Drivers and Obstacles to Implementing Co-creation in Sustainable Heating

A Multiple Case Study Addressing the Institutional Rules underlying Co-creation

Master's Thesis

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Interreg 2 Seas Mers Zeeën SHIFFT

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by

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Having spent a decade of my academic and professional life pursuing the quantitative sciences, attempting qualitative research was surprisingly challenging, yet refreshing. This thesis challenged me in ways I could not have imagined - it was as much a professional journey, as it was a personal one. The process of qualitative research challenged the way I think about the world, and about myself and the work I produce. It feels extremely satisfying to behold the end result of this arduous journey.

I am deeply grateful to my friends and family who supported me through this demanding period. For every time that I lost faith, they have been by my side, cheering me on. I would not have been able to make it through successfully without their unrelenting faith in me.

Madhumita Naik
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Executive Summary

Reaching net-zero carbon emissions by 2050 is vital to limit global warming to 1.5° C. Decarbonizing the heating sector that is globally responsible for half of total energy consumption is necessary to achieve climate-neutrality goals. The heating sector is fraught with complexity - characterized by variable market demands, and complicated stakeholder networks. Although the use of sustainable heating technology is backed by political support, aligning diverse stakeholders to develop sustainable solutions has proven to be challenging so far. Co-creation provides a viable solution to this problem, by providing an alternate governance system characterized by multiple, semi-autonomous centres for decision-making, that are connected by effective methods of co-ordination and communication. Co-creation projects are unique as they are a function of the historical, political, environments and social contexts from which they originate. The objective of this thesis is to understand the institutional rules underlying the evolution of co-creation, in an effort to discover the elements that contribute to successful implementation of co-creation in any setting. It will address the following research question:

How can co-creation be implemented effectively to enhance the transition to sustainable heating at the municipal level?

The research is a qualitative, multiple case study of four pilot projects that are involved in the transition to sustainable heating in the cities of Norwich, Mechelen, Fourmies and Bruges, under the EU-Interreg 2 Seas SHIFFT project. The Institutional Analysis and Development (IAD) Framework was used to analyze qualitative data obtained from interviews of co-creation participants and SHIFFT co-creation experts, and archived data from the SHIFFT database to categorically analyze the drivers and obstacles to implementing successful co-creation. The framework is used commonly to analyze policy situations. The action situation, which is the arena for decision-making, is broken down into the constituent physical and material conditions, community attributes, and implicit rules that govern actors' interactions to uncover patterns of interaction that influence potential outcomes. The observed, dominant patterns of interaction were traced back to the aforementioned sub-components to identify underlying drivers and obstacles.

Results

The study showed that stable project management conditions such as stable funding, comprehensive planning support and involvement of key stakeholders across all stages of the project is vital for successful co-creation. Community attributes such as shared values and goals, supportive attitudes towards co-creation (especially from planners), effective stakeholder participation and a focus on societal acceptance from government officials provide a supportive

environment for co-creation to take place. The study also found that political support from higher levels of government played a significant role in the evolution of co-creation.

The common obstacles observed over the four cases were setbacks caused by the Covid-19 pandemic (such as delays and the need to readjust communication and collaboration strategies), biased/skewed stakeholder representation, ineffective stakeholder management, and negative attitudes towards co-creation from actors in co-ordinator roles. The perception of government officials that citizen participation should end at the election stage, and concerns over the potential disruptive effect of citizen participation on existing governmental policies also proved to have a negative effect on the efficacy of co-creation strategies.

The study showed further that existing governance structures between stakeholders play a vital role in the evolution of co-creation. While openness to collaborating with stakeholders is crucial in participatory governance, it is not the determining factor that influences the manner in which co-creation evolves in a social context. Pre-existing power dynamics, combined with the crucial role played by co-ordinators in the group, form patterns of interaction that tend to reinforce governance structures that do not allow for effective co-creation.

Conclusions
Overall, the present research has shown that to achieve effective co-creation when initiated by actors that hold traditionally powerful roles in society, it is vital to make provisions for capacity-building of technological and administrative expertise across stakeholders of various sectors and power profiles. Without this, the gap in resources does not naturally reduce especially when other supporting factors such as communication in-person are not present.

Suggestions for Future Research
The present study has focused on the exploration of factors that influence co-creation pathways in sustainable heating in liberal democracies in Western Europe. The pilot projects were predominantly initiated in a top-down fashion. Future research can focus on the exploration of factors that are conducive to bottom-up initiation of co-creation in sustainable heating. The present study has shown that governance structures are difficult to modify due to pre-existing social networks and professional roles of prominent actors. Future research can focus on the interaction of powerful actors and institutional roles in bottom-up co-creation initiatives.

Due to the overlap of the research period of this project with the global Covid-19 pandemic, the researcher was unable to conduct interviews in-person, and participate in co-creation sessions as an observer. Further research where there researcher participated as an observer can be useful in identifying patterns of interaction between actors that provide insight into the evolution of governance structures in co-creation.

Contents

1

Introduction

The surge in human population, accompanied by the globalization of human activities (both in terms of the geographic spread, and the scope of impact of these endeavours) has generated unique ecological and social repercussions at local and global scales (Turner II et al., 1990). Energy and material processes have become so intricately connected that many actions, despite originating locally, have far-reaching regional and global consequences(Ekins and Folke, 1994; Turner II et al., 1990). Modern resource management has focused primarily on achieving social objectives such as employment and economic growth by controlling the flow of natural resources into the economy, with success being defined by increasing economic returns(Folke et al., 2007). Conventional resource management of this sort has shown adverse effects on local ecology - at times even destroying it altogether.

Addressing human production and consumption patterns through socio-technical transformation is necessary to curb human impact on the environment (Reay et al., 2007). Even the oil and gas sectors, that contribute to more than half of the world's energy supply, recognize the importance of transitioning to a lower-carbon energy system (IPIECA, 2015) to fight climate change. The success of such climate change initiatives depends on the large scale adoption of sustainable energy alternatives. International and national agreements are not enough to guarantee the shift to sustainable energy due to the complex economic, social and political linkages in the present day globalized society. For ensuring a long term strategy to protect ecological systems, it is vital to develop policies that focus on multiple levels of governance (Brondizio et al., 2009).

Furthermore, the shift to a sustainable society must be a gradual transition rather than a planned single step, to avoid social resistance (Rotmans and al, 2001). Policy development that incorporates transition management is especially important to foster continual societal innovation and optimization in the direction of a sustainable system.

Heating accounts for more than half of the global energy consumption ("Renewables" 2020), which is significantly higher than the contribution of electricity (20%).

However, at the international level, the issue of sustainable heating transition remains absent in the United Nations' Sustainable Development Goals report (Sustainable and Goals, 2020). Heat markets are diverse, and fragmented - with a complex mix of prosumers making up the supply side ("Renewables" 2020). These aspects further complicate the necessary process of heat transition.

Local-level institutions have a higher propensity than centralized institutions to learn and develop the capacity to respond to changes in their environment (Berkes and Folke, 2000). Furthermore, the shift to sustainable heating heralds disruption in heat markets as it impacts energy providers (Dütschke and Wesche, 2018). Sustainable heating policies are constrained in their enforceability in the domestic environment (Trencher et al., 2014). These aspects make co-creation a compelling method to accelerate the transition to sustainable heating.

Co-creation offers an alternative to top-down policy-making and implementation, by providing an arena for multiple stakeholders to come together to find solutions that work for all. Successful participatory governance, however, is influenced by several contextual factors. Whether a co-creation initiative was successful or not is determined by several contributing factors such as good leadership, trust amongst stakeholders, willingness of citizens to participate, etc (George, 2018). Moreover, there are several sociopolitical factors that influence local citizens participation and engagement.

The EU-Interreg 2 Seas SHIFFT (Sustainable Heating Implementation of Fossil-Free Technologies) project concentrates on working with local communities in a co-creation process to increase bottom-up demand for sustainable heating. This research project in conjunction with EU-Interreg 2 Seas SHIFFT (henceforth referred to as SHIFFT) explores the development of co-creation pathways in five cities across four countries (France, Belgium, the UK and the Netherlands) in a multi-level governance environment. The research will focus on qualitative data obtained from the participating members, and the multilevel governance environment they are functioning within - to develop a typology of the factors that influence co-creation in sustainable heating.

1.1. Knowledge Gap

The heating market remains resistant to decarbonization to a large extent, as use of carbon-based heating equipment still prevails (Scenario, 2021). Although organizations at the local scale have begun to target this problem through co-creation, academic research on this subject has been slow on the rise (Itten et al., 2021).

Due to the broad nature of the definition of co-creation, literature documents several types of citizen participatory initiatives under this umbrella(Dudau et al., 2019). Moreover, every co-creative endeavour is highly specific and subject to the political, social, economic and historic contextual factors of the case.

There is also a tendency to believe that user involvement in the creation of public

services must automatically lead to an increase in value creation. Given the highly subjective and unique nature of every collaborative venture, this cannot be assumed straightaway. Failure is highly probable when goals are not defined and communication between the myriad stakeholder groups goes awry (Schrevel et al., 2020). The potential pitfalls of poorly orchestrated co-creation include reduced accountability, possible co-destruction of public value and citizen rights, etc (Dudau et al., 2019). To avoid unfavourable results, it is important to investigate and understand the drivers and obstacles to successful co-creation.

The literature review reveals the existence of several frameworks that talk about drivers and obstacles to co-creation in varied spheres such as education, health, renewable energy, urban planning , etc. Documented case studies also refer to contributing factors in myriad stages of the co-creation process (inception, design, implementation, maintenance). However, not much attention has been given to the strategies (co-creation or not) to achieve decarbonization in heating.

Therefore, the chosen area of focus for this Masters Thesis project are the factors that support and impede the implementation of co-creation in the domain of sustainable heating.

1.2. Research Objectives

Every co-creation project is unique by virtue of the historical, environmental, political and social aspects that define it. As a consequence, the development pathway for each co-creation initiative is peculiar to the case. The objective of this thesis is to explore who and what constitutes co-creation in sustainable heating, how it is achieved, and what factors contribute to the specific development of each case. The project is a qualitative, multiple case study of four pilot projects in the cities of Norwich, Mechelen, Fourmies and Bruges that are involved in the transition to sustainable heating.

The main research objectives for this project are:

- Understand the composition (social, political, and material) of each co-creation pilot project in sustainable heating
- Understand the process of evolution that resulted in the initiation and development of each project
- Describe the methods used by each co-creation project to organize themselves and reach consensus on important topics
- Understand the drivers and obstacles to implementing co-creation in sustainable heating

The requisite comprehensive analysis for each case study is guided by the Institutional Analysis and Development(IAD) Framework that was developed by Elinor Ostrom (Ostrom et al., 1994). The thesis further aims to contribute to an understanding of the application of IAD Framework in the context of co-creation in sustainable heating.

1.3. Relevance for the Engineering and Policy Analysis Programme

The MSc program of Engineering and Policy Analysis lies at the nexus of wicked sociotechnical problems, and the use of data to drive sound decision-making. This research proposal is driven by growing the need for participatory governance structures in sustainable heating in the domestic context, and a way to develop them. As an EPA thesis, this research project has direct societal significance in solving the wicked problem of sustainable governance in a complex socio-technical system. Participatory governance systems address the need for better information transmission through impacted stakeholders which is required for effective decision-making.

1.4. Research Questions

The primary research question is formulated as follows:

How can co-creation be implemented effectively to enhance the transition to sustainable heating at the municipal level?

The following sub-questions will contribute to answering the main research question:

1. How can local government facilitate the transition to sustainable heating?
2. What is co-creation in the context of sustainable heating and what are the institutional rules underlying co-creation?
3. How do project conditions, community attributes, organizational structure and political context create the institutional rules that influence co-creation in the four pilot projects?
4. What are the contributing factors and obstacles that influence the planning and implementation of co-creation in the transition to sustainable heating?

1.5. Research Outline

The thesis is structured as follows. Chapter 2 describes a literature review on energy transition management in the heating sector, with a focus on local governance and citizen participation. The chapter ends with an exploration of definition and perceptions of co-creation. Chapter 3 describes the co-creation through the lens of the IAD framework, with an elaboration on the institutional rules that form the framework for successful co-creation. Chapter 4 contains the methodology and research design for this research project. Chapters 5 through 8 describe each of the case studies extensively. Chapter 9 contains an analysis of the project conditions, community attributes, political context and operational dynamics that influence co-creation pathways in sustainable heating. In Chapter 10 the conclusion of this thesis project will be presented including the discussion, policy recommendations and pathways for future research.

2

Literature Review

It is crucial to reach net-zero emissions by 2050 if global warming is to be limited to 1.5 ° C by the end of the century(Allen et al., in press). This necessitates rapid, and systemic transformation of our energy systems, that are majorly powered by fossil fuels. Energy use is intricately tied with our daily functions and quality of life, and thus requires a radical transformation of the society that is built around it.

2.1. Sustainable Heating Transition

While heating was responsible for close to half of the global energy consumption, and 40% of global carbon dioxide emissions in 2018, renewable heating is only projected to reach 12% of total heat consumption by 2024("Renewables" 2019). This estimation falls gravely short of the necessary deployment to reach climate change targets. This also means that a energy transition can be greatly bolstered by increased heating efficiency.

Heating is a crucial lifestyle element in temperate climates and is intrinsically energy intensive. Although the renewable heating technology is sufficiently accessible, and backed by local political support, successful heat transitions are negligible (Heldeweg et al., 2017). The heating sector is complex - heat demand is subject to climate and cultural parameters, and adoption of new heating technologies has faced resistance from local communities (Itten et al., 2021). Furthermore, heat markets are also complex and fragmented (IEA, 2018). Achieving transition to sustainable heating requires collaboration between myriad stakeholders part of the heating sector (energy companies, citizen communities, multiple levels of government, etc.) Aligning diverse stakeholder perceptions, interests and solutions to bring together the appropriate governance structures and heat infrastructures is the roadblock to a smooth sustainable heating transition (Heldeweg et al., 2017).

2.2. Energy Transition and Transition Management

Meadowcroft (2009) describes transition as the process of the transformation of established societal and technological practices that extends several generations. En-

ergy transitions are multi-level processes that involve innovation spanning the technological arena as well as the social and institutional context around it (Geels et al., 2017; Mah, 2019). For the large-scale adoption of a different energy system, multilevel institutional change (at the niche, regime and landscape levels) as well as cross-sectoral change is required. (Geels et al., 2017).

Energy transition literature illustrates several models that describe the origin and development of societal transformation towards greater sustainability (Meadowcroft, 2009). Transition management is one such model that deals with several mechanisms to steer transition towards desirable outcomes (Kemp et al., 2007), with the implicit understanding that sustainable development is a continuous process that lacks a well-defined destination state (Voß et al., 2006) but finds its origin in a social consensus on unsustainable practices (Wilkinson and Cary, 2002).

The transition to a sustainable society is not straightforward, and lacks a clear-cut set of definite steps. Instead, this process comprises of simultaneous evolutionary trajectories - where societal inputs facilitate progress, and exploratory ones - through which collective discovery of preferred development pathways occurs. (Meadowcroft, 2007).

2.3. The Role of Local Governance in facilitating the Energy Transition

The transition to sustainable energy requires both a transformation in the energy sector and the society. The dependence on fossil fuels is so deeply ingrained in our society that the realization of the UN Sustainable Development Goals cannot be achieved merely through top-down style mandates from national governments. Economic globalization and the global impact of climate change necessitates the development of policies that focus on institutions (and their linkages) at multiple levels to ensure long-term protection of ecological systems (Brondizio et al., 2009). Bottom-up approaches to governance (Stern et al., 2014) along with active participation from governments at all levels is crucial to ensure a successful transition.

The European Union adopts local-level initiatives as part of its multi-level governance approach, which achieves the dual purpose of supporting environmental governance dynamics in pioneering countries and buttressing governance efforts in countries with weaknesses at the national level (Jänicke and Quitzow, 2017). The 2015 Paris agreement highlights that local level mitigation policies play a crucial role in protecting people, livelihoods and ecosystems in the long-term global response to climate change(UNFCCC, 1968).

Environmental governance is fast moving towards collaborative planning at a local scale (Zingraff-Hamed et al., 2020). Cities today face a series of interrelated issues, competing for economic growth in a global platform while the natural resources that underpin this growth are increasingly constrained (Hodson and Marvin, 2010). Given the uncertainty associated with the impact of climate change, cities

must develop new networks and relationships, and become self-reliant on local resources to help them address issues of longer-term access to critical materials (Hodson and Marvin, 2010).

Local community-level initiatives in the field of sustainable energy transition cannot take place in isolation from the broader regional and national political environment. Local governments respond to larger-scale political movements and are supported by them. Similarly, regional governance processes respond to policy developments at the national level. From a governance perspective, Boogers et al. (2016) shows that small municipalities benefit from regional (inter-municipal) level collaboration to develop effective policy, attain local policy goals, perform municipal operations effectively, etc. However, ongoing negotiations at higher levels of governance create a high degree of uncertainty (Hoppe and Miedema, 2020), and must be considered as crucial factors that affect decision-making on a local scale.

2.4. What constitutes good community governance?

The term community generally refers to a group of people who are geographically proximate, but might also share interest and social relations (Haggett and Aitken, 2016; Rudolph et al., 2015). Mcginnis (2011) provides a useful shorthand expression defining governance as being what "determines who can do what to whom, and on whose authority." Local-level governance thus involves the direct involvement of local citizens in the decision-making processes pertaining to the area (George, 2018). A related term is self-governance, which Mcginnis (2011) describes as the "capacity of communities to organize themselves so they can actively participate in all (or at least the most important) decision processes relating to their own governance."

Local institutions are more capable than centralized institutions to quickly learn and develop responses to environmental feedbacks (Folke et al., 2007). Local communities possess a relatively high degree of adaptive capacity to respond to change - a trait that signifies resilience, which is vital to handle the effects of climate change (Adger, 2005).

While there does not exist a definitive normative ideal for good governance, there are common themes between ideas that attempt to describe it as integrated governance, polycentric governance, resilience governance, etc. Some characteristics of good governance are participatory, consensus oriented, effective and efficient, transparent, responsive, accountable, following the Rule of Law and equitable and inclusive (George, 2018). There is evidence that community-level governance for local level green infrastructure can deliver effective outcomes when supported by best practices such as "strong leadership, open trust, inclusive support and working systems" (George, 2018; Mah, 2019). A strong capacity for visioning and leadership, networking within stakeholders, and institutionalization of community leaders are some of the prerequisites for community governance that can effectively achieve sustainability outcomes at a local scale with the involvement of community members (Mah, 2019).

2.4.1. Co-management Arrangements between communities and governments

There are several forms of possible cross-scale linkages between governments and local community stakeholders and organizations. These are appropriate to the history and culture of the people, and also to the type of land and resource being governed. The type of institutional linkage also depends on the stakeholders involved and their roles, societal structure, power relations, etc. Underdal and Young describe aptly that "effectiveness and the robustness of social institutions are functions of the fit between the institutions themselves and the biophysical and social domains in which they operate"(Underdal and Young, 1996).

Berkes (2000) describes six different types of institutional linkages between local communities and governments -

- Type 1 - Co-management between government bodies and local institutions
- Type 2 - Multi-stakeholder bodies that link user-groups and interests between organizations at different scales (local, regional, etc.) and different sectors
- Type 3 - Empowerment arrangements by local governments through support organizations such as NGOs to bolster local communities or organizations such that they eventually become self-sufficient
- Type 4 - Institutions that provide linkages between local citizens and regional-scale organizations
- Type 5 - Research and Management approaches that support linking between organizations at different scales
- Type 6 - Citizen science - citizen driven governance and natural resource management initiatives. These are efforts to protect local communities' practices and knowledge regarding biodiversity management and ways of living.

The above strategies all result in an increase the capacity for a community to govern itself. As can be seen from the above types of co-management strategies, community level governance does not always start with a full-fledged community organization that is capable of local-governance.

Mcginnis (2011) describes social capital as being social assistance that one can draw upon in times of need, or a group's cumulative capacity to generate such potential assistance. Social capital between groups thus creates a stable network of organizations within and without a community. Ostrom et al. (1994) further explains that institutional capital is also a form of social capital. Strengthening institutional capital is vital for a community to develop self-governance.

2.5. The Growing Trend of Citizen Participation

A democracy can be best described as a government that functions on behalf of all the people it will govern, in accordance with their will (*Democracy* 2017). The two opposing schools of thought pertaining to citizen participation are representative and direct democracy. While representative democracy describes a model where

elected officials take actions on behalf of citizens, direct democracy calls for a deeper involvement of citizens in the decision-making processes that impact them.

Governance structures in accordance with representative democracy are no longer regarded as sufficiently democratic by wide groups of citizens and leaders of NGOs (Head, 2007). Newer approaches recommend higher levels of citizen engagement and participation in planning processes to ensure that citizens' concerns are addressed(Brody et al., 2003). Representative democracies are more pliable to the interest of organized groups, but the increase in participatory governance aims to include broad constituencies and other disadvantaged groups also.

Degrees of Citizen Participation

Citizen participation is a contested concept(Callahan, 2007), with diverse interpretations regarding the type and extent of citizen involvement in decision-making processes. This research paper follows the World Bank Participation Sourcebook's definition of citizen participation as "a process through which stakeholders influence and share control over development initiatives and the decision and resources which affect them" (*The World Bank participation sourcebook.* 1996).

Arnstein's Ladder of Participation describes types of citizen participation ranging from manipulation and tokenism(inauthentic) to shared discussion and decision-making where citizens have authentic power Arnstein (1969). The type of participatory process chosen depends on the capacity of the institutions or citizens that are part of the community (social or industrial)(Head, 2007).

Engaging the community in the decision-making process has several advantages aside from sole benefit of upholding democratic ideals. For instance, shared responsibility in the success or failure of community-level decisions, increased trust in the political process, the hope for better outcomes for ordinary citizens and disadvantaged groups, and do on. Businesses too stand to benefit from participatory governance by developing influence in new forums, demonstrating their belief in corporate social responsibility, etc. (ibid.) Furthermore, the growing awareness of the 'wickedness' of interconnected (across societal, economic, political and environmental spheres) has made both governments and citizens realize the need for communities to build their capacity for self-management(Loorbach et al., 2017; Rotmans and Loorbach, 2009).

2.5.1. Factors that affect Citizen Participation

Voorberg et al. (2015) details contributing factors to citizen participation in co-creative processes. From an organizational perspective, these include but are not limited to supportive communication infrastructure, training facilities, attitude of government officials, and so on. Government administrative environments are usually not designed to support citizen involvement in their processes, as it is perceived as "uncontrollable and unreliable". According to Devine-Wright (2011), officials are also

risk-averse, and often pejoratively view citizens as subscribing to NIMBYism (attributing hostility, ignorance or prejudice to members of the public).

2.5.2. Social and Political aspects that affect Citizen Participation

The political scope of an energy initiative also influences the manner in which government organizations approach citizens for collaborative endeavours. For instance, in the context of large scale energy transitions, citizens at the local-scale are considered as merely the target of measures to encourage wider adoptions through one-way communication (information and advice campaigns). Members of the public are viewed primarily as consumers and their motivation behind the choice to adopt new technology is not given sufficient attention. At larger scales, renewable energy policy refers to the public as communities that 'host' renewable energy projects instigated by private developers(Devine-Wright, 2011). In such situations, citizens develop expectations of specific modes of government communication. Opposing responses from the public, in such situations reinforce the NIMBYism conceptions held by decision-makers. Such dynamics are political in nature and are reinforced by persisting governance structures.

In a globally connected, knowledge-based society, citizens are constantly responding to knowledge-related developments at different spatial and political scales. These influence citizen perceptions in ways that directly or indirectly impact their participation and performance in co-creative ventures. For example, political narratives can create different sense of communities among citizens based on race, economic strata, etc. In the case of technoscientific advances, scientific and business communities are perceived as agile and versatile, while policymakers as slower and lagging behind (Felt, 2015). Broader nationwide competitive narratives also have the potential to influence citizen performance and expectations from co-creation ventures. Boltanski and Thevenot (2006) showed that participation is built on the fundament of the shared imagination of a community, a national developmental trajectory, perceived position in the global environment, on recognized sociopolitical structures and their role in time, as well as the perceived priority of all the above factors in a particular place.

Social factors that impact citizen participation in community governance include education level, family circumstances, awareness of political rights, and personal inclinations(R dulescu et al., 2020). The presence of social capital amongst members of a community is also a major driver for successful and sustainable relations between public organizations and citizens (Voorberg et al., 2015).

This shows the importance of metagovernance, i.e., organizing the right conditions for the governance (Jessop, 2003), in developing institutions that support citizen involvement given the plethora of diffused extant factors that influence effective citizen participation.

2.6. Co-creation - Definitions and Perspectives

Co-creation refers to the active involvement of end-users in various stages of the production process (Prahalad and Ramaswamy, 2000) - which, in the public sector would be creation of a public service. As the belief of the necessity of co-creation with citizens as a means to solve complex societal changes is growing, this concept is gaining traction as the cornerstone for social innovation in the public sector (Voorberg et al., 2015).

Involving consumers in the design process ensures that the final product meets their needs, helps end-users understand how the product or service works and is developed, while also fostering an active interest in its success (Davis and Andrew, 2017). In the context of a public service such as heating, the stakeholder groups are multi-level and multi-sectoral. Therefore, a successful transition requires a high degree of collaboration between governments at all levels (local, state and national), energy companies, research institutions, energy advocacy groups, and citizen communities (Sillak et al., 2021). Furthermore, engaging the local community in energy governance increases the chances of societal acceptance and public trust, thereby creating an inclusive society which has as its cornerstone a mutual consensus on the sustainability goal and the solutions employed to reach it(Brummer, 2018; Mah, 2019; Stagl, 2004).

For those who are involved in the development of the service, the learned knowledge that local residents, stakeholder groups, university researchers and students provide are highly useful(Davis and Andrew, 2017). Sillak et al. detail the benefits of adopting co-creation to accomplish transition to sustainable resources - by involving citizens in all stages of the planning process the real needs of local people are understood in a context that existing dynamics of citizen participation don't provide (Sillak et al., 2021). This ensures that disempowered and underprivileged sections of the community are also heard. Such an arena also allows for the development of more potential solutions.

Gjørtler Elkjær et al. (2021) have identified the three prominent perspectives of co-creation in the field of sustainable energy transitions - co-creation of representations and identities of actors,co-creation of innovation in sociotechnical systems, and co-creation of participatory governance. This also implies that the term 'co-creation' takes on a different meaning in different settings. Torfing et al. defines co-creation in the public sector as a process with the following characteristics - involving two or public and private actors, the attempt to solve a shared problem, a constructive exchange of different types of resources to enhance public value through a continuous feedback system or an incremental step-change system that aids the problem-solving process (Torfing et al., 2019). In the context of the present study, co-creation is taken to mean the joint creation of sustainable heating solutions with the active involvement of all relevant stakeholders in the decision-making process.

Co-creation as referred to in this report, follows the complete cycle of initiation, design, implementation and evaluation as surmised by Sillak et al. (2021). Co-

creation also includes the 'co-production' of the heat strategy and public heat services in the heating transition. Usually, relevant actor groups lie at the intersection of three different classifications (public/private, formal/informal, for-profit/non-profit). They assume diverse roles as they move through the stages of co-creation. The end goals vary between projects (and also between stakeholders within a project) and are usually effectiveness, efficiency, citizen involvement and citizen satisfaction (Voorberg et al., 2015).

Co-creation is highly subjective, and is deeply influenced by the particular social, political, cultural and economic context of a situation. Literature shows that there is still need for empirical evidence pertaining the reasons for the efficacy of co-creation. There is also a need to develop the theoretical foundations for co-creation (Dudau et al., 2019). The appeal behind co-creation lies in its "broadness, normative attractiveness, the implication ofconsensus, and global marketability"(Pollitt et al., 2011). However, if co-creation is not performed correctly, it can destroy the very ideals it aims to uphold. Steen et al. shows that ineffective co-creation initiatives can results in loss of accountability (fuelled by rejection of responsibility), rising costs, and the loss of democracy and even increased inequality(Steen et al., 2018). This highlights the importance of understanding the factors that aid and impede co-creation so that supportive conditions can be created elsewhere for effective co-creation.

3

Theoretical Framework

3.1. Institutional Analysis and Design Framework

The IAD framework was developed in association with work on public service industries and local public economies (Oakerson, 1999; Ostrom et al., 1994) by Elinor Ostrom. The purpose of Institutional Analysis and Design Framework is to aid a comprehensive analysis and thorough understanding of public institutions.(Mcginnis, 2011)

The IAD framework focuses on an action situation, where all policy decisions under study are made. The action situation takes place in the action arena - which constitutes of all the actors that participate in the action situation. The framework enables extensive analysis of the action situation by assigning all relevant explanatory factors and variables to specific categories and establishes these categories within a "foundational structure of logical relationships" (ibid.).

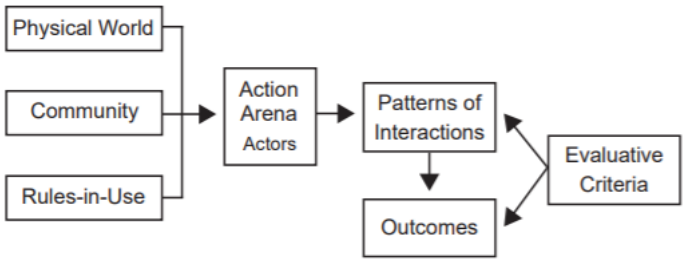

Figure 3.1: Institutional Analysis and Development Framework adapted from Ostrom et al. (1994)

The progress of each pilot project through the stages of co-creation will be examined using the IAD framework to answer the research questions detailed in Section 1.4 to discover the factors that influence the implementation of co-creation.

3.2. Application of IAD Framework to Co-creation

Under the IAD Framework, a key component of analysis is the Action Situation. An action situation can be thought of as a negotiation arena where two or more decision-making entities (or actors) occupy relative positions, and engage in a decision-making

process and come to a consensus and chosen actions from a set of possible alternatives. Co-creation draws on the concept of polycentric governance which has "multiple, semi-autonomous centres of decision-making"(Parks et al., 1981) with varied methods of co-ordination to form a coherent and consistent system(Ostrom, 2010). Thus co-creation can be thought to be made up of multiple action situations. The structure of these action situations can vary through the stages of co-creation, as different actors change roles and drop in or out between phases.

Institutional analysis of traditional policy situations can segregate between the production inputs and the outcomes (as the product or service). Within this analysis of co-creation through the IAD framework, however, the main inputs are the participants themselves, while the outcomes are dual - one technical, and the other social. The technical outcome is the development of a heat strategy through the process of negotiation between key players. The social outcome is the development of a new governance structure for decision-making and the increased level of social capital in the community. The elaboration of the components of the action situations that constitute co-creation uncovers the underlying rules in use that govern co-creation practices.

3.2.1. Step 1: Policy Analysis Objective and Approach

The IAD Framework will be used as a diagnostic tool to understand the patterns of interactions in each pilot project to unearth the driving factors that have contributed to its unique development.

The main questions that drive the analysis are:

- What are the activities followed in each action situation?
- What is the nature of the governance structure associated with the action situation?
- What are the factors that contribute to the specific development of the action situation?
- Which outcomes result from actions situations? Which outcomes are satisfactory, and which are most important?

The exploration of each of the segments in the IAD Framework leads to the resolution of these broad themes. The primary mode of research is hence inductive.

3.2.2. Step 2: Analyzing Physical and Material Attributes

The purpose of each co-creation initiative is to enhance the adoption of sustainable heating strategies among the actors within the scope of the project. Therefore, in each co-creation project, the outputs produced are a combination of the following (depending on the specific characteristics of each case):

- The development of a new participatory governance structure among the actors
- The strategy to implement the sustainable heating solution
- The strategy chosen to increase community-level adoption of the sustainable heating solution

To this end, the "production inputs" are identified as the following:

- **Key stakeholders of the project** - Participants have several attributes such as number of participants, status of individual or corporate actor, and other individual attributes (such as age, gender, education, etc.) whose relevance varies as per the situation (Ostrom, 2005). For example, the number of participants(cumulative, and constituent) influences the representation of stakeholders, which has a significant impact on the operational dynamics, thereby affecting the outcome of the action situation.

- **Resources required to support the co-creation space** - these refer to the logistics for co-creation - for example, the physical space to hold meetings, finances to rent conference rooms or conduct webinars to gather participants, management and administrative skills to organize the meetings, etc. All such resources are provided by the participants themselves.

- **Technology** used to bring together the stakeholders - The choice of technology used for communication is decided by the members themselves.

- **Sources of funding** for the development, implementation and widespread adoption of the heating strategy. Funding could be sourced from public, business or private capital (Lutz et al., 2017), the total composition of which varies per the case.

3.2.3. Step 3: Analyzing Community Attributes

In the context of a co-creation activity, the community includes all the players that are impacted by the internal working and outcomes of the project. Fig. 3.2 shows the types of actors that are relevant in an energy transition issue such as sustainable heating.

Polski and Ostrom (1999) defines community attributes as demographic characteristics of the community, commonly accepted norms about policy activities, the degree of understanding that key players share about activities in the action situation, and the extent to which participants' values, beliefs, and preferences about policy-oriented strategies and outcomes are aligned.

Successful co-creation hinges on several community attributes such as trust between stakeholders, political context, local tradition, social capital and local practices(Mah, 2019). Community attributes determine perceptions to the problem at hand, the choice of co-creation as a strategy and the willingness to collaborate with other actors - these heavily influence the progress and outcomes of co-creation.

3.2.4. Step 4: Analyzing the Rules in Use

Within any action situation, there are spoken and unspoken rules that govern policy-related actions, interactions and outcomes. Analysis of these rules helps uncover overarching patterns of interaction in the action situation. It is usually directed towards the exploration of operational rules that are not usually explicitly stated, but

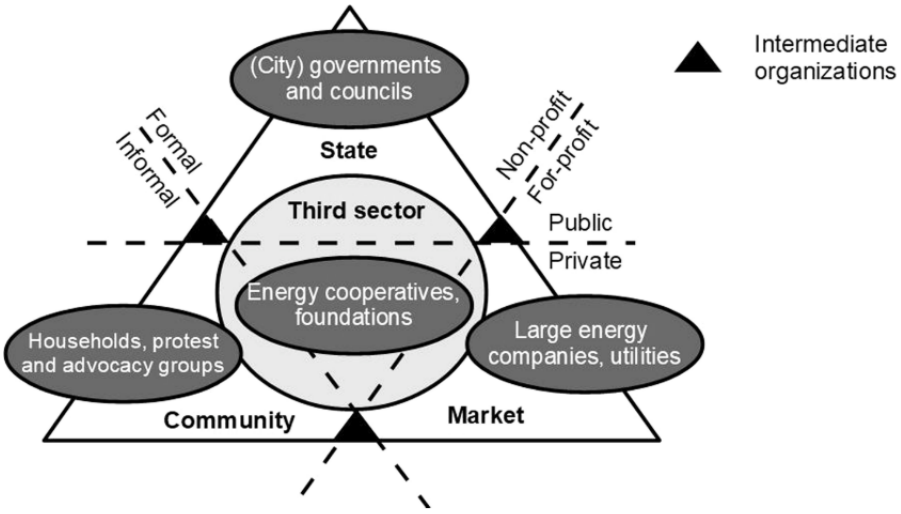

Figure 3.2: The classification of actor groups in co-creation at the organizational level by Sillak et al. (2021)

govern people's actions regardless. The IAD Framework describes three types of rules - operational, collective-choice and constitutional rules. The manifestation of these rules in the context of co-creation is described below.

Collective Choice and Constitutional Rules
The rules in use described above concern operations within an action situation. The IAD Framework describes two other types of rules - collective-choice and constitutional rules(Ostrom, 2005). Collective-choice rules determine who is eligible to participate in activities that affect the operational level. Constitutional rules describe who is allowed to craft collective-choice rules, and the manner in which they can do so.

Collective-choice Rules

In the context of co-creation, collective-choice rules determine who is eligible to decide the stakeholders are involved in the project, and also the choice of actors that would be involved in its component stages. Ideally, collective-choice rules are determined by the participants themselves.

Constitutional-choice Rules

Within the scope of a co-creation initiative, constitutional-choice rules govern the procedures that determine entities that are involved in collective-choice processes. The guiding principle behind choosing the individual participants of the pilot projects within SHIFFT is that "everyone who is affected by the issues and the outcome of a decision should have the right to participate or to be represented in that process" (Hoppe, Jansen, et al., 2020a). In accordance with this, the snowball method was used to identify relevant actors from a list of potential stakeholders which was obtained as a result of comprehensive analysis by co-creation experts in the SHIFFT

project.

Giddens defines power to be ”generated in and through the reproduction of structures of domination”. These structures are defined by institutional rules such as those described by Ostrom. For instance, in a representative democracy, elected officials in government institutions hold the power to develop operational-choice rules for specific situations. A broader interpretation of power proposed by Avelino characterizes it as the ”(in)capacity of actors to mobilize resources and institutions to achieve a goal” (Avelino, 2017). Power is thus contextual and depends on the social network and context. Engaging in the process of co-creation provides an avenue, and the requisite context for restructuring these power relations. This is bound to create tension between actors regarding government officials' presumed role in co-creative decision-making processes.

Theoretically, collective choice and constitutional choice rules are meant to be decided by those taking part in the co-creation project. In practice, however, this is harder to implement, for instance, when the number of stakeholders is too high for effective discussion, or when some stakeholders are passive in the co-creation process.

Operational-Choice Rules
The types of operating-choice rules that underlie participants' actions in an action arena are described below, in Table 3.1.

Table 3.1: Description of the Types of Operational Rules according to Ostrom (ibid.)

Type of rule in use	Description of the Rule
Position	Specify the set of positions or roles that participants assume in an action situation, and the number and type of participants who hold each position
Boundary	Specify which participants enter or leave positions and how they do so
Authority	Specify the actions participants in given positions may take
Aggregation	Determine how decisions are made in an action situation
Scope	Specify the jurisdiction of outcomes that can be affected and whether these outcomes are or are not final
Information	Affect the amount and type of information available to participants in an action arena
Payoff	Determine how costs and benefits are meted-out in the action arena

Position Rules

Position rules describe positions that actors that connect them to a set of actions permitted for the role. The roles present in an action situation are indicative of the relationships between participants (and their roles), and represent the governance

structure adopted within.

Barnett (2014) describes each role as having rights, duties, expectations, norms, and behaviors that a person has to face and fulfill. For example, an actor that takes on the role of a planner would be responsible for organizing co-creation sessions, and setting the agenda while a technical expert might be responsible for the dissemination of critical technical information between the participants. Although these roles can go by different names, the functions assigned to these roles are vital to the smooth operation of an organization. It is possible for one person to hold multiple roles, and one role to correspond to several participants. No actor is forbidden from adopting a role, so long as they can provide required resources such as social capital,monetary support, technical know-how, etc.

Nyström et al. (2014) outlines the different methods of approaching the creation and designation of roles within a network - as predetermined by the actors in a network, based on the existing social network, as the tools to control other resources or establish structure, or determined on the basis of actors' actions and the set goals for the group. The chosen method (or combination of methods) for role adoption is specific to each case.

Boundary Rules

As per the IAD Framework, boundary rules are used to define who is eligible to enter a position, the process that determines eligibility for positions and how a person may leave a position (Ostrom, 1983). These are distinct from rules that prescribe who can be part of the co-creation process, which can be categorized as collective-choice rules, as described in section 3.2.4.

The co-creation trajectory requires different activities and hence, relevant expertise over the course of the project. It is possible for actors to change their positions over the duration of the project in response to phase-specific activities. This is not commonly followed, in the interest of ensuring continuity within the project.

Authority Rules

Authority rules specify the set of actions available, over the course of a decision-making process, to specific positions within the co-creation situation. **Agenda control** rules, i.e. the power to decide items on an agenda, are also one type of Authority rule that proves to be quite important in scenarios that involve decision-making.

Within the context of co-creation, choice rules must be developed in a manner to distribute power in a relatively equal manner between actors, to prevent vastly contrasting power centres within an action situation. For example, a simple way to distribute equal power is to provide every vote equal weight in a decision-making scenario(Ostrom, 2005).

Aggregation Rules

Aggregation rules come into play when the decision of a single participant or of multiple participants is needed prior to an action that is the result of a decision process. Such rules come into play when participants at multiple positions have control over the same set of actions.

By its nature, co-creation in the sustainable heating transition involves agenda setting, and decision-making over critical and sensitive issues impacting a large portion of stakeholders. Some examples are the choice for heating solution (which has strategic impact for producers, consumers, policy makers, urban planners, etc). Three major generic forms of these rules are "nonsymmetric aggregation rules, symmetric aggregation rules, and rules that define outcomes in cases of nonagreement" (Ostrom, 2005).

Co-creation is a method to implement direct participatory democracy, and by its nature involves negotiation and decision-making by consensus. The pre-requisites for an action to pass are free to be decided by the participants. Some examples are majority vote, super majority vote and unanimous consent(ibid.).

Scope Rules

Scope rules define the breadth of the outcomes that must (or must not) be impacted by the decision-making process in a co-creation meeting(Mcginnis, 2011). Scope rules do not relate to the actions taken by the group, only to the outcomes that are under discussion.

The goal of co-creation in sustainable heating is two-fold. The technical goal is the consensus-based choice of a heating solution and the specific strategy to implement it. The societal goal is to achieve widespread acceptance of the heating strategy that is developed in conjunction with the views of various stakeholder groups, while also developing social capital for future projects. This facilitates social learning over longer periods of time.

Information Rules

Information rules pertain to the level of information available to participants in an action situation. These rules authorize certain positions to communicate requisite information to participants at critical moments in specified formats during the decision-making process(Ostrom, 2010).

In the context of co-creation in sustainable heating observed in the pilot projects that are the focus of this research, stakeholders who are in planning roles usually are responsible for key information and the distribution channels. However, subject matter experts of any kind are the stakeholders who are responsible for such roles in a co-creation context.

Payoff Rules

Payoff rules specifically assign rewards or penalties to specific actions or outcomes in an action situation(Ostrom, 2005). They are external to the participant's motivations. Some examples of these are financial rewards (or fines), time invested in a project, etc. In co-creation, the payoffs are intrinsic. Stakeholder groups are motivated by the personal value judgements they assign to fairness, or equality, or representation.

However, the costs are considerable compared to the traditional methods of decision-making. The are costs that are usually associated with direct representation in a democracy - lack of time and knowledge in stakeholders, possibility of misrepresentation of the broader citizen interests due to high involvement of a few citizens groups, among others (Callahan, 2007).

The Evolution of Rules in Co-creation

The absence of rules in an action situation would imply an unpredictable configuration of resources where any member could adopt any position, take any action, etc. and the outcomes would be impossible to determine. If one were to analyze a situation where there were truly no rules, the resulting configuration might be akin to a "Hobbesian state of nature" Ostrom (2005).

Although the co-creation process is seemingly devoid of rules, there are many implicit rules that underlie all constituent action situations. For instance, participants share the understanding that co-operating will be mutually beneficial to reach a shared goal. They may also have preconceived ideas about co-creation, and the roles that participants might adopt. These factors influence active operational dynamics that can be understood through the exploration of the rules-in-use.

In the case studies that are part of this project, stakeholders default to their usual roles, despite the understanding that they are partaking in co-creation. This shows the relevance of unspoken and implicit rules in an action situation.

3.2.5. Step 5: Integrating the Analysis into a Coherent Action Arena

The Action Situation is a **conceptual space** in which actors "inform themselves, consider alternative courses of action, make decisions, take action, and experience the consequences of these actions" (Mcginnis, 2011). This is the **heart of the policy analysis and design activity**. The action arena can be considered to constitute of two main aspects, the action situation and the actors involved. For the sake of brevity and simplicity, the action arena will be referred to as the action situation, henceforth.

Action Situation

The steps described from section 3.2.1 to 3.2.4 can be integrated to develop an understanding of the development of each co-creation project by providing insight into the following elements:

- Who are the key stakeholders that participate in co-creation meetings? What information about the project is available to participants in co-creation meetings?
- What positions do each of the participants occupy during meetings?
- What actions are available to each participant, and how do these link to project outcomes?
- What level of control does each actor possess over action in any decision-making situation in the co-creation meeting?
- What outcomes are possible with the chosen structure of the arena?

The case studies explored in the body of this research follow the above described pattern of exploration to obtain a deeper understanding of the operation of each co-creation pilot project.

Actors

To assess the efficacy of the co-creation projects, it is important to analyze the decision-making capabilities of all key players in their respective action arenas. According to the IAD framework, this can be assessed by considering the resources, valuations, information processing and selection processed that pertain every actor.

Actors' decision choices are affected by "capital, labor, knowledge, technology, time, and social influence" (Polski and Ostrom, 1999). Specifically in the context of co-creation, none of the actors are provided financial remuneration for their participation. The resources available to each actor determine the capacity for action that they possess in an action situation. For example, if an actor has invested a large amount of resources in the facilitation of the co-creation process, they tend to be more involved and driven in achieving their goals through the project. Similarly, what values an actor possesses determines the manner in which they perceive the project, and hence influence the extent to which they participate in the project.

3.2.6. Step 6: Analyze Patterns of Interactions

Once the constraints of the physical and material world, community attributes, and rules-in-use develop, patterns of interaction flow logically about the behavior of actors in the action situation (Ostrom, 2005). These are useful to understand the pathways of evolution of co-creation and the obstacles and drivers to these.

3.2.7. Step 7: Analyze Outcomes

In co-creation the potential outcomes of an action situation cannot be determined beforehand. The number of variables is high - participants, resources, finances, decision-making processes involved, information available. These are all also subject to actions taken by the participants, and circumstances external to the AS (for example, actions taken by other related but mostly uninvolved actors such as regional government). By design, co-creation is intended to provide insights towards solutions that may not be obvious. Sometimes, these solutions also challenge the status quo between stakeholders. Hence, there is no way to know outcomes prior

to the resolution of the action situation. This implies that there does not exist a standard against which the outcome can be compared.

The pilot projects do not use a standard framework or performance indicators in monitoring their outcomes. Co-creative efforts have developed uniquely in all pilot projects, and every stakeholder has a subjective expectation of its process and evolution. This has led to a lack of consensus, or even confusion regarding the methods to evaluate co-creation. It is important not to accept the legitimacy of co-creation without evaluating its outcomes thoroughly(Jentoft, 2000; Mikalsen et al., 2007). In the absence of a standard monitoring system in the pilot projects, the evaluation of the co-creation outcomes will therefore be made on the framework developed by Sillak et al. (2021). This framework reflects the democratic ideals that make up the foundation of co-creation. Aspects of co-creation such as citizen involvement, activities that are undertaken to facilitate decision-making and problem-solving, and all subsequent outcomes that result from this process are a reflection this underlying principle. According to this framework, co-creation can be assessed on the following criteria:

- the involvement of actors (state, market, community, and third sector) and their roles in different phases (initiation, design, and implementation) of co-creation
- the use of four sets of activities (expectation alignment, social learning, resource acquisition, assessment, and evaluation) to foster transformative power
- outcomes of co-creation

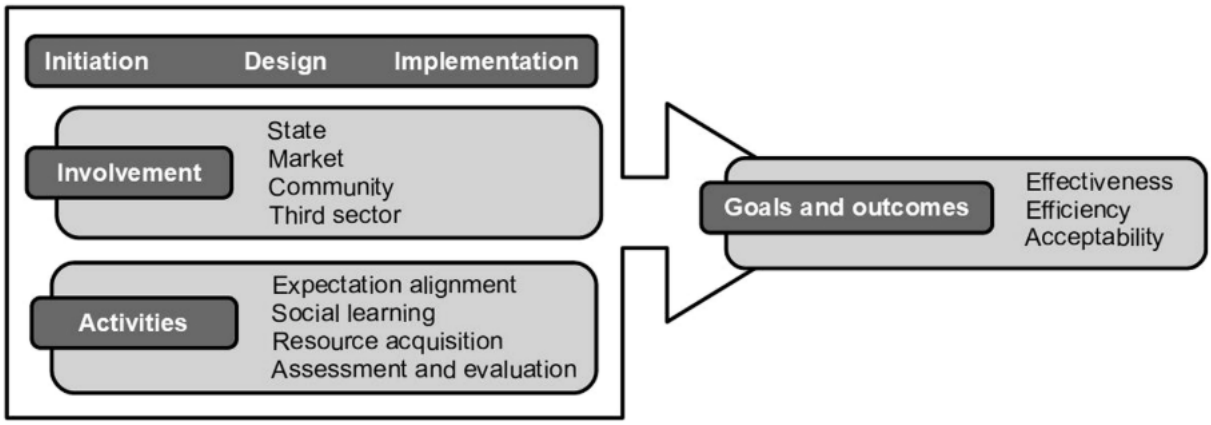

Figure 3.3: Framework for assessing co-creation in strategic planning for energy transitions from Sillak et al. (2021)

4

Methodology

The methodology structures the research and describes the research approach, the data acquisition process, the analytical framework, and finally how this will contribute to answering the main research question. The chapter is divided into five sections that describe different aspects of the methodology. As a starting point, section 4.1 covers the research question and the research approach. Section 4.2 covers the scope of the research and its research design. Section 4.3 addresses the literature review and data collection methods, while section 4.4 explains the framework used for the analysis of the data. Finally, section 4.5 concludes this chapter and provides an outline of the next chapters.

4.1. Research Approach

The initial focus of the research approach was to understand multilevel governance and its evolution. This eventually progressed to understanding co-creation, and its adoption in the field of energy transition. Due to the subjective and unique nature of such projects, many case studies provide a narrative of case development. Academic literature also consists of multiple case studies that employ the same method to further identify different aspects of co-creation such as best practices in the field, efficacy, outcomes, etc.

A parallel line of research was to understand the IAD framework and its application in energy transition. The comprehensive nature of the framework allows diverse application styles for different research objectives. The choice was made to use the concept of the Action Situation as described by the IAD framework and apply it to the field of co-creation. Applying the IAD framework in multi-case study enables comprehensive analysis of each case, and provides a method to compare emergent features in a structured fashion.

4.2. Research Design and Scope

4.2.1. Case Study Design

The research is designed as an exploratory project spanning multiple case studies. Each case is constituted by the co-creation project in one city. (R. K. Yin, 2012) explains the possible rationales for a case study methodology, one of which is a revela-

tory angle. The current work of research attempts to comprehensively understand the drivers and obstacles to pathways for co-creation, and hence fits in this description.

Further, for effective comparison between cases R. K. Yin, 2012 recommends replication logic similar to that of designing experiments. One of two replication strategies must be used - literal, or theoretical. This projects follows the latter by employing the use of the IAD framework in every case to discover underlying patterns of interaction in each case.

4.2.2. Case Study Scope

ibid. describes a case-study "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". This necessitates a clear demarcation of the scope for every case:

- Temporal Scope: The evolution of every co-creation project is considered from origin up until the duration of this research effort.
- Physical Scope: Consists of all actors that are part of the case and the location (physical or virtual) of the co-creation meetings.
- Political Scope: The evolution of every project is determined by several political influences. However, only those that bear a direct impact on the project itself, or the members included, will be addressed.

Scope: does not include development of technology. This case study only focuses on the social drivers and obstacles to implementing co-creation in sustainable heating. These cases are unfolding at a time when sustainable heating technology already exists and is easy (define easy) to obtain in the market, so barriers related to technology development and procurement are not explored in this study.

4.2.3. Case Study Selection

The EU-Interreg 2 Seas SHIFFT Project work package 2 consists of 6 pilot projects. These were selected for work package 2 on the basis of their prior engagement with SHIFFT to develop local heat strategies involving related stakeholder groups.

Co-creation projects usually follow the analysis, design, implementation and evaluation cycle (Sillak et al., 2021). Each of these phases come with different social, technical, and logistical challenges. Every case also responds to the cultural, economic and political context that surrounds it. Explained below are the reasons for the cases selected for analysis.

- **Norwich, UK** - The Norwich case has proceeded in a timely fashion as per the original timeline proposed by the pilot managers. The project currently stands in the implementation phase and has progressed the furthest amongst all the cases. The Norwich case is also the most contained, as it is implemented on a small scale by a private housing association at one site. This makes it easier to observe and analyse. For these reasons this was the first project to be chosen for this case study.

- **Ville de Fourmies, France** - The Fourmies case has passed the design phase, and is the first urban-level case to do so. Fourmies is part of the French Troisième Révolution Industrielle (TRI), and is involved in several activities associated with the sustainable transition. The municipality places a strong emphasis on societal acceptance regarding the transition to sustainable heating. The case allows an exploration of the influence this factor bears on co-creation.
- **Mechelen, Belgium** - The Mechelen case study carries with it a high degree of complexity, as a large number of stakeholders have been involved since the its inception. This project is currently entering the implementation station and proceeding with deeper citizen engagement strategies.
- **Bruges, Belgium** - The Bruges case has currently completed the design stage following a learning phase where the citizen engagement strategy was revised. This unique feature allows for the analysis of social learning and the role of technical institutes in co-creation, and was chosen for this reason.

The case studies chosen thus provide the scope for a rich analysis of the factors affecting co-creation implementation pathways in multiple countries and different urban scales, across varying stages of co-creation.

4.3. Data Collection Methods

4.3.1. Semi-structured Interviews

The data material for this case study has largely been obtained from 9 in-depth interviews carried out between March-June 2021. Informants were selected using the snowball method. All interviewees were participants in co-creation meetings in their respective pilot projects. Four of the nine interviewees hold co-ordinator roles, and were largely responsible for the organization and/or facilitation of activities related to co-creation. Consequently, the analysis is more focused on the drivers and obstacles to co-creation pertaining the role and activities of planners in the context of co-creation.

The interviews lasted approximately 1-1.5 hours and focused on the interviewees' impressions and memory of the evolution of the co-creative process.

Table 4.1: Overview of Conducted Interviews

Date	Section	Function and Organization
2021-03-26	Norwich	Places for People Manager
2021-03-30	Norwich	Postdoc Research Fellow, University of Exeter
2021-05-18	Fourmies	Manager - Mairie de Fourmies
2021-05-19	Mechelen	Participant 1, Co-creation meetings
2021-06-07	Norwich	Places for People Environmental Manager
2021-06-21	Bruges	Project Manager - City of Bruges
2021-06-25	Bruges	Home Renovation Expert - City of Bruges
2021-06-28	Norwich	Places for People Environmental Sustainability Coordinator

Table 4.1 (continued)

2021-07-01	Mechelen	Project Leader - City of Mechelen

4.3.2. Direct and Indirect Observation

Apart from semi-structured interviews, qualitative data was obtained from the below sources:

- **Archived materials** that were part of the SHIFFT Project database
- **Co-creation Webinars and Pilot Meetings** - The pilot project managers engaged in co-creation webinars organized by researchers in the University of Exeter and the Technical University of Delft. There were also occasional partner meetings where updates about pilot progress were given. These meetings act as a feedback mechanism, and also provide a platform where imminent issues can be discussed. Observations 1-3 in the Table 4.2 refer to these meetings.
- **Discussions with the SHIFFT WP2 Research Team** - Three members of the SHIFFT Research Team acted as informants pertaining to co-creation activities under SHIFFT. The researcher engaged in several discussions with them over the duration of the Masters thesis project. Observations 4-6 in the Table 4.2 refer to these meetings.

An account of the SHIFFT meetings that the researcher attended follows in table 4.2.

Table 4.2: Overview of Data Collection through Observation of SHIFFT activities

Date	Observation Number	Function and Organization
2021-03-10	1	Co-creation Pilot Meeting for Norwich
2021-04-15	2	Webinar on Evaluating Co-creation
2021-06-29	3	Co-creation Pilot Managers Meeting
-	4	Expert Member 1, Technical University of Delft
-	5	Expert Member 2, Technical University of Delft
-	6	Expert Member 3, University of Exeter

4.3.3. Obstacles in Data Collection

As the data collection stage of this project coincided with the Covid-19 pandemic, it was necessary to conduct all interviews online. This reduces the quality of interviews, as an important component of body language is missed in virtual discussions.

The Covid-19 pandemic resulted in delays in all of the cases studied in this body of research. This unavoidable setback, combined with the hectic schedule of pilot

managers resulted in delays, and two cancelled interviews.

The political nature of the co-creation projects might also have resulted in obfuscation of sensitive information during interviews. The researcher faced language barriers in some cases in communicating with participants that were not comfortable conversing in English.

4.3.4. Data Management and Ethics

Since the heating transition is a sensitive political issue, the names of all co-creation participants that were interviewed have been anonymized. A thorough Data Management Plan (DMP) was developed under the guidance of the Mr. Nicolas Dintzner, Data Steward for the Technology, Policy and Management faculty at the Technical University of Delft. In accordance with the DMP, all consent forms were pseudo-anonymized, and video interviews were encrypted and password-protected before storage. These files are only available to the SHIFFT Research Team. These measures were employed to ensure confidentiality of the participants private data, in accordance with the General Data Protection Regulation.

4.4. Data Treatment

4.4.1. Interview Themes

The interviews conducted as part of the data collection stage were open, semi-structured. These themes are categorized broadly following the components of the IAD Framework. Interview questions were focused on understanding factors that influence co-creation according to the different components of the IAD framework. A complete description of the themes and questions can be found in B.

4.4.2. Coding Interview Transcripts

All interviews were video-recorded using Microsoft Teams and transcribed using Microsoft Streams. To analyze the transcripts, the interviews were manually coded in Atlas.ti. The developed codebook is presented in Appendix A.

A total of 40 codes were used to characterize and analyze interview transcripts. A hierarchical 2-level frame of coding was developed to maintain structure during the coding process. Transcripts were analyzed multiple times to narrow down codes to identify salient features pertaining to each component of the IAD Framework in the context of co-creation. The components of the IAD Framework were used for a high-level grouping of the codes, which is reflected in level-1 categories. Aside from these, two new level-1 category was identified - 'Actors' and 'Political Context'. Both these categories were provided individual status as they can not be sufficiently subsumed under any other category, and demand this level of granularity. The Level-2 codes reflect factors that influence co-creation. The level of granularity obtained through hierarchical coding ensure consistent coding practices over multiple analyses of the transcripts.

4.5. Data Validity

Qualitative methods are most suited for exploratory research (Corbetta, 2003). The validity of evidence presented through qualitative data collection is usually maximized through the triangulation method, which entails the consultation of at least three independent data sources that confirm a piece of evidence or finding (R. Yin, 2003). Since all the case studies pertain to projects that are in progress, it was necessary to obtain data primarily through interviews. Furthermore, perceptions of co-creation and value judgements regarding co-creation activities and outcomes are highly subjective in nature, and can be captured only through interviews or direct observation. Further, since the researcher was not part of any co-creation meetings, interviewing was ascertained to be the most effective method of collecting data.

Due to the lack of published data pertaining to the pilot projects, triangulation demands a minimum of three interviewees per case study. The interviewee was also required to be a regular participant of co-creation processes in their respective project, so that they would be able to accurately comment on such activities. This was possible only for one case (Norwich Case Study : Chapter 5, with 4 interviewees. For the remaining cases, only 1-2 interviews were possible to organize. For the Mechelen Case Study (Chapter 6) , only two interviews were organized, and the third interview was cancelled due to scheduling constraints. For the Fourmies Case Study (Chapter 7), only one interview was conducted. This was in part due to scheduling constraints with the citizen engagement consultant, and also because the case is organized such that no other participant attends more than one meeting in co-creation process. The Bruges Case Study (Chapter 8) was based on data collected from two participants. This was because the project has just completed the design phase after redeveloping their co-creation strategy. So far, no other participants have been sufficiently involved in order to be able to comment co-creation practices in the project.

To increase validity of the data collected, the researcher participated in co-creation webinars and pilot meetings (as recorded in table 4.2. In some cases, secondary sources of data (consultations with SHIFFT WP2 experts, as recorded in table 4.2) were used to clarify co-creation activities in pilot projects.

4.6. Data Interpretation

Interview transcripts were coded as per the method described in 4.4.2. These were used to develop a detailed description each case study the constituent parts of which follow the components of the IAD Framework. The description of the case in terms of the physical and material constraints, community values, and the operational-choice rules-in-use brings to light the predominant patterns of interaction within the action situations (as described in section 3.2.6). Following this, the progress of each case is evaluated according to the assessment framework described in fig. 3.3.

The following stage pertains to the identification of relevant drivers and obstacles to co-creation. Once patterns of interaction within action situations are uncovered,

the nature of their impact on the specific outcomes becomes evident. Working backward from this point, factors influencing co-creation, according to the components of the IAD Framework can be identified. Drivers and Obstacles were categorized into the following groups - Physical World, Community, Patterns of Interaction, Outcomes and Political Context. Although 'Political Context' is not a component from the IAD Framework, it was found that this factor plays a significant role in the evolution of co-creation, and cannot be subsumed under any other category.

The key takeaways from all cases were then compiled and contrasted together. It is not possible to compare the four cases that have been explored in this study due to the diverse political, social and geographical characteristics that are specific to each case. The case-wise compilation of drivers and obstacles to co-creation for each component of the IAD Framework can be found in Appendix C. Following this step, the common patterns in drivers and obstacles over all the pilot projects were compiled and can be found in Table 9.1.

5

Norwich

Case Summary

The Norwich case explores the evolution of co-creation in a small-scale low-complexity project in the social housing sector. This project succeeded in developing an acceptable technical solution for all key stakeholders but relied heavily on the existing network of professional relationships between important actors.

The main obstacles for co-creation were delays due to the Covid-19 pandemic, a unique community structure that precluded direct representation of tenants, and the embedded governance structures due to pre-existing professional relationships. The key drivers for this case were supporting and comprehensive planning, stable sources of funding, shared interests between active stakeholders throughout the project, along with expectation management and effective feedback mechanisms.

5.1. History and Political Background

Norwich is a city in the Norfolk county of East Anglia, home to roughly 150000 citizens(*Norwich Population @ population.city* n.d.). The city does not yet operate under a local or regional sustainable heat policy. With regards to heating, the city has only an Affordable Warmth Strategy the major focus of which is to target energy poverty in the city(Council, n.d.).

The Norwich pilot project concerns the transition to sustainable heating in a property called "Leeway Refuge". It is owned and maintained by the Cotman Housing Association(CHA) which is part of the People for Places(PfP) group. The PfP group is a placemaking and a regeneration company that develops customized "places" for specific functions such as work, play, housing, etc(*Places for People - About the Group* n.d.). The Cotman Housing Association is a Norwich-based housing provider which manages over 3,000 homes in the Norfolk, Suffolk, Essex and Cambridgeshire counties in East Anglia. The Cotman Housing Association is operating in a local socio-political context where renewable heating is not a high priority. The association's

decision to choose co-creation in the transition to renewable heating *" was a part of the bid for international funding"* (Places for People Manager , Personal Communication, March 2021).

5.2. Case Introduction

The Places for People Group is a private corporation operating in the housing sector with a broad range of activities. One of their commercial offerings is to provide care and housing for people who are homeless and/or are victims of domestic abuse. The Leeway Refuge property contains 12 apartments used as a shelter for women and children who are victims of domestic violence and abuse. These apartments are not available on the 'normal' housing market. The scheme is managed by a local charity (Leeway) but tenancies are held with Cotman Housing Association, which is a part of the PFP Group, while PFP carries out all maintenance and repairs activities.

PfP not only aims to provide housing for their clients, but also a platform for them to achieve their ambitions through education and employment opportunities. They have prior experience with tenant engagement activities, and some degree of tenant participation in their projects. Tenant engagement is a selling point for PfP, and also features on their adverts. They pride themselves on the quality of service they provide their tenants, and want to improve the client communication and collaboration through this co-creation project.

The Norwich pilot site is currently heated by two ground source heat pumps, that are over a decade old and break down frequently. The air source heat pumps used to provide hot waters to residents onsite is also in a state of disrepair. The backup heating solution constitutes of immersion heaters that are expensive and not sustainable in the long term. The chosen renewable heating solution for the Norwich pilot comprises solar panels with batteries that can store solar energy that can be used for heating purposes on-demand. The use of new and renewable heating technology was also useful to secure external funding. The Norwich pilot project is the first SHIFFT project to start installation of the renewable heating equipment.

5.3. Physical and Material World

5.3.1. Key Stakeholders

The stakeholders that are formally part of the co-creation meetings are:

- The Local Municipality - Norwich City Council
- Heating technology suppliers and consultants
- Housing and Care Managers
- Co-ordinators from Places for People
- Tenant Representatives

5.3.2. Resources

The PfP management provided the physical space (PfP offices) and financial assistance to host co-creation meetings. They also provide the managerial and adminis-

trative skills to organize these meetings.

5.3.3. Technology

All co-creation meetings have been virtual since the start of the Covid-19 pandemic in keeping with the imposed social distancing regulations. Stakeholders find it much more preferable and effective to hold meetings in person - *"I think that if we could change anything at the moment it would be that we could hold our stakeholder meetings in person."* (Places for People Environmental Sustainability Coordinator , Personal Communication, June 2021). The Norwich pilot project is currently in the Implementation phase. The Planning and Design phases were almost complete before the Covid-19 pandemic started, so the inability to organize meetings physically resulted in a delay of 6 months.

5.3.4. Sources of Funding

The cost of this project is partially borne by the European Union through the SHIFFT Project(estimated 60%). The remaining portion of the costs are borne by PfP group. The project has seen stable and sufficient financing.

5.4. Community

Tenants who reside at Leeway Refuge are not part of co-creation meetings because their tenancy is short-lived, and their challenging circumstances are not conducive for them to participate in co-creation in its current format. Instead, a group of democratically elected active tenants are invited to participate to represent the viewpoints of the tenants as a group. The tenants and their representatives are predominantly women. They face financial constraints due to the challenging circumstances that led them to seek housing at Leeway Refuge. Concerns over climate change, and reducing energy bills are some of the factors that motivate tenant representatives to get involved in finding sustainable heating solutions. Tenants' primary needs from the heating system are ease of use, comfort and low costs. Co-creation sessions included technical experts so participants understand the intricacies of the new technology being installed.

The PfP management considers the decision to move to sustainable heating sources to be pragmatic. Although the process of co-creation requires a significant financial investment on their part, the potential outcomes of reduced costs and increased comfort for their tenants make this a win-win situation. The PfP management also feels that climate action is important, and that the switch to renewable heating sources is inevitable. They predict that political pressure to improve energy efficiency of building stock will increase in the next decade, and making the transition now would put them ahead of the curve in this aspect.

The management group finds that it is challenging to get other stakeholder groups to take initiative in co-creation sessions. Since they are the initiators and coordinators of the co-creation process, this role seems to have cemented over time, with the rest of the participants following their lead in the meetings - *" I think it's not lack of*

know how..it's more lack of initiative - people are sometimes afraid to to be the frontrunner there."(Places for People Manager , Personal Communication, March 2021). They also find that occasionally the tenant representatives are unable to appreciate the financial and administrative constraints that they operate under - *"Sometimes..some of their comments and requests do have to be managed because they're unrealistic when you consider other stakeholder requirements."*(Places for People Environmental Sustainability Coordinator , Personal Communication, June 2021).

However, the PfP management also accepts that the gap in administrative and technical know-how between the different stakeholder is considerable, and not easy to cover over the span of this project. The management also finds that engaging in co-creation is capital, time and energy intensive.

5.5. Rules-in-Use

5.5.1. Position Rules

The stakeholders that are formally part of the co-creation meetings are

Table 5.1: Key Stakeholders for Norwich Pilot Project

Key Stakeholders	Role
The local municipality (Norwich City Council)	Review alignment with current municipality policies and utilize know-how of co-creation for further plans
The heating technology consultants and providers	Share technical support and learn about user experience
The housing and care managers	Learn from the user experience and prepare the wider organisation for uptake of the new technologies in other estates owned by PfP.
Places for People	Provide administrative and operational support for the co-creation process
Tenant representatives	As the primary recipient of the sustainable heating products, they are involved from an early stage to understand details of the decision-making process.

5.5.2. Boundary Rules

The section 3.2.4 describes boundary rules as those that define who is eligible to enter, hold and exit a position. As the coordinator for the Norwich pilot project, the PfP management was responsible for decisions about when and how to involve stakeholders. At the start of the co-creation venture, energy companies were not invited to meetings. The involvement for this stakeholder was deferred till the contractor for heat equipment installation was chosen.

Some of the tenant representatives have held these roles for almost a decade, and

understand problems that tenants face. Building managers, or housing managers have also heard feedback from tenants over several years. Both stakeholder groups were invited from the beginning of the co-creation process.

5.5.3. Authority Rules

The PfP management has been the stakeholder that has taken the initiative to organize the co-creation process. They retain the authority to decide if any of the proposals that result from the process are feasible to sponsor, support and maintain. They have also been responsible for the executive decision to involve tenants early on, in the co-creation process. As the managing body for the property, they are also responsible for the executive decision to share any information that they deem to be useful for the co-creation project.

The management set expectations early in the co-creation process, that tenant representatives can influence the process and outcomes. However, it has been observed that most stakeholders do not take initiative to lead discussions, or introduce new items on the agenda. *"We ask.. whether they want to have things on the agenda. [..] These elements should be on the agenda today - would you like to add something? It's often very silent."*(Places for People Manager, Personal Communication, March 2021).

The existing power dynamics between the PfP management, housing managers and tenant representatives have been reinforced over the duration of this project. Since these stakeholders are already engaged in a professional network with predefined power relations, altering the power dynamics is especially challenging.

5.5.4. Aggregation Rules

In the initial stages of the project, the staff from Places for People that resided onsite at Leeway Refuge were not entirely convinced of the need to switch to renewable heating. Over time, they have come to appreciate the benefits of this transition. Since then, however, the members of the project have largely been in consensus for the duration of observation.

5.5.5. Scope Rules

The sustainable heating solutions developed over the course of the co-creation process in the Norwich pilot project impact the 12 apartments on the Leeway Refuge property.

Since majority of the stakeholders present at co-creation meeting share a professional relationship with the PfP management, the power dynamics cannot be equated to those between the government and citizens. The aspect of societal acceptance as described in section 3.2.4 can be substituted with tenant acceptance, or widespread acceptance of the heating solution among all the stakeholders of the project.

5.5.6. Information Rules

The members of the project have access to the feasibility study that was conducted by the management of Leeway Refuge about the different heating options considered and the corresponding financial and energetic implications of each of these. This information is distributed by the CHA management amongst the members, under the assumption that this is the scope of information that is relevant for the participants.

The PfP management proactively managed the dearth of technical know-how regarding sustainable heating amongst the co-creation participants by involving heating technology consultants and maintenance persons in all meetings. *"There were always people involved that understood the technology that we were planning to do"* (Places for People Manager, Personal Communication, March 2021). As described in section 5.7.2, the executive framework for co-creation meetings follows an iterative pattern where the PfP management updates participants about action items from the previous meeting.

5.5.7. Payoff Rules

The management of Leeway Refuge bears the financial and administrative costs for the whole project. They also provide a physical space to hold co-creation meetings. The project requires investment of time and effort on the part of all the stakeholders that are involved.

The primary benefit of the co-creation project in the Norwich pilot is the sustainable heating solution that would be implemented (solar panels with battery storage). Although expensive to implement in the short term, it is highly beneficial in the longer term for tenants due to the reduction in expense and increased home comfort. This outcome predicts higher rates of customer satisfaction, creating a win-win situation for both the tenants and the management. Furthermore, the switch to renewable heating also reduces carbon emissions at the Leeway Refuge site. In the long term, the switch to sustainable heating also provides them with a buffer against political pressure to improve energy efficiency of building stock.

5.6. Action Situation

The action arena is the cumulative sum of the sections 5.3 to 5.5. In the Norwich pilot project, discussions follow an iterative process. Every meeting is succeeded by a follow up meeting where action items agreed upon in the previous meeting are executed by the management. Updates are provided to all stakeholders in the subsequent meetings for their review and further contributions. This action situation repeats several times over the course of the project with different agendas.

The decision-making processes are still primarily under the purview of the PfP management. However, the results of these processes are open to discussion and negotiation during the group meetings. The management is also open to incorporating feedback given by other stakeholders, if feasible from financial, technical and administrative perspectives.

The City Council has shown low engagement in co-creation on this site. One representative of the local municipality was involved in co-creation webinars, but the local government does not get representation in the periodic co-creation meetings (Observation #5 with Expert Member 2, Technical University of Delft, Personal Communication, August 2021). Technical consultants and maintenance staff usually do not contribute actively to negotiations in meetings. They perform a predominantly consulting role answering questions from both the landlords and the tenants, rather than contributing any initiatives of their own. Their primary incentive is commercial – to understand user experience.

As the managing body for the property, the CHA is responsible for conducting a thorough study prior to investing in, and implementing property-wide change. However, since this information belongs to the organization, they are not obliged to divulge it to participants of the co-creation project. Any information that they disclose to aid the process is entirely subject to their discretion. A conditional information flow pattern of this sort can cause blocks in later stages of the project, or limit the number of potential solutions that can be developed.

5.7. Patterns of Interactions

5.7.1. Timeline

The timeline for the project is laid out in the below manner:

Figure 5.1: Past milestones for Norwich pilot project

5.7.2. Executive Framework for co-creation meetings

The meetings follow an iterative process. Every meeting is succeeded by a follow up meeting where tasks agreed upon in the previous meeting are executed by the management. The update is provided to all stakeholders in the following meeting for their review and subsequent contribution.

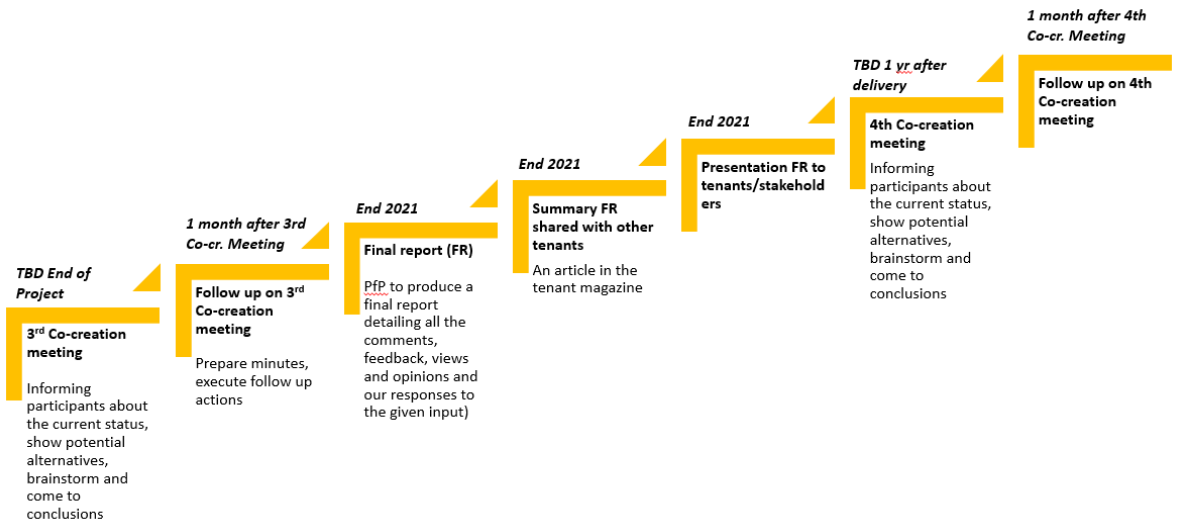

Figure 5.2: Upcoming milestones for Norwich pilot project

5.7.3. Impact of the Covid-19 pandemic

The spread of the global pandemic in 2020-21 has not failed to leave its mark on the Norwich pilot project - the installation of the solar panels, and batteries was delayed by 6 months. All group meetings had to be conducted virtually, on account of social distancing regulations.

5.7.4. Timely and staggered involvement of stakeholders

An executive decision not to include energy companies in the earlier stages of co-creation was made by the Cotman Housing Association. They were involved once the contractor for the heating solution was selected. Since energy companies' representatives are primarily the source of technical know-how about the equipment, their absence was made up for by educating tenant representatives about the consequences of different energy solutions for them.

5.7.5. Governance structure within the co-creation meetings

Since the PfP Management provides administrative, operational, informational and even financial resources, it has inevitably occupied an apex position in the governance hierarchy. The consequence of this is that decision-making is also driven by them. Although stakeholders are updated on the progress made by the management, they are not truly involved in the decision-making processes - *They kind of had already decided on a technological solution. And then they went out to ask other people to validate their choice.* (Postdoc Research Fellow, University of Exeter, Personal Communication, March 2021).

Since PfP played a constitutional role in the origin of the co-creation project, and they are also invested in the successful completion of the project, the natural consequence of this is an increased predisposition to taking initiative in the decision-making process. This creates a pseudo-hierarchical governance structure within the group. While it is true that the management desires more involvement from the

participation of the co-creation meetings, the disparity in the spread of resources between the participants makes the likelihood of this low.

Remarkably, it seems that there exists a gender divide between the management (predominantly male) and the tenant representatives (who are predominantly female, in consideration of the fact that this is a housing association for victims of domestic violence) - *"It was fascinating. [..] from a gender perspective, if nothing else, because all of the tenant representatives are women and everyone from Places for People are men."*(Postdoc Research Fellow, University of Exeter, Personal Communication, March 2021). The differences in communication styles between the genders perhaps also contributes to this pseudo-hierarchical governance structure.

5.7.6. Growth of Knowledge Base for Tenant Representatives

The tenant representatives have grown to better understand the intricacies of problem-solving in sustainable heating. However, the marked difference in the understanding of the sustainable heating technology between the tenant representatives and the PfP management is still a significant obstacle for tenant participation en masse. While some members among the tenant representatives are able to contribute to the co-creation process, this has not heightened contribution amongst all the representatives.

5.8. Outcomes

The Norwich pilot project is concerned with the development and installation of renewable heating solutions on the Leeway Refuge property. The technical aspect of this endeavour relies on the competencies of actors that have performed similar small-scale and low-complexity projects before. Although there has been a delay due to the Covid-19 pandemic, the installation of the heating equipment has started and is likely to complete successfully. The matter of social acceptance does not apply in this case; instead customer satisfaction can be considered as an equivalent parameter. The tenant representatives and housing managers have been consulted about the choice of technology and its intricacies, and are satisfied with the evolution of the project so far. The performance of the chosen heating technology after installation remains to be seen; the PfP management will monitor customer satisfaction 18 months after installation is complete.

5.8.1. Evaluative Criteria

The Norwich project has not yet developed a method of evaluating its outcomes pertaining to co-creation. As a private organization, however, they are keen on the performance of the newly adopted technical solution, which will be monitored on the parameters of reliability, cost, reduction of CO2 emissions, aesthetics, comfort level and ease of use (Observation #5 with Expert Member 2, Technical University of Delft, Personal Communication, August 2021). The installation stage is estimated to be completed by October 2021, following which PfP will monitor the performance of the heating equipment for a *"full heating season to monitor also the effects of the investment - whether we use less energy or not"*(Places for People Manager , Personal

Communication, March 2021).

Below is the assessment of the co-creation activities pertaining to sustainable heating transition in the Norwich pilot project:

- **Involvement of actors** - Across all the observed phases of the project the key stakeholders, except for the local municipality, were involved. The Norwich pilot project is involved in regular knowledge-sharing sessions with research universities and other pilot projects under SHIFFT. The research universities also provide guidance if required, but are not actively involved in the co-creation process.
- **Activities** - Alignment of expectations between tenant representative and the CHA management was observed. Further, negotiation during decision-making was observed to a small extent. The project receives stable funding via European Union subsidies and committed PfP management. The pilot project is organized such that regular feedback activities and monitoring of progress towards targets takes place. Minimal cross-phase cross-stakeholder competence development was observed.
- **Goals and Outcomes** - The project was delayed by 6 months due to the Covid-19 pandemic, but has progressed according to plan since then. It has been effective in developing an acceptable technical solution for all stakeholders. However, with low cross-sectoral development of technical knowledge, and with the continuation of the pre-existing governance structure, the social aspects of co-creation has not been achieved successfully.

5.9. Key Takeaways

A summary of the obstacles and drivers to co-creation in the Norwich Pilot Project, categorized according to the components of the IAD Framework is shown below.

Table 5.2: Drivers and Obstacles for co-creation in the Mechelen Pilot Project

Type	Drivers	Obstacles
Physical World	Administrative Capacity and Logistical Support (Comprehensive Planning) Stable sources of funding for all stages Key stakeholders involved throughout project	Delays due to inabiliy to organize meetings in-person due to Covid-19
Community Attributes	Shared and/or complementary goals - reduced costs, customer satisfaction, climate action	Direct participation of tenants not possible
Political Context	Desire to make the sustainable heating transition before political pressure builds	Low involvement from the local government
Patterns of Interaction	Key stakeholders involved in all stages of project Knowledge sharing sessions between universities and other pilot groups Alignment of expectations between stakeholders Feedback mechanisms between stakeholders in place	PfP management holds key resources, also in authority position - makes all decisions; authority in professional context - this makes changing governance structure hard
Outcomes	Acceptable sustainable heating solution for all stakeholders developed Cross-phase, cross-sector competency development	Low time-efficiency; High collaborative effort required to reach outcomes

6

Mechelen

Case Summary

The Mechelen pilot project explores the evolution of co-creation in a complex socio-technical context with large number of stakeholders working to develop a city-wide local heating strategy and implementation plan. The City of Mechelen intends to use the following strategies to increase citizen engagement - customized advice for householders with respect to renewable heating, the use of Participatory Value Evaluation to understand citizen opinions about policy options and strategies for implementation, and conducting home audits with consultants.

The main obstacles for co-creation were delays due the covid-19 pandemic, capital intensive implementation stage, low involvement of citizens in planning stages, high complexity in stakeholder management, government-perceptions towards co-creation, high governmental focus on persuading citizens to adopt renewable heating technology. technical complexity in sustainable heating, and pre-existing power dynamics between stakeholders.

The drivers for co-creation were planning support provided by the municipality, stable funding in planning stages, involvement of diverse stakeholder groups from the start of the project, supportive community attributes such as shared interests and increased ownership, supportive political environment, among others.

6.1. History and Political Background

Mechelen is a mid-sized Belgian city from the province of Antwerp that houses roughly 86,000 people (*Mechelen @ www.citypopulation.de* n.d.). It is situated at close proximity to prominent metropolitan cities such as Brussels and Antwerp. Mechelen has seen an increase in its population and economy in the past decade due to strategic investments by the City (*European Green Capital* n.d.). The City of Mechelen

was one of the winners of the European Green Leaf Award 2020, and is committed to climate neutrality by 2050. It is also a signatory of the Covenant of Mayors and has a Sustainable Energy Action Plan in place to reduce carbon emissions to 40% of 2011-levels by 2030(*Covenant of Mayors - Mechelen* n.d.).

Mechelen has an old building stock, with a high renovation potential to improve energy efficiency and reduce green house gas emissions (*mechelen @ www.triple-a-interreg.eu* n.d.). Over the past decade, the City has made efforts to improve the energy performance of its residential building stock through several initiatives such as the "Energiepunt Mechelen" - an information centre that provides financial and technical guidance for homeowners to renovate their dwellings (*energiepunt-mechelen-meer-informatie @ klimaatneutraal.mechelen.be* n.d.).

The province of Antwerp does not have a well define heat strategy that Mechelen can operate under. In the void created by the lack of a heat strategy, many stakeholders look to the City to take the initiative in developing a local heat policy - *" [They] feel like it's really empty space and several stakeholders are really looking for which role should I take here?"* (Participant 1 - Co-creation Meetings, Personal Communication, May 2021). This co-creation project in Mechelen leads the way for regional level governments to developing similar strategies in other municipalities.

6.2. Case Introduction

The municipality has undertaken several urban renewal projects, and is beginning its foray into sustainable heating. This is demonstrated by the Keerdok neighbourhood, where a low temperature district heating system based on the Borehole Thermal Energy Storage System(BTES) with heat extracted from the river Dyle and sewage water has been implemented. (*Eandis Keerdok Mechelen - Ingenium* 2021; Hoppe, Jansen, et al., 2020b). The City of Mechelen is also involved in other EU-funded projects with a co-creation approach towards making a policy strategy and city vision,such as "Cities of Tomorrow", which fund some of their projects.

The city of Mechelen is currently developing a local heat strategy by involving key stakeholders to develop a "heat coalition", as part of the SHIFFT project.

6.3. Physical World

6.3.1. Key Stakeholders

The key stakeholders for the Mechelen pilot project are:

- The City of Mechelen
- Municipal Departments - Related branches such as AGB Energiepunt, Marketing and Communication, and Housing
- Distribution Service Operator - Fluvius
- Renovation Coaches and Installers
- Regional Government - Province of Antwerp

- Consultants - Ingenium (Sustainable Construction Consultant) and Levuur (Participation and Stakeholder Management)
- Klimaan - Citizens' Movement focused on developing a sustainable and climate-neutral society, i.e., community energy collective
- Citizens

6.3.2. Resources

The City of Mechelen is currently in the stage of developing the local heat strategy. This corresponds roughly with the Design phase of co-creation. The municipality initiated the development of a heat strategy through the SHIFFT Project and aims to design it with the involvement of key players. They possess the administrative and organizational skill, and also the legitimacy required to oversee this process. The City has borne all supporting organizational costs so far.

6.3.3. Technology for Logistical Purposes

Due to the Covid-19 pandemic, all co-creation meetings have been held virtually. The Miro board has been used extensively in this pilot project as a tool to facilitate collaborative participation within meetings.

6.3.4. Sources of Funding

Funding is currently obtained from public government sources, as the pilot project is operating under SHIFFT. The City strategy for Mechelen developed as part of SHIFFT Work Package 1 has already triggered external investment in sustainable heating technology in additional buildings in Mechelen. However, for future phases of the Work Package 2 project (that is the subject of the analysis in this chapter), sources of funding are yet to be determined. At the current juncture, the sustainable heating solutions in contention are heat pumps and a local heat network. Both these solutions require large financial investments and cannot be funded by solely the local government.

- **Heat Pumps and Thermal Insulation** pose several challenges for homeowners. For instance, they are required to adapt their heating systems to accommodate such heating equipment. These also require specific building locations and soil conditions for optimal performance(Frontier Economics and Element Energy., 2013). Such renovations are expensive and put the burden of financing entirely on householders, likely posing barriers to widespread acceptance.
- **District Heating Network** can provides a large-scale heating solution for the city, but is capital-intensive, requiring investment from multiple stakeholders. The high expenditure and lack of freedom to choose custom heating solutions are potential challenges for this option.

A sustainable heating solution is complex in its organization and implementation, and requires a high degree of technical know-how. The process of understanding, developing and implementing these systems is perceived to be complicated, uncertain and time-intensive, accompanied by a high rate of failure. Such characteristics make it difficult to attract investment for such projects, and are also obstacles for societal acceptance.

6.4. Community

Attitudes towards Co-creation The municipality has varied opinions about co-creation. They perceive co-creation as being time-intensive, and difficult to implement. Co-creation is markedly different from the usual method of developing solutions through discussion only with consultants, and hence requires effort. Conversely, involving multiple viewpoints in developing a solution prevents tunnel vision and provides for a robust solution - *"Multiple viewpoints makes your work also more robust, because it takes a lot of things in consideration. That's a bit of a paradox because it's also more complex and not always easy to understand all those viewpoints."* (Project Leader - City of Mechelen, Personal Communication, July 2021).

The understanding of co-creation has also evolved over time. Co-creation meetings have evolved from having a large number of stakeholders with a broad agenda, to more focused meetings with participants who have a stake in the theme being discussed - *"I think it's not only about quantity, but it's also about the quality. You really need to think about which viewpoints you include and who are who is providing them."*(Project Leader - City of Mechelen, Personal Communication, July 2021). The municipality also perceives citizens to be lacking the technical know-how to comfortably be part of such meetings, preferring to involve them at a later time.

The City of Mechelen faces various supportive and unsupportive political pressures from within the local government. Different branches within the local government find it beneficial to be involved in the development of the heat strategy, as it fosters a sense of ownership. The co-creation process also exposes them to different stakeholders' points of view, which in turn is helpful in generating local political support for a heat strategy developed through co-creation. Contrastingly, several elected officials also subscribe to the notion that the role of the citizens ends with electing the civil servants that represent them - *"they don't really see the added value anymore over [citizen] participation because they already had the opportunity to participate"*(Project Leader - City of Mechelen, Personal Communication, July 2021). The use of Participatory Value Evaluation (PVE) as a tool to aid effective co-creation was deferred as several officials were of the opinion that extant politically unfavourable positions would render this strategy too risky (Observation #4 with Expert Member 1, Technical University of Delft, Personal Communication, August 2021). Despite several reminders from the SHIFFT WP2 Research Team, PVE has not been implemented in the city of Mechelen.

Citizens are currently only involved in one-directional information sessions. The municipality considers it vital to make citizens comfortable with the issue of sustainable heating transition through these sessions before involving them in the decision-making process. The assumption underlying this strategy is that the shift in citizens' attitudes will take time.

On a broad scale, there is an ambiguous vision concerning citizen involvement. On the one hand the city takes the initiative for citizen participation (for example, through projects such as SHIFFT and Cities for Tomorrow) , and on the other the idea

that citizen involvement is complete with the election process is also prevalent. The city intends to carry out a Participatory Value Evaluation to collect opinions from citizens about policy options and strategies to implement them - however, this strategy has been deferred *"several times due to unfavourable political conditions"*(Observation #4 with Expert Member 1, Technical University of Delft, Personal Communication, August 2021).

6.5. Rules-in-Use

6.5.1. Position

Table 6.1: Key Stakeholders for Fourmies Pilot Project

Key Stakeholders	Role
The City of Mechelen	Focused on developing a data-driven, technically sound local heat strategy with high levels of social acceptance that avoids lock-in complications. Keen on improving city service in regards to sustainable heating by improving Energy Information Centres. Currently also involved in heat-related policy-making in regional and national level.
Other Municipal Departments,in particular AGB Energiepunt, Marketing and Communication, and Housing	The involvement of different city groups allows them to understand the value of developing a heat strategy for their work.
Renovation coaches and DSO (Distribution System Operator) Fluvius	Fluvius builds and manages the networks that provide electricity, natural gas and heat to homes and businesses. DSO - Fluvius stands to be impacted negatively with the sustainable heating shift. In the absence of a coherent heat strategy, they expect the City to take the lead in organizing the transition at the moment. They find it important to be part of the process to develop a heating solution. They are also considered an important strategic partner by other city departments and higher authorities as they are the primary provider of current heating services in Mechelen.

Table 6.1 (continued)

Key Stakeholders	Role
Installers	Retain decision-making powers and provide administrative guidance for renewable heating strategy. The city council has to be briefed about the project and future plans regarding all the developments and co-creation activities.
Kamp C	Centre for Sustainability and Innovation - provides guidance to homeowners to monitor their energy consumption and improve the energy performance of their homes
Province of Antwerp	Regional Government that is interested in seeing sustainable heating projects evolve, to use this experience and knowledge to support other municipalities
Ingenium and Levuur	These private consultants won the bidding process from the City. Ingenium was hired to perform techno-economical analysis of heat usage in Mechelen. Levuur provides support in organizing participatory sessions which will eventually aid the development of a ”heat coalition”.
Klimaan	The Klimaan climate co-operative has two branches (VZW - citizen involvement, CVSO - Citizen Energy cooperative). Klimaan CVSO has been invited in the co-creation process because they are closely connected to a very highly motivated group of citizens. This makes them a valuable strategic partner.
Citizens	Part of information sessions. One of these was with Klimaan(non profit branch).

The municipality aims to develop a heat coalition, although its membership and format are yet to be determined. The purpose of this coalition is to develop a local heat strategy and implement it. Stakeholder groups spanning industrial, regulation and governance, knowledge institutes, finance, and citizen sectors are to be involved in the development of the heat strategy.

6.5.2. Boundary

The centres for decision-making in the Mechelen project are multiple, have a variable list of participants, and are spaced out over time. The municipality is responsible for organizing these sessions, and controls who is invited to these sessions. Participation is voluntary and members are free to exit the process at any time.

Studies have shown that involving too many stakeholders does not guarantee higher rates of success in participatory planning (Zingraff-Hamed et al., 2020). It is far more beneficial to involve relevant stakeholders to improve communication across multiple sectors - a strategy that the City of Mechelen has found useful. Co-creation discussion happens over multiple "organically evolving" focus groups that are described below:

Focus Group with Project Developers - includes real estate project developers and also city departments related to spatial planning, urban renewal, etc. Spatial planner consultants provide help with the data analysis part of the heat strategy development - for instance, in drafting heat zoning maps for the city. Collaboration between these stakeholders also provides a way to align process flows with other local initiatives.

Focus Group with Businesses and Industry - includes business and industry representatives along with business area managers.

Focus Group with Non-Profit Organizations - includes any nonprofit organizations that work on energy and sustainable and heating and services for citizens.

Steering Groups - The participants of this group include decision makers, the management team of the city administration, Klimaan (citizen cooperative), Fluvius (Distribution Service Operator), policy makers, managers of various city departments, technical experts, and participation experts. Occassionally, some of these key decision makers do not take part in the meetings due to time constraints. Steering group meetings are infrequent, and focussed on themed discussions with a small group of influential actors.

6.5.3. Authority

As described in section 3.2.4, authority rules specify the set of actions available to participants in co-creation sessions. Section 6.5.2 shows the various arenas where discussions pertaining to the development of the heat strategy take place. In all these sessions, the municipality continues to retain the position of the co-ordinator collecting feedback from other stakeholders. Although the participants are not denied the opportunity to organize these sessions and take the initiative in the heat strategy development, they do not possess the technical skills or social capital required to do so. This it seems, the municipality is the actor that has the most authority. They are responsible for driving the whole project, and are the most involved actor so far.

The municipality is responsible for agenda control over the focus group meetings:
Focus Group with Project Developers - The agenda revolves around the intersection of the heat strategy and stakeholders' concerns. Relevant topics such as what the heat transition means for project developers, current development practices, and their take on these issues are discussed. External keynote speakers are invited to motive participants and bolster engagement in these meetings.

Focus Group with Businesses and Industry - The agenda for this focus group per-

tains to the intersection of the heat strategy and the concerns of the private sector. Topics of discussion include residual heat opportunities within business areas, and the role of businesses in the evolving energy systems. These meetings are also feedback sessions where sustainable heating consultants from the municipality present their work and collect feedback from businesspersons and their representatives.

Focus Group with Non-Profit Organizations - Non-profit organizations such as Klimaan CVSO are invited to participate in this group. Depending on necessity, they are asked to be part of focus group or just provide feedback on reports. The agenda in these meetings involves updates about the work being done by the local government and feedback regarding how these stakeholders can be involved in the future.

Steering Group - The agenda here focuses on updates regarding the development of the heat strategy and inputs from key stakeholders regarding the progress.

6.5.4. Aggregation

Meetings under the Mechelen Pilot Project so far have been feedback sessions or information sessions where stakeholders have not strayed beyond their predefined professional roles. Discussions are organized to collect opinions or convey updates, and by design do not include deliberation over contentious issues. This is partly also due to the relatively early stage that the pilot is currently in.

6.5.5. Scope

The Mechelen pilot project intends to develop a local heat strategy in collaboration with key stakeholders as outlined above. The heat strategy developed as an outcome of the co-creation process will be aligned with the long term goal of climate-neutrality by 2050. Citizen involvement efforts over the duration of the project aim for a CO2 reduction of 103 tonnes CO2/year which are estimated can be achieved by 25 households investing in sustainable heating installations, and 225 households reducing their energy use from heating by taking measures to optimise their existing installations. This will be a stepping stone to a lasting trend of transitioning to renewable heating.

6.5.6. Information

The City of Mechelen holds the authoritative position and co-ordinates most activities under the co-creation initiative. They have organized several information sessions for citizens focusing on the need to transition to sustainable heating as preparation for their involvement in co-creation. The municipality conveys information about what options are available for citizens in the switch to sustainable heating. Meeting invites are put up on the city website or Facebook, open for all interested citizens. The Mechelen local government has recently launched information campaigns, for example through the group heat pump offer where a group of government-approved installers will help homeowners identify if their home is ready for renovation(*groepsaanbod-warmtepompen @ www.vlaamsbrabant.be* n.d.). Another such initiative is the "50 degree test" (*Krijgt jouw huis het warm van 50 graden? @ www.milieucentraal.nl* n.d.), to encourage homeowners to self-identify if their homes are ready for a heating renovation.

The dearth of technical know-how pertaining to sustainable heating has been observed in stakeholders across all sectors. This has proven to be a barrier to effective communication even in the presence of subject matter experts due to the high complexity of the issue.

6.5.7. Payoff

The payoffs for all stakeholders are pragmatic, and lie in the outcomes of the project:

- **Local businesses** understand the complexity and capital-intensive nature of the heat transition and have a large stake in ensuring that the heating solutions are suitable for them - participating in the solution development is the best method of ensuring a successful outcome.
- **Local governments** are aware of the organizational and technical complexity of the heat transition, and the need for societal acceptance for a successful heating solution.
- **Fossil-based Businesses** have the best chance of a suitable solution by being involved in the decision-making process, although the outcomes of this project are potentially disruptive to their livelihoods.
- **Citizens** have thus far not played and active role in the Mechelen pilot project's decision-making processes pertaining to the sustainable heating transition. Since renovating their homes is likely to be costly, there are clear benefits to being involved in the co-creation project. However, the City of Mechelen is choosing to involve these stakeholders at a later stage due to a perceived dearth of technical know-how in this group, and unfavourable attitude to sustainable heating. This perception of government officials has been shown to common (Devine-Wright, 2011).

Commonly observed costs associated with the co-creation process are low technical know-how in stakeholders across all sectors, and the time-intensive nature of the participatory process.

6.6. Action Situation

The Action Situation is the cumulative sum of the parts described above between section 6.3 and 6.5. To summarize, in the Mechelen project, pseudo decision-making processes take place in multiple repetitive action situations comprising of varying groups of stakeholders, in such a way that existing power dynamics between the participating groups are reinforced. Participants retain their professional roles and engage in new participatory activities such that the status quo is retained. Homeowners are not privy to decision-making processes pertaining the local heat strategy, nor the increase the adoption of sustainable heating solutions amongst citizens. Citizen co-operatives are involved to a small extent through feedback loops. Members of co-creation meetings are free to provide opinions on their vision of the heat policy and their concerns, but are not part of the final decision-making scenarios.

Discussions take place in groups with closely related actors around relevant themes causing information to be retained in silos while the role of the City as the co-ordinator gets further established. For most participants, the co-creation process brings with it high demands on time and collaborative skills, although the benefits of collaboration are apparent. The current trajectory will allow the municipality to produce a heat strategy, and perhaps also a heat coalition in consultation with all key stakeholders, although the degree of co-creation will be low. The decision not to involve citizens in the negotiation stages of the project is likely to result in less than optimal societal acceptance and slow uptake of renewable heating technologies.

6.7. Patterns of Interactions

6.7.1. Effect of the Covid-19 Pandemic

The Covid-19 pandemic forced all meetings to be organized virtually. Virtual meetings offered an arena for increased participation than usual, as the traditional method of policy-making involved minimal participation.

6.7.2. Bottom up Expectations

External stakeholders at the local level expect the City to take a leading role in organizing the heat strategy. The transition to a sustainable heat strategy could spell high levels of disruption for the Distribution Service Operation Fluvius, and they expect the City to take the initiative in setting the context in which they operate. Fluvius also expects to be part of the decision-making process as it is an influential stakeholder. Citizens are not actively demanding a climate-friendly heat policy, but the municipality recognizes the need for social acceptance for large scale adoption of sustainable heating renovation.

6.7.3. Top-Down Political Pressure

At the moment, Mechelen does not face political pressure from higher levels of government to develop a heat strategy, and consequently does not receive financial assistance for this task. The funding that Mechelen receives through the SHIFFT project has sustained progress thus far. Under the SHIFFT Project, Mechelen is also accountable for their progress in the transition to sustainable heating. Lacking a coherent regional-level heat transition policy, the Flemish government views this project as an experiment in municipal-level policy development. This opens a window of collaborative opportunities between multiple levels of governance in this arena. The SHIFFT Project also provides support for the development of an extensive heat strategy from the co-creative process - *"I think that's a very nice bubble because here we managed to investigate the feasibility of a heat network along our ring roads and that would be an idea that... the local government would never have invested [in].. to investigate... but because it got selected we were able to do that now."*(Project Leader - City of Mechelen, Personal Communication, July 2021). This heat strategy is meant to lead the way in Belgium so other cities may develop such strategies.

Although departments in the local government recognize the benefit of collaboration with stakeholders, resistance to involving citizens in the decision-making pro-

cess remains. That the heat strategy can be linked with related ongoing initiatives, such as the urban renewal project provides political support for its development.

6.8. Outcomes

For a co-creation project, it is not possible to predict the final outcome of the process (both technical and social). The dynamics uncovered by the rules in use show that if the project were to continue on its current trajectory, a heat coalition could formulate from its efforts. Although efforts are being directed to develop a network of actors that function as a coherent unit to develop and implement the heat strategy, it is more likely that the current roles will be reinforced as can be inferred from the rules in use.

However, the sustainability target that Mechelen has committed to, with SHIFFT, is the adoption of renewable heating technology by 25 households by August 2021. To increase adoption of heat pumps as a renewable heating source, the municipality is increasing its citizen engagement initiatives through this project. Although this might succeed in reducing the societal prejudice against heat pumps and heat networks, no efforts have been made so far to identify the underlying issues that the citizens of Mechelen face with regards to adopting these technologies. Not including critical players in the key stages of planning and implementation can lead to blocks in the last stages of implementing a solution (Rossano, 2016).

6.9. Evaluation Criteria

The stakeholders in the Mechelen project have not yet developed a system to monitor their progress. The existing practice to to monitor each session and examine the progress make. Future steps are identified based on past experience and a general idea of the goal to be achieved.

Below is the assessment of co-creation for the sustainable heating transition in Mechelen:

- **Involvement of actors** - Due to the nature of the SHIFFT project, regular meetings between pilot managers are organized by the lead technical institutes for the purpose of knowledge-sharing. Thus universities are involved as observers and sources of information about co-creation for the entire duration of the project. The project is currently in the design phase. For both the initiation phase and the design phase, the municipality continues to retain the role of the coordinator. The initiation phase of the project involved understanding meetings to understand stakeholders' perceptions on the topic of sustainable heating and has evolved into focus groups with related actors. However, these meetings revolve primarily around information dissemination or collection of feedback. Key stakeholders have not involved been involved in the decision-making processes in any of the phases of the project thus far.
- **Activities** - Alignment of expectations between market, state and social sectors was done satisfactorily - the representative participants understood their roles and the outcomes they could influence through their participation. Social learning between stakeholders of different sectors over the phases of the

project was not planned specifically, and was not observed. The project is adequately funded so far due to its involvement in SHIFFT, however sources of funding for future phases are yet to be determined. Participants have not yet agreed to a method of monitoring progress. The municipality, as the driver of this process also does not yet have a method of evaluating progress towards targets. However, the SHIFFT WP2 expert team are in the process of developing a monitoring tool (in collaboration with pilot hosts) which will be adopted by Mechelen shortly.

- **Goals and Outcomes** - The project is not yet complete, so the final assessment on the parameters of effectiveness and efficiency cannot yet be made. So far, however, the pilot project has not been effective in developing cross-sectoral technical knowledge. On the account of developing social capital, there has been some progress made. The project has not been time-effective so far as it has been delayed, partly due to the Covid-19 pandemic. It is too early yet to assess the societal acceptability of the solutions that will be the outcome of this project.

6.10. Key Take-aways

A summary of the obstacles and drivers to co-creation in the Mechelen Pilot Project, categorized according to the components of the IAD Framework is shown below.

Table 6.2: Drivers and Obstacles for co-creation in the Mechelen Pilot Project

Type	Drivers	Obstacles
Physical World	Administrative Capacity and Logistical Support (Comprehensive Planning)	Delays due to inabiliy to organize meetings in-person due to Covid-19
	Stable sources of funding for planning stages	Capital-intensive implementation stage
	Several key stakeholders involved from the start of project	

Table 6.2 (continued)

Type	Drivers	Obstacles
Community Attributes	Shared and/or complementary interests	Citizen perceptions about sustainability transitions not explored; Citizens not involved in planning stage
	Platform for understanding multiple perceptions of sustainable heating	Large number of stakeholders; complexity in organizing effective communication and decision-making processes
	Belief that multiple viewpoints help in developing robust solution	
	Focus on effective stakeholder participation	Co-creation perceived as being time consuming by the municipality
	Increased sense of ownership	Perception of government as ″service provider″ and that citizen participation ends at election stage
	Involvement of community energy collective(Klimaan) in co-creation processes	
Political Context	Heating strategy is linked with other policies such as urban planning	Perception of government as ″service provider″ and that citizen participation ends at election stage
	Support from higher levels of government to explore sustainable heating solutions	Concerns over citizen involvement leading to conflicts or disruptions in existing governmental policies
	Opportunity for local government to influence decision-making at different levels	

Table 6.2 (continued)

Type	Drivers	Obstacles
Patterns of Interaction	Knowledge sharing sessions between universities and other pilot groups	Dearth of technical know-how about sustainable heating transition across sectors
	Multiple decision-making arenas to manage high number of stakeholders	More importance given to private sector and government actors than citizens in development of heat strategy
	Information sessions for citizens to become familiar with sustainable heating transition	Citizen involvement through citizen co-operatives only
		Information retained in silos with co-ordinating stakeholders being the only actor with an overview
		Existing power dynamics between stakeholders reinforced
Outcomes	Social capital developed for some stakeholders	Low time-efficiency; High collaborative effort required to reach outcomes
	Development of a data-driven heating strategy that considers multiple viewpoints	Citizen viewpoints not factored in development of heat strategy
	Acceptance of heating solution by many stakeholders	Cross-sector cross-phase development of competencies not observed
		Difficulty in estimating efficacy regarding heat technology adoption, CO2 emission reduction and societal acceptance

7

Fourmies

Case Summary

The Fourmies pilot project explores the evolution of co-creation in a rural town following a phased approach in the transition to sustainable heating. The municipality aims to develop public awareness and societal acceptance towards sustainable heating transitions by involving them in the design of select aspects of the development of a renewable heat network for municipal buildings in the city centre.

The main obstacles for co-creation in this project were delays due to the Covid-19 pandemic, budgeting challenges in the implementation phase of the project due to discontinuation of intergovernmental funding scheme, low involvement of citizens in the project, ineffective expectation management, and the lack of feedback mechanisms, among others. The primary drivers for co-creation were planning support provided by the local government, a shared interest in climate action among stakeholders, a focus on societal acceptance and a political environment supportive of sustainable development, to mention a few.

7.1. History and Political Background

The City of Fourmies is a commune that lies in the northern part of France. It is a rural town with a small population of 13,000 inhabitants, located far from cultural and commercial centres within the country (such as Lille, Amiens). It lies close to the Belgian border of France, and is also proximal to Luxembourg.
For its inhabitants, the physical distance is a much lesser source of anguish than the economic distance from major hubs (HIRAUX, 2016). During the first and the second industrial revolutions, the town flourished thanks to the textile industry, and the household appliance industry, respectively. Since then, employment has languished, with the total number of unemployed citizens approaching 34% (Maurice, 2017).

The Town of Fourmies has committed to a social, ecological and energetic transformation as part of the Third Industrial Revolution that started at the end of 2015 (*REV3* 2020). The TRI is propelled by five major areas of transformation - "switching to renewable energies, developing energy-producing buildings, acquiring energy storage capacities, developing the Internet of energy and reinventing the mobility of people and goods" (ibid.).
Through collaboration between the President of the Regional Council of Hauts-de-France, and the Mayor of Fourmies, the City was nominated as the "original demonstrator" under the Troisième Révolution Industrielle (TRI) or the Third Industrial Revolution. The third revolution will become a "structuring axis of municipal policies", around digitally-connected smart buildings powered by renewable energy (used in the service of mobility) under mayor Mickaël Hiraux (Hiraux, 2017). The Town Hall-Fourmies works with the Mayor to develop and implement heat strategies for the city. The recent ruling by the France top court mandating the French government to take climate action by March 2022 increases top-down political pressure(Guillot, 2021).

7.2. Case Introduction

The Fourmies pilot project is part of a series of phased transitions to sustainable heating in the city. Through the SHIFFT Project, five municipal buildings will make the transition to heating through a **locally sourced wood-based biomass heat network**.

The benefits of this are twofold:

- Administrative Risk reduction – With municipal buildings, any disruption caused during the switch from the old to the new heat network can be contained and managed.
- Reduced Financial Risk – The municipality received a subsidy to carry out the SHIFFT project. Since its conception, the cost of the project has gone up considerably – the excess financial burden of which has been shouldered by the Town Hall-Fourmies municipal body. However, the presence of the subsidy reduces the economic burden that the project poses.

This project aims to instil confidence among the citizens regarding the future adoption of sustainable heating in residential buildings by dispelling concerns regarding several aspects of the technology - for instance financial, or pertaining to the level of comfort. Through the SHIFFT Project, the city government aims to demonstrate a successful model of a transition to sustainable heating, thereby setting the stage for similar thermal transitions in the future.

7.3. Physical World

7.3.1. Key Stakeholders

The main stakeholders for the SHIFFT sustainable heating transition in the city of Fourmies are the city associations (music, theatre, museum, and the smart-lab), regional authorities (Hauts-de-France, Parc Naturel Régional, REV3), national author-

ities (ADEME), the new city council made up of elected representatives, energy providers, farmers, citizens and children.

7.3.2. Resources

The City of Fourmies is currently at the end of the design phase of the project. The City provides the administrative, and financial resources required to oversee the project. So far, the city has borne all organizational costs.

7.3.3. Technology used for Logistical Purposes

Due to the Covid-19 pandemic, group meetings have been held online in keeping with social distancing regulations. This has negatively impacted the quality of participatory meetings -*"[The event was] a considerably mediocre success because we didn't have as much participation as we wanted...It was because we don't still find it quite easy, even the citizens don't find it easy to communicate [online]"*(Manager - Mairie de Fourmies, Personal Communication, May 2021).

7.3.4. Sources of Funding

Funding for the project is currently obtained from public government sources, as the pilot project operates under SHIFFT. The City is financing the transition to sustainable heating for four buildings in the city centre. The project faces budgetary challenges due to the increase in cost of raw materials since the planning phase.

7.4. Community

Although during the first and second industrial revolutions trade flourished in the City of Fourmies, in the recent past, the total number of unemployed citizens has reached very high levels - upto a third of the population 34% (Maurice, 2017). The Mayor of Fourmies and the Regional Council of Hauts-de-France are looking to revolutionize the image of the city by undertaking digital and sustainability initiatives.

The City of Fourmies has taken part in the SHIFFT project, to engage citizens in limited aspects of the sustainable heating transition to increase the level of societal acceptance around this issue. Citizens that participated in the co-design event (further described in sections 7.5.2 and 7.7.1) were motivated by their desire to contribute to climate action through this project. The Town Hall-Fourmies conducts meetings that are open to all to attend. Meeting details are put up on the organization website for any interested citizen to participate. As a public institution, the municipality does not engage in targeted invitations for citizens, to support a transparent co-creation process.

The unintended consequence of this approach is that it was not possible to ascertain demographic parameters of participants, in keeping with GDPR Regulations regarding meetings that are conducted virtually.

7.5. Rules-in-Use

7.5.1. Position

Table 7.1: Key Stakeholders for Fourmies Pilot Project

Key Stakeholders	Role
Town Hall – Fourmies (Municipal Organization)	Organize and lead the SHIFFT Project
City Associations	Immediate initial users of the renewable heat network. Familiarize themselves with the existing heat network, understand development plans for the renewable heat network and provide advise regarding its aesthetic integration.
New City Council	Retain decision-making powers and provide administrative guidance for renewable heating strategy. The city council has to be briefed about the project and future plans regarding all the developments and co-creation activities.
Citizens	Learn about the heat network, understand issues pertaining to design and implementation of heat network. Participate in co-creation activities regarding aesthetic decisions for boiler building part of the renewable heat network.
Regional and National Authorities	Learn about relevance of the heat network, gain know-how about the potential of biomass, understand financial requirements for future projects. Promote and share technical, cultural, ecological and administrative aspects
Children	Learn about principles of heat network;As future residents of the city, they are educated about city development and understand city requirements for sustainable heating
Energy Providers	Provide know-how about the potential of biomass in the region. They are involved in promoting renewable heat technologies
Farmers	The farmers and agriculture entities of the region have to be informed about the value of the hedges to ensure the availability of the biomass.

7.5.2. Boundary

The Fourmies pilot project does not offer a stable avenue for co-creation through the different phases of the development of the heat network. As a result different

stakeholders do not have specific roles in the co-creation process.

At the start of the co-creation venture, citizens were invited to a co-design meeting where they gave their opinions on aesthetic constraints for the boiler building. Based on the outcome of the co-design event, the City of Fourmies extended invitations to tender to recruit renewable energy companies to construct and maintain the heat network for the following 6 years. For any activity involving citizens, the municipality maintains an open attendance approach for all those who are interested.

The municipality made the decision to keep the attendance open for all interested citizens. The attendance was around 20-25 people. The other invited participants were municipality officials and two energy companies. Stakeholders that were perceived as key to this stage of the development of the heat network were invited by the Town Hall-Fourmies municipal body. However, the municipality is careful not to invite any groups of citizens specifically, to avoid misconceptions of preferential treatment. Among those who register for the meeting, every participant is treated equally regardless of age, gender and profession.

The design of the co-creation events is such that the municipality is the only consistent attendee. Consequently, there is no scope for development of administrative or technical capabilities in the citizens that participate in these events. As long as the municipality chooses to retain the primary authoritarian role, citizens will not truly be able to negotiate changes on their terms.

7.5.3. Authority

The Fourmies pilot project does not show a stable arena for an action situation to develop. Thus there are no authorized rules available as per different positions. However, the Town Hall – Fourmies had the power over the agenda in the co-design event. They have been responsible for setting up meetings and inviting the appropriate stakeholders for the different parts of the heat network design and installation. As the coordinator of the process, they retain the authority to decide if any of the proposals that result from the process are feasible to sponsor, support and maintain. However, they are accountable to the Fourmisiens regarding the outcomes of the sustainable heat projects they undertake, especially with respect to the activities where citizens were asked to participate – such as the co-design venture.

7.5.4. Aggregation

The key stakeholders involved in the project have largely been in consensus for the duration of observation. The behaviour of the group under a situation with opposing viewpoints among stakeholders has not yet revealed itself.

7.5.5. Scope

The scope of the sustainable heating project in Fourmies extends to the construction of a wood-based biomass heat network for 4 public buildings in the city centre. Citizens were invited to provide their opinions on a limited set of aesthetic constraints for these buildings only.

The municipality published tendering documents to recruit a company (or a group) for the construction, maintenance and exploitation of this network for the duration of the 6 years or more. The recruited energy company(s) are obligated to use biomass originating within a radius of 50 - 100km around the city. In support of this requirement, provisions have been made to facilitate local suppliers to make direct contracts with the city (*VILLE DE FOURMIES* 2021). The choice of the renewable heating source and the process to select the organization for the management of the network were outside the scope of this project.

7.5.6. Information

At the start of the SHIFFT project, the Town Hall - Fourmies identified the communication strategy to inform citizens about the co-creation meetings. However, the strategy to communicate relevant information regarding the project itself is solely decided by the government organization itself.

The citizens were consulted on their opinions regarding certain aesthetic parameters of the boiler buildings. However, they were given only the information that the municipality deemed relevant to this process of consultation.

7.5.7. Payoff

The perceived benefit of the Fourmies pilot project for the municipality is increased societal acceptance regarding their initial foray into transitioning to sustainable heating. However, mismanagement in planning and communication have reduced the chances of this outcome.

There are no external rewards that the citizens benefit from for participating in the co-design event. The City of Fourmies bears the costs related to organizing the co-design event.

7.6. Action Situation

For this project, the decision-making space includes municipality officials as they make executive level decisions about the project. However, this action situation does not fall under the purview of the SHIFFT project. The participatory event under this project was the webinar, the purpose of which was primarily to obtain feedback and provide information to the citizens.

Co-creation has not been used as the overarching method of executing this project. Citizen participation in the decision-making process was limited to choosing aesthetic aspects of the design and boiler buildings. This was done through an online event where participants were invited to cast their votes on the material composition of the building exterior and the chimney. The company chosen to implement this project must adhere to these restrictions.

These outcomes were not binding. This aspect became apparent when the municipality realized that the cost of these constraints were beyond the scope of the project.

7.7. Patterns of Interactions

The timeline for the project is laid out in the below manner:

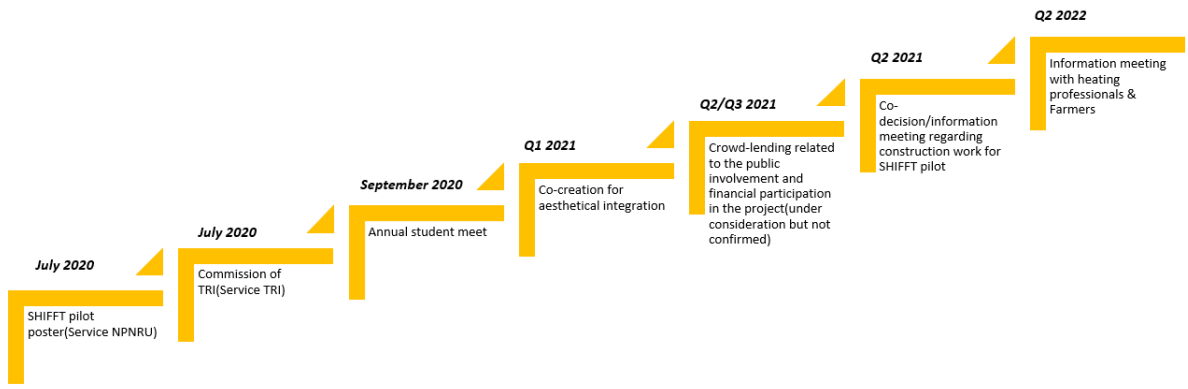

Figure 7.1: Fourmies Pilot Project Timeline

7.7.1. Choice of Technology for co-design meetings

The co-design meetings took place during the Covid-19 pandemic. In accordance with the social distancing regulations active during the time period, these meetings were arranged in a virtual environment. Invitations for interested citizens were posted on social media (for instance, the TRI Fourmies Facebook page). The meeting itself was a video conference streamed live on YouTube, for an audience of 20-25 participants.

7.7.2. Consequences of Information Strategy Chosen by Town Hall-Fourmies

The Town Hall-Fourmies (Municipal Organization) made available to the attendees of the co-design event, only the information that it deemed useful for the process. Key information regarding financial constraints was not made available for the participants of the meeting. This resulted in an unfortunate repercussion - the energy companies that were chosen (by tender) to construct these buildings misconstrued the funds allocated for this project to be 2 or 3 times the actual amount. As a result, on the account that the involvement of the citizens in the SHIFFT Project was to increase their familiarity with the idea that sustainable heating is affordable, the initiative has failed.

In the co-design event, citizens opted for 100% of heat network (powering the five chosen municipal buildings) to be based on renewable sources. This was later found to be infeasible - the technology only permits 90-93% renewable heating. The communication strategy for this setback has not yet been decided - *"But that is something we still haven't informed the citizens about."* [Regarding the communication strategy:]*" That's something which still hasn't taken place, and we don't know [how]"*(Manager - Mairie de Fourmies, Personal Communication, May 2021).

7.7.3. Nature of Involvement of the Citizens in the Fourmies SHIFFT Project

Citizens are not truly involved in the various stages of planning of the project. The Town Hall - Fourmies is responsible for the key executive decisions, such as which stakeholders to involve at what time, and to what extent. This is natural, since the target buildings for the project are public municipal buildings. However, at no stage in the planning process was any stakeholder given more power than deemed sufficient by the municipality. There was also no attempt made to cultivate ownership among the citizens regarding the project.

Citizens were given only the opportunity to provide opinions on predetermined aspects of the boiler buildings - such as materials used to construct the exterior. Future events also follow the same design where citizens are consulted once planning is complete. This process of surveying citizen attitudes is not true co-creation. Citizens are only being consulted (in a limited scope), and there is no guarantee that their views will be implemented. Though the Town Hall - Fourmies intends to adhere to the outcomes of the co-design event, they can easily find themselves in a position not to (as shown already in section 7.7.2). In the event that citizens are unhappy with the outcomes of the project, there are no feedback mechanisms to address these concerns beyond the level of voicing their opinions. The level of participation thus falls in the ”tokenism” range on Arnstein's Ladder of Participation (Arnstein, 1969).

7.7.4. Political Drivers for the transition to sustainable heating

Top-Down

The municipality and the Mayor are accountable to the national and regional authorities above it on its performance as the “original demonstrator” under the Troisième Révolution Industrielle (TRI).

Bottom-Up

Heating is a fundamental requirement in our society and the transition to sustainable heating impacts many socio-technical systems that depend on it. For a successful transition, it is vital that all key stakeholders are supportive of the move – this makes it paramount that citizens understand the reasons for the move and participate in it. As a public institution accountable to its citizens, the Town Hall-Fourmies has taken steps to ensure a smooth transition by strategically targeting municipal buildings first. The contained nature of the SHIFFT Project, combined with strategic participation for the citizens is designed to expose citizens to both the nuances of the transition, and its reliability on completion, so that citizens are more comfortable with the further phases of decarbonizing residential areas.

7.7.5. Including Children in the co-creation process

Children between the ages of 14-17 were involved in citizen engagement activities through “energy days”. This initiative was co-designed with school teachers. Roughly 400 students were invited to participate in conferences to discuss the future of the city and the vision of the city for 2050. The municipality has adopted a forward-thinking approach in sustainability by educating future generations of the

importance of sustainability, and involving them in present-day activities to cultivate a sense of ownership. The outcomes of this event were not used further in any co-creation activities that were part of the SHIFFT project.

7.7.6. Prior Experience with Co-creation

As part of the third industrial revolution, the City has committed to transitioning to renewable energy for all its services. Other similar transition initiatives involved co-creation in various forms – storytelling, living lab, customer journeys, etc. These have been perceived to have somewhat of a positive effect on citizen participation in transition activities. Ville de Fourmies also employs a citizen engagement specialist to support activities related to co-creation in the city.

7.8. Outcomes

The patterns of interactions in the Fourmies pilot project show that citizen participation is at the level of tokenism as described by Arnstein's Ladder of Participation (Arnstein, 1969). Citizens have some degree of control on the outcomes of the project, but in a narrow sense. This project, however, provides a learning ground for the municipality in acquiring skills to better communicate with local citizens for future projects. Efforts have been directed to increase public awareness and societal acceptance regarding the transition to sustainable heating. However, the advancement of public understanding about the intricacies of energy transitions through involvement in this project has been minimal. Capacity-building, defined as "the sum of efforts needed to nurture, enhance and utilize the skills and capabilities of people and institutions" (NRTEE, 1998), was not achieved through this project. The development of new governance structures that provide the space for different ways of problem solving - a hallmark of co-creation, was not observed.

7.9. Evaluation Criteria

- **Involvement of actors** - Key stakeholders were not involved in a true decision-making process in any of the phases of the project, as most activities were information sessions or feedback sessions. All important actors from the biomass supply chain have not yet been involved.
- **Activities** - Alignment of expectations between market, state and social sectors was not done effectively, and the project faced financial setbacks due to a combination of budgeting issues and misalignment of expectations between key stakeholders. Social learning was minimal. Cross-phase cross-stakeholder competence development was not planned and was hence non-existent. Resource acquisition has been problematic in this project, with budgetary issues that are likely to impact the implementation phase. Feedback or monitoring activities have not been organized,
- **Goals and Outcomes** - The time-efficiency of the project suffered due to the Covid-19 pandemic. The technical aspects of the project pertaining to the installation of the renewable heat network have been moderately successful. As the project is scheduled to end in August 2022, the final assessment regarding

effectiveness cannot be make. However, acceptability of the publicly chosen aesthetic solution is likely to be low, as predicted by the municipality.

For the primary driver of the project, the Town Hall - Fourmies municipal body, the purpose of the project is twofold - to create confidence within the citizens regarding the adoption of renewable heating by demonstrating a successful transition in the municipal buildings, and to involve them in limited aspects of decision making in preparation for future co-creation for the public heat network. Farla et al., 2012 have shown that actors that pursue systemic change to initiate transition find themselves swimming against the current. Accordingly, the strategy chosen by the Fourmies' Town Hall is fitting with the circumstances. Transition is made easier by supportive governance structures, that can be developed through two routes - "associating with other actors in formal and informal networks, and strategically engaging in 'expectations work' (ibid.). Both these routes are employed partially in this pilot project.

However, in the current framework of the project, citizens have not been given the space to partake in high-level decision making, neither have they been made aware of the planning process and its intricacies. Although the municipality places emphasis on transparency in the co-creation process, the initiation, planning, implementation and monitoring phases of the project are all managed by the government with events punctuating these phases for citizens to provide their opinions on limited aspects. The project is also designed in a manner that makes it difficult for citizens to hold the municipality accountable to the decisions being made, in conflict with the value of transparency they aim to uphold. Another consequence of this is that the development of competencies across actors pertaining planning and managing skills has not taken place.

7.10. Key Take-aways

A summary of the obstacles and drivers to co-creation in the Fourmies Pilot Project, categorized according to the components of the IAD Framework is shown below.

Table 7.2: Drivers and Obstacles for co-creation in the Fourmies Pilot Project

Type	Drivers	Obstacles
Physical World	Administrative Capacity and Logistical Support	Delays due to inability to organize meetings in-person due to Covid-19 Budgeting challenges in implementation phase

Table 7.2 (continued)

Type	Drivers	Obstacles
Community Attributes	Shared interest in climate action	Citizen perceptions about sustainability transitions not explored
	Transparency in process used to invite citizens to participate in meetings	
	Focus on societal acceptance	
Political Context	Fourmies is part of TRI (Third Industrial Revolution) - focus on sustainable development	Termination of an intergovernmental support scheme funded by higher levels of government
Patterns of Interaction	Knowledge sharing sessions between universities and other pilot groups	Municipality retains authority for almost all executive decisions
		Lack of key information amidst stakeholders about financial constraints led to disadvantageous repercussions
		Strategy to deliver feedback about unfavourable outcomes not decided
		Project was designed such that citizens were not part of planning stages; they could only influence narrow set of decisions
		Lack of stable group of actors over the duration of the project
		Lack of feedback mechanisms
Outcomes	Awareness of sustainable transitions	Learning opportunity for future communication with citizens
	Effective risk management by targeting municipal buildings first for transition to sustainable heating	Alignment of expectations not done correctly
		Minimal social learning reduces effectiveness of future co-creation initiatives

8

Bruges

Case Summary

The Bruges pilot project explores the evolution of co-creation in a city with a distinctive architecture style where neighbourhoods have detached-stock type of homes. The City of Bruges intends to use the following strategies to increase citizen engagement - develop a one-stop shop to facilitate collective neighbourhood renovations, employ the thermographis façade scanner to develop city heating maps, carry out participatory value evaluation studies, set up a subsidy system for sustainable heating for homeowners, develop an approach similar to that of Buurtkracht(more in section 8.5.2) with energy ambassadors.

The main obstacles to co-creation in this case are delays caused by the Covid-19 pandemic, high costs of heat renovation to be borne primarily by citizens, detached housing-stock that tends to amplify a sense of isolation amongst citizens, etc. The primary drivers in this case are comprehensive planning support, stable sources of finance, supportive political environment and knowledge transfer resulting in a redefined and more effective co-creation strategy.

This case is unique in that no definable action situations have yet been observed. To account for this, the case has been analysed using the assessment framework as described in 3.3.

8.1. History and Political Background

Bruges is the largest city in the province of West Flanders in the Flemish region of Belgium. The city is a historic centre and has been designated a World Heritage Site by UNESCO. The architecture of the city was untouched by the industrial revolution of the 19th century and reflects the cultural evolution of medieval Europe (*Historic Centre of Brugge @ whc.unesco.org* n.d.). The city has been a continuous urban settlement since the 13th century, and although modern renovations have been

carried out, their impact on city architecture has been minimal. This poses a significant challenge to city-wide transition to sustainable heating structures, as municipal building regulations are very strict (*Historic Centre of Brugge @ whc.unesco.org* n.d.).

Bruges' original local climate plan was developed in response to the increased demand from local citizens about the need to address climate change (Botselier, 2019). The City of Bruges joined the Covenant of Mayors in 2016 (*Brugge Action Plan @ www.covenantofmayors.eu* n.d.), with a Sustainable Energy Action Plan that committed to a reduction of CO2 emissions by 20% of 2011 levels by the year 2020. The new Sustainable Energy Action Plan details 35 multi-sector actions for the city to achieve climate targets for 2030 and 2050 (Futureproofed, 2020).

The City of Bruges is familiar with the sustainable heating transition, having taken several initiatives in this arena. The local government has made investments in sustainable thermal renovations of city buildings, and has planned for future construction to be sustainably heated and cooled (*anders-verwarmen-en-efficient-energieverbruik @ klimaat.brugge.be* n.d.). The municipality supports citizens that want to shift to fossil-free heating by providing energy scans and general advice to prepare their homes for the "Bruges heating revolution" (*brugse-verwarmingsrevolutie @ energieplatform.brugge.be* n.d.).

8.2. Case Introduction

The City of Bruges envisages a co-created heating solution to bolster the adoption of renewable heating technologies in three areas of the city. The Bruges pilot has used a neighbourhood approach (partly adopted from the 'Buurtwarmte' approach taken in the Netherlands - an active example of 'policy learning' facilitated via the SHIFFT project network). This approach focuses on working with neighbourhood energy ambassadors. In addition to this, neighbourhood (energy saving) competitions are also conducted. This evidence-based strategy has been adopted by Bruges.

These neighbourhoods were chosen for the co-creation pilot on the basis of their strategic location, type of housing stock (detached, semi-detached, etc.) and demographics of the residents(>75% of homeowners in the neighbourhood, >50% of people within the ages of 25-65 yrs, roughly 19% senior citizens). Since these areas are not strategically located to develop smooth connections to a heating network, the **preferred heating solution is the heat pump in combination with insulation and PV panels**. These renovations are necessary to reduce the city's CO2 emissions, nearly half of which can be attributed to heating (ibid.).

The aim of the Bruges co-creation pilot is to renovate 2000 dwellings by the end of the year.

8.3. Physical World

8.3.1. Key Stakeholders

The important stakeholders for the Bruges project are:

- The City of Bruges
- Other related departments part of the local government - environment, spatial planning, patrimony management, public domain) and De Schakelaar (department that is in charge of renovations scans)
- Supply side stakeholders - the Intergemeentelijk samenwerkingsverband voor vuilverwijdering en -verwerking in Brugge en Ommeland (IVBO) - waste incineration plant, Heat Pump suppliers, Insulation companies, etc.
- Citizens - The citizens referred to here are residents of the neighbourhoods chosen for the pilot project.
- Citizen cooperatives such as Beauvent, Coopstrom
- Members of citizen committees especially at the neighbourhood level - The City of Bruges focuses on separate neighbourhoods, taking a neighbourhood approach
- Headmasters of schools, institutions, services centres in the neighbourhood

8.3.2. Resources

The City of Bruges is in the process of developing a local heat strategy. This corresponds to the Design phase in co-creation. They City is currently drawing on its organizational and administrative expertise to develop the heat strategy, while simultaneously gathering citizens to initiate the co-creation process. The municipality has borne organizational costs for the all organizational activities related to co-creation thus far. The City also provides technical expertise, in particular the civil servants who previously worked with De Schakelaar.

8.3.3. Technology used for Logistical Purposes

All co-creation meetings have been organized virtually due to the Covid-19 pandemic. In Bruges, citizens have developed fatigue with respect to this method of communication adding to the delay caused by the pandemic. The City of Bruges also makes YouTube videos of citizen engagement events, as part of its citizen communication strategy.

8.3.4. Sources of Funding

The co-creation project is currently funded by public sources of money, as it is operating under SHIFFT. Sources of finance for future stages of the project have not yet been determined. The Belgian national government recently terminated a subsidy scheme to encourage the adoption of renewable energy technology among households in Bruges. This scheme was originally envisaged as vital move to limit usage costs. This development could critically threaten renewable heating adoption targets set by the City of Bruges, as increased expenses rendered by the lack of a governmental subsidy would deter most homeowners from adoption. Tt seems likely that citizens will have to invest themselves to renovate their homes.

8.4. Community

Attitudes towards Co-creation The neighbourhoods being targeted for co-creation have detached or semi-detached homes. Homes are designed as single units with

lawns separating the space between two dwellings. The morphology of these neighbourhoods brings about a sense of isolation in the residents pertaining to heat renovation. Furthermore, municipality officials find that the average citizen is not inclined to participate in co-creation. Citizen representatives tend to already have undertaken some sustainable renovations, are more enthusiastic about community solutions, and eagerly participate in group discussions. Although most homeowners are unsure of the steps needed to move to renewable heating, they are predisposed to finding solutions individually. Many homeowners tend to feel alone and overwhelmed by the effort required to transition to sustainable heating. The lack of familiarity with the process of heat renovation is a source of trepidation for many. Older citizens tend to get greater representation in participatory meetings as they have more time to invest in co-creative meetings. They tend to find home renovation stressful, and the local government aims to make this transition easier for them through community support.

The local government recognizes this problem, and aims to solve it by engaging renovation scanners to provide various resources (technical, regulatory, logistical, etc) to support citizens. The municipality also finds co-creation to be a suitable method to foster a sense of belonging within the community through the shared goal of achieving sustainable heating. Municipal officials perceive co-creation as a method to empower people to take charge of their own transition to a sustainable home. They want to inspire citizens and facilitate the process by which homeowners take responsibility to organize this transition as a community. The City can provide guidance in organizing co-creation sessions, provide a place for these meetings, legitimize the sessions by permitting use of the city logo for communication, etc. Citizens would be enthused by their interactions around sustainable heating, creating the space for innovative ideas to blossom around this theme. The municipality finds this to be the preferable alternative to enforcing the shift to renewable heating technology.

8.4.1. Involvement of Actors

Initiation and Planning Phase

The Bruges pilot project is currently in the initial planning phase, and has engaged in brainstorm sessions with citizen representatives and homeowners to understand their perspectives on the sustainable heating. Energy scanners advise homeowners on good renovation practices and are also privy to some of the obstacles they face. They are also important participants in brainstorm sessions. It has been observed that elderly citizens have more time on their hands and find it easier to get involved in citizen committees. This is a form of biased participation favouring segments of the population with more time (and perhaps other resources such as knowledge, energy, etc) that could help them influence collective decisions for the community Torfing et al., 2019.

The local government, with the aid of De Schakelaar intends to find ”Energy Ambassadors”. These are commonly members of citizen committees, headmasters of schools, or other citizens who are active in service centres within neighbourhoods. Energy Ambassadors are enthusiastic about the project and important to the contin-

uation of the neighborhood-wide transition. This role is time consuming, and hence cannot be taken up by larger portions of the society.

It is important to involve key actors in all phases of the transition(Farla et al., 2012), failing which the project can get blocked in later stages after a lot of resources have already been invested (Rossano, 2016). While it is commendable that the municipality has made efforts to involve citizens even in these early stages, other important stakeholders are missing representation.

Implementation Phase
Citizens and energy scanners will be more involved in the implementation of the heat strategy. Energy scanner advise the citizens about how the intricacies of home renovations related to renewable heating. Energy scanners have a unique challenge in providing guidance pertaining to renovation such that when the heat network is in place, homeowners are connect to it, thereby avoiding lock-ins. They are a crucial stakeholder as they also help homeowners understand the climate-neutrality goal of 2050.

8.5. Activities Carried Out

8.5.1. Brainstorm Sessions with Citizens

Brainstorm sessions have been carried out in neighbourhoods with the municipality, energy scanners, and some members of the community. These sessions were organized in an informal setting with food and drinks for people to join. Participants were not given much technical information at the start of the meeting to prevent biased opinions, as these were primarily feedback sessions. The municipality finds that these sessions are more effective than surveys sent out with similar questions. One session was carried out with students in one primary school. The municipality co-ordinates these discussions around the following themes:

- **CO2 reduction** - Actions citizens have already taken, activities they have planned for the future, and what challenges they face in carrying out these actions.
- **Convincing neighbours to participate in climate-friendly activities** - How to encourage more citizens to engage in heating renovation, and whether participants want to be part of such activities.
- **Home Renovations** - What motivates citizens to renovate their homes, whether citizens are aware of their energy consumption and what needs to be done to make it fossil-free, and what incentives would ensure a smoother transition for them.

These discussions were useful for the municipality to understand citizen perceptions and challenges around sustainable heating. This step is essential to the development of a heat implementation plan that addresses problems faced by citizens. The videos made from these events are even broadcasted on social media, to increase citizen awareness regarding activities around the sustainable heating transition.

The local government also organizes frequent renovation scans. These help homeowners understand their energy profile and how to proceed to make their homes energy-efficient for a climate neutral 2050.

8.5.2. Redefining the Co-creation Strategy

With guidance from the researchers of the Technical University of Delft, the Bruges co-creation strategy was redefined to foster more active participation from citizens. The municipality called for citizens to take part in committees through Facebook and the city magazine. Knowledge sharing through SHIFFT Webinars was highly effective in this case. Through this activity, the Bruges municipality learned about Buurtkracht - a Netherlands-based organization that brings together citizens in neighborhoods to function as a coherent unit in their transition to a gas-free neighbourhood(*Buurtkracht - About* n.d.). Another example provided to Bruges for strategies to increase citizen engagement was the EU-H2020 REScoop Plus, where a French energy cooperative 'Enercoop' organizes energy parties (i.e. 'TupperWatt' parties).

Collaboration with Buurtkracht helped the Bruges' municipality to develop different methods of involving citizens in co-creation. Buurtkracht provides information on how to set up co-creation at the neighbourhood level, and also provides process facilitation services to this end. In the Bruges pilot project, neighborhood-level plans to increase energy efficiency will be tailored according to demographics and location of the neighborhood. The City of Bruges will employ new tools to foster active citizen engagement:

- **Customer Journey** - steps to be taken by homeowners in the process of heating renovation
- **Neighbourhood Safaris** - where the municipality visits all the neighbourhoods to talk to citizens to understand their motivations to live in and improve their local environment
- **Energy Parties** - meetings in active citizens' homes to foster shared discussions around citizen stories of heating renovations

Going further, Energy Ambassadors(when chosen), will be instructed by energy scanners about information specific to heating renovation. Ambassadors will be equipped to help homeowners by organizing home viewings. These meetings will then no longer be led by the municipality. This approach looks promising in cultivating a self-sustaining culture of fostering sustainable renovations in these neighbourhoods. If this strategy is successful, this pilot project would achieve co-creation goals of transferring competencies, and sharing power with citizen groups.

8.5.3. Participatory Value Evaluation

Participatory Value Evaluation is a tool to collect opinions from citizens about preferred policy options and strategies to implement them, and has great utility for effective co-creation in the sustainable heating transition, especially with large scale city-wide projects such as the Bruges pilot. Although this strategy was perceived favourably in the initial stages, it was eventually postponed several times due to political reasons and risks identified that go along with stated preferences by citizens vis-a-vis current policy agendas. Currently, it's still not clear when and if a PVE will be implemented by City of Bruges.

8.5.4. Effect of the Covid-19 Pandemic

The Covid-19 pandemic caused several delays in the Bruges co-creation pilot. Although the pandemic inadvertently provided the municipal officials of Bruges with the opportunity to learn about co-creation and how to foster it in their city, the primary challenge that the municipality faces currently is the inability to organize physical meetings. Citizens are no longer interested in following virtual webinars. The municipality finds it challenging to reach out to them as they are more preoccupied. Local citizens are also not responsive to communication from the energy scanners about sustainable heating issues.

In response to this, the City intends to develop a one-stop shop by September 2021, where citizens can find all requisite information on how to renovate their homes. These will include personal actions, subsidies that are available, etc. The one-stop shop is intended to address all logistical, regulatory and technical issues that homeowners might face while renovating their homes for renewable heating. Citizens must also be able to approach the organization to find best-fit suppliers for their renewable heating needs.

8.5.5. Development and Implementation of Heat Strategy

This local hear strategy developed by the City of Bruges will work in tandem with the Policy Plan of the City, the Multi-annual Planning of the City, the Housing Policy Plan and the Ratification of the Covenant of Mayors. The Bruges municipality is currently working on the heat strategy through internal co-operation between city departments. The heating strategy at its core, is to scientifically validate technologies that can used by citizens without resulting in lock-ins. Citizens are meant to take on a more active role in implementing the strategy through Task force teams. Energy scanners will be support energy ambassadors in becoming self-reliant with regards to legal, technical and logistical issues that homeowners could face in transitioning to sustainable heating technology.

8.6. Evaluation Criteria

The City of Bruges intends to monitor their progress with co-creation based on the number of homes that have newly been renovated with sustainable heating sources. Studies show that even when homeowners voluntarily install sustainable heating sources, they complement existing fossil-based heating leading inefficient energy usage (Wrapson and Devine-wright, 2014). Following the redefinition of the co-creation strategy, new performance indicators are yet to be decided.

Below is the assessment of co-creation for the sustainable heating transition in Bruges:

- **Involvement of actors** - The SHIFFT Project is organized such that knowledge transfer sessions occur periodically. It can be inferred that technical universities are involved in all stages of the project, though not as active participants. The City of Bruges separated the the development of the heat strategy and implementation into separate activities with different sets of stakeholders. Only the internal departments of the municipality, and technical consultants are involved in the creation of the local heat strategy. Citizens and energy scanners

are involved with the development of the implementation strategy only.

In the Bruges pilot, stakeholders from the private sector have not been invited to participate in the process of co-creation at all. Their role and expectations in the sustainable heating transition has not been explored. Similarly, of the key stakeholders identified, majority have not been invited to participate in the process so far in any capacity.

- **Activities** - So far, no activities have taken place that offer a platform for negotiation. While several activities to foster co-creation have been planned, they are yet to be realized. Thus, alignment of expectations in a co-creation forum has not yet taken place.

  Social learning has taken place for the Bruges local government in the form of knowledge transfer from technical universities and the Buurtkracht organization. For the rest of the local stakeholders, planned activities are yet to unveil their impact on this parameter.

  Since most sustainable heating renovation will be carried out by individual homeowners, the majority of the burden of cost must be borne by private citizens. The municipality has put efforts into making this transition smoother by gathering sources of alternate funding for their citizens, such as through subsidies.

  The monitoring criteria chosen the City of Bruges is one-dimensional and does not evaluate progress of the societal aspect of co-creation. They have chosen to monitor the number of homes that have opted for sustainable heating since the introduction of this project, as a measure of progress. Other strategies for monitoring societal acceptance such as the PVE have not gained much traction due to law political support (elaborated in section 8.5.3).
- **Goals and Outcomes** - As the project is not yet complete, the final assessment regarding effectiveness and efficiency cannot be made. Thus far, the Bruges pilot project has faced severe delays in realizing co-creation due to the Covid-19 pandemic. With respect to the parameter of developing social capital, not much progress has been made yet. Cross-sectoral transfer of technical knowledge and social acceptability of the co-creation process and the chosen heating technology has also not been observed yet, as expected.

8.7. Key Take-aways

A summary of the obstacles and drivers to co-creation in the Bruges Pilot Project, categorized according to the components of the IAD Framework is shown below.

Table 8.1: Drivers and Obstacles for co-creation in the Bruges Pilot Project

Type	Drivers	Obstacles
Physical World	Administrative Capacity and Logistical Support (Comprehensive Planning)	Delays due to inabiliy to organize meetings in-person due to Covid-19
	Stable sources of funding for planning stage	Citizens to shoulder capital-intensive implementation of heating equipment
Community Attributes	Familiarity with challenges of sustainable heating	Citizens are hesitant to virtual modes of collaboration
	Focus on understanding citizen perceptions around sustainable heating	Detached or semi-detached housing stock
	Municipality views co-creation as a method to empower people to be responsible for their own transition to sustainable heating	Sense of isolation among homeowners pertaining to heat renovation
		Citizen representation biased to favor groups with more spare time
	Efforts directed towards support citizen-driven transition, especially in implementation stage	All key stakeholders are not involved in planning stages
Political Context	Ratification of Covenant of Mayors initiative	Lack of political support as shown by terminated subsidy scheme and resistance towards PVE adoption
	Internal co-operation between city departments supports development of sustainable heating strategy	

Table 8.1 (continued)

Type	Drivers	Obstacles
Patterns of Interaction	Knowledge sharing sessions between universities and other pilot groups	Citizens show virtual meeting fatigue
	Delay caused by covid-19 provided opportunity to redefine citizen engagement strategy for more effective co-creation	Reduced enthusiasm pertaining renovation scans
	Knowledge transfer from more experienced stakeholders in co-creation	
Outcomes	Social learning has taken place benefiting the Bruges municipality	Severe delay of 18months due to Covid-19 pandemic
		Probable failure to meet initial co-creation goals by Aug2022

9 Results

This chapter compiles the key drivers and obstacles that were found to be common over the four pilot projects. These factors are categorized according to the major components in the IAD Framework, a summary of which is provided below:

- **Physical and Material Attributes** - This factors comprises of 'inputs' to the action situation. Specifically in the context of co-creation, these have been identified as the key stakeholders, resources required for logistical support (financial, spatial, administrative, etc.), technology used for co-creation meetings, and sources of funding for the development, implementation and adoption of the heating strategy,
- **Community Attributes** - This factor comprises of the community, commonly accepted norms about policy activities, the degree of understanding that key players share about activities in the action situation, and the extent to which participants' values, beliefs, and preferences about policy-oriented strategies and outcomes are aligned.
- **Political Context** - Although this category does not feature in the IAD Framework, the subfactors have been observed to play a significant role on the evolution of co-creation.
- **Patterns of Interaction** - The implicit operational-choice rules in use in an action situation provide insight into dominant patterns of interaction.
- **Outcomes** - This factor pertains to the potential outcomes of an action situation. Co-creation is an evolving process, and the outcomes impact similar future initiatives.

9.1. Overview of Common Drivers and Obstacles

The key takeaways from all cases were compiled and contrasted together. It is not possible to directly compare the four cases that have been explored in this study due to the diverse political, social and geographical characteristics that are specific to each case. The case-wise compilation of drivers and obstacles to co-creation for each component of the IAD Framework can be found in Appendix C. Common factors that were drivers and obstacles observed through all the pilot projects can be found in Table 9.1.

Table 9.1: Overview of Drivers and Obstacles for Co-creation

Type	Drivers	Obstacles
Physical World	Comprehensive Planning Support Stable sources of funding Key stakeholders involved in all stages	Delays due to covid-19 Financial obstacles
Community Attributes	Shared and/or complementary goals Focus on Societal acceptance Focus on effective stakeholder participation Familiarity with sustainable heating challenges Stakeholder with authority views co-creation as a tool for empowerment	Lack of exploration of citizen perceptions and/or low involvement of citizens for various reasons Biased/skewed stakeholder representation Perception of co-creation being time-consuming Ineffective stakeholder management Government attitudes to citizen engagement
Political Context	Support from higher levels of government for transition to sustainable heating	Perception of government as ”service provider” and that citizen participation ends at election stage Concerns over citizen involvement leading to conflicts or disruptions in existing governmental policies
Patterns of Interaction	Knowledge sharing between stakeholders Involving key stakeholders in all phases Effective stakeholder management for decision-making Focus on effective citizen engagement in co-creation	Lack of technical know-how across sectors Difficulty in changing governance structure

Types of Drivers and Obstacles The categorization of the drivers and obstacles to co-creation was carried out on the basis of various components in the IAD Frame-

work. The above table 9.1 shows an overview of the drivers and obstacles over the different pilot projects that were analyzed as part of this thesis.

9.2. Physical World

9.2.1. Drivers

The "Physical World" category of factors refers to the tangible material factors that influenced co-creation in the pilot projects. Comprehensive planning support is a fundamental and crucial factor to ensuring the success of a co-creation project. This role is usually performed by a stakeholder that is in a coordinating or authority role and has the requisite mark of legitimacy. Unsurprisingly, stable sources of funding are vital for the success of co-creation. For the pilot projects analyzed, public sources of funding through the SHIFFT project were essential for their progress. In projects where key stakeholders were involved in all stages of the project, more positive results (such as the potential to develop robust solutions) were observed in later stages, despite the added complexity of collaboration between actors.

9.2.2. Obstacles

A major part of the SHIFFT Project overlapped with the Covid-19 pandemic. This posed a serious obstacle for co-creation, that relies heavily on extensive participation between actors. Participants had to adapt to communicating and collaborating on virtual platforms, quite often resulting in less-than-optimal co-creation solutions. All activities that were scheduled to be carried out in person were cancelled. In some cases, severe delays resulted when participants were no longer willing to partake in virtual discussions, as in the case of the Bruges pilot project.

9.3. Community Attributes

9.3.1. Drivers

The presence of shared community attributes was found to be a supportive factor in the evolution of co-creation, and solution discovery. It was observed that a focus on societal acceptance was a catalyst for efforts to increase citizen engagement. Pilot projects that made an extra effort to foster effective stakeholder participation also found it easier to navigate stakeholders and collaborate effectively. When stakeholders in powerful positions embrace co-creation as a method to empower citizens, the process of implementing it becomes much easier.

9.3.2. Obstacles

Very often, pre-existing perceptions of citizen involvement became barriers for effective citizen engagement, which is a precursor for successful co-creation. Since all the pilot projects under SHIFFT were initiated by local government (or powerful actors, as in the case of the Norwich pilot project), the onus of sharing power lies on them. Since they are also in co-ordinating roles, perceptions of such actors permeate the entire organization of the project. This was observed even in situations where a community energy cooperative was involved, such as in the case of the Mechelen pilot project. Although the cooperative follows the mandate of co-creating energy

solutions with local communities, citizen participation in decision-making processes pertaining sustainable heating under the SHIFFT project did not take place.

It was observed that actors in co-ordinating roles across all pilot projects were able to grasp the concept of co-creation, but were unable to translate it to effective co-creation in practice. The evolution of these projects, has effectively equated co-creation with citizen participation. In some cases such as the Fourmies pilot project, powerful actors designed processes unconduncive for sharing of power to foster negotiation and decision-making by consensus. In others such as the Norwich pilot, efforts were made into managing expectations and clarifying that all actors were free to take the initiative to contribute ideas and solutions. In practice, this was found to be insufficient in modifying the operating governance structures due to the heavily skewed distribution of resources such as knowledge, money, social capital, etc. The issue of behavioral change is now beginning to be addressed in the Mechelen and Norwich projects, partly due to the influence of social learning over time.

A common argument against forms of direct democracy is the biased representation of interests in the favour of those that have more time to engage in participatory processes. This was also observed in the course of this study. Other obstacles include the complexity of stakeholder management, and the perception of co-creation being time-intensive.

Role of Research institutes
The SHIFFT Project organization includes frequent knowledge-sharing sessions between pilot projects and researchers. These provide an opportunity to learn from others who are facing similar obstacles. The presence of a third-party can also provide a new perspective, and guidance in solving tough problems. The research institutes involved in the SHIFFT project played a major role in the decisions made by the Bruges and Norwich pilots to undertake co-creation approaches to transition to renewable heating.

9.4. Political context

9.4.1. Drivers

Support from higher levels of government was found to be a strong driving factor in co-creation. When local governments are answerable regarding their progress in sustainable transition, they are likely to be more motivated to achieve targets.

9.4.2. Obstacles

A common political obstacle is the perception that citizen participation stops at the stage of electing officials. Frequently, elected officials are hesitant to share power with other stakeholders. Another concern amongst government officials is the need to ensure that co-creative solutions are not disruptive in other spheres of political activity. This was evident in the Bruges and Mechelen cases where the decision to adopt PVE as a tool to aid co-creation has been deferred several times due to the risk pertaining citizen opinions regarding current policies.

9.5. Patterns of interaction

There are some patterns of interactions observed which reinforce impacts (positive or negative) and influence the development of co-creation.

9.5.1. Drivers

Knowledge sharing between stakeholders, involving key stakeholders in all phases of the project are patterns that reinforce each other and support beneficial outcomes. Similarly effective stakeholder management reduces fatigue from poor communication, and encourages people to participate more effectively. This factor also improves time-efficiency in a project. In projects where actors in co-ordinator roles directed their attention towards effective citizen engagement, trends of power sharing and collaborative governance were observed.

9.5.2. Obstacles

The lack of technical expertise with respect to sustainable heating and its challenges proved to a common barrier observed across all cases and sectors. The technical complexity of the problem makes it difficult for actors to cross the knowledge gap and contribute effectively in co-creation, further reinforcing low participation for them.

When the existing governance structure is embedded deeply in social relations between actors, barriers to effective co-creation become much higher. This is especially true in cases such as the SHIFFT Pilot projects where co-creation is being initiated from administrative actors.

10 Conclusions

This research project aims to analyze the factors that support and impede the effective implementation of co-creation in the field of transition to sustainable heating. Globally, heating is responsible for close to half of total energy consumption. With rising mean global temperatures, the quickest way to achieve climate neutrality is through the decarbonization of the heating sector. The complex stakeholder relationships, and market environment of the heating sector make co-creation a suitable method to implement long-term solutions using renewable technologies. Co-creation offers the opportunity to develop solutions that consider the views of multiple stakeholders such that innovative solutions that benefit all actors can be developed.

The following research question was used for this project: *How can co-creation be implemented effectively to enhance the transition to sustainable heating at the municipal level?*

This research question was answered through the exploration of the research subquestions, as addressed below.

10.1. Answers to sub-questions

SQ1: *How can local government facilitate the transition to sustainable heating?* This sub question was addressed in Section 2, through the literature review. There is evidence to show that local communities are best equipped to handle environmental feedback. They also possess the capacity to develop self-governance systems that are resilient and can quickly respond to changes in the local environment. Local governments possess the administrative and technical skills to perform some of these functions. Through mechanisms appropriate to the social context that they are part of, local governments are ideal to foster the development of skills that are essential for self-governance.

An excellent example of this is observed in the Bruges case study, where social learning through the SHIFFT project proved highly useful in the adoption of a co-creation strategy (neighbourhood approach with energy parties, energy ambassadors, etc.) tailored to the layout of the heating stock of the city. Other strategies

such as involving citizen engagement consultants (observed in the Mechelen pilot), and employing subsidy schemes (observed in the Mechelen, and partly in the Norwich cases) also facilitate citizen engagement and adoption of renewable heating technology. A key takeaway from this body of research is that local governments can benefit from the involvement of citizens in planning stages. This will ensure societal acceptance, and also prevent the development of blocking issues in the future.(Rossano, 2016).

SQ2: *What is co-creation in the context of sustainable heating? What are the institutional rules underlying co-creation?* Co-creation in the context of sustainable heating has been analyzed in Sections 2 and 3. Co-creation in sustainable heating means the involvement of all stakeholders relevant to the process of implementing a heating solution, and effectively using it. To use co-creation as a method of developing a sustainable heating solution requires that all relevant actors be involved through the phases of the project, while contributing through meaningful negotiation to decision-making processes. The institutional rules that underlie co-creation are elaborated in detail in section 3.

SQ3: *How do project conditions, community attributes, organizational structure and political context create the institutional rules that influence co-creation in the four pilot projects?* This question is the basis of the multiple case study that makes up the major portion of this research project. This question is addressed through chapters 5 to 8. A summary of the results is provided below:

- **Project Conditions** - Material attributes that provide stability to the pilot projects played a major role in the evolution of co-creation. Stable sources of funding(or the lack of) played a major role in the implementation stages of co-creation in sustainable heating. In the Mechelen pilot, stable funding has enabled a more extensive heat strategy than would otherwise have been possible. In the Fourmies and Bruges case, the termination of funding has contributed to less-than-favourable results. The covid-19 pandemic had a destabilizing effect on all projects, creating delays and preventing in-person collaboration.
- **Community Attributes** - The presence of shared or complementary goals, belief in the efficacy of co-creation and citizen participation (especially for actors in coordinator roles), increased focus on effective stakeholder participation, and familiarity with sustainable heating challenges support the evolution of co-creation. Alternately, poor representation of stakeholders, ineffective stakeholder management, and unconducive attitudes to citizen engagement among public officials created unfavourable circumstances for the evolution of co-creation.
- **Political Context** - Support from higher levels of government is a key contributor for co-creation in sustainable heating (as is evident from the Mechelen case study). Where government officials were reluctant to share power with citizens, or felt that citizen involvement could disrupt existing policies, co-creation initiatives suffered.

When supportive project conditions, community attributes, organizational struc-

ture and political context are present, effective knowledge sharing takes place between stakeholders across sectors and over different phases of co-creation. There is a focus on effective citizen engagement practices, and key stakeholders are involved in all stages of co-creation with efficient stakeholder management for decision-making.

SQ4: *What are the contributing factors and obstacles that influence implementation of co-creation in the transition to sustainable heating?* An overview of the factors that aid and impede co-creation is available in Table 9.1. The overview is divided into four categories that follow the components of the IAD Framework, a summary of which follows:

- **Physical and Material Attributes**
  Drivers - Comprehensive planning support, stable sources of funding, key stakeholders involved in all stages

  Obstacles - Delays due to covid-19, financial obstacles
- **Community**
  Drivers- Shared and/or complementary goals within the community, focus on societal acceptance of the renewable heating transition, emphasis on effective stakeholder participation, familiarity with challenges of the transition to sustainable heating, actors in coordinator roles view co-creation favourably

  Obstacles - Lack of exploration of citizen perceptions combined with low citizen participation, Negative attitudes towards citizen engagement held by coordinators, ineffective stakeholder management, perception of co-creation being time-consuming, biased/skewed representation of key stakeholders
- **Political Context**
  Drivers - Support from higher levels of government for transition-related activities

  Obstacles - Perception that citizen participation ends at election stage, concerns over citizen engagement leading to disruptions in existing governmental policies
- **Patterns of Interaction** - Patterns of interaction result from the interplay of the above factors and operational-choice rules in use between actors in action situations

  Drivers - Knowledge sharing between stakeholders, involving key stakeholders in all phases, effective stakeholder management for decision-making, focus on effective citizen engagement

  Obstacles - Lack of technical know-how across sectors, difficulty in changing governance structure

10.2. Results

The main research question that formed the basis of this body of research was:

How can co-creation be implemented effectively to enhance the transition to sustainable heating at the municipal level?

Results from the four SHIFFT pilot projects have shown that supportive project management conditions such as stable funding, comprehensive planning support and the involvement of key stakeholders across the different stages of co-creation are vital for its success. The presence of community attributes such as shared values and goals motivate stakeholders to collaborate together. When actors who adopt the role of coordinators view co-creation favourably, they can use their administrative skills and social capital to bring together actors in an effective manner to find solutions acceptable to all. Involvement of key actors in the initial planning stages is important to develop strategies that are tailored to specific communities. The presence of neutral actors such as research institutes is helpful across all stages and was shown to be key in initiating co-creative strategies and facilitating supportive conditions for social learning.

The sustainable heating transition concerns actors across all sectors (public, private and in-between). To ensure effective transition, it is necessary to develop platforms where key stakeholders are part of the planning process. When local governments initiate co-creation as in the three of the four pilot projects studied in this body of research (Mechelen, Bruges and Ville de Fourmies), political support from higher levels of government proved to be a significant factor in the evolution of co-creation.

This study found that pre-existing governance structures between actors in a social context determine the pathway in which co-creation evolves. Although societies with high social capital are crucial for effective co-creation, the determining factor that influences the manner in which co-creation evolves in a social context are the existing governance structures between actors. In situations where co-creation is initiated by actors that hold traditionally powerful, decision-making roles in society, expectation management is not enough to guarantee equitable participation from all actors. Pre-existing power dynamics, combined with the crucial role played by co-ordinators in the group, form patterns of interaction that tend to reinforce governance structures that do not allow for effective co-creation.

10.3. Conclusions

Overall, the present research has shown that to achieve effective co-creation, it is crucial to invest in enhancing technological and administrative expertise across stakeholders of various sectors and power profiles in order to reduce the resource and power gap between them. Barring this, power dynamics are reinforced, especially when supporting factors such as collaborating in person are not feasible.

10.4. Policy Recommendations

On the basis of the results from this research project, the following recommendations can be made for policymakers:

- When co-creation is initiated by actors who are traditionally in authoritative positions in society, provisions must be made for capacity-building in other stakeholder groups.

  This strategy is a safeguard to ensure that power disparities between stakeholder groups do not get reinforced, and social learning is given priority. An emphasis on transference of technical competencies between actors from different sectors, over the evolution of the project, makes for meaningful participation from all stakeholders in the decision-making process. This is essential to move away from strategies that revolve primarily around awareness-building, consultation and receiving feedback.
- When implementing co-creation, co-ordinators must commit to involving key stakeholders, including citizens in all phases of co-creation.

  It is important to involve citizens in all phases of co-creation. This recommendation ensures that all stakeholders' views are considered in solutions that impact all participants. This strategy prevents the development of solutions that adversely favour powerful and prominent actors at the expense of lesser represented sectors of society. Since the number of stakeholders involved in the heating transition is high, effective stakeholder management is key.

10.5. Limitations of this Study

10.5.1. Process of Interviewing

Mah, 2019 explains that face-to-face interviews provide great depth in information gathering by revealing the complexity of critical interactions that take place in the context of the specific people involved and the topic they choose to discuss. However, this method of gathering information is subject to "limitations of interpretivism". ibid. further describes that interviewer bias may "undermine the validity of the findings".

To counter these, various measures were used. In all possible situations, secondary sources of information such as government documents, news articles and related academic publications were used to triangulate information obtained from interviews, and to provide supplementary references. The IAD framework used for analysis of qualitative data also provides a comprehensive structural framework.

10.5.2. Impact of Covid-19

Since the research was carried out during the Covid-19 pandemic, in-person interaction with interviewees was not possible. This limits one component of interpersonal interaction of body language.

10.5.3. Methodology
Throughout the research project, the method of collection of data is through participants of co-creation processes. This means that past experiences of participants were collated. Processes that were ongoing for the duration of the project were the only real-time experiences that were assembled. The method of data collection also did not involve direct researcher observations as the co-creation meetings are only open to stakeholders that are involved in each of the case studies.

10.5.4. Choice of cases
The pilot projects that were studied in this project are located in Western Europe with liberal representative democracies. Government and public agencies in the pilot projects are open to citizen participation initiatives (albeit, in varying forms and degrees). Political support for sustainable development is increasing in these countries. While citizens are pushing for their governments to take climate action, the supra-national political environment also places emphasis on the sustainable transition through the European Green Deal. This factor has played a significant role in the evolution of co-creation in these case studies.

10.6. Suggestions for Future Research
The present study has focused on the exploration of factors that influence co-creation pathways in sustainable heating in liberal democracies in Western Europe. The pilot projects were predominantly initiated in a top-down fashion. Future research can focus on co-creation pathways when initiated through a bottom-up approach. The exploration of factors that are conducive to bottom-up initiation of co-creation in sustainable heating, given the fragmented nature of the heating sector would be interesting to explore. The present study has shown that governance structures are difficult to modify due to pre-existing social networks and professional roles of prominent actors. Future research can focus on the interaction of powerful actors and institutional roles in bottom-up co-creation initiatives. Furthermore, research into developing methods to modify governance structures to foster shared governance in top-down initiated co-creation can also be carried out.

For this project, the researcher was unable to take part in direct observation of co-creation in the pilot projects. Interviews were conducted online, and missed a key component of body language. Direct participation in co-creation can provide observations necessary to unearth implicit operational-choice rules that provide deeper insights into the evolution of governance structures in co-creation.

10.7. Academic Discussion
10.7.1. Co-creation in Public Services
The concept of co-creation is highly subjective, carrying different meanings for participants from different professional and cultural backgrounds. The manner in which co-creation manifests is also high contextual, subject to specific sociopolitical circumstances. As a result, there does not exist a standard prescribed model for co-creation.

Within the setting of public services, co-creation must be focused on citizen empowerment through a reorganization of governance structures. In practice, this is not straightforward. This is especially true where co-creation is initiated by local governments, in a top-down manner. Empirically, co-creation takes the form of an increased emphasis on citizen engagement initiatives. There is a greater focus from actors in authoritative roles on citizen consultation, validation of strategies, and gather citizen feedback. True participation of citizens in decision-making processes is far from ideal, or sufficient. This body of research has aimed to provide insights into facilitating this process.

10.7.2. Suitability of the IAD Framework for Analysis of Co-creation

The Institutional Analysis and Development Framework provides a systematic framework to analyze policy activities, over varying temporal, geographic and socioeconomic frames of reference. However, it is challenging to observe the transition between different phases of co-creation when viewing them through the lens of the IAD Framework. This is further complicated by the fact that these progressions are sometimes not evident to the participants themselves.

The Framework has proved to be highly useful in exploring the institutional rules that form the framework for effective co-creation. These can also be used as guidelines for those intending to initiate co-creation at any level. The IAD Framework was also essential in categorizing the different factors that impact an action situation. Uncovering the underlying rules in use follows logically when interacting components become clear. A comprehensive analysis of this sort can be effective in identifying influencing factors which can themselves be extensive topics of research.

The Importance of the Exploration of Rules in Use

Literature shows that there is still need for empirical evidence pertaining the reasons for the efficacy of co-creation, and also the necessity to develop the theoretical foundations for co-creation (Dudau et al., 2019). The potential dangers of co-creation performed ineffectively are many - including, but not limited to loss of democracy and increased social inequality (Steen et al., 2018). In many cases, even though less-than-favourable outcomes have been observed, co-creation has been viewed favourably (Voorberg et al., 2015).

There are two methods of evaluating a new model of public participation - an outcome-based approach, and procedural approach. It is important to consider both the efficacy of outcomes, and the process used to obtain them. The IAD Framework provides a method to analyse both the outcomes and the process for co-creation. Although co-creation carries subjective meanings and outcomes for all the participants, the IAD Framework can be used to categorize these aspects effectively.

This body of research has demonstrated the use of the IAD Framework to uncover implicit rules-in-use that are in play in constituent action situations of co-creation in all pilot projects. These were used to understand dominant patterns of

interaction and their connection the outcomes so far. These patterns also provide insight into potential final outcomes for these projects, and can be used to support course-correction in the right direction necessary for achieving final goals.

10.7.3. Shortcomings of the IAD Framework

Important aspects of Practical Co-creation Unexplored

Within co-creation, the action situation does not already exist for observation, and part of effective co-creation is the involvement of the right stakeholders in the right stages of the process. The IAD Framework focuses on the analysis of the action situation as it presents itself. An important aspect of co-creation is the manner in which key stakeholders are involved, and in which stages. The decision behind which stakeholders to involve is vital as it determines the constitution, operation and outcomes of an action situation. The normative ideal of involving all those who are impacted, does not translate to effective planning in co-creation. For instance, it is not possible to involve all citizens who are impacted from a city-level heating policy in one co-creation session. The IAD Framework does not allow for an exploration of these aspects of co-creation.

Approach to activities that foster co-creation

Social learning is an important concept in environmental and sustainability science that states that people learn over time and increase the adaptive capacities of the systems they are part of through their participation in decision-making (Brondizio et al., 2009; Reed et al., 2010). This absorbed learning becomes gradually embedded in the system, thereby changing the nature of the governance framework. Such an evolving system becomes more robust by virtue of the interpersonal interactions within actors. It is different from a traditional institution in that the flow of information between actors, and the roles they adopt over time adapt for better functioning. Milchram et al. (2019) outline this knowledge gap and use a dynamic IAD framework that combines social learning to conduct institutional analysis between multiple action situations. However, the IAD framework does not provide this functionality for a single action situation alone. Furthermore, effective co-creation hinges on activities such as effective planning, good management of stakeholders, expectation management, and competence development throughout all phases and within sectors. The Framework does not provide a method to address these activities within each action situation readily.

Policy Cycle and Learning Cycle in Sustainability Transition

According to Pahl-wostl et al. (2013), political learning mechanisms are connected to formal policy processes in all phases and at different political levels. However, learning at the local and regional levels is mainly linked to bottom-up initiatives, such as the co-creation projects being studied as part of this research. In sustainability transition, the management process is cyclical in nature(De Laurentis et al.,

2017). The development of a vision, it's propagation through an actor network, the resultant learning processes and consequent corrective feedback are all fundamental processes of transitioning. Management develops into searching, learning and experimenting rather than a process of command and control (Rotmans and Loorbach, 2009). The scope of the IAD framework limits the exploration of such temporally developing trends.

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A

Codebook

Categorization	Code	
Case Description	normal obstacles normal process	
PW	PW_stakeholders PW_technology PW_funding PW_logistics	
Comm	comm_values comm_vision comm_demographics comm_motivator	
RiU	RiU_position RiU_authority RiU_aggregation RiU_boundary	RiU_scope RiU_information RiU_payoff
Action Arena	arena_description	
PoI	delay PoI_covid PoI_gov PoI_initiation PoI_knowledge	PoI_motivation PoI_authority PoI_obstacles PoI_process PoI_scope
Outcomes	O_endproduct O_social O_renewabletech	
EC	EC_involvement EC_activities EC_goals	

Table A.1 (continued)

Categorization	Code
Actors	actors_resources actors_valuation actors_infoprocessing actors_selectionprocess
Politics	political

Table A.1: Codebook for IAD Framework in Co-creation

B

Interview Themes

B.1. Overall Theme for the Interviews

- What is happening in the policy arena?
- Which outcomes are satisfactory? Which are not?
- Which outcomes are most important?
- When are these outcomes occurring?
- Where are they occurring?
- Who is involved?

B.2. Physical and Material Attributes

The broad themes that are explored to understand the physical and material attributes of the co-creation pilot projects are:

- What is co-creation? How do you view it?
- What physical and human resources are required to provide and produce this good or service? What technologies and processes are required?
- How is each stakeholder group represented (given the size and their relationship to process)?

B.3. Community Attributes

The broad themes that are explored to understand the community attributes in the projects are:

- What knowledge and information do participants have about the ongoing co-creation strategies and how they relate to the social and technical outcomes of the project?
- What are participants' values and preferences with respect to the co-creation strategies for achieving outcomes?
- What are participants' beliefs about the relationship among co-creation strategies, actions, and outcomes?
- What are participants' beliefs about other participants' strategy preferences and outcomes?

B.4. Rules in Use

Open questions were used to understand the operation-choice rules in each co-creation project. The description of each role is provided below.

Rules-in-use	Rule Description
position	specify the set of positions or roles that participants assume in an action situation, and the number and type of participants who hold each position
boundary	specify which participants enter or leave positions and how they do so
authority	specify the actions participants in given positions may take
aggregation	determine how decisions are made in an action situation
scope	specify the jurisdiction of outcomes that can be affected and whether these outcomes are or are not final
information	affect the amount and type of information available to participants in an action arena
payoff	determine how costs and benefits are meted-out in the action arena

Table B.1: Operational-choice Rules in Use as per the IAD Framework (Ostrom, 2005)

B.5. Action Situation

Exploration of the below themes during the interviews was used to put together a coherent action situation:

- Who are the key stakeholders that participate in co-creation meetings? What information about the project is available to participants in co-creation meetings?
- What positions do each of the participants occupy during meetings?
- What actions are available to each participant, and how do these link to project outcomes?
- What level of control does each actor possess over action in any decision-making situation in the co-creation meeting?
- What outcomes are possible with the chosen structure of the arena?

B.6. Decision-making Capacities of Actors

Quite often, we assume intentionally or unintentionally, that participants in an action situation are perfectly informed and use rational decision-making to arrive at so-

lutions. In practice, decision-making capacities of actors are subject to the resources available to them, their valuations about various solutions, quantity and quality of information available to them, and the selection criteria they use to evaluate solutions. To explore these factors, open-ended questions along the below themes were employed:

- What are the positions or roles that actors play in this situation? What actions can participants take, and how are actions linked to outcomes?
- What is the level of control that each participant has over action in various situations?
- How has the issue of low technical understanding regarding sustainable heating been addressed in each co-creation pilot?
- What outcomes are possible in each situation? What information about the action situation is available to participants?
- What costs and benefits do participants incur when they take action?

B.7. Project Outcomes

Below are listed the main questions that pertain to interviewees' perceptions of the outcomes of the co-creation project:

- What is the chosen end for the co-creation process?
- Who is accountable for the end of the project?

C

Results by Category

C.1. Physical World and Material Attributes

Table C.1: Case-wise Drivers and Obstacles pertaining to Physical World and Material Attributes

Pilot Project	Drivers	Obstacles
Norwich	Administrative Capacity and Logistical Support (Comprehensive Planning) Stable sources of funding for all stages Key stakeholders involved throughout project	Delays due to inability to organize meetings in-person due to Covid-19
Mechelen	Administrative Capacity and Logistical Support (Comprehensive Planning) Stable sources of funding for planning stages Several key stakeholders involved from the start of project	Delays due to inabiliy to organize meetings in-person due to Covid-19 Capital-intensive implementation stage
Fourmies	Administrative Capacity and Logistical Support	Delays due to inability to organize meetings in-person due to Covid-19 Budgeting challenges in implementation phase

Table C.1 (continued)

Type	Drivers	Obstacles
Bruges	Administrative Capacity and Logistical Support (Comprehensive Planning)	Delays due to inability to organize meetings in-person due to Covid-19
	Stable sources of funding for planning stage	Citizens to shoulder capital-intensive implementation of heating equipment

C.2. Community

Table C.2: Case-wise Drivers and Obstacles pertaining to Community

Pilot Project	Drivers	Obstacles
Norwich	Shared and/or complementary goals - reduced costs, customer satisfaction, climate action	Direct participation of tenants not possible
Mechelen	Shared and/or complementary interests Platform for understanding multiple perceptions of sustainable heating Belief that multiple viewpoints help in developing robust solution Focus on effective stakeholder participation Increased sense of ownership	Citizen perceptions about sustainability transitions not explored; Citizens not involved in planning stage Large number of stakeholders; complexity in organizing effective communication and decision-making processes Co-creation perceived as being time consuming Perception of government as ”service provider” and that citizen participation ends at election stage
Fourmies	Shared interest in climate action Transparency in process used to invite citizens to participate in meetings Focus on societal acceptance	Citizen perceptions about sustainability transitions not explored

Table C.2 (continued)

Type	Drivers	Obstacles
Bruges	Familiarity with challenges of sustainable heating	Citizens are hesitant to virtual modes of collaboration
	Focus on understanding citizen perceptions around sustainable heating	Detached or semi-detached housing stock
	Municipality views co-creation as a method to empower people to be responsible for their own transition to sustainable heating	Sense of isolation among homeowners pertaining to heat renovation
		Citizen representation biased to favor groups with more spare time
	Efforts directed towards support citizen-driven transition, especially in implementation stage	All key stakeholders are not involved in planning stages

C.3. Political Context

Table C.3: Case-wise Drivers and Obstacles pertaining to Political Context

Pilot Project	Drivers	Obstacles
Norwich	Desire to be ahead of the curve	
Mechelen	Heating strategy is linked with other policies such as urban planning Support from higher levels of government to explore sustainable heating solutions Opportunity for local government to influence decision-making at different levels	Perception of government as ″service provider″ and that citizen participation ends at election stage Concerns over citizen involvement leading to conflicts or disruptions in existing governmental policies
Fourmies	Fourmies is part of TRI (Third Industrial Revolution) - focus on sustainable development	
Bruges	Ratification of Covenant of Mayors initiative Internal co-operation between city departments supports development of sustainable heating strategy	

C.4. Patterns of Interaction

Table C.4: Case-wise Drivers and Obstacles pertaining to Patterns of Interaction

Type	Drivers	Obstacles
Norwich	Key stakeholders involved in all stages of project	PfP management holds key resources, also in authority position - makes all decisions; authority in professional context - this makes changing governance structure hard
	Knowledge sharing sessions between universities and other pilot groups	
	Alignment of expectations between stakeholders	
	Feedback mechanisms between stakeholders in place	
Mechelen	Knowledge sharing sessions between universities and other pilot groups	Dearth of technical know-how about sustainable heating transition across sectors
	Multiple decision-making arenas to manage high number of stakeholders	More important given to private sector and government actors than citizens in development of heat strategy
	Information sessions for citizens to become familiar with sustainable heating transition	Citizen involvement through citizen co-operatives only
		Information retained in silos with co-ordinating stakeholders being the only actor with an overview
		Existing power dynamics between stakeholders reinforced

Table C.4 (continued)

Pilot Project	Drivers	Obstacles
Fourmies	Knowledge sharing sessions between universities and other pilot groups	Municipality retains authority for almost all executive decisions Lack of key information amidst stakeholders about financial constraints led to disadvantageous repercussions Strategy to deliver feedback about unfavourable outcomes not decided Project was designed such that citizens were not part of planning stages; they could only influence narrow set of decisions Lack of stable group of actors over the duration of the project
Bruges	Knowledge sharing sessions between universities and other pilot groups Delay caused by covid-19 provided opportunity to redefine citizen engagement strategy for more effective co-creation Knowledge transfer from more experienced stakeholders in co-creation	

C.5. Outcomes

Table C.5: Case-wise Drivers and Obstacles pertaining to Outcomes

Type	Drivers	Obstacles
Norwich	Acceptable sustainable heating solution for all stakeholders developed	Low time-efficiency; High collaborative effort required to reach outcomes
	Cross-phase, cross-sector competency development	
Mechelen	Awareness of sustainable transitions	Learning opportunity for future communication with citizens
	Effective risk management by targeting municipal buildings first for transition to sustainable heating	Alignment of expectations not done correctly
		Minimal social learning
		Lack of feedback mechanisms
		Low societal acceptance predicted
Fourmies	Social capital developed for some stakeholders	Low time-efficiency; High collaborative effort required to reach outcomes
	Development of a data-driven heating strategy that considers multiple viewpoints	Citizen viewpoints not factored in development of heat strategy
	Acceptance of heating solution by many stakeholders	Cross-sector cross-phase development of competencies not observed
Bruges	Social learning has taken place benefiting the Bruges municipality	Severe delays of 18months due to Covid-19 pandemic