.

A process of *scaling up* is influenced by the results of the experiments. Positive results create enthusiasm among inhabitants both within and outside of the experiment. This results in inhabitants, companies or municipal civil servants that want to join a program and start an experiment themselves, or elaborate existing experiments. Scaling up is constrained by the differences between contexts, which results in regime actors that do not acknowledge the applicability of the results of the experiments for their own environment. The government could play an active role by promoting results of the districts. Additionally, if frontrunners do not actively share their positive results, the effect of the results for scaling up also remains limited. The formulated mission does improve the pace of scaling up, as the government clearly stated that no more natural gas should be used in 2050. As a gas network runs for 30 years, municipalities start automatically looking into alternatives if their gas networks need to be replaced at the moment, because they realize that it will not be profitable to asset a new gas network if it cannot work for 30 years anymore.

Relations between factors and success

Remarkably, some above mentioned factors influence each other (see figures 4 & 5). Most districts are found to especially focus on internal success in their districts, as they are dedicated to be frontrunners. While the aim to be a frontrunner positively influences the chance for internal success, it contradicts

with processes of broadening and deepening. Additionally, subsidies promote internal success by contributing to the creation of a clear business case, but constrain processes of scaling up as the experiments are not considered representative other districts. The need for a clear business case constrains processes of deepening; while processes of learning by experimenting, which are used for deepening, are decreasing social acceptance among some groups of inhabitants.

Moreover, some factors that influence deepening, broadening, or scaling up also influence each other. Technological pressure to start implementing alternatives instead of replacing a gas network reduces time and space for deepening, while it promotes scaling up. Processes of deepening are stimulated by small groups of experiments that are geographically close or dealing with the same challenges. These groups also need time and money for in depth learning processes, which creates a less representative context for other districts. Therefore, broadening processes are inhibited.

To conclude, accomplishing both internal success and external success is constraint by the factors that contribute to these dependent variables. As most stakeholders are currently focused on internal success, and thereby on implementing a mission on a specific location, the external success of the experiments is achieved more accidentally than purposive. To create externally successful experiments, which would have a broader, more general impact on achieving the mission, policy makers should specifically choose which process of external success they aim for. Therefore, some policy recommendations are discussed in the discussion section.

Discussion

In this section, the conclusions of the research are placed in a broader context. Firstly, the societal implications of this research are discussed by providing policy recommendations to program leaders, followed by a discussion of the theoretical implications. To conclude this section, the limitations of this study are discussed.

Policy recommendations

This thesis points to the need for a program leader of an experimental program to consider which type of success is most helpful for achieving a mission. Two types of success are distinguished, being internal success and external success. An overview of policy recommendations to achieve these types, can be found in figure 6. Internal success is about achieving the goal of the experiment within its own scope. Therefore, it is important as a program leader to provide knowledge about possible solutions that can be applied in the experiment to help creating social acceptance. Once a suitable solution has been chosen, support for this solution can be provided to further stimulate the process of creating social acceptance. Additionally, flexible financial resources may be needed for the experiment to create a solid business case that is needed for attracting other investors and needed stakeholders. Providing tools for creating a solid network between the involved stakeholders in an experiment, like an independent project leader or the selection of experiments in which it is possible to work with the same people multiple times, is helpful for creating a smooth process without unexpected delays.

External success considers the wider impact of an experiment. Three processes are distinguished that result in different types of impact: broadening, deepening, and scaling up. If a project leader wants an experiment to achieve a solution to the societal challenge of the mission that would also be applicable to other contexts within the mission, circumstances that are favorable for *broadening* should be developed. This means that a strong network is important for the experiments: by collaborating with the same people for a longer time, lessons are more easily shared. Both program leaders and stakeholders within the experiment should think about how their results and conducted research are relevant in other contexts, and clearly communicate this to starting experiments. Starting experiments should be challenged to first look at experiments that are further developed, and use these experiments to create their plans. It should be considered how the design of the experiment can be implemented in other groups of stakeholders and within the budget that government has per district. Independent project leaders should be hired in multiple districts at the same time, to share lessons and guide the collaboration process, as results are dependent of involved stakeholders.

If experiments are used to explore a new technology or policy solution to the societal challenge that is starting point of the mission, a program leader should design the program to achieve a process of *deepening*. Therefore, a network of experiments that are geographically close and dealing with the same topic should be connected. Stakeholders and districts that are willing to take risks to experiment should be selected, which implies that districts with a higher average level of education and income are most suitable. Also, a good monitoring program should be used to be able to share results and have in depth reflection processes. The program leader should be intensively involved to make sure that the stakeholders within the experiment have enough freedom in resources, time and realization of the technology to have an in-depth learning process.

If the results of the experiment should become the new mainstream way of working, a program leader should work towards processes of *scaling up*. As results of experiments are influencing the attitude of regime actors towards new technologies or policies, the results should be communicated at all levels of policy making. Besides, the results should be translated to other contexts to explain their relevance. Frontrunners should get an incentive to share knowledge with starting districts, and by setting clear goals at the highest levels of policy making, the feasibility of regime technologies should be decreased, while the use of niche technologies should be stimulated.

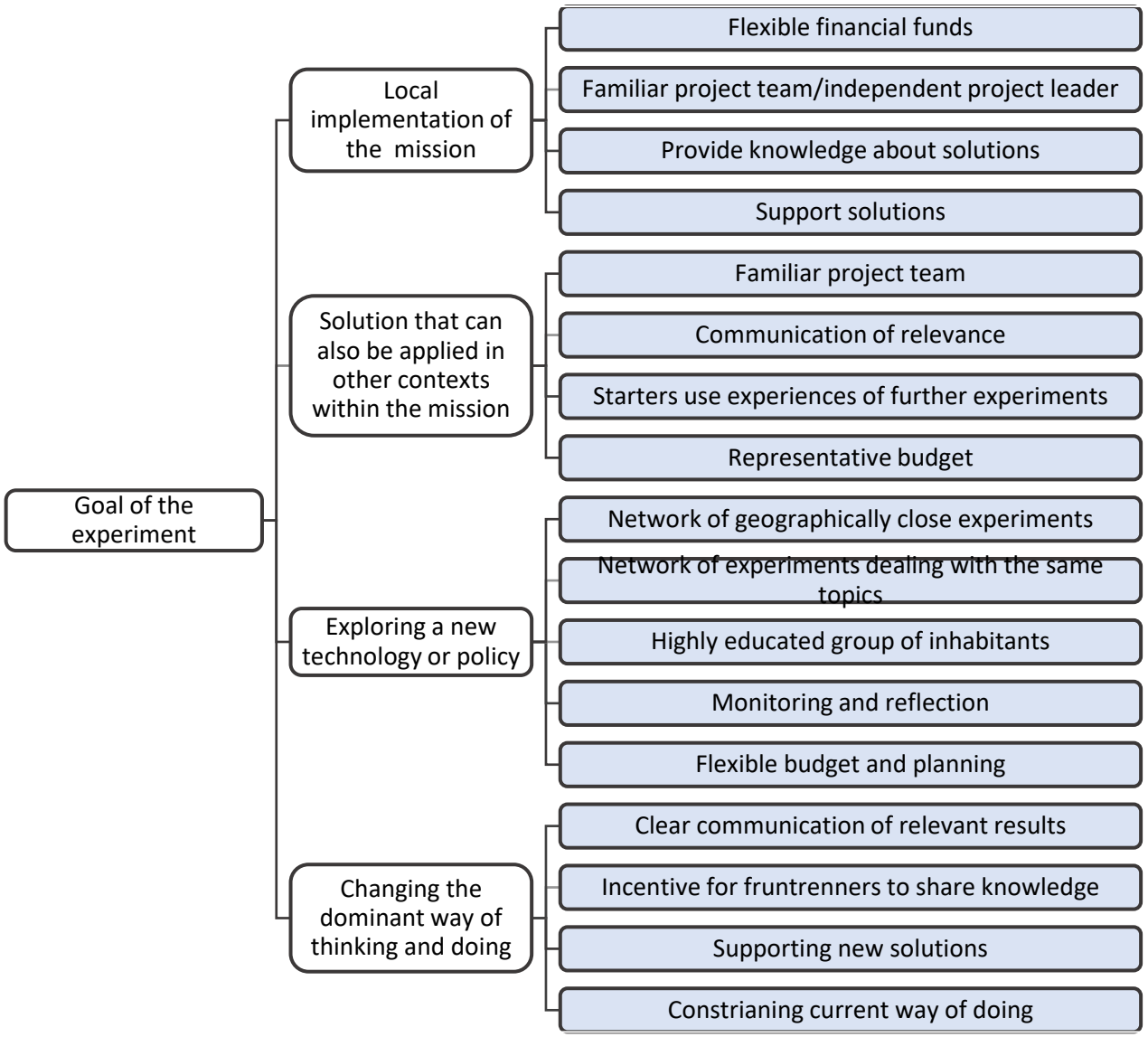

Figure 6: Overview of policy recommendations.

Theoretical context

This research furthers our theoretical understanding of how experiments can be used, linking MIP to literature on experiments. While the use of experiments is recommended in MIP literature, this thesis fills the gap with regard to an explanation of how such experiments actually can contribute to achieving a mission. Therefore, it is important to distinguish between internal and external success of an experiment, in which internal success refers to local implementation of a mission and external success to a broader impact of the local experiment on the mission. External success thereby is divided in three dimensions, being broadening, deepening and scaling up. It is concluded that processes of internal success, broadening, deepening and scaling up can constrain each other. This is in line with Van den Bosch & Rotmans (2008), who describe separated management processes that are needed to achieve broadening, deepening or scaling up. Also Bos and Brown (2012) study a case in which the processes followed up on each other, starting with deepening, which was followed by broadening and concluded by scaling up.

In the context of the mission of a natural gas free built environment in the Netherlands, it became clear that the design of an experimental program determines whether the results of such experiments can be broadened, deepened or scaled up. More specifically, the way subsidies are used, the selection of districts, the communication of results and the network that is built are considered the most influencing factors. By studying and comparing 12 cases that varied in their choice of technology, size, and type of ownership but all contributed to the same mission, these general conclusions could be drawn for the case of this specific mission. However, further research to the influence of these factors in other missions is needed. For example, one interviewee shared the thought that having a decentralized, short term shared goal within a small network of municipalities would improve the process by creating a stronger motivation as the mission itself is formulated more long term, and as said before, some program leaders are considering incentives to motivate frontrunners to share their knowledge with others. Therefore, further research is required to the role of networks and their relation to the formulation of a mission and how they can be most effective in MIP contexts. As the included experiments are pessimistic about the relevance of other experiments, further research is needed to find out how experiments can be selected in a way to improve the relevance of knowledge sharing among experiments. Lastly, it would be worth investigating how results of an experiment can be communicated in a way to motivate regime actors to start using niche technologies and take over lessons of previous experiments.

Limitations and research quality

Some limitations to this research should be considered. Firstly, interviews are only conducted in 12 out of 80 experimental districts. The most important criterium for selection of these 12 districts is variety, which has been chosen to improve the external validity of the research. However, some interviewees mentioned the impact of their choice of technology on the processes of social acceptance and resource collection, or the characteristics of the district were mentioned as constraining or promoting factors. Because of the variety in the case selection, these statements could have only been applicable to a few districts. By doing more in depth case studies with a larger number of more equal districts, these kinds of factors could be researched.

Secondly, while a variety of cases is included, all cases were approximately in the same phase of the experiment, while some results are expected to be only applicable to this specific phase in the mission. The creation of social acceptance might differ when the mission proceeds, as this research pointed out that more positive results in a district influence the process of creating social acceptance in other districts. Also, the technologies may become cheaper over time. Therefore, it would increase the value of the findings if it would be researched whether the lessons learnt in the districts are

applicable on the long term, and how experimental processes may change during different phases of the mission.

Thirdly, the amount of interviews per case is limited and mostly focused on municipal civil servants. To ensure a sufficient degree of internal validity and to gain a broader perspectives on the processes within the experiments, newspaper articles and governmental documents are included as well. Nonetheless, more interviewees of a broader range of organizations would benefit the internal validity of the findings and reduce the impact of subjectivity of the interviewees.

Lastly, only one mission is studied, therefore the results are not generalizable to MIP in general. As MIP is applied to a broader scope of societal problems, they differ in the sectors that are involved, the topics that are discussed and the time frames that are applied. It would be of added theoretical value to apply the same coding scheme to other experiments in missions, as a more general view on the contribution of experiments to MIP is lacking. By applying the coding scheme to other missions in or outside the Netherlands, the external validity of these findings can be improved. A good starting point would be other missions in which citizens have a prominent role, like missions considering public health care or other built environment missions as citizens turned out to be an highly influential factor in this research. Therefore, it would be of added value to study their role in other missions where their input is required.

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Appendices

Appendix 1: Overview of all experimental districts

Municipality:	*District:*	*Amount of houses*	*Score - amount of houses*	*Technology:*	*Score - Technology*	*Ownership*	*Score – ownership*	*Program*	*Existing district*
Vlieland	Duinwijck	38	Small	Heat pump, Thermal energy storage	Collective		Particular	PAW	Yes
Westvoorne	Landgoed Drenkeling	70	Small	Zero energy homes	Individual		Corporation	Green Deal	Yes
Barendrecht		100	Small					Green Deal	Yes
Veere	Domburg Singelgebied	100	Small	All electric		Particular	Particular	Green Deal	Yes
Winsum	Munster	150	Small	Individual geothermal				PAW, Wijkenergieplannen & Green Deal	No
Haarlem	Hof van Egmond	162	Small	Zero energy homes	Individual		Corporation	Green Deal	Yes
Westland	Westerhonk	187	Small	Geothermie + District heating	Collective	44% particular, 37% particular rent, 19% corporation	Particular	Wijk van de Toekomst & Green Deal	Yes
Wijchen	Hart van Zuid	195	Small				Corporation	Wijk van de Toekomst	Yes
Culemborg	Lanxmeer	300	Small	District heating with heat pump	Collective		Particular	Green Deal & Wijk van de Toekomst	Yes
Renkum	Heveadorp	321	Small				Particular	Wijk van de Toekomst	Yes
Drimmelen	Terheijden	334	Small	District heating (thermal energy &biomass)	Collective	70% privately-owned houses, 28% rental houses, 22% housing association	Particular	PAW	Yes

Middelburg	Essenvelt	350		All electric				Green Deal	No
Utrecht	Overvecht (Noord)	372	Small	District heating & idividual	Combi	20% privately-owned houses 80% rental houses 67% housing association	Particular	PAW & Green Deal	Yes
Loppersum	Loppersum- Het Zandt- Westeremden	373	Small	District heating; Isolatie	Collective		Particular	PAW	Yes
Appingedam	Opwierde-Zuid	398	Small	Natural gas free; Heat Pumps isolatie nieuwbouw	Individual		Particular	PAW	Yes
Assen	Lariks West	428	Small	Natural gas free	Individual	57% privately-owned houses, 43%rental houses, 25% housing association	Particular	PAW	Yes
Tilburg	Quirijnstok	433	Small	All Electric	Collective		Corporation	PAW	Yes
Zevenaar	Angerlo	450	Small				Particular	Wijk van de Toekomst	Yes
Wageningen	Benedenbuurt	470	Small	District heating	Collective	44% particular, 9% particular rent, 46% corporation	Particular	Green Deal & PAW	Yes
Noordoostpolder	Nagele	497	Small	Solar and season energy	Collective	65% privately-owned houses 35% rental houses 22% housing association	Particular	PAW	Yes
Ermelo	West Midden	500	Small	Own choice	Individual		Corporation	Wijk van de Toekomst	Yes
Groningen	Paddepoel-Noord en Selwerd	500	Small	District heating	Collective	23% privately owned 77 % rental	Corporation	Green Deal, wijkenergieplannen & PAW	Yes

						houses 53% housing association			
Hengelo	Nijverheid	500	Small	District heating	Collective	44% privately-owned houses, 56% rental houses, 50% housing association	Particular	PAW	Yes
Katwijk	Smartpolder	500	Small	Thermal energy storage	Collective		Corporation	PAW	Yes
Middelburg	Dauwendaele	500	Small	Residual heat	Collective	38% privately-owned houses, 59% rental houses, 49% housing association	Corporation	PAW	Yes
Brunssum	Brunssum-noord	525	Small	Aqua thermal	Collective	52% privately-owned houses, 48% rental houses, 40% housing association	Particular	PAW	Yes
Eindhoven	t Ven	526	Medium		Collective	40% privately-owned houses, 54% rental houses, 41% housing association	Corporation	PAW	Yes
Pekela	Boven Pekela en de Doorsneebuurt	600	Medium	Hybrid heat pump; Solar panels; Green gas from waste streams; All-electric heat pump	Collective		Particular	PAW	Yes
Sliedrecht	Sliedrecht-Oost	600	Medium	District heating	Collective	50% privately-owned houses 48% rental	Particular	PAW	Yes

						houses 38% housing association			
Tytsjerksteradiel	Garyp	603	Medium	All electric	Individual	79% privately-owned houses 21% rental houses 13% housing association	Particular	PAW	Yes
Didam	Bloemenbuurt	750	Medium				Particular	Wijk van de Toekomst	Yes
Arnhem	Hoogkamp	752	Medium	District heating, solar energy	Collective		Particular	Wijk van de Toekomst	Yes
Amsterdam	Van Der Pekbuurt	827	Medium	District heating	Collective	7% privately-owned housese, 92% rental houses, 86% woningcorporatie	Corporation	PAW, Geen Deal	Yes
Nijmegen	Dukenburg	828	Medium	District heating from ARN	Collective	All privately-owned	Corporation	PAW	Yes
Sittard-Geleen	Limbrichterveld-Noord	847	Medium	District heating	Collective		Corporation	PAW	Yes
Den Haag	Bouwlust/Vrederust	848	Medium	District heating	Collective	25% privately-owned houses, 75% rental houses, 62% housing association	Corporation	PAW	Yes
Delfzijl	Delfzijl Noord	865	Medium	Residual heat of industry	Collective	36% privately-owned houses, 61% rental houses, 5 4% housing association	Corporation	PAW	Yes
Woerden	Schilderkwartier	900	Medium	Individual	Individual	51% particular, 4% particular rent, 45% corporation	Particular	Green Deal	Yes

Groningen	Reitdiep	918	Medium	All electiric	Individual	12% rent, 86% particular	Corporation	Wijkenergieplannen	Yes
Apeldoorn	De Parken	996	Medium				Particular	Wijk van de Toekomst	Yes
Haarlem	RamPlaankwartier	1100	Medium	Energy collective	Individual		Particulier	Green Deal	Yes
Oldambt	Nieuwolda-Wagenborgen	1200	Medium	Locally produced biogas; Hydrogen; isulation; electric heating	Collective	69% privately-owned houses	Particular	PAW	Yes
Purmerend	Overwhere-Zuid	1276	Medium	District heating Biogas Electric	Collective	More rental	Corporation	PAW, Green Deal	Yes
Apeldoorn	Loenen	1300	Medium	Combi, initiatives	Combi		Particular	Wijk van de Toekomst	Yes
Arnhem	Cranevelt-Alteveer	1607	Medium				Particular	Wijk van de Toekomst	Yes
Lochem	Laren	1647	Medium				Particular	Wijk van de Toekomst	Yes
Culemborg	Voorkoop	1740	Large				Particular	Wijk van de Toekomst	Yes
Rotterdam	Pendrecht	1900	Large	Residual heat from industry (District heating)	Collective	30% privately-owned houses 69% rental houses 56% housing association	Corporation	PAW & Green Deal	Yes
Meppel	Nieuwveense landen	2000		District heating				Green Deal	No
Groningen	Noorderplantsoendiep	2071	Large	Heat pumps, isolation	Individual	52% rent, 44% particular	Corporation	Wijkenergieplannen	Yes
Huissen	Zilverkamp	2735	Large				Particular	Wijk van de Toekomst	Yes
Arnhem	West (Lombok Heijenoord Klingelbeek)	2870	Large	District heating (research phase)	Collective		Particular	Wijk van de Toekomst	Yes

Zoetermeer	Palenstein	3000	Large	District heating; Thermal energy storage	Individual	24% particular, 2% particular rent, 74% corporation	Corporation	PAW & Green Deal	Yes
Arnhem	Spijkerbuurt	3200	Large				Particular	Wijk van de Toekomst	Yes
Nijmegen	Hengstdal	3467	Large	All electric	Individual	36% particular, 64% particular rent, 55% corporation	Corporation	Green Deal	Yes
Almere	Almere Haven	4000	Large	Thermal energy storage, all electric, existing district heating				Green Deal	No
Den Haag	Zuidwest	4000	Large	Geothermal	Collective			Green Deal	Yes
Leiden	60 wijk	5000	Large	District heating & individual	Combi		Corporation	Green Deal	Yes
Groningen	Paddepoel	5350	Large	District heating	Collective	75% rent	Corporation	PAW, Green Deal & Wijkenergieplannen	Yes
Haarlem	Schalkwijk	6000	Large	District heating	Collective		Corporation	PAW & Green Deal	Yes
Schiedam	Groenoord	6000	Large	District heating	Collective	31% particular, 12% particular rent, 56% corporation	Corporation	Green Deal	Yes
Schiedam	Nieuwland	6000	Large	District heating	Collective	30% particular, 54% corporation, 14% particular rent	Corporation	Green Deal, PAW	Yes
Delft	Voorhof Oost	8400	Large	District heating (open)	Collective	(49/32% corporation)	Particular	Green Deal	Yes
Maastricht	Centrum	11545	Large	District heating	Collective	20% particular, 52% particular rent, 23% corporation	Particular	Green Deal	Yes
Zaanstad	Zaanstad Oost	2200		District heating	Collective			Green Deal	Yes

Alkmaar		Bio energy; District heating	Collective approach		Green Deal	Yes
Boxtel	Selissen	District heating; residual heat; individual heat pumps			Green Deal	No
Leeuwarden	Yet to choose	Geothermal			Green Deal	Yes
Leidschendam-Voorburg	Klein Paspoelpolder				Green Deal	No
Noord-Oostpolder	Emmelhage	Heat pumps			Green Deal	No
Groningen	Zilverackers	Zero energy homes			Wijkenergieplannen	No
Culemborg	Achter Het Zand		Collective	Particular	Wijk van de Toekomst & Green Deal	Yes
Zutphen	Voorsteralleekwartier-Noord, Berkelpark	Not clear yet		Particular	Wijk van de Toekomst	Yes

*Table 10: Overview of experimental districts in the four programs (**bron**).*

Appendix 2: Overview of newspaper articles and governmental documents

Newspaper articles:

Reference:	*Title:*	*Newspaper:*	*Date (dd-mm-yyy):*	*Search term:*
NP1	Zutphen heeft nu een Wijk van de Toekomst	De Stentor	26-6-2017	Wijk van de Toekomst
NP2	Bijna geen energiekosten in eerste 'waterstofhuis: 'Dit is de wijk van de Toekomst	Algemeen Dagblad	12-9-2019	Wijk van de Toekomst
NP3	Hoe ziet wijk van de Toekomst eruit? Kinderen komen met ideeen	Aalten vooruit	11-3-2017	Wijk van de Toekomst
NP4	Heveadorp wil best verder zonder aardgas, maar maakt zich zorgen over de kosten	De Gelderlander	18-2-2020	Wijk van de Toekomst
NP5	Met deelfiets naar moestuin in nieuwe hippe wijk De Tippe	De Stentor	22-3-2020	Wijk van de Toekomst
NP6	Wijchen-Zuid aardgasvrij' komt stap dichterbij	Algemeen Dagblad	12-12-2019	Wijk van de Toekomst
NP7	Wijchense wijk van het gas af	De Gelderlander	12-12-2019	Wijk van de Toekomst
NP8	Niemand verplicht mee te doen	De Gelderlander	12-12-2019	Wijk van de Toekomst
NP9	Leren koken zonder aardgas	De Stentor	17-12-2018	Wijk van de Toekomst
NP10	Laren wil vanaf 2023 van het aardgas af	De Stentor	8-1-2019	Wijk van de Toekomst
NP11	Nuchterheid voorop in Ermelo-West; Serie Warme wijken	NRC Handelsblad	11-10-2019	Wijk van de Toekomst
NP12	Nuchterheid voorop in Ermelo-West; Serie Warme wijken	NRC Next	11-10-2019	Wijk van de Toekomst
NP13	Bewoner eerste 'waterstofhuis' Nederland heeft dadelijk nauwelijks energiekosten	Algemeen Dagblad	11-9-2019	Wijk van de Toekomst
NP14	Aardgasvrije woningen	Ermelo's Weekblad	24-7-2019	Wijk van de Toekomst
NP15	Maldenaren denken mee over duurzaam maken van hun wijken	Algemeen Dagblad	3-12-2019	Wijk van de Toekomst
NP16	Werken aan duurzame wijk in Malden	De Gelderlander	4-12-2019	Wijk van de Toekomst
NP17	Flierderweg vanaf maandag afgesloten	De Stentor	13-11-2019	Wijk van de Toekomst
NP18	Bijna geen energiekosten in eerste 'waterstofhuis: 'Dit is de wijk van de Toekomst	Algemeen Dagblad	12-9-2019	Wijk van de Toekomst
NP19	Eigen vaart is goud waard	Het Financieele Dagblad	2-2-2019	Wijk van de Toekomst
NP20	Proefwoning met infraroodkachel	De Stentor	12-10-2019	Wijk van de Toekomst

NP21	uit en gaan	De Brug Nijmegen	12-6-2019	Wijk van de Toekomst
NP22	Kort nieuws	De Brug Nijmegen	29-3-2017	Wijk van de Toekomst
NP23	Op naar een gasvrij Laren Informatieavond in kerk	Berkelbode	19-12-2018	Wijk van de Toekomst
NP24	Kinderen OBS De Wereld zitten vol duurzame ideeen	Stad Wageningen	15-3-2017	Wijk van de Toekomst
NP25	Laren wil voorloper zijn met gasvrij maken	De Stentor	19-12-2018	Wijk van de Toekomst
NP26	Haveadorp wil best verder zonder aardgas, maar maakt zich zorgen over de kosten	WebNews	18-2-2020	Wijk van de Toekomst
NP27	Maldenaren denken mee over duurzaam maken van hun wijken	WebNews	3-12-2019	Wijk van de Toekomst
NP28	Subsidie voor aardgasvrije wijken	Groot Rijswijk	20-2-2020	Aardgasvrije Wijken
NP29	Gemeenten gaan voor aardgasvrije wijken met Europees geld	Gouwe Koerier	19-2-2020	Aardgasvrije Wijken
NP30	Aardgasvrije wijken	De Nieuwsbode Heuvelrug	29-3-2017	Aardgasvrije Wijken
NP31	De nieuwe Plasterk die oude Plasterk afdroogt; column	NRC Handelsblad	27-2-2020	Aardgasvrije Wijken
NP32	ENERGIE	Het Financieele Dagblad	29-2-2020	Aardgasvrije Wijken
NP33	In Terheijden zijn ze baas over hun eigen energie	BN/DeStem	29-2-2020	Aardgasvrije Wijken
NP34	Ze maken er een feestje van'	BN/DeStem	29-2-2020	Aardgasvrije Wijken
NP35	Aandgasvrije wijken	De Telegraaf	10-3-2018	Aardgasvrije Wijken
NP36	Plan voor aardgasvrije wijken in 2020 klaar'	Dagblad van het Noorden	17-12-2019	Aardgasvrije Wijken
NP37	Flats Parkweg tegen de vlakte	AD/Rotterdams Dagblad	27-2-2020	Aardgasvrije Wijken
NP38	Tien wijken mogelijk snel van gas af Gemeenten hopen op subsidie EIB	De Posthoorn, Laak	19-2-2020	Aardgasvrije Wijken
NP39	Wehouder geeft startsein voor 'aardgasvrije wijken'	AD/Rotterdams Dagblad	1-4-2019	Aardgasvrije Wijken
NP40	Subsidie voor 'proeftuinen' aardgasvrije wijken	Nederlands Dagblad	2-10-2018	Aardgasvrije Wijken
NP41	Nieuwe warmtevisie is concreet plan voor aardgasvrije wijken	De Stentor	27-9-2019	Aardgasvrije Wijken
NP42	GL stelt vragen over aardgasvrije wijken	De Twentsche Courant Tubantia	27-4-2018	Aardgasvrije Wijken
NP43	Aardgasvrij met Europees geld? Energietransitie in Groenoord	Het Nieuwe Stadsblad	19-2-2020	Aardgasvrije Wijken

NP44	School en woningstsichting haken aan bij aardgasvrij Berg	Dagblad de Limburger	13-2-2020	Aardgasvrije Wijken
NP45	Arnhem krijgt miljoenen voor aardgasvrije wijken	De Gelderlander	25-5-2019	Aardgasvrije Wijken
NP46	Schiedam dingt mee naar 'gasgeld' voor Groenoord	AD/Rotterdams Dagblad	15-2-2020	Aardgasvrije Wijken
NP47	Vergroning woning wordt duurder, maar niemand kent kosten	AD/Groene Hart	15-2-2020	Aardgasvrije Wijken
NP48	Onderzoek aardgasvrije wijken	De Twentsche Courant Tubantia	29-8-2018	Aardgasvrije Wijken
NP49	Lekker nasi maken met Bas en Ramon	De Telegraaf	14-2-2020	Aardgasvrije Wijken
NP50	PvdA: Doe mee aan landelijke proef aardgasvrije wijken	De Twentsche Courant Tubantia	11-4-2018	Aardgasvrije Wijken
NP51	Culemborg zet handtekening onder Green Deal aardgasvrije wijken	De Zakengids	15-3-2017	Aardgasvrije Wijken
NP52	Utrecht gaat voorop bij aardgasvrije wijken	De Telegraf	9-3-2017	Aardgasvrije Wijken
NP53	Huizen moeten van het gas af, maar hoe?	Leeuwarder Courant	12-2-2020	Aardgasvrije Wijken
NP54	Van gas los' is geen ideologie	Dagblad de Limburger	12-2-2020	Aardgasvrije Wijken
NP55	Van het gas af, Kamer wil duidelijkheid	Dagblad de Limburger	12-2-2020	Aardgasvrije Wijken
NP56	Van het gas af, maar wie weet hoe?	AD/Groene Hart	12-2-2020	Aardgasvrije Wijken
NP57	Sturen in onzekerheid	de Volkskrant	24-1-2020	Aardgasvrije Wijken
NP58	Geef gemeenten weer ruimte voor politiek	de Volkskrant	8-2-2020	Aardgasvrije Wijken
NP59	We moeten hier wél van het gas af, stap voor stap;	AD/Rivierenland	7-2-2020	Aardgasvrije Wijken
NP60	Energie-armoede dreigt in Nieuwstraat	De Twentsche Courant Tubantia	6-2-2020	Aardgasvrije Wijken
NP61	Meent moet aardgasvrije wijk worden	De Gooi- en Eemlander	25-2-2020	Aardgasvrije Wijken
NP62	Onderzoek duurzame wijken uitgebreid met 100.000 gasaansluitingen ; Gas Dit jaar moet onderzoek uitwijzen of er nog	NRC Handelsblad	25-1-2020	Aardgasvrije Wijken
NP63	Over op elektrisch koken met stappenplan en 500 euro subsidie!	De Havenloods Alexander	8-1-2020	Aardgasvrije Wijken
NP64	Acht miljoen huizen van het gas af: doe dat maar even'	Trouw	28-10-2010	Aardgasvrije Wijken
NP65	Laber besluit over Hoornes	Leidsch Dagblad	13-11-2019	Aardgasvrije Wijken

NP66	Extra geld voor Hoornes	Leidsch Dagblad	19-12-2019	Aardgasvrije Wijken
NP67	Tweede proef met aardgasvrij-wijk	De Telegraaf	6-12-2019	Aardgasvrije Wijken
NP68	Groninger Huis zoekt nieuwe directeur	Dagblad van het Noorden	26-12-2019	Aardgasvrije Wijken
NP69	Boekel is tegen klimaatakkoord	Brabants Dagblad	9-11-2019	Aardgasvrije Wijken
NP70	33 miljoen voor proef aardgasvrij wonen	Dagblad van het Noorden	2-10-2018	Aardgasvrije Wijken
NP71	Samen van het gas af	Het Financieele Dagblad	25-8-2018	Aardgasvrije Wijken
NP72	Bijeenkomst over energie verplaatst	Dagblad van het Noorden	6-11-2019	Aardgasvrije Wijken
NP73	Een aardgasvrije wijk	Dagblad de Limburger	2-11-2019	Aardgasvrije Wijken
NP74	Nieuw elan in oude mijnwerkerswijk	Dagblad de Limburger	2-11-2019	Aardgasvrije Wijken
NP75	Nieuwe kans op 'gasvrij'-subsidie	Noordhollands Dagblad	23-11-2018	Aardgasvrije Wijken
NP76	eld nodig voor wijk zonder gas	AD/Haagsche Courant	21-9-2018	Aardgasvrije Wijken
NP77	800 flats gaan van het gas af	BN/DeStem	22-6-2018	Aardgasvrije Wijken
NP78	Flats in Roosendaal van gas af	BN/DeStem	22-6-2018	Aardgasvrije Wijken
NP79	Bewust gebruik bij aardwarmte'	AD/Haagsche Courant	9-9-2017	Aardgasvrije Wijken
NP80	Geldgebrek frustreert energieproject Berkum	De Stentor	10-9-2019	Aardgasvrije Wijken
NP81	Alternatieven zijn er, dus laten we afscheid nemen van aardgas	Trouw	5-4-2017	Aardgasvrije Wijken
NP82	Huysackers wordt eerste aardgasvrije wijk in regio	Eindhovens Dagblad	9-3-2017	Aardgasvrije Wijken
NP83	Provincie tegen rijk: 'Niet boren naar gas'	AD/Groene Hart	6-4-2017	Aardgasvrije Wijken
NP84	Terneuzen voorlopig niet aardgasvrij	BN/DeStem	26-6-2017	Aardgasvrije Wijken
NP85	Kort nieuws en activiteiten in regio Den Bosch	Stadsblad Den Bosch	28-8-2019	Aardgasvrije Wijken
NP86	Halsema's openheid was te laat'	Het Parool	15-8-2019	Aardgasvrije Wijken
NP87	Deal: 230.000 huizen, en niet te duur	Het Parool	5-7-2019	Aardgasvrije Wijken
NP88	Hulp bij beter plan aardgasvrije wijk	De Stentor	4-7-2019	Aardgasvrije Wijken

NP89	Wees een nuchtere klimaatrentmeester	Reformatorisch Dagblad	13-7-2019	Aardgasvrije Wijken
NP90	Meer woningen en aanpak excessen	De Brug	26-6-2019	Aardgasvrije Wijken
NP91	Vijf buurten als proeftuin voor aardgasloos bestaan	Brabants Dagblad	7-6-2019	Aardgasvrije Wijken
NP92	'De Bezetting van de stal in Boxtel was een selfiefeest"	Reformatorisch Dagblad	20-5-2019	Aardgasvrije Wijken
NP93	De revolutie van onderop	Trouw	20-5-2019	Aardgasvrije Wijken
NP94	Energietransitie RTVRijnstreek TV	Stad Wageningen	22-5-2019	Aardgasvrije Wijken
NP95	Goedbedoelde initiatieven	Eindhovens Dagblad	20-4-2019	Aardgasvrije Wijken
NP96	Hengelo aardgasvrij, wijk De Nijverheid is daar als eerste bij	Hengelo's Weekblad	23-4-2019	Aardgasvrije Wijken
NP97	Ik zou mezelf nooit vergeven als het misgaat'	Leidsch Dagblad	19-4-2019	Aardgasvrije Wijken
NP98	Dit zeggen anderen	De Telegraaf	6-4-2019	Aardgasvrije Wijken
NP99	Energietransitie Geen subsidies, wel goedkope leningen voor geisoleerde, aardgasvrije huizen	NRC.NEXT	30-3-2019	Aardgasvrije Wijken
NP100	Waarom we van het aardgas gaan	AD/Rotterdams Dagblad	28-3-2019	Aardgasvrije Wijken
NP101	Zwolle	De Twentsche Courant Tubantia	16-3-2019	Aardgasvrije Wijken
NP102	Subsidie huiseigenaren om woning op Zuid samen te voegen of te vergroten	NRC Handelsblad	9-2-2019	Aardgasvrije Wijken
NP103	Aardgasvrij: wat betekent dat?	Metro	2-12-2018	Aardgasvrije Wijken
NP104	Berkum grijpt weer naast energiegeld	De Stentor	4-1-2019	Aardgasvrije Wijken
NP105	Dauwendaele is proeftuin voor Zeeland	BN/DeStem	22-12-2018	Aardgasvrije Wijken
NP106	Er moet weer bezuinigd worden	Het Parool	5-1-2019	Aardgasvrije Wijken
NP107	Klimaatprijs komt terecht in de NOP	De Stentor	8-12-2018	Aardgasvrije Wijken
NP108	Leren koken zonder aardgas	De Stentor	17-12-2018	Aardgasvrije Wijken
NP109	PERSONALIA	Het Financieele Dagblad	27-12-2018	Aardgasvrije Wijken
NP110	Rotterdam gaat voor 100% aardgasvrij	Metro	2-12-2018	Aardgasvrije Wijken
NP111	Situatie in proeftuin Berkum is zrogelijk'	De Stentor	8-1-2019	Aardgasvrije Wijken
NP112	Vragen stellen over reizen met het OV	De Stentor	10-1-2019	Aardgasvrije Wijken

NP113	Wat rest er van het Klimaatakkoord?	Trouw	21-12-2018	Aardgasvrije Wijken
NP114	Aardgasvrij: wat betekent dat?	Metro	17-10-2018	Aardgasvrije Wijken
NP115	Coach voor lagere nota energie	Dagblad van het Noorden	23-10-2018	Aardgasvrije Wijken
NP116	Duurzaam kan óók in Wierden	De Twentsche Courant Tubantia	3-11-2018	Aardgasvrije Wijken
NP117	Effecten van klimaatplan onderschat'	Provinciale Zeeuwse Courant	1-11-2018	Aardgasvrije Wijken
NP118	Giebelend meisje ziet door raam wat ze al dacht: daar zit de koning	AD/Utrechts Nieuwsblad	18-10-2018	Aardgasvrije Wijken
NP119	Oud wijkt voor gasloos	AD/Haagsche Courant	23-10-2018	Aardgasvrije Wijken
NP120	Politiek onderschat negatieve effecten klimaatplannen'	Leeuwarder Courant	1-11-2018	Aardgasvrije Wijken
NP121	Politiek Roermond na zes jaar in rustiger vaarwater	Dagblad de Limburger	9-11-2018	Aardgasvrije Wijken
NP122	Rotterdam gaat voor 100% aardgasvrij	Metro	17-10-2018	Aardgasvrije Wijken
NP123	Wals niet over mensen heen met klimaatmaatregelen'	Nederlands Dagblad	13-10-2018	Aardgasvrije Wijken
NP124	6 miljoen voor aardgasvrije wijk Palenstein wordt proeftuin	Streekblad Zoetermeer	4-10-2018	Aardgasvrije Wijken
NP125	Aanpassingen bij Brokxlaan	Stadsnieuws Woensdag	3-10-2018	Aardgasvrije Wijken
NP126	Aardgasvrij	De Brug Nijmegen	3-10-2018	Aardgasvrije Wijken
NP127	Aardgasvrij is kostbaar	AD/Haagsche Courant	8-9-2018	Aardgasvrije Wijken
NP128	Assen krijgt geld voro gasvrij maken wijk Lariks	Dagblad van het Noorden	29-9-2018	Aardgasvrije Wijken
NP129	Dukenburg 'gaat van het gas' Rijkssubsidie voor 'proeftuin'	De Brug Nijmegen	3-10-2018	Aardgasvrije Wijken
NP130	Duurzaam gaat nog moeizaam	De Twentsche Courant Tubantia	18-9-2018	Aardgasvrije Wijken
NP131	Geen geld van rijk voor peftuin	De Twentsche Courant Tubantia	4-10-2018	Aardgasvrije Wijken
NP132	Geen geld voor aardgasvrije wijk	BN/DeStem	2-10-2018	Aardgasvrije Wijken
NP133	Geen subsidie? Plan 'gasloos' niet van tafel	Brabants Dagblad	4-10-2018	Aardgasvrije Wijken

NP134	Hier geeft Rotterdam het geld aan uit; Begroting De eerste begroting van het nieuwe college: waar gaat het geld naartoe?	NRC Handelsblad	6-10-2018	Aardgasvrije Wijken
NP135	Inspraak beperkt zich tot rotprobleempjes	Het Parool	22-8-2018	Aardgasvrije Wijken
NP136	Kabinet helpt Katwijk, Purmerend van gas af	Haarlems Dagblad	2-10-2018	Aardgasvrije Wijken
NP137	Klimaatbeleid? In de gemeente loopt het zo'n vaart niet; Klimaatbeleid In de gemeenten loopt het niet zo'n vaart met de ambitieuze plannen van het kabinet Economie	NRC.NEXT	24-9-2018	Aardgasvrije Wijken
NP138	Maak alternatief voor aardgas aantrekkelijk'	Nederlands Dagblad	4-10-2018	Aardgasvrije Wijken
NP139	Miljoenen voor aardgasvrij Garyp	Leeuwarder Courant	28-9-2018	Aardgasvrije Wijken
NP140	NIEMAND IS EEN EILAND	Dagblad van het Noorden	22-9-2018	Aardgasvrije Wijken
NP141	Overeenkomst voor duurzaam Zutphen	De Stentor	22-8-2018	Aardgasvrije Wijken
NP142	Plan Vortum-Mullem gasvrij kan prullenbak in	De Gelderlander	28-9-2018	Aardgasvrije Wijken
NP143	Rijk wil bijdragen aan gasloze wijk Palenstein	AD/Haagsche Courant	29-9-2019	Aardgasvrije Wijken
NP144	Subsidie voor aardgasvrij centrum van Terheijden	BN/DeStem	2-10-2018	Aardgasvrije Wijken
NP145	Subsidie voor gasvrij Limbrichterveld	Dagblad de Limburger	29-9-2018	Aardgasvrije Wijken
NP146	Vortum-Mullem niet gekozen Voor proeftuin aardgasvrij	Boxmeers Weekblad	2-10-2018	Aardgasvrije Wijken
NP147	Warmtetransitie	De Schakel	19-9-2018	Aardgasvrije Wijken
NP148	Wijk aardgasvrije proeftuin	De Telegraaf	28-9-2018	Aardgasvrije Wijken
NP149	Binnen drie jaar warmteplan Oldenzaal	De Twentsche Courant Tubantia	4-8-2018	Aardgasvrije Wijken
NP150	Ede wil 5,5 miljoen voor aardgasvrije woningen	De Gelderlander	5-7-2018	Aardgasvrije Wijken
NP151	Hopen op 5,5 miojen warmtenet Meerwijk	Haarlems Dagblad	10-5-2018	Aardgasvrije Wijken
NP152	Klimaatakkoord: Mienskip centraal	Leeuwarder Courant	11-7-2018	Aardgasvrije Wijken
NP153	Klopvaart nu duurzamer	Stadsblad Utrecht	25-7-2018	Aardgasvrije Wijken
NP154	Mogelijk meer woningen van het gas in Brunssum	Dagblad de Limburger	4-7-2018	Aardgasvrije Wijken
NP155	Ook Schiermonnikoog wil van het aardgas af	Leeuwarder Courant	10-8-2018	Aardgasvrije Wijken
NP156	Ook Schiermonnikoog wil van het aardgas af	Leeuwarder Courant	10-8-2018	Aardgasvrije Wijken
NP157	Op naar Aardgasloos Hof van Twente	De Twentsche Courant Tubantia	18-6-2018	Aardgasvrije Wijken

NP158	Planestein gasvrij kost miljoenen	AD/Haagsche Courant	22-6-2018	Aardgasvrije Wijken
NP159	Rioolwaterzuivering wordt energiebron	De Stentor	30-6-2018	Aardgasvrije Wijken
NP160	Vijf Friese aanvragen voor gasvrije proeftuin	Leeuwarder Courant	6-7-2018	Aardgasvrije Wijken
NP161	Zaanstad wil geld warmtenet	Noordhollands Dagblad	4-7-2018	Aardgasvrije Wijken
NP162	Brainport moet zich op duurzaamheid richten	Eindhovens Dagblad	25-5-2018	Aardgasvrije Wijken
NP163	Groen licht voor aardgasloos	Noordhollands Dagblad	2-6-2018	Aardgasvrije Wijken
NP164	Kort	De Stentor	13-6-2018	Aardgasvrije Wijken
NP165	Noordwijkse woonwijken voorlopig niet van gas af	Leidsch Dagblad	2-5-2018	Aardgasvrije Wijken
NP166	Regio enthousiast over proef gasvrije wijken	AD/Amersfoortse Courant	6-4-2018	Aardgasvrije Wijken
NP167	Van gas los komt dichtbij	Trouw	12-4-2018	Aardgasvrije Wijken
NP168	Vooruit met dat milieu	Het Parool	7-4-2018	Aardgasvrije Wijken
NP169	Wijk Gageldonk West moet aardgasvrije proeftuin worden	BN/DeStem	30-5-2018	Aardgasvrije Wijken
NP170	Amsterdammers, dat aardgas gaat echt verdwijnen	NRC.NEXT	24-2-2018	Aardgasvrije Wijken
NP171	Extra investeringen in regio Arnhem-Nijmegen	De Brug Nijmegen	7-2-2018	Aardgasvrije Wijken
NP172	Groningen: nu nog een milieuzone	Dagblad van het Noorden	28-2-2018	Aardgasvrije Wijken
NP173	Hoorn mag zich 'lichtgroen' noemen, maar meer ook niet	Noordhollands Dagblad	7-3-2018	Aardgasvrije Wijken
NP174	Rijk trekt de knip voor beter klimaat	Reformatorisch Dagblad	10-3-2018	Aardgasvrije Wijken
NP175	Voor aardwarmte gaat Vathorst liefst vier kilometer diep	AD/Amersfoortse Courant	16-3-2018	Aardgasvrije Wijken
NP176	Voor D66 Wijdemeren is duurzaamheid topprioriteit	De Gooi- en Eemlander	21-2-2018	Aardgasvrije Wijken
NP177	Aardgasvrije stad stapje dichterbij	AD/Haagsche Courant	30-8-2017	Aardgasvrije Wijken
NP178	Aardgasvrij gaat niet vanzelf	NRC Handelsblad	15-9-2017	Aardgasvrije Wijken
NP179	Als de koop van je huis ineens op losse schroeven staat	Streekblad	27-11-2017	Aardgasvrije Wijken

NP180	Niet meer op aardgas	De Brug	2-8-2017	Aardgasvrije Wijken
NP181	Zelfbouwwijk gaat voor all electric	Metro	26-9-2017	Aardgasvrije Wijken
NP182	Aardgasloos Leiden stap dichterbij	Leidsch Dagblad	9-3-2017	Aardgasvrije Wijken
NP183	Aardgasvrije wijk op komst	Brabants Dagblad	9-2-2017	Aardgasvrije Wijken
NP184	Bedrijvenplatform	BN/DeStem	21-4-2017	Aardgasvrije Wijken
NP185	Domburg krijgt aardgasvrije wijk	Provinciale Zeeuwse Courant	9-2-2017	Aardgasvrije Wijken
NP186	Eerste woonwijk zonder aardgas	Woerdense Courant	12-4-2017	Aardgasvrije Wijken
NP187	Gasloze stad en stadsdichter Amal Karam in Nieuwscafé	De Gelderlander	9-3-2017	Aardgasvrije Wijken
NP188	Glasvezel in loze leidingen	De Telegraaf	9-6-2017	Aardgasvrije Wijken
NP189	GroenLinks voor nul op de meter	Provinciale Zeeuwse Courant	7-6-2017	Aardgasvrije Wijken
NP190	Investeren maar	Nederlands Dagblad	15-3-2017	Aardgasvrije Wijken
NP191	Leeuwarden wil aardwarmte	Leeuwarder Courant	2-2-2017	Aardgasvrije Wijken
NP192	Lokale overheden vragen nieuw kabinet mee te investeren in duurzaamheid	Het Financieele Dagblad	11-3-2017	Aardgasvrije Wijken
NP193	Loze gasleidingen voor glasvezelnetwrek	De Telegraaf	9-6-2017	Aardgasvrije Wijken
NP194	Mis het niet Gelderlander Nieuwscafé	De Gelderlander	10-3-2017	Aardgasvrije Wijken
NP195	Rotterdam wil af van aardgas	AD/Rotterdams Dagblad	7-6-2017	Aardgasvrije Wijken
NP196	Zonder aardgas zit bijna iedereen in de kou	Leeuwarder Courant	14-2-2017	Aardgasvrije Wijken
NP197	‘We schrokken eerst van de kosten, maar zien ze nu dalen’	NRC Handelsblad	3-12-2019	Wijk van de Toekomst

Table 11: Overview of used newspaper articles

Governmental documents:

Reference:	*Title:*	*Date:*
GO1	Evaluatie selectieproces 'Proeftuinen aardgasvrije wijken'	21-3-2019
GO2	Integrale visie op de woningmarkt	29-5-2019
GO3	Aardgasvrij in 2019	22-11-2018
GO4	Duurzame ontwikkeling en beleid	28-8-2019
GO5	Kabinetsaanpak Klimaatbeleid	30-10-2019
GO6	Rapportage Reflectieve Monitor 2019	22-1-2020
GO7	Voortgangsrapportage Overlegorgaan Fysieke Leefomgeving	16-5-2019
GO8	Jaarverslag en slotwet Ministerie van Economische Zaken en Diergezondheidsfonds 2017	16-5-2018
GO9	Kortetermijnraming voor emissies en energie in 2020	25-1-2019
GO10	Tweede Nederlandse SDG-rapportage	1-5-2018
GO11	De staat van ons water	x-5-2018
GO12	Praktijkervaringen Crisis- en herstelwet	18-6-2018
GO13	Milieueffectrapport Nationale Omgevingsvisie	6-6-2019
GO14	Vaststelling van de begrotingsstaten van het Ministerie van Economische Zaken en Klimaat (XIII) voor het jaar 2020	16-4-2020
GO15	Kabinetsaanpak Klimaatbeleid	12-6-2018
GO16	Vaststelling van de begrotingsstaten van het Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (VII) voor het jaar 2020	10-12-2019
GO17	Resultaten verantwoordingsonderzoek 2018 Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (VII)	4-6-2019
GO18	Analyse van het voorstel voor hoofdlijnen van het klimaatakkoord	28-9-2019
GO19	Startdocument Nationaal Programma Groningen	5-10-2018
GO20	Motie van het lid Ronnes C.S.	12-11-2018
GO21	Vragen van de commissie EZK aan het Planbureau voor de Leefomgeving (PBL) over de doorrekeningen van het ontwerp-Klimaatakkoord (bijlage bij Kamerstuk 32813, nr. 306)	16-5-2019
GO22	Doorrekening Ontwerp-Klimaatakkoord	x-3-2019
GO23	Regio Deal Den Haag Zuidwest	15-7-2019

GO24	Regio Deal ZaanIJ	13-12-2019
GO25	Regio Deal Rotterdam	9-12-2019
GO26	Discussie notitie Bouwgroep Dijkstra Draisma	X-3-2019
GO27	Woondeal zuidelijke Randstad	5-6-2019
GO28	Vaststelling van de begrotingsstaaten van het Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (VII) voor het jaar 2020	17-9-2019
GO29	Duurzame ontwikkeling en beleid [letter of government]	20-12-2019
GO30	Woondeal BZK-Stedelijk gebied Eindhoven-provincie Noord-Brabant	7-3-2019
GO31	Grondstofvoorzieningszekerheid Integrale visie op de woningmarkt	8-10-2019
GO32	Integrale visie op de woningmarkt	13-2-2020
GO33	Conceptverslag Klimaatakkoord in de gebouwde omgeving	20-2-2020
GO34	Duurzame ontwikkeling en beleid verslag van een algemeen overleg	21-3-2019
GO35	Woondeal Regio Utrecht	24-6-2019
GO36	Voorgangsrapportage operatie Inzicht in kwaliteit	27-9-2019
GO37	BIJLAGE - resultaten Gebouwde omgeving	1-1-2020
GO38	Bijlage - overzicht regelingen voor het verduurzamen van woningen	17-12-2019
GO39	Wijziging van de begrotingsstaat van het gemeentefonds (B) voor het jaar 2019 (wijziging samenhangende met de Najaarsnota)	26-11-2019
GO40	VNG position paper t.b.v. Rondetafelgesprek Omgevingswet 11 december	9-12-2019
GO41	Duurzame ontwikkeling en belie	29-10-2019
GO42	Agenda	1-11-2019
GO43	Regio Deal Parkstad Limburg	15-7-2019
GO44	Tweede herziene convocatie i.v.m. toevoeging nieuw agendapunt	3-7-2019
GO45	Vaststelling van de begrotingsstaat van het gemeentefonds (B) voor het jaar 2020 - memoire van toelichting	17-9-2019

Table 12: Overview of used governmental documents.

Appendix 3: Interview guides

Interview guide for participants in experimental programs

Dutch:

Algemeen:

1) Bent u betrokken geweest in het ontwerpen van het plan van aanpak voor de aardgasvrije wijk?
2) Welke andere partijen zijn bij de transitie in deze wijk betrokken?
3) Hoe is samenwerking georganiseert?
4) Heeft u ook kennis van andere overkopelende programma's of initiatieven die zich bezig houden met aardgasvrije (woon)wijken? Zijn er partijen betrokken bij zowel de wijk uw wijk als bij andere experiments?
5) Hoe draagt het programma bij aan uw lokale situatie?
6) Hoe is er een keuze gemaakt voor een technologie?

Doel van de wijk:

7) Is er een specifiek doel gesteld voor uw wijk? Hoe is dat doel gedefinieerd en welke partijen waren hierbij betrokken?
8) Welke partijen hadden hierin de meeste invloed?

Gang van zaken binnen de wijk:

9) Heeft u een duidelijk plan van aanpak voor uw wijk? Is hierin ook een planning opgenomen en loopt u nu op schema?
10) Welke factoren bevorderen of hinderen de voortgang in de wijk? Denk hierbij aan middelen (financieel/mankracht), vrijheid om de plannen uit te voeren, (tegenstrijdig) ander beleid/belangen etc.).
11) Zijn er ingeplande momenten van reflectie en evaluatie?

Interactie met andere partijen/gemeenten/overheden:

12) Welke kennis heeft u gebruikt voor uw aardgasvrije wijk? Denk aan kennis van andere gemeenten/experimenten/onderzoeksbureaus/universiteiten of andere bronnen.
13) Is er voldoende mogelijkheid om eventueel de technologie, het plan of de strategie aan te passen als een andere strategie beter lijkt te passen? Waarom?
14) Heeft u het gevoel dat u ook kritische opmerkingen over het plan of het uitvoeren hiervan kunt maken?
15) Heeft u georganiseerd contact met andere gemeenten of andere overheden (provinciaal/nationaal) hierover?
16) Wat heeft u tot nu toe geleerd? Heeft u genoeg mogelijkheden om opgedane kennis te delen met anderen? Heeft u het gevoel dat hier ook echt wat mee gedaan wordt?
17) Wordt dit programma serieus genomen door andere wijken/gemeenten? Hoe beïnvloedt het zijn omgeving?

English:

General:

1) Have you been involved in the design phase of the experiment?
2) Which other actors have been involved in this phase?
3) How is collaboration organized?
4) Do you know other experimental programs? Are there actors involved in both your experiment and other experiments or programs?
5) How does the experimental program contribute to your local situation?
6) How has a technology been chosen?

Goal of the district:

1) Has a specific goal been set for your district?
2) Which parties have been most influential during goal setting?

Progress in the district:

1) Is a clear action plan made for your district? Does it include a time schedule, and are you on track?
2) Which factors hinder or promote progress in the district? Consider resources (financial/HR), freedom to execute plans, (contrasting) other policy/interests etc..
3) Have you scheduled moments of reflection and evaluation?

Interaction with other actors/districts/municipalities/governments:

1) Which knowledge did you use for your natural gas free district? Think of knowledge from universities, other municipalities, research agencies or others.
2) Are you experiencing sufficient possibilities to adjust the technology, plan or strategy if a better alternative is available? Why?
3) Do you feel like being able to make some critical remarks about the plan or execution of the plan?
4) Are you having organized contact with other municipalities or governments (province/national level) about the experiment?
5) What did you learn so far? Do you have enough possibilities to share learnt lessons with others? Do you feel like others adopt your lessons?
6) Is this program/experiment taken seriously by other districts/municipalities? How does it influence its environment?

Interview guide for program leaders

Dutch:

Algemeen:

Hoe verhoudt <programma van interviewee> zich tot andere programma's?

Design van het programma:

1) Hoe werd het programma geïnitieerd?
2) Wat is het doel van het programma?
3) Waar bestaat het programma uit?
4) Hoe zijn betrokken wijken geselecteerd/geworven?
5) Hoe is onderscheid gemaakt tussen technologieën?
6) Wat wordt verwacht van deelnemende wijken?
7) Wat biedt het programma aan deelnemende wijken?
8) Stellen de wijken hun eigen doelen? Hoe doen ze dat?

Voortgang in de wijken:

1) Wordt er gemonitord of wijken de gestelde doelen halen?
2) Welke factoren versnellen of beperken het proces van aardgasvrije wijken? '
3) Wat doet u met de bekende factoren?
4) Wat betekenen deze factoren voor wijken die de komende jaren dit proces moeten opstarten?

Extern succes:

1) Observeert u dat wijken informatie delen onderling? Is dit gefaciliteerd in het programma?
2) Hoe wordt potentie voor opschalen meegenomen inde selectie van de wijken?
3) Is er veel technologische/strategische verscheidenheid onder de gemeenten?
4) Hebben gemeenten de mogelijkheid om de plannen eventueel aan te passen tijdens het proces? Gebeurt dit veel?
5) Merkt u dat wijken die niet deelnemen aan Wijk van de Toekomst zich bezig houden met de voortgang van de deelnemende wijken?
6) Wat heeft u geleerd van de deelnemende wijken?
7) Wat heeft de overheid geleerd van de deelnemende wijken?
8) Hoe ervaart u de reputatie van het programma?

English:

General:

1) How does <program of interviewee> relate to other experimental programs?

Design of the program:

1) How is the program initiated?
2) What is the goal of the program?
3) What does the program consist of?
4) How are involved districts selected/gathered?
5) How has been distinguished between technologies?
6) What is expected of participating districts?
7) What does the program offer to participating districts?
8) Do districts have their own targets? How do they set them?

Progress in the districts:

1) Does the program monitor whether or not districts achieve the set goals?
2) Which factors promote or hinder the progress in the districts?
3) How are you dealing with these factors?
4) What do these factors mean for districts that will have to start the transition in the next years?

External success:

1) Do you observe that districts share information amongst each other? Does the program facilitate this?
2) How has potential for scaling up been taken into account when selecting the districts?
3) Is there a lot of technological/strategic diversity amongst municipalities?
4) Is it possible for municipalities to eventually adjust plans during the process? Is this happening often?
5) What did you learn from the participating districts?
6) What did the national government learn from the participating districts?
7) How do you experience the reputation of the program?

Appendix 4: Coding scheme

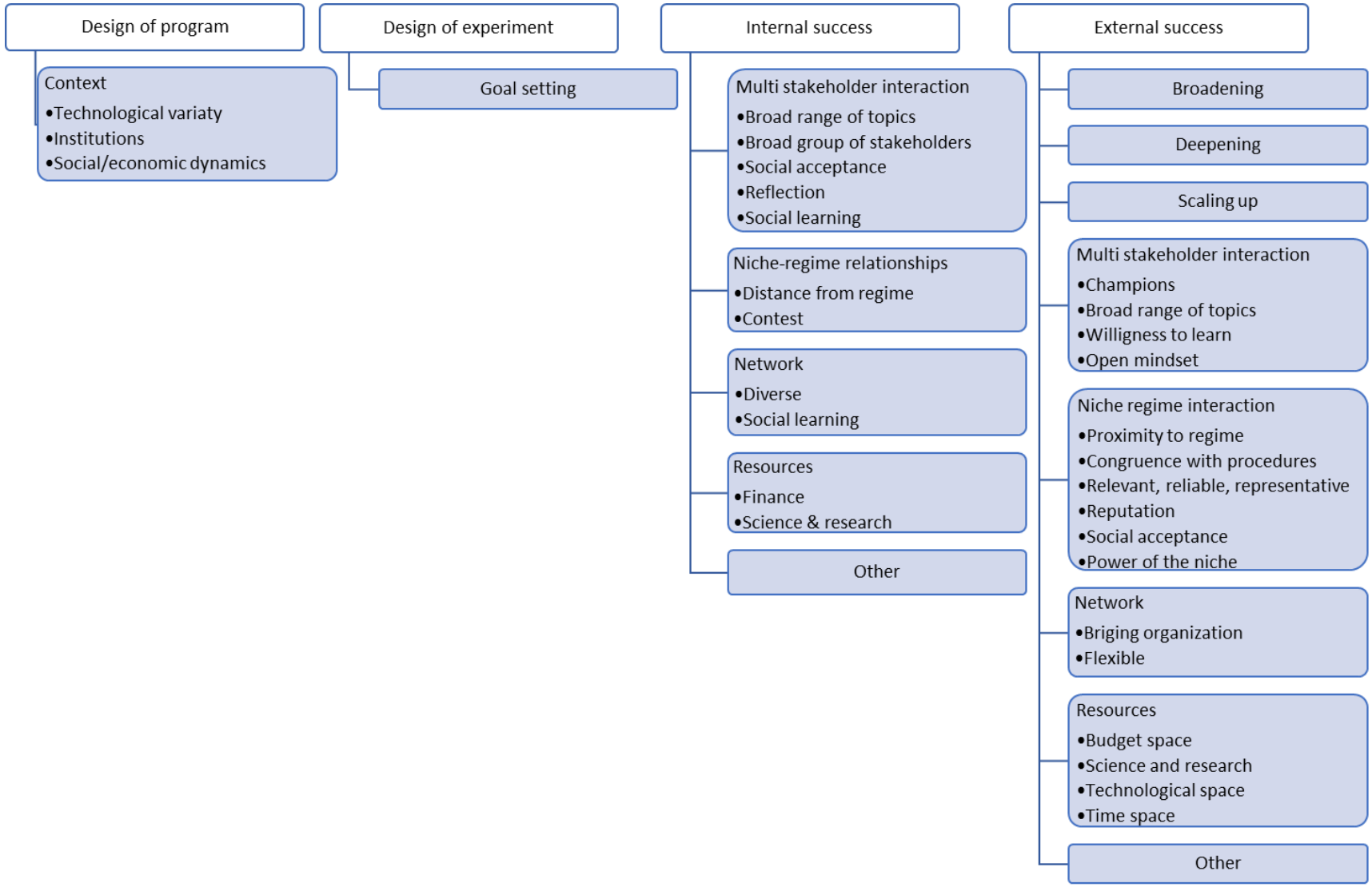

Figure 7: Coding scheme