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Abstract

Smart city initiatives have in many ways become an answer for solving societal issues in an urban context. But lately, a debate has arisen concerning to what degree the smart city, with its technological focus, facilitates sustainable cities and societies. This study investigates to what extent smart city initiatives and climate and environment initiatives can co-exist and mutually solve climate and environmental challenges in cities. The study applies an abductive research strategy to qualitative data produced from a case study of Stavanger municipality in Norway. It draws on document analysis and semi-structured interviews with actors from the public and private sector related to the smart city and climate and environment commitment in Stavanger. The findings from this research will be discussed up against relevant theoretical frameworks. Governmental inter-organizational information integration (GIII) will be applied to the discussion to evaluate communication, transparency, collaboration, and coordination in the municipality organization. Additionally, the discussion will use regional industrial path development (RIPD) to map out possibilities for sustainable industry development in the Stavanger region. The research has shown that the smart city and the climate and environment commitments in Stavanger municipality fail to coordinate their work. However, they share several of the same focus areas with their related challenges. These commitments show different sets of values and approaches towards climate and environmental challenges. These differences result in misconceptions and cast a shadow over possible collaborations. The Stavanger region finds itself struggling from solid dependency on the declining oil and gas industry concerning sustainable business development. But the smart city commitment can facilitate the growth of new, green industries in the region, given that local policies facilitate it.

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1. Introduction

This master thesis is about the smart city commitment in Stavanger Municipality. Its overlying topic is climate and environment measures implemented in the smart city, and the area that will be investigated is different actors' interpretation of Stavanger municipality's smart city work concerning sustainability and climate and environment. It aims to uncover to what degree these two commitments are connected in the municipality. In the following, the theme will be presented together with the basis of necessities to conduct an analysis on the research field.

1.1 Theme

This thesis study to what degree smart and sustainable are linked in the smart city commitment in Stavanger. The background for this topic is that by 2050, it is estimated that 66% of the world's population will live in urban areas (United Nations, 2015), which raises several challenges regarding air pollution, congestion, waste management, and human health, issues that need to be addressed consecutively. We have set ambitious goals for reducing our climate footprint and lowering our energy demand. However, the challenge of urbanization is still an important issue to address to reach those goals (Ahvenniemi et al., 2017). Cities cover around 3% of the Earth, but they produce approximately 72% of all global greenhouse gas emissions (European Commission, 2020, p. 3) and stand for two-thirds of the total energy consumption (Viitanen & Kingston, 2013). Therefore, cities hold a crucial role in decreasing greenhouse gas emissions and improving energy efficiency. The application of new, smart, and resource-efficient technologies can be the answer for solving these issues (Ahvenniemi et al., 2017).

The growing interest in the smart city concept and the need to solve urbanization challenges have led to both the private and public sectors taking an active role in smart city technology investments. This can be observed through various smart city initiatives, projects, and jointly funded public research projects (Ahvenniemi et al., 2017). "The idea of smart cities is becoming more important to the way future cities are planned, developed and governed" (Shelton & Clark, 2016). Sustainable cities are often mentioned in the literature when addressing smart cities. They are defined by whether "its conditions of production do not destroy over time the conditions of its reproduction" (Castells, 2000). Development in urban

areas is viewed as sustainable when it manages “achieving a balance between the development of the urban areas and protection of the environment with an eye to equity in income, employment, shelter, basic services, social infrastructure and transportation in the urban areas” (Hiremath et al. 2013).

In the case of Stavanger, the municipality is meeting some other additional, both local and regional, challenges that require innovative thinking. This is connected to demographic changes and lower activity in industry and commerce because of the recession in the oil and gas industry (Stavanger Kommune, 2016, p. 3). As the first municipality in the country, Stavanger initiated in cooperation with local businesses and industries, the development of a smart city department in 2017. With aim to address these challenges, inviting all sectors in the region to come together to find new, innovative, and smart solutions (Stavanger Kommune, 2016, p. 6). Technology and digital solutions, both new and improved, are strong drivers for innovation and are considered a cornerstone in smart city work. They are a tool for creating economic, social, and environmental improvements (Stavanger Kommune, 2016, p. 7). Additionally, cooperation between industry and commerce, public actors, academia, and citizen involvement is considered a key driver in smart city work (Stavanger Kommune, 2016, p. 11).

1.2 Relevance of the thesis

In 2014 Stavanger was named a lighthouse city in the Triangulum project. Triangulum was Europe's first and largest innovation and demonstration project in the search for smarter cities and communities, and the lighthouse cities in Triangulum integrated energy, mobility, and ICT in new solutions that have not been shown before (Stavanger Kommune, 2017). The project was finished in 2019, resulting in the municipality, with the technology company Lyse as a great external initiator, establishing a smart city office in Stavanger. With high ambitions for smart city development, they have also agreed on a roadmap for the smart city Stavanger to foster its three primary drivers: technology, cross-sector cooperation, and citizen involvement. Stavanger also hosts the Nordic Edge Expo, the largest Smart City event in the Nordics. “The ambition of Nordic Edge is to be the Smart City accelerator that puts the Nordic region on the global map as a vibrant and vital region where innovative solutions for a smarter, safer, greener and a better world are fostered” (Triangulum, 2019).

In 2005 the city council of Stavanger adapted its first climate plan. It was considered ambitious and innovative and one of the first of its kind in the country (Stavanger Kommune, 2005). Now climate, environment, and sustainability construct the baseline for all overall plans in the municipality, and the UN's sustainability goals are set as a basis in all parts of the municipality's activities (Stavanger Kommune, 2021a). In addition to being known as the energy capital, Stavanger wants to be one of Norway's greenest and most climate-friendly municipalities. The municipality, therefore, aims to be at the forefront of the development of new, sustainable solutions and reduce greenhouse gas emissions by 80% by 2030 and become fossil-free by 2040. The work with climate adaptation shall contribute to developing a climate-smart and attractive municipality with increased well-being and better public health (Stavanger Kommune, 2020a).

A sustainable economy must be converted to become less dependent on non-renewable resources such as oil and gas. The green shift is expected to mean a gradual transformation away from non-renewable energy such as oil and gas over to renewable energy such as wind power. The strength and scope of such changes challenge the economy's oil and gas dependence (Stavanger Kommune, 2021a). For Stavanger, the case of lower activity in industry and commerce calls for increased competition for the best minds and productive, profitable enterprises. The municipality believes that focusing on energy, climate, and environment in a smart city context will positively affect industrial and commercial development. Additionally, find answers for societal challenges related to climate and environment and make it easier for citizens, industry, and commerce to make choices that contribute to a climate-neutral city (Stavanger Kommune, 2016). Also, by setting high environmental standards when purchasing, the municipality can contribute to «maturing» the market into becoming “greener” (Stavanger Kommune, 2018a).

For Stavanger municipality, all these different commitments evolve around many of the same principles, so the main struggle is to find a strategic way for them to work together. What makes this research relevant now is the fast-going transitions in our society that demands us to work more efficiently, cross-sectorial, and targeted. Looking into different actors' interpretation of the municipality's work on these topics is needed to explore what works and what should be done differently.

1.3 The basis for the chosen topic

To build up the groundwork for the choice of topic, a literature review of some important work in the field will be presented in the next chapter. However, with Stavanger's commitment towards smart city and a more increasing understanding of the need for good climate and environmental measures, it will be essential that the smart city commitment advocates for good climate and environmental measures to stay relevant. Therefore, this thesis will explore how and to what degree Stavanger, as a smart city, handles the societal challenges we are standing up against with the climate and environmental changes and how they can improve this work.

In Stavanger, there has been a significant focus on technology and the development of new, sustainable industries. Going from being highly dependent on natural resources like oil and gas and agriculture, there is now an interest in creating an industry independent of natural resources and dependent on only human capacity. Stavanger has been focusing on exploiting the existing knowledge in the region, mainly consisting of engineering expertise within oil and gas. With the foundation Stavanger has, highly reliant on oil and gas, it is interesting to see if it is possible to "break out" from that path, moving into greener sectors. Even though technology, digitalization, and efficiency have a strong position within the smart city term, the environmental focus has shown great importance and is increasing as time goes by. It is, therefore, interesting to uncover how Stavanger is implementing this in the organization.

The purpose of the smart city work is to strengthen the ability to handle the major societal challenges, develop better and more efficient services for the inhabitants, contribute to new businesses and new jobs and reduce greenhouse gas emissions and contribute to a more sustainable societal development (Stavanger Kommune, 2016). Therefore, the smart city work tries to grab hold of several of the most prominent challenges Stavanger municipality is standing up against. Still, to do this work, it is crucial that the whole municipality cooperate. Illuminating perceptions about the work and accessing different actors' realities will help create an understanding of these trajectories and why it is perhaps valuable [or unnecessary] for Stavanger municipality. The municipality and other public entities can also benefit from the knowledge that can be derived from this thesis.

1.4 Problem statement and research question

Many are struggling with understanding what a smart city is and what it can and will achieve. The UN's Sustainable Development Goals (SDGs) and the last year's commitment towards reducing greenhouse gas emissions and living more sustainably have not made this less relevant. Stavanger has adopted a smart city initiative and significant commitments toward climate and environment. It will be crucial for these two commitments to be aligned to achieve the best result. The core of this thesis is investigating how these commitments are coordinated in the municipality and in what way these two can be better aligned.

To what extent are climate and environmental measures implemented in the smart city commitment in Stavanger municipality?

A set of research questions and a set of hypotheses have been formulated to guide the analysis and discussion into answering the problem statement.

Research questions:

- *Is there a joint effort in work done by the smart city commitment and the climate and environmental commitment in promoting climate and environment measures in an urban context?*
- *Can there be observed transparency, communication, collaboration, and coordination between departments and sectors in the municipality?*
- *In what ways is Stavanger municipality facilitating green industry development in the region?*

Hypotheses:

- *The smart city commitment and the climate and environmental commitment in Stavanger municipality are currently initiated separately, even though climate, environment, and sustainability are common interests.*
- *There is a lack of transparency, communication, collaboration, and coordination between the two commitments, which can result in less productive work.*
- *The lack of coordination between these two commitments can be traced back to 1. The organizational setup of the municipality. 2. Conflicting approaches to the domain.*

- *The smart city commitment promotes the use and production of new technologies as a solution for societal issues related to climate and environment and believe that new industries will emerge as a positive outcome of this.*
- *The interpretations of each other's work can cause stigmas and decrease communication and collaboration between the two commitments. However, several overlapping focus areas exist, and the two commitments have great potential for collaboration and synergies.*

How the problem statement ought to be understood: The research questions in this thesis are designed to investigate how smart city- and climate and environment initiatives in Stavanger municipality are coordinated. This is done by seeking out interpretations from actors across departments and sectors in the municipality – looking especially into approaches towards the green shift, collaboration and cooperation, and green industry development. Thus, this thesis will not engage with evaluating the different perspectives' truth but engage in the different perspectives and how they can be interpreted.

The scope of the thesis is to a higher degree concerned about the societal transition in the municipality and their approach towards implementing different strategies systematically, resulting in working towards the same goal with precise results and not in different directions. It will, therefore, not directly investigate how “green” smart city initiatives affect mitigating climate change. The scope of this thesis is limited to Stavanger municipality and will not engage with perspectives on smart cities combined with climate and environment in other locations.

Within the field of research, the problem statement that is to be investigated consists of many different actors, and thus, probably differences of opinion amongst those involved in the implementation and development of the smart city and climate and environment commitments. It is, therefore, necessary to explore these together and look at how they relate to each other. By doing so, one can uncover possible junctions with the same aims and objectives on these topics and uncover where these junctions stop existing.

1.5 Structure of the thesis

This master thesis will be structured as follows:

The next chapter is the *background chapter* which will contain a literature review looking into previous work addressing the topic for this thesis. It will also consist of an overview of Stavanger municipality as a unit for analysis, both in a geographical and organizational sense.

Continuing with the *theory chapter*, which will present the theoretical framework in which the analyzed data will be discussed. The theories that will be elaborated on are Governmental Inter-Organizational Information Integration (GIII) and Regional Industrial Path Development (RIPD). These theories' function is to understand better the importance of communication in big organizations to work more purposefully and efficiently (GIII) and the ways of industry development in a region (RIPD). Additionally, the theories will conduct a baseline for answering parts of the research questions

Further, the *research design and methodological chapter* will explain the different sources and collection processes. This thesis will use two main data sources: interviews and (mostly) official documents published by the municipality. The methods used are, therefore, interviewing and document analysis. This section also describes how the interviews were conducted and the approaches used.

All the collected data are presented and analyzed in the *findings and analysis chapter*. The presentation of the data, as well as the analysis, has been integrated into one chapter. This choice was made deliberately to maintain a good information flow. In this part of the thesis, the relevant gathered data are presented with belonging results. The aspects that make the specific data relevant serve as the basis for the discussion.

The theories and all the analyzed data will construct the baseline for answering the research questions in the discussion part. Further, this chapter will conclude the findings in this thesis and the results of the study. The concluding remarks are the final chapter, and will present the main results up against the research questions and the belonging hypotheses. Depending on the findings, some thoughts at the end of the thesis as concluding remarks are given to what could be useful to investigate further.

2. Background

This part of the thesis aims to address why this study is relevant now and how it can gain valuable insight into solving the societal issues related to smart cities and climate and environment. Accordingly, an overview of Stavanger as a unit for analysis has been added to give the basic necessities to understand the structure of the municipality and its additional challenges.

2.1 The literature review

A literature review was conducted to gather a greater understanding of the purpose of the thesis. To explain why this topic was chosen and why it is an important issue to investigate, it first and foremost explores the existing literature on smart cities concerning sustainable environment measures. Further, it investigates the Regional Industrial Path Development and how it is possible to transition from oil and gas to greener industries. Lastly, it explores relevant research on how different institutions can facilitate transition and innovation.

2.1.1 The smart and sustainable city

Because “smart city” is such a wide and disputed term, it has been challenging to choose which part of the smart city term to focus on. When researching the smart city topic, there is a lot of literature on the topic “smart city,” but often seen in a technological aspect. To narrow down the search, “smart city” was combined with “sustainability,” “climate,” and “environment.” This resulted in some articles looking into how smart city initiatives should and can be combined with a sustainability focus, creating even more resilient cities that will help to reach the climate targets. Focus areas like green mobility, renewable energy, and energy efficiency, air, and water quality, and new, smart technology were elements mentioned in the literature as important to make this possible. The articles mention the importance of a sustainable climate and environment to have healthy and livable cities. But it is also mentioned as a problem that the smart city approach has proven to be more rooted in the technological aspects, focusing on digitalization, efficiency, and new technology, with a healthy climate and environment falling into “second row.” This created the baseline for my research. I want to analyze how the smart city commitment in Stavanger municipality can be linked to sustainability, climate, and environmental measures.

Four papers stood out: Polzonetti and Sagratella (2018) addressing smart cities and green development. Ahvenniemi, Huovila, Pinto-Seppä, and Airaksinen (2017) investigated the differences between sustainable and smart cities. Huang-Lachmann (2019) with a systematic review of smart cities and climate change adaptation. Lastly, Angelidou, Psaltoglou, Komninos, Kakderi, Tsarchopoulos, and Panori (2018) investigating the enhancing of sustainable urban development through smart city applications.

Polzonetti & Sagratella (2018) designed their study to investigate if smart cities and green cities had similarities. They stress that the economy and respect for the environment should be considered objectives to pursue synergy and harmony. Polzonetti & Sagratella (2018) consider cities as a key factor for meeting new needs and requirements, as they increase pollution and consumption because of the growth of urban centers. Additionally, cities are a place where people, students, and enterprises are concentrated, making them the center for production of goods and services, marketing, and consumption. They believe that cities are meeting these challenges through four strategies: Digital, green, smart, and sustainable (Polzonetti & Sagratella, 2018). These four strategy fields, or cities, do not coincide with each other but show strong overlapping areas (Polzonetti & Sagratella, 2018, p. 191). The “digital city” focuses on data, information, and communication between different actors. The “green city” aiming to develop infrastructures, spaces, facilities, and urban activities with low or non-environmental impacts. The “sustainable city” creates a socio-economical urban context balancing economic development with the environment and social equality in mind. And lastly, the “smart city” focusing on technologies to improve life quality in urban areas (Polzonetti & Sagratella, 2018).

When addressing issues in urban areas, a holistic view is essential to accomplish a good result. Ahvenniemi et al. (2017) recognize that a broad understanding of the smart city term highlights the use of technologies to provide more efficient services, optimize infrastructure, promote collaboration between different economic actors, and encourage innovative, collaborative business models in both private and public sectors. Further, they highlight the role of citizens and human needs, focusing on economic, social, and environmental sustainability. These focus areas suggest smart city as a tool to bring together technology, government, and society to enable a smart economy, smart mobility, smart environment, smart people, smart living, as well as promoting awareness to environmental sustainability with a focus on technology and people (Ahvenniemi et al., 2017). As a result, you achieve a

mix of all these different “cities” mentioned by Polzonetti & Sagratella (2018), a mix that can lead us to a development path that is both sustainable and inclusive.

The research done by Ahvenniemi et al. (2017) was a comparison between smart city assessment framework and urban sustainability frameworks aimed to review the development of these two. In the research, it was reported a misalignment between the targets of these two frameworks. With the acknowledgment that smart city assessments were devaluating the importance of environmental sustainability, they proposed redefining the smart city concept towards being more integrated with environmental sustainability identity (Ahvenniemi et al., 2017). Huang-Lachmann (2019) considers climate change adaptation and smart cities as emerging topics in the climate change and sustainability domain. She believes that understanding policy consequences for cities is crucial, especially in connection with the development of solutions for big challenges. Huang-Lachmann (2019) saw many common characteristics and objectives in the agendas of climate adaptation in cities and smart cities. Therefore, her research systematically reviews synergies of smart city applications in urban climate change adaptation literature to better understand policy consequences (Huang-Lachmann, 2019). The results from the research identified benefits from having smart cities and climate change adaptations coexisting, but that the people and government having a smart approach played the fundamental role. She also observed that smart city applications in climate change adaptation could increase competitiveness in cities by exploiting new opportunities concerning reducing urban and climate change challenges (Huang-Lachmann, 2019).

Angelidou et al. (2017) saw the value of investigating the potential contribution of smart city approaches and tools to sustainable urban development in the environment domain. They acknowledge that recent research has highlighted the need to explore the relation of smart and sustainable cities more systematically, focusing on more tangible applications. Their research aims to help fill this research gap and enable a deeper understanding of the topics. The findings from Angelidou et al. (2017) suggested that the smart and sustainable city landscape is extremely fragmented both on the policy and the technical levels. They stress that there are many unexplored opportunities for smart, sustainable development and solutions towards environmental challenges in cities. They consider their research valuable for policy makers both locally and globally and advises them to be more proactive and impactful when adopting new policies within these fields (Angelidou et al., 2017). Angelidou et al. (2017) also noticed

the interest in niches, as a part of the smart city applications market, from developers, user communities, and digital entrepreneurs, which is interesting from an industry development point of view.

Angelidou et al. (2017) and Polzonetti & Sagratella (2018) both highlight the European Union for the emerging of smart city, through policies that feature synergies between smart technologies and urban development (Angelidou et al., 2017) and through guidance with funds and financing for research and implementation of smart projects (Polzonetti & Sagratella, 2018). In the view of the EU, smart cities aim to use diverse technologies to achieve sustainability, focusing on the intersection between energy, transport, and ICT. These fields are also the ones that have received most of the EU's funding related to smart cities (Horizon 2020 program). The smart city supports the idea of using innovative technology to reduce greenhouse gas emissions in urban areas (Ahvenniemi et al., 2017). Therefore, the EU can function as a tool for both established companies and start-up companies to emerge from new, sustainable technology.

In the case of Stavanger, this is highly relevant considering one of the biggest challenges the region is standing up against is the lower activity in the business sector because of the recession within the oil and gas industry (Stavanger Kommune, 2016). Therefore, public authorities, businesses, and academia must collaborate as equal parts to solve important societal challenges sustainably and efficiently, providing positive business development effects. Furthermore, they see it as valuable to exploit the already existing competence in the region, especially within the energy sector (hydropower, oil, and gas), to push forward strong technology communities (Stavanger Kommune, 2016). This literature review will continue by looking into some relevant studies on Regional Industrial Path Development and institutions and how these can facilitate innovation and transition.

2.1.2 Regional Industrial Path Development – The case of Stavanger

As previously mentioned, the region of Stavanger has since the beginning of the 1970s, when the discovery of oil in the North Sea evolved to be the oil and gas capital of Norway. For most of the time, this has been economically advantageous for the region and has also led to some drawbacks. Because the oil and gas industry is superior, with big wages, they often find themselves recruiting the biggest talents, leaving other industries in the region in a “lock-in.”

Also, the region is so dependent on oil and gas that they have become a victim of oil price dependency, which has caused big consequences for the industry, for example, with the oil price drop in 2014. In that period, the region was forced to find solutions, resulting in two strategies: to trust that the oil prices and related employees would return, or they had to find new long-term strategies for a more diversified regional industry development. But when the oil prices went back up, the oil and gas industry was far more profitable than other industries in the region, and the people and resources went back into the oil and gas industry, leaving several new business ideas behind. However, the last year's focus and attention on the climate and environmental challenges we are standing up against, ambiguity and uncertainty related to the oil and gas industry are starting to rise, and public and politicians are starting to see the end of the oil and gas era. This makes it interesting, especially in the case of Stavanger, to see how we are equipped to handle an upheaval in the industry and work toward finding new, sustainable solutions that can employ the oil and gas workers.

Studies on Regional Industrial Path Development are highly relevant for researchers in the Stavanger region. Two research has been chosen for a closer look into the topic. One of them is a researcher from the region. Fitjar and Timmermans (2019) have studied the consequences of related industries, focusing on the Norwegian petroleum industry, and Hassink, Isaksen, and Trippel (2018) researched how new economic activities emerge in regions also known as Regional Industrial Path Development.

Relatedness between industries is often identified from applying similar resources and technologies, for example, flow of resources or co-occurrence of technologies between industries (Neffke and Henning 2013; Essletzbichler 2013; Fitjar & Timmermans 2019). Fitjar & Timmermans (2019) states that competition between related industries on factor markets hasn't been given much attention. They, therefore, conducted research based on this. They acknowledge that relatedness can facilitate interindustry knowledge spillovers but stress that it might entail interindustry competition (Fitjar & Timmermans, 2019). Fitjar & Timmermans (2019) promote this as a prominent risk in situations where there are large power asymmetries between industries. This can result in a decline in the related industries by decreasing regional diversification and subsequently lowering interindustry knowledge spillovers. Negative impacts of dominant industries, especially natural resource industries, due to them having big effects on macroeconomic and political-institutional dynamics, and labor-market competition because of the higher wages in natural resource industries

(Venables 2016; Fitjar & Timmermans 2019), is highly relevant for this thesis, with the Stavanger region being highly dependent on oil and gas. Fitjar & Timmermans (2019) has, through an examination of the Norwegian petroleum industry in 2004-2011, which was a period of significant growth, isolated the labor-market implications of resource extraction in the best possible way. By maintaining their focus on Stavanger, they were able to examine the impacts of co-location as well.

By analyzing the effect on other industries in the region as the petroleum industry expands, they saw that industries related to petroleum grew more than industries not related, suggesting that it is beneficial to be related to a highly growing industry (Fitjar & Timmermans, 2019). Fitjar & Timmermans (2019) discovered several negative impacts for the related industries as well, like rising salaries, de-skilling, and the loss of employees to the petroleum industry. Additionally, the petroleum industry tended to select the most productive workers from related industries, while the less productive once moved from petroleum to related industries (Fitjar & Timmermans, 2019).

Hassin, Isaksen & Trippel (2018) use the term “new path development” as an executive term for all new economic activities in regions. They remark that scholars within evolutionary economic geography (EEG) has devoted much of its attention towards how new path developments unfold in particular spaces and over time. EEG research is highly concerned with the birth and death, innovation, and co-evolution of firms and highlights the importance of geographical differences as they consider economic actions to be contextual (Hassin, Isaksen & Trippel, 2018). This type of research is particularly interesting concerning studies on specific geographical locations as it pays attention to the micro-foundation of economies by stressing the importance of organizational routines, as well as directing attention to local processes of paths and trajectories in technologies, firms, and industries (Hassin, Isaksen & Trippel, 2018). New regional industrial path development and path dependence are important explanatory notions in EEG. However, EEG has been criticized for not giving enough attention to the role of the social, cultural, and institutional environment of economic activities (Hassin, Isaksen & Trippel, 2018).

Hassin, Isaksen & Trippel’s (2018) study on how industrial paths emerge and grow over time in the context of EEG identified several neglected issues which they believe to be essential for a more comprehensive understanding of new path development: First, a multi-actor approach

that also directs attention to the critical role played by actors at different levels. Second, a multi-scalar view that takes nonlocal sources and influences on new industrial paths seriously. Third, the integration of expectations and visions in analyses of new regional growth paths to acknowledge that the past and the future can shape their development. And lastly, broader conceptualizations of interpath relations and dependencies (Hassin, Isaksen & Trippel, 2018, p. 1637). To sum it up, the result of their study shows that one should pay more attention to how non-firm actors, such as users, universities, and policy actors, shape new regional industrial path development. One should pay more attention to the multi-scalar of sources, relations and influences, and expectations, visions, and conventions in future research on new path development. Lastly, to do a broader analysis of inter-path relations.

2.1.3 Institutions as facilitators for innovation and transition

Different institutions are key to facilitate this transition in the context of both green transitions in our societies and green industry development. For example, various actors and institutions have actively shaped the smart city agenda, leading to different approaches to the term accordingly to placement and regimes (Shelton & Clark, 2016). Institutions can facilitate or block regional development paths. And in the context of transformational needs, institutions must at least adapt to changing environments. At best, they are a vital driving force for change. Generally, institutions create incentives and guidelines for action (Scott, 2003). Morgan (1997) explains institutions as recurrent behavioral patterns and socially constructed norms and rules that establish routine-like and repetitive behavior. Or North (1990) defines institutions as the rules of the game and act as resilient humanly devised constraints that structure interaction in society. Changing institutions is, therefore, a way to transform regions by altering the rules of the game.

The concept of “institutional thickness” was introduced by Amin and Thrift (1995). The term was used to discuss the influence institutions, actors, agents, and the culture of collaboration have in regional economic growth. It is often considered advantageous for a region to be “institutional thick” because it helps them respond better to an external event. However, it is important to keep in mind that too much thickness may result in the region being detrimental to change-making institutions and actors competing for resources, resulting in ambiguous goals and conflicting activities. Recently the EEG scholars have begun to focus on the role of institutions in new path development, like mentioned by Hassink, Isaksen & Trippel (2018). And one can explain new industrial development path ‘as a set of functionally related firms

and supportive actors and institutions that are established and legitimized beyond emergence and are facing early stages of growth and developing new processes and products...’ (Steen & Hansen, 2018, p. 4; Hassink, Isaksen & Trippel, 2018, p. 1637). Therefore, a strong focus on institutional elements, conditions, and dynamics is key to understand new development paths (Hassink, Isaksen & Trippel, 2018).

2.2 Stavanger as a unit for analysis

The following section will contain an overview of the geographical aspects of the municipality, as well as the organizational setup, to ensure that the reader gets a correct and concrete perception of the unit that is to be researched in this thesis, namely Stavanger municipality.

2.2.1 *Stavanger as a geographical unit*

An elaboration of Stavanger municipality as a unit for analysis is favorable to gather a better understanding. Stavanger is a city in the South-West of Norway in Rogaland County. The city has for some decades been considered “the oil capital” in addition to having a strong industrial profile. In the latest year, Stavanger has become more and more acknowledged for its research through the university, which holds around 11 000 students, and a large regional hospital and investment in health research.

With a population of around 144 000 citizens, Stavanger is Norway’s fourth-largest municipality. From January 2020, Stavanger increased drastically in size due to the merge of several municipalities in Norway and more than tripled its area from 68 km² to 237 km², even though the population only had a marginally increase from 134 000 citizens (Stavanger Kommune, 2020b). The merge has resulted in Stavanger going from a relatively urban, densely populated municipality to a municipality with a great extent of natural areas and large areas of agriculture.



Figure 1: Map over new Stavanger municipality after the merge (Stavanger Kommune, 2020b)

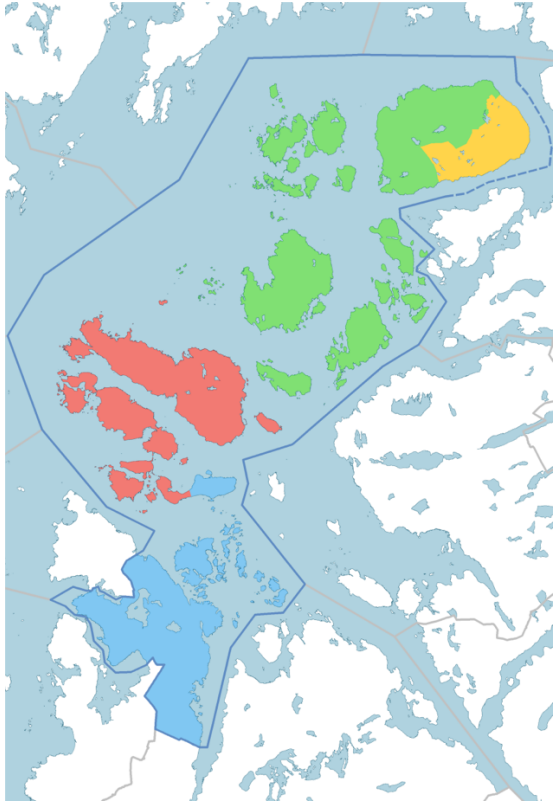


Figure 2: Map over new Stavanger municipality, with color codes (Stavanger Kommune, 2020b)

The blue area shows the area of Stavanger municipality before the municipal amalgamation. The area in red (previously Rennesøy municipality) and the area in green (previously Finnøy municipality) show the two new areas that have been added to Stavanger after the amalgamation. The blue area holding the city core of Stavanger will be the most interesting to address in this research.

2.2.2 The organizational set-up of the municipality

The figure below shows the organizational setup for Stavanger municipality. In addition to the municipality director, assistant municipality director, and the municipality attorney, the organization hold seven service areas. These seven do additionally hold several different departments. This figure has only added the smart city and climate and environment department because they are the once relevant for this research.

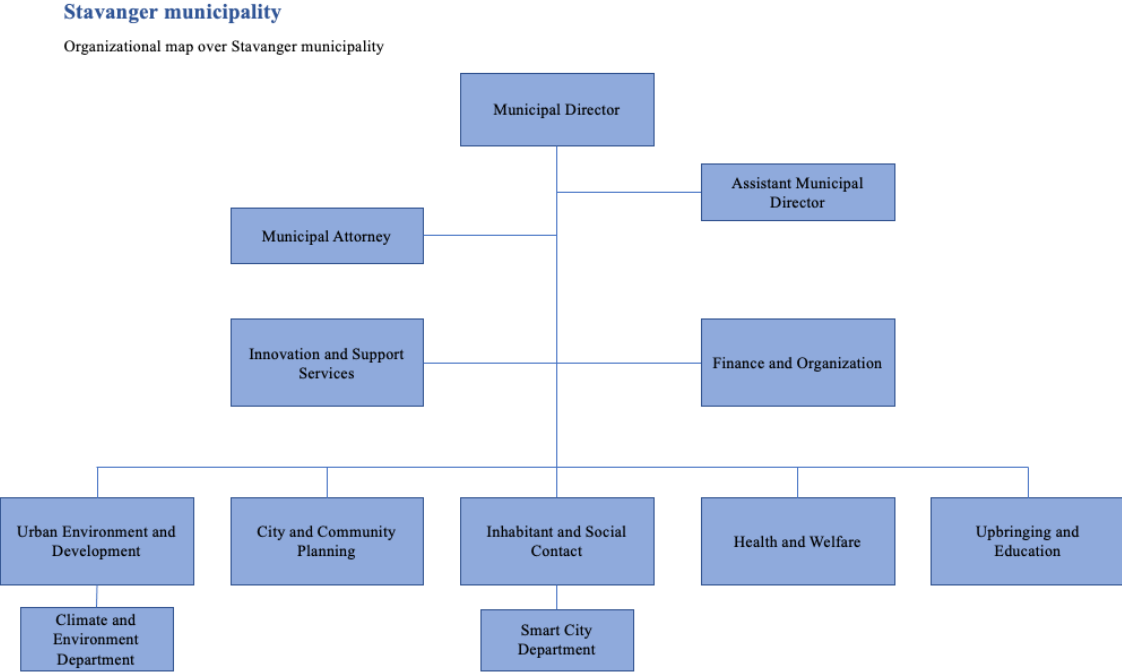


Figure 3: Organization map over Stavanger Municipality (Stavanger Kommune, 2021b). My translation.

2.3 Aims and significance

This research’s contribution (Blaikie, 2010, p. 27) is first that it will provide a clearer insight into the smart city commitment in Stavanger municipality and how climate and environmental commitment is implemented in this, through an investigation of the interpretation, work, and results of relevant actors. Further, the thesis will provide a better understanding of the municipality's strategies, plans, and projects related to these topics and how they cooperate.

This study's significance is that it will fill the gaps and provide a recommendation to how this work can become more tangible, more efficient, and better linked.

3. Theory

The different theoretical frameworks introduced in this chapter continues the analytical framework for interpreting the findings in this research. Choosing theoretical frameworks depends on the focus and aim of what is being studied, and theories based on inter-organizational work and industry development were chosen for this thesis. The theories are used as a tool to guide the focus of this thesis in a relevant direction and help structure a systematic way of obtaining answers to the research questions. The theories used are necessary tools to gain a better understanding and interpretation of the findings.

3.1 Government Inter-organizational Information Integration (GIII)

To discuss to what degree Stavanger municipality is coordinated in their work and to what degree there can be found information sharing and collaboration internally and externally, governmental inter-organizational information integration (GIII), as outlined by Gil-Garcia (2012), will be applied to the discussion. Because a smart city is such an interdisciplinary topic, its projects and initiatives can cover several departments in the municipality organization. It is therefore essential that commitments are initiated across the whole organization and not separate from one another. Furthermore, for both the smart city commitment and the climate and environmental commitment, climate, environment, and sustainability are common interests. Lack of communication, collaboration, and coordination between these two can therefore result in less productive work, making it essential for this research to evaluate the current state of these aspects in the organization.

Governmental inter-organizational information integration (GIII) is a theoretical framework approaching how government organizations increasingly look to new technologies to solve problems, become more efficient, and enhance collaboration with citizens and organizations (Gil-Garcia, 2012). GIII looks to the creation of new network structures across sectors, which is often described as a whole-of-government approach. This inter-agency collaboration using new technological solutions to become more efficient is what has become the characteristics of GIII, a socio-technical phenomenon that contains 1. trusted social networks, 2. shared information, 3. integrated data, and 4. interoperable technical infrastructure. The use of GIII has lately become more cross-sectoral among government agencies, other branches of government, not-for-profit organizations, and private firms. It uses information technologies to enable collaboration across organizational boundaries. Addressing relevant societal issues

through information sharing across sectors is considered being favorable as it acquires a more holistic perception of the issue at hand (Pardo, Gil-Garcia, & Luna-Reyes, 2010).

In covering both technical and social aspects, it is necessary to consider that integration can happen in many ways through information, business processes, systems, perspectives, value propositions, resources, cultures, missions, practices, and professions (Gil-Garcia, 2012, p. 271). It can be difficult to achieve deep enough integration, especially in terms of organizational politics and culture, such as through values, perspectives, and motivations. GIII is a complex and multidimensional phenomenon including technology, organizational, institutional, political, economic, and social components (Gill-Garcia, 2012, p. 271). In the case of smart cities, where they're in many cases can be observed a gap between different cities focus on either technological aspects or social aspects (Van Den Bergh & Viaene, 2016), GIII seeks to address different concerns as distinct phases along a continuum from social to technical aspects.

Gil-Garcia (2012) highlights several benefits from GIII, like reducing duplication of data and more coordinated efforts, leading to higher efficiency. These benefits can be “seen as either an organizational outcome alone or as a complex combination of changes in organizational results, processes, and structures” (Gil-Garcia, 2012, p. 271). Looking at some concrete examples of benefits from GIII, active public participation, transparency, efficiency, cost savings, policy effectiveness, and service quality are some of the ones that are highlighted. One can classify expected results from government information-sharing projects into three categories: (1) Technical results covering actual handling of data and the improvement of situations through information sharing, reducing duplicate data collection, processing, and storage. (2) Organizational benefits resulting in “reducing costs, improving the quality of services, enhancing existing professional networks, or gaining better control and coordination in the organization” (Gil-Garcia, 2012, p. 272). (3) Political benefits such as “enhanced public image, value creation, increased government transparency and accountability, integrated planning, and more comprehensive public information” (Gil-Garcia, 2012, p. 272).

On the other hand, there are several challenges related to GIII as well. These challenges are often associated with the political nature and diversity of the different stakeholders. Most prominent are challenges related to political or institutional aspects, where politics or politicians can hinder co-operation through power relations deciding how the governmental

bodywork and decision-makers. Furthermore, from an institutional point of view, an organizational structure with formal and informal rules can affect technology and interaction with others (Gil-Garcia, 2012). Looking into the organizational structure of Stavanger municipality will be essential to address the degree of transparency, different actors' approaches towards the smart city, and climate and environment commitment. Organizational challenges such as individual's resistance to change, diverging motivations, priorities, and goals between or within organizations are also challenges that need to be addressed. Finally, there can be experienced technological challenges related to software incompatibility, lack of technological skills, or challenges associated with the implementation of new technologies (Gil-Garcia, 2012). The mentioned challenges are highly relevant for this research and were previously highlighted in the hypotheses as factors for lack of transparency in Stavanger municipality. These mentioned factors will therefore be investigated in the analysis and later discussed in the discussion chapter.

Newer research from Gil-Garcia, Guler, Pardo, and Burke (2019), stresses the importance of clarity of roles and responsibilities when initiating inter-organizational collaboration and information sharing initiatives. Clarity of roles and responsibilities (CRR) has been shown to influence the effectiveness and performance of inter-organizational efforts. Additionally, it has been shown to increase job satisfaction, commitment, and involvement, reducing misunderstanding and tension among the organization members (Gil-Garcia et al., 2019). For this research, uncovering different actors' interpretations of each other's work and responsibility will be relevant due to the factors mentioned above. Also, exposing the degree of collaboration, coordination, and communication skills in the organization will be key for making up an opinion if the inter-organizational work is successful or not (Gil-Garcia et al., 2019).

3.2 Regional Industrial Path Development

Smart city has been seen as the development of a new industry in Stavanger, and the smart city cluster Nordic Edge has as its main vision to establish a new, exportable industry of smart and sustainable products and solutions. To be able to answer in what ways Stavanger municipality is facilitating green industry development in the region, the theoretical framework for Regional Industrial Path Development (RIPD) will be applied to the discussion. This topic is relevant for this research to see how the municipality and local

politicians facilitate the development of new, greener industries. And to test the hypotheses saying that the smart city commitments approach towards climate and environment can result in new industries.

In regional innovation systems (RIS), the private sector is often described as innovators and value-creators, whereas the public sector is a policymaker and facilitator (Grillitsch, 2016). This description is also relevant for industrial path development. A path is, in this context, defined as the course of the interrelated event in which a technological, institutional, and/or organizational option gains momentum in a time-space. A path includes firms, a dominant technology and industry platform, and an institutional arrangement (regulation/legislation, policies, and supporting organizations like universities and research institutions) (Sydow et al., 2012). A path development involves a process of both continuation and change (Jakobsen, Byrkjeland et al., 2012). For the municipality to develop these new paths, it is favorable that the organization is coordinated in the same direction as the path is moving, in this study, a green direction. Exploring whether there can be observed overlapping focus areas and ambitions between the smart city and the climate and environment commitments, leading to potential collaborations and synergies, will also give a better impression of what ways Stavanger municipality is facilitating green industry development in the region

3.2.1 Types and mechanisms of regional industrial path development

Categories of new path development are rather broad. Grillitsch, Asheim, and Trippel (2018), inspired by Isaksen et al. (2018), suggest a distinction between path extension, upgrading, branching, importation, diversification, and creation. Table 1 summarizes the main forms and mechanisms of regional industrial path development:

Table 1: Overview of types and mechanisms of RIPD Retrieved from Grillitsch et al. (2018)

Forms of path development	Mechanisms
Path extension	Continuation of an existing industrial path based on incremental innovation in existing industries along well-established technological trajectories.
Path upgrading I - Climbing GPN	Major change of a regional industrial path related to the enhancement of position within global production networks; moving up the value chain based on upgrading of skills and production capabilities.

II – Renewal	Major change of an industrial path into a new direction based on new technologies or organizational innovations or new business models.
III - Niche development	Development of niches through the integration of symbolic knowledge.
Path importation	Setting up an established industry that is new to the region (for example, through nonlocal firms) and unrelated to existing industries in the region.
Path branching	Diversification into a new related industry for the region building on competencies and knowledge of existing industries.
Path diversification	Diversification into a new industry based on unrelated knowledge combinations.
Path creation	Emergence and growth of entirely new industries based on radically new technologies and scientific discoveries, social innovation, or new business models

The growth of new paths depends on ambiguous contexts. For example, in times of high uncertainty and ambiguity, new ideas tend to arise, seeds of ideas leading to path importation and/or creation. The smart city initiative in Stavanger can, for example, be categorized as a path creation. Looking at the region's interest and commitment towards cleaner and renewable energy, we can observe several regional industrial path developments, like path extension in the way the regions work with new and innovative ways to continue the oil and gas production. Path renewable can be observed within big oil and gas companies creating renewable energy development strategies, like offshore wind. And lastly, path branching in the way the region wishes to use existing competence from oil and gas to produce new, renewable energy sources.

3.2.2 Opportunity space for regional industrial path development

According to Grillitsch et al. (2018), there are some opportunity spaces for regional industrial path development specialization, related variety, and unrelated variety, which can be put into two dimensions; *space* and *industry structure*.

Space refers to local arenas for knowledge exchange and learning in a specific geographic space (local space). Specialization in spaces like these is often associated with dynamic regions, such as Silicon Valley, or declining, old industrial regions, all dependent on different types of specialization within the region (Grillitsch et al., 2018). Related variety, on the other hand, “allows for a better allocation of resources to economic activities that generate higher value” (Grillitsch et al., 2018, p. 268). Therefore, firms in regions with many related industries will be better suited to adapt from declining to more dynamic industries. And related variety in specific geographical spaces can be a source for shifting competencies and resources from one industrial path to another (Grillitsch et al., 2018, p. 268). Lastly, unrelated variety offers potential for emerging new industries, both new for the world (path creation) and unique for the region (path importation). Grillitsch et al. (2018) argue that specific geographic space plays a significant role in creating new paths due to the learning value of face-to-face contact and direct social ties.

Industry structure is an abstract economic space for knowledge and technology used and developed in a specific industry that cannot be directly linked to a specific geographical territory. This abstract space is defined by industry-specific institutions and technologies, creating a common frame for interaction regardless of the location of the actors. Specialization in an industry structure rests on knowledge linkages between actors in that specific industry. This promotes learning within the framework of the industrial path, leading to path extension. In looking at related variety, this opportunity space is considered a source for path branching through one industry branching into another because it requires similar competencies that do not exist in the region. Path branching can also occur here when firms from related industries decide to locate or open new branches in the region. Lastly, unrelated variety opens for path upgrading through path renewal and niche development and path diversification by capturing firms’ diversification into hitherto unrelated industries. Unrelated variety is considered a source for learning and innovation, but due to relative cognitive distance, this opportunity space is considered to have a better outcome for industrial path development in the same concrete geographical space (Grillitsch et al., 2018).

3.2.3 Institutions as facilitators for regional development paths

Institutions can facilitate or block regional development paths. To do so, institutions need to adapt to changing environments or lead as a driving force for the change. This usually occurs

through incentives and/or guidelines for action (Scott, 2003). Institutions can be defined as the game rules and function as resilient humanly devised constraints that structure interaction in societies (North, 1990). These developments can happen in three types of institutions: regulative institutions, which often reside at the national level, including formal rules, laws, and constitutions. Normative institutions usually occur at a more regional level, including norms of behavior, conventions, self-imposed codes, and conduct. And lastly, cultural-cognitive institutions stand for the creations of interpretive frameworks where meaning is established and shaped, framing the way actors perceive, interpret, and understand themselves, their actions, and positions in broader structures (Scott, 2001). Institutional change is one of the ways one can transform regions by altering the rules of the game.

Institutional thickness is a concept that is used to discuss the influence that institutions, actors, agents, and the culture of collaboration have on regional economic growth. Most will say that institutionally thick regions will have an advantage and are likely to be more responsive to change and external events. But it is fair to mention that too much institutional thickness can have the opposite effect. Institutions and actors may compete for resources, resulting in ambiguous goals and conflicting activities (Amin & Thrift, 1995). These are issues that need to be addressed by institutions like municipalities as well. And for Stavanger being an institutionally thick region and a victim of oil price dependency. A transition like this is extra challenging when the oil price and reduced activity level lead to lower revenues in oil and gas production. This could also lead to lower investments in green technology, which will be necessary for the green shift. Such circumstances can make it difficult for both public and private sectors to facilitate the growth of new industrial paths, especially if they do not work coordinated and systematically in the same direction.

4. Research design and Methodology

In this master thesis, several methodological choices have been made to explain what has been studied and how it has been studied to ensure a trustworthy study. A research design, which will be conducted in the section below, is an explicit plan to make these choices (Blaikie, 2010, p. 15; Bryman, 2016, p. 40). According to Yin (2011), a research design should connect the research question, the data collection, and how this will be analyzed (p. 76). In this part of the thesis, the different methodological choices will be accounted for.

4.1 Problem statement and research questions

The thesis aims to investigate to what extent climate and environmental measures are implemented in the smart city commitment in Stavanger municipality. It will seek to analyze the current situation by looking into how different stakeholders (both within the smart city and climate and environment) work within and across organizations, how they collaborate, and which focus areas they have. It also aims to evaluate the work to seek out improvement areas and valuable synergies. This approach is descriptive in the way it attempts to account for the current situation in the municipality and analytical by looking into how the smart city and climate and environment commitment are coordinated in their work. The problem statement has been deconstructed into specific sub questions to address the different units of the issue. In addition, I found it favorable to rest these questions on my hypotheses on the topic.

4.1.1 Hypotheses

- The smart city commitment and the climate and environmental commitment in Stavanger municipality are currently initiated separately, even though climate, environment, and sustainability are common interests.
- There is a lack of transparency, communication, collaboration, and coordination between the two commitments, which can result in less productive work.
- The lack of coordination between these two commitments can be traced back to 1. The organizational setup of the municipality. 2. Conflicting approaches to the domain.
- The smart city commitment promotes the use and production of new technologies as a solution for societal issues related to climate and environment and believe that new industries will emerge as a positive outcome of this.

- The interpretations of each other’s work can cause stigmas and decrease communication and collaboration between the two commitments. However, several overlapping focus areas exist, and the two commitments have great potential for collaboration and synergies.

4.1.2 Research questions

To what extent are climate and environmental measures implemented in the smart city commitments in Stavanger municipality?

- *Is there a joint effort in work done by the smart city commitment and the climate and environmental commitment in promoting climate and environment measures in an urban context?*
- *Can there be observed transparency, communication, collaboration, and coordination between departments and sectors in the municipality?*
- *In what ways is Stavanger municipality facilitating green industry development in the region?*

4.2 Strategy

The thesis aims to understand further the smart city commitment and their approach towards the green shift. Therefore, this is an explorative study, looking at and exploring, seeking to explain reasons, thus creating understanding. It is essential not to confuse this with causal explanation, explaining the “why’s” and causes for a phenomenon. This thesis aims to understand social reality and find the meaning of an event through social actors (Blaikie, 2010, pp. 71-72).

4.2.1 The Abductive research strategy

When conducting research, four main research strategies can be used: Inductive, retroductive, deductive, and abductive research strategies. They present a different logic on pursuing the research questions (Blaikie, 2010, p. 81).

There are different ways of defining the abductive research strategy, whereas several authors have their way of describing the term. Blaikie & Priest (2019) defines abductive logic as a way of “producing understanding, rather than an explanation, providing reasons rather than

causes” (Blaikie & Priest, 2019, p. 99). Using this logic, one can construct theories based on observations of actors' meanings and accounts of certain activities, forming an understanding of the case (Blaikie & Priest, 2019). In this case, the interviewees meanings, and accounts of the implementation of climate and environment to the smart city work in Stavanger municipality.

On the other hand, abduction can apply an existing theoretical framework to a phenomenon, focusing on gaining new insight through seeing social research problems against different theoretical frameworks. In this case, abduction can move from one interpretation of something to a different and possibly deeper or more developed impression by placing the original idea of phenomena in the frame of a new set of ideas (Danermark, Ekström, Jakobsen, & Karlsson, 2002). Compared to Blaikie & Priest, Danermark et al. place more emphasis on applying existing theories to new knowledge than letting new theories aspire from new observations. Thus, it not only observes the events up against theory but will simultaneously test how the theory holds up against the new set of data. In this way, one can discover new explanations and new ways to find these explanations (Dey, 2004, p. 91).

Even though these definitions are somewhat the same, focusing on new ways to interpret existing phenomena and data, they have a different approach in applying theory. For this research, both Blaike & Priest (2019) and Danermark et al. (2002) definitions are favorable to use. Blaike & Priest (2019) definition in the way that this research attempt to gain new insight into the implementation of climate and environment measures in the smart city work in Stavanger municipality, finding factors that could have or can promote or hinder this implementation. But also, to a high degree, use theoretical frameworks to substantiate collected data, which is the baseline for several of the research questions. Using Danermark et al. (2002) approach makes it possible to a greater extent to be able to defend the results as they are based on theoretical frameworks.

4.2.2 Ontological and epistemological assumptions

The research strategy builds on ontological and epistemological assumptions. “Social research is usually conducted against a background of some tradition of theoretical and methodological ideas” (Blaikie & Priest, 2019, p. 105). These traditions are here referred to as paradigms. These paradigms embody theoretical ideas, ontological and epistemological assumptions, holding the foundation of social science requirements. In this thesis, the paradigm of

Interpretivism is preferable to explain the understanding of social reality (Blaikie & Priest, 2019). It can be understood as “the product of its inhabitants” (Blaikie & Priest, 2019, p. 107), where social reality is seen as something composed by the meanings the different actors produce and reproduce (Blaikie & Priest, 2019). This paradigm is used in the research because all the interview object's interpretations, actions, and decisions are based upon the assumption of social reality.

The different interview objects work with either smart city, climate, environment, politics, or industrial development. These actors should, therefore, in most cases be concerned about the municipality's development, as well as they are often updated on climate change. Therefore, “the viewpoint of an idealist” is applied to the analysis, which is based upon that “social reality is made up by sheared interpretations that social actors produce and reproduce as they go about their everyday lives” (Blaikie & Priest, 2019, p. 102). Further, the associated term of Constructionism states that “access to the world has to be through the language of the participant, social reality has to be discovered from the inside rather than being filtered through or distorted by experts' concepts and theory” (Blaikie & Priest, 2019, p. 104), will be used as an epistemological assumption to understand how knowledge can be obtained. These assumptions were chosen because they are the most suitable in conjunction with an abductive research strategy (Blaikie & Priest, 2019).

4.3 Case Studies

This research is a case study of Stavanger municipality, which is, according to Yin (2018), an empirical method that conducts an in-depth investigation of a present situation or phenomena in its natural context. The prospect of a case study is to gain new insight into a phenomenon. The goal of conducting a case study is to expand and generalize theories, not extrapolate probabilities (Yin, 2015, p. 100)

There are still some concerns that need to be addressed when doing a case study. In this research, it's important to be aware that a single case study on Stavanger municipality will limit the results and understanding to one geographical area. Even though theoretical and analytical generalization can be used for researching other similar cases, it is essential to be aware that differences may occur in similar research. The results can be used as inspiration and/or guidelines for similar research elsewhere or as a tool for comparison. Instead of doing

a multiple case study with an embedded approach, looking at several similar cases with one focus, I have found it more suitable to have a holistic approach looking deeper into every aspect of the case.

Flyvbjerg (2004) states that concrete context-dependent knowledge is more valuable than knowledge aspiring from predictive theories of universals. This is because one rarely finds these universals when studying human affairs. Context-dependent knowledge and experience are therefore useful for gaining a deeper understanding as well as developing new theories.

4.4 Data

The thesis is an empirical study based on mixed methods in collecting and analyzing data. It is a qualitative study in that it seeks meanings and interpretations and creates the discursive conceptualizations of the representations that can be found in the social world (Blaikie, 2010, p. 204-205). Merely of the collected data that will be analyzed will be qualitative data, both from interviews and text. Interviews with relevant actors and the investigation of data sources will establish a baseline for establishing meanings and representations on the chosen topic (Blaikie, 2010, p. 207).

4.4.1 Data selection

Three types of data can be used in a scientific paper: Primary, secondary, and tertiary data. Primary data is retrieved directly from the source; interviews are an example of a primary data source. Secondary data is data that has already been collected by another researcher but hasn't been analyzed yet. Lastly, tertiary data is already analyzed by another researcher (Blaikie, 2010, p. 161). This thesis will use primary data through interviews and tertiary data, mainly from official municipality documents and reports. Doing interviews is a favorable way of gaining access to firsthand data and especially when doing case studies. A disadvantage is that it is relatively time-consuming. Selecting the interviewees was a non-probability process, whereas they were not randomly chosen, but chosen based on their profession, expertise, or other had valuable information or relations to the smart city and climate and environment commitments in Stavanger.

This thesis is interested in the selected interviewees accounting of the phenomenon in the social reality that is studied, which makes this a collection of data in a semi-natural setting.

The individuals are in this setting treated as informants accounting for motives, meanings, and interpretations that represent actors within the smart city and/or climate and environment. Therefore, the individual itself is not relevant for this thesis and can, without disadvantageous, stay anonymous (Blaikie 2010, p. 167).

4.4.2 Data collection

The data collection was done with the intention to acquire a better insight of the theme and make a basis of comparison up against the interviews and up against the different stakeholders’ approaches. By using semi-structured interviews, I was able to tailor each interview for each informant and ask relevant questions based on their expertise. This also made it possible to add supplementary questions during the interviews, which was an advantage to clarify answers or follow up on interesting, new information. It is relevant to start presenting the data collection process to relate the thesis to the methodology. Previously the plans, considerations, and choices have been presented, but the following will account for how it was done.

4.4.2.1 Interviews

In the collection process of the interviews, ten interviews were conducted, all in semi-natural settings. When choosing interview objects for this research, they were chosen within four fields; Actors working in the smart city body, actors working with climate and environment, politicians in the city council, which is involved in adopting policies, and actors working with industry development. There has been an overweight of actors working within the municipality, but actors from the private sector have been included as well.

Ten interviews were carried out between April - May 2021.

Table 2: List of interviewees

Interview object	Organization	Field	Date of interview
Smart city department 1	Stavanger municipality	Smart city	20.04.21
Politician 1	Stavanger municipality	Politician	20.04.21
Smart city department 2	Stavanger municipality	Smart city	21.04.21

Politician 2	Stavanger municipality	Politician	21.04.21
Nordic Edge 1	Nordic Edge	Smart city	22.04.21
Nordic Edge 2	Nordic Edge	Smart city	22.04.21
Business Developer 1	Creator Makerspace	Business development	23.04.21
Climate Partners 1	Climate Partners	Climate and environment	23.04.21
Climate and environment department 1	Stavanger municipality	Climate and environment	26.04.21
Procurements 1	Stavanger municipality	Green Procurements	20.05.21

Contact with the interview objects was made through e-mail. Additionally, the snowball technique allowed the informants to recommend other possible candidates (Blaikie, 2010, p. 179; Yin, 2011, p. 312). This was a good way of finding new, relevant interview objects. Still, it was important to keep in mind that relying totally on recommendations can create biases due to people who are recommended often have a connection or collaboration of some sort, which can affect their responses. All interviews were carried out in Norwegian; this was favorable for better understanding and minimizing the risk of miscommunication due to the interviewer and all the interviewees being Norwegians. The range of people that were interviewed was quite big, in my opinion, even though it would always be preferable with more opinions. But looking at the size and timeframe of this research, It was narrowed down to ten interviews. Most of the people that were contacted had a positive response and wanted to contribute to the research. Some couldn't contribute but referred me to someone else. Everyone doing digital meetings due to the restrictions in relation to the Covid-19 pandemic could have positively affected the number of people contributing to interviews.

In qualitative research, semi-structured interviews are a common way of gaining new insight into a field. This research has conducted interviews with relevant actors working within the smart city body, climate and environment, politics, and industry development in Stavanger municipality. All interviews had to be carried out digitally using a video conferencing program. This was due to restrictions related to the Covid-19 pandemic. It has to be mention that this can affect both the validity and reliability of the data. That is because the interview

object's body language and reactions are harder to read over a digital screen; they can also use notes and even search for information online during the interview without the interviewer being aware.

In advance of the interviews, an interview guide was created to be submitted to NSD (Norsk senter for forskningsdata) as a part of an application to conduct interviews. The interview guide was somewhat adapted for the various actors but contained first and foremost open questions that were angled towards all the interview objects. But it must be acknowledged that the background knowledge and expertise of the different actors is a factor for responding to the questions. But as Rapley (2004) points out, conversation on the same issue will point out different perspectives. Therefore, the interviews were built up of some key questions that were compatible with follow-up questions, allowing to follow up on interesting elements that arise during the interviews. Also, following a relatively similar interview structure ensured that comparable data was generated from each interview.

The intention of the interviews was to get information on the research topic and questions. This method is called "interview-data-as-resource," where the interviews are used as a resource to gather a greater understanding of a topic. It is essential to mention that this can be difficult to achieve in practice due to interviews being an arranged event where the participants can create a joint reality wanting to portray themselves as "adequate interviewees" (Rapley, 2004). A risk with interviews is, therefore, that the interview objects give the answers they think you want to hear and/or answers that reflect well on themselves, their work, and their professional role. It is therefore important to be aware of the reliability and validity of the collected data. The validity of the data can be compromised if the answers from the interview objects don't represent the whole reality of the situation. In addition, the reliability of the data being compromised due to interviews being a constructed situation makes it difficult to know if the information that was told would be the same if someone else were conducting the same interview in a different context (Neuman, 2014).

Another problem that can arise when using interviews as a research method is the interpretation of the answers from the interviewer. According to Alvesson (2003), prior knowledge, language, and the interviewer are inextricably linked. Therefore, the provided data is a subject of the interviewer's interpretation of the answers and would most likely be

interpreted differently by different interviewers based on their prior knowledge, beliefs, values, and preconceptions (Alvesson, 2003).

4.4.2.2 Documents

In addition to interviews, documents have been a big part of the collected data. Documents are tertiary data, which has some disadvantages. Firstly, the trustworthiness of the data must be verified, but having in mind that even though the sources are reliable, they can have been collected to achieve a specific outcome, resulting in the reporting being possibly selective (Blaikie, 2010, p. 161). In this research, documents will be used to compare up against the data retrieved from the interviews. This can help source out potential errors in the documents. On the other hand, it is fair to mention that this research aims to find different representations of the phenomenon, not merely straight facts, but subjective meaning and interpretations on the smart city and climate and environmental commitment in Stavanger municipality. Using already existing research also gave good insight and ideas, in addition to narrowing down time-consuming processes.

The documents used in this thesis consist mainly of official documents deriving from the public sector, hence, the municipality. These documents are official reports, strategy documents, action plans, white papers, and statements from politicians. Public and official document from the state is considered to be reliable sources, but it does not mean that they are free from biases or errors (Bryman, 2016, p. 552), it is as previously mentioned therefore favorable to compare these documents up against the different interviewee's interpretation of the same phenomenon. In addition, official documents deriving from private sources like organizations and private companies will also be used. These documents will be reports and statements, but also virtual documents like websites. These sources are more typical for public sources, as they do not always produce the same types of documents as the public sector. It needs to be considered that official documents from private sources are often written from a particular point of view to send a message (Bryman, 2016, p. 553).

4.5 Data reduction and analysis

Choosing to do a case study of Stavanger municipality narrowed down the amount of relevant data to a great extent making it easier to relevant data sources, both in documents and

interview objects. The topic also narrowed down relevant data, and there was a deliberate choice to focus on documents relevant to the smart city and climate and environmental commitment. When selecting interview objects, the scope was somewhat more significant to ensure sufficient perspectives on the topics. When transcribing all the interviews, the relevant information for this thesis was picked out and placed in coded tables to easier be able to compare and analyze the obtained information. Comparing the obtained data like this was favorable concerning the abductive research strategy, making it easier to understand and place the data in a larger context and within different perspectives (Danermark et al., 2002). The theoretical frameworks of Government Inter-organizational Information Integration (GIII) and Regional Industrial Path development constructed the baseline for how the research question where to be analyzed. Lastly, an analysis of projects was done, with the reduction that the projects had to be initiated by the smart city department and in some way be relevant for climate and environment measures.

4.6 Reliability

According to Yin (2015), to measure if you have conducted a reliable study, one must be sure that the study's objectives would have led to the same findings and conclusion if the same research was to be made over again. Documenting the procedures and making as many steps as operational as possible will ensure that others and even yourself are able to conduct the same research all over again (Yin, 2015). Previously in this chapter, the data collection and selection have been accounted for and the methodological choices. Accounting for all these steps is important to ensure that the procedures are as operational as possible. However, there are some consequences related to some of my methods and data. Interviews will, for example, be hard to reiterate as the interview objects are anonymous (even if they weren't, one could not guarantee that they will give the same answers). The interviews were also semi-structured, making it challenging to obtain the same information. Most of the analyzed documents were also published in Norwegian and needed to be translated. It has to be accounted for those errors that may occur in the translation process due to language barriers.

5. Findings and analysis

In this chapter, the finding from the data will be presented and analyzed simultaneously. A document analysis of governmental documents produced by Stavanger municipality and an analysis of ten semi-structured interviews with relevant actors has been done to address the research questions.

5.1 Document analysis

In this sub-section, documents of relevance to the smart city and the climate and environmental commitment produced by Stavanger municipality internally or in collaboration with other organizations will be analyzed. The baseline for this document analysis is to discover possible junctions between the smart city commitment and the climate and environmental commitment. I seek to address existing junctions, as well as pointing out potential once.

Table 3: List of analyzed documents

Analyzed documents:	Year of publication:
<i>1. The municipality plan – Community part</i>	<i>2020</i>
<i>2. Roadmap for the Smart City Stavanger</i>	<i>2016</i>
<i>3. Six half-year reports from Stavanger smart city department between 2018 – 2020</i>	<i>2018 – 2020</i>
<i>4. Roadmap for smart and sustainable cities in Norway</i>	<i>2016</i>
<i>5. Climate and environment plan for 2018 - 2030</i>	<i>2018</i>

The municipality documents in the table above will address thematic, focus areas and strategies, and compare the data up against the information obtained from the interviews. Additionally, there will be a section consisting of a comparison of planned, ongoing and completed projects. This section is based on a project overview. These analysis is done to obtain sufficient information to answer the research questions.

5.1.1 The municipality plan – Community part

The municipal plan is a plan for how the municipality will develop over the next 15 years.

It consists of two parts: An area part that shows where we will, for example, build new houses, roads, parks, and playgrounds, and a community part with goals and strategies that tell which direction we want society to go in. The community part has three focus areas: 1. **The region engine** – aiming for a diverse business community and a strong city center. 2. **Good everyday life** - everyone should be fine where they live, whether they are four years old or eighty years old. 3. **Green spearhead** - we must take care of our nature and become more climate and environmentally friendly (Stavanger Kommune, 2020a).

The municipality plan is anchored in the seventeen sustainability goals, with the climate and environment plan as an associated sub-plan. All three focus areas are relevant for this research in one way or another, but it's more general than the plans that will be explained in the next sections. However, it is an interesting observation that the "smart city" isn't mentioned at all in the new municipality plan, especially considering Stavanger municipality being "the smart city Stavanger". The word smart is only mentioned twice in relation to the focus area "Green Spearhead," accounting for the municipality's need to become smarter and finding more climate-smart solutions (Stavanger Kommune, 2020a).

5.1.2 Roadmap for the Smart City Stavanger

The roadmap for the smart city Stavanger is a public document adopted by the Stavanger city council in December 2016. The document indicates the desired direction for the development of the smart city Stavanger and functions as a framework for implementing the smart city commitment. The roadmap was created with broad involvement from both the private and public sectors. Over 250 contributors from the public sector, business, organizations, academia, and other resource persons have provided input along the way (Stavanger Kommune, 2016).

Stavanger municipality wanted to strengthen the ability to handle the bigger societal challenges, developed better and more efficient services for the inhabitants, contribute to industry development and new workplaces, reduce emissions, and contribute to a more sustainable social development. Therefore, the roadmap was developed to determine goals and focus areas that can contribute to solving these societal challenges (Stavanger Kommune, 2016).

The roadmap proposes five focus areas:

1. Health and welfare
2. Education and knowledge
3. Energy, climate, and environment
4. Urban art
5. Governance and democracy

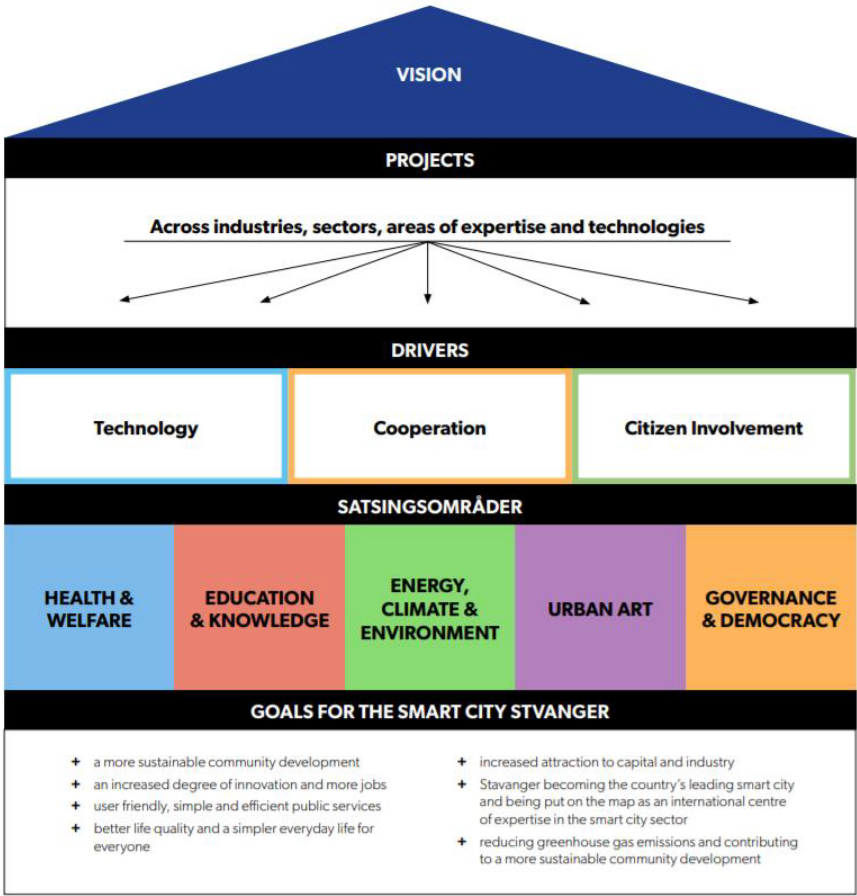


Figure 4: Illustration of the Smart City Stavanger (Stavanger Kommune, 2016).

Several of these focus areas can be directly or indirectly relevant for this thesis, but the analysis and discussion will address focus area 3: Energy, climate & environment. This selection was made based on it being the most relevant focus area and the only relevant for comparison to the information collected in the interviews.

Because of Stavanger’s position as energy capital in Europe, the smart city commitment wants to take an active role in solving the planet's energy, climate, and environmental challenges. They want to build on the existing expertise in the energy sector (hydropower, oil,

gas) and draw on the region's robust technology environments. They believe that investing in energy, climate, and the environment in a smart city context will have both positive industry development effects in the region and a macro perspective through providing better answers on how to solve the global energy, climate, and environmental challenges (Stavanger Kommune, 2016, p.18).

As the main direction for the topic, the municipality aims to develop and implement technological solutions that make a real contribution to adopted targets for emission reductions. At the same time, the solutions will make it easier for residents and businesses to make choices that contribute to a climate-neutral city. This will strengthen Stavanger's position as energy capital (Stavanger Kommune, 2016, p. 19).

As a part of this, seven objectives have been developed:

- Develop and implement new technological solutions that reduce local greenhouse gas emissions.
- Develop and implement new technology solutions that make it easy for citizens to make climate-friendly choices in everyday life.
- To further develop the region's expertise in energy production to bring about a strong escalation of green energy, and at the same time make the extraction of non-renewable energy resources in Norway the most environmentally friendly in Europe.
- Work to establish new forms of cooperation and arenas that use the competence-base in the energy industry to benefit new areas of society important for climate, energy, and the environment.
- Explore and push for new solutions that can ensure an exceptionally high level of ambition for climate and energy in all major urban development projects.
- Quickly adopt new and environmentally friendly technologies in the transportation of goods and people - both on land and at sea.
- Actively explore the possibilities of using new driverless transport systems.

(Stavanger Kommune, 2016, p. 19)

5.1.3 Half-year reports - Stavanger smart city department

Every half-year, the smart city department in Stavanger makes and presents a half-year report. Publicly on their websites, one can read six reports from spring 2018 until autumn 2020,

containing information about the department's work. One (from autumn 2018) out of six reports is thematically structured, placing projects under their five focus areas. The other reports are more a listing of projects done in this period, making it a bit challenging to obtain insight on projects related to focus area number 3 – energy, climate, and environment.

The report from spring 2018 is not very informative and tells very superficially what the department is and how it should be used. They write that they have 21 ongoing projects but do not specify what they are. With that said, it was the first report since the department was established in September 2017, and not being established for so long, and being in the starting phase of most projects, may be the reason why the report is less tangible (Stavanger Kommune, 2018b).

The report from autumn 2018 was a clearer and more informative report where projects (both ongoing and finished) were sorted under the department's five focus areas. For example, under focus area 3 – energy, climate, and environment they have listed the following projects:

- Smart street drains
- Air quality in the city center
- Movement overview
- Electric car charging in lamp posts
- Innovative bus stops and mobilityspots
- City logistics

This was the focus area with the most reported projects (six in total), except from focus area 5 – governance and democracy with seven projects (Stavanger Kommune, 2018c).

The spring 2019 report is shorter and more superficially compared to the autumn 2018 report. They have an overview of the most important deliveries so far in 2019, which contains nine projects. Of these nine, three can somewhat be related to focus area 3: (1) Nine lamppost chargers in operation, (2) completed two hackathons: Future Energy Hack in collaboration with the University of Stavanger and Miljøhack with Creator Makerspace, and (3) contributed to national smart city roadmap (Stavanger Kommune, 2019a).

Further, in autumn 2019, the smart city department report in the same way as in the previous report, but they amplify their work to a higher degree, and they are better at reporting on how

smart city work affects their surrounding environments. This report has a stronger focus on which issues a smart city can solve and highlight climate and sustainability as the most prominent issues. Over half of the projects they have worked on can be linked back to focus area 3 (8 out of 14). Several on mobility like investing in new charging points and a comprehensive strategy for charging and enabling more smart bus stops. Some on research like participating in two research projects on “everyday innovation” and “sustainable tourism in the port.” Doing “Kvikkttest” for the first time, a new procurement method that makes it easier to test new solutions together with the business community. On climate and sustainability, they developed and implemented “Bootcamp sustainability” with around 100 participants. And Stavanger was one of five cities that enter a national collaboration with the UN organization UNECE with the goal to develop and establish a systematic standard for implementing the UN's sustainability goals. Lastly, a large national survey conducted by the insurance company IF and Center for Climate Research (CICERO) named Stavanger the country's best climate-adapted municipality (Stavanger Kommune, 2019b).

The report from spring 2020 shows a more technological focus on the smart city work and some industry development focus through the implementation of “Kvikkttest.” The focus on energy, climate, and environment is through the first mobility point, and the “Stavanger Declaration,” which was signed by five municipalities: Trondheim, Ålesund, Asker, Bærum, and Stavanger at the Nordic Edge Expo 2019. This is based upon the national collaboration with the UN organization UNECE to implement a systematic standard for implementing the UN's sustainability goals mentioned in the previous section. The five municipalities have thus committed themselves to the “Sustainability Promise” to achieve the 17 sustainability goals. Additionally, with several other municipalities, Stavanger has, through the “Sustainability Promise” created the Sustainability Network, a joint charity across sectors. The network's ambition was to bring together Norwegian municipalities and county municipalities for joint efforts in local development projects, involvement of citizens, cooperation with the business community, and local priorities that put social, economic, and environmental sustainability higher on the agenda (Stavanger Kommune, 2020c).

Finally, autumn 2020 is the last published report. This report is naturally colored by the Covid-19 situation and elaborates how the smart city has adapted to the situation. There can be an observed focus on working with digitalization, citizen involvement, and smart art in this report. The only new project that hasn't been mentioned in earlier reports related to focus area

3 is a project named AI4Cities. That is a three-year EU project where leading European cities will, through a pre-commercial procurement, facilitate solutions based on artificial intelligence. The goal is to reduce greenhouse gas emissions and contribute to meeting the cities' ambitious climate goals (Stavanger Kommune, 2020d).

5.1.4 Comparison of planned, ongoing, and completed projects

In the roadmap for the smart city Stavanger, an appendix with examples of possible smart city projects within the different focus areas was made. Below, the thirteen projects ideas under focus area 3 – energy, climate and environment will be listed:

1. *Establish a zero-point analysis of the status in the region as of today and follow this up to measure effects.*
2. *Implement accelerator programs in the energy area where one looks at the possibilities for alternative energy solutions in different areas.*
3. *Establish a coordinated plan for public charging in the region - faster replacement of the car fleet.*
4. *Contribute to the establishment of a test and education center for renewables, charging infrastructure, storage, and CO₂-neutral solutions in collaboration with UiS and the industry – “Smart Energy Lab”.*
5. *Establish shore power solutions for cruise traffic in the region.*
6. *Establish a pilot for the Bus-road project which is based on a fleet of automated vehicles, which transports people and goods based on immediate needs (not established routes).*
7. *Use sensor technology for monitoring traffic, parking, etc., to be able to introduce services which helps to reduce car traffic.*
8. *Introduce sharing services for electric cars and electric bicycles that help to reduce car traffic.*
9. *Initiate research project that identifies how Stavanger's households can use technology to convert their energy consumption in a more environmentally friendly direction.*
10. *Facilitate for dialogue with the largest players in real estate to establish larger area- and urban-development projects such as smart city projects, where one looks at how both construction, indoor environment, outdoor environment, and infrastructure can be solved with comprehensive measures using smart technology.*

11. *Take the initiative to a project that looks at how Stavanger together with neighbor municipalities can develop 'seamless' transport solutions for transport both at sea and on land, where technology is used to achieve efficiency and environmental benefits.*
12. *Develop solutions for better public transport coverage outside the main routes for public transport - "Last mile".*
13. *Evaluate technological solutions that can contribute to more environmentally friendly ports.*

(Stavanger Kommune, 2016, p. 35)

It can be observed that every one of the project ideas have a strong technological focus, and 8 out of 13 are directly linked to mobility and/or electrification. There cannot be observed much diversity in the project ideas. Citizens and measures toward a better environment are, to a low degree, included in this section (Stavanger Kommune, 2016).

From documents and interviews there were mentioned eighteen projects with connection to smart city and climate and environment:

Table 4: Project Overview

AI4Cities	<i>EU innovation project using technology to reduce emissions.</i>
Mobility points	<i>Project to test and evolve a mobility points in Stavanger, to make it easier for the citizen to travel without using a private car.</i>
Lamppost chargers	<i>Charging solutions for electric cars.</i>
Smart city challenge platform	<i>Innovation project.</i>
Triangulum	<i>EU innovation project.</i>
Kvikkttest	<i>Innovation project.</i>
Nordic Edge Expo	<i>Smart city conference.</i>
“100 climate neutral cities – by and for the citizens”	<i>EU innovation project.</i>
Climate neutral construction sites	<i>Mentioned by interviewee, could not find any public information about the project.</i>

Climate footprint app	<i>Mentioned by interviewee, could not find any public information about the project.</i>
Smart street drains	<i>Street drains with sensors to prevent flooding.</i>
Air quality data	<i>Sensors to measure air quality in the city center.</i>
Movement overview	<i>Mappin of citizens movement patterns.</i>
Innovative bus stops	<i>Bus stops where you can charge your phone and use a screen to figure out what is happening in the city center</i>
City logistics	<i>A reloading point for pre-delivery in the city center, to deliver goods by smaller fossil-free vehicles such as small electric cars and cargo bikes.</i>
Sustainable tourism in the port	<i>Workshop based innovation project.</i>
Bootcamp sustainability	<i>Workshop based innovation project.</i>
Stavanger Declaration and Sustainability Network	<i>A national collaboration to develop and establish a systematic standard for implementing the UN's SDGs.</i>

The table show that there can be observed several ongoing and finished projects related to mobility and electrification, like mobility points and EV-charging. Several of these projects are initiated by the smart city department and the climate and environment department in collaboration. A positive observation is that the smart city department rarely does projects independently but almost without exception in collaboration with both internal and external actors. Additionally, from the report from the smart city department, there can be observed several innovation and workshop based projects. These can result in many good ideas, but the question is to what degree they aspire to tangible solutions. There is little to non-reporting on what happens after the projects are finished and what they have resulted in.

The project ideas were intended as exemplifications of possible measures and not as a decision basis for the selection of projects or measures (Stavanger Kommune, 2016). However, it was relevant to make a comparison between the project ideas and reported and mentioned projects from documents and interviewees. This to create a better understating of to what degree the smart city department is following up on their strategies and planned projects towards focus area 3 – energy, climate, and environment. Six out of eighteen mentioned or observed projects can be directly or partly linked back to the project ideas.

There can be several reasons for this, like not enough time and/or staff, new priorities, or projects initiated by other actors where the smart city sees value in taking part, which has been presented after the roadmap was conducted. A solution for the smart city department could be to make a more updated roadmap for the smart city Stavanger. The new version should, to a higher degree, promote climate, environment, and sustainability, with an additionally new appendix of project ideas which is better linked to their new set of goals and ambitions.

5.1.5 Roadmap for smart and sustainable cities and communities in Norway

The roadmap for smart and sustainable cities and communities in Norway is a guide for local and regional authorities developed by Design and Architecture Norway (DOGA), the Norwegian Smart City Network (whereas Stavanger municipality is a member), and Nordic Edge. It was made to promote the development of sustainable, productive, and resilient cities and communities. It functions as a framework for smart city initiatives in Norwegian local and regional authorities, describing overriding principles and visions (DOGA, 2016).

The roadmap is supposed to serve as, first, a guidebook, describing how smart city initiatives can provide positive societal effects, helping identify key opportunities, challenges, and issues. Second, a bridge-builder; defining a clear definition of smart cities in a Norwegian context establishes a common set of values, promoting collaboration and co-creation across sectors and professions. Third, a value creator; contributing to renewal and innovation in the public sector to promote the smart city, urban, and community development. Local and regional authorities can be facilitators for this transformation. Fourth, a platform; by positioning Norway within the smart city context and serve as a communication link internally and externally. By stimulating innovative, multidisciplinary solutions that can be scaled, thereby promoting value creation (DOGA, 2016, p. 3).

The roadmap places the main emphasis on three of the sustainable development goals:

- SDG 9: Industry, innovation, and infrastructure
- SDG 11: Sustainable cities and communities
- SDG 17: Partnerships for the goals

Smart solutions within the city- and community development can contribute to reaching several of the SDGs. The ambition is that the roadmap can inspire and promote a development

that meets the needs of the citizens today without destroying the opportunities for future generations. In helping Norway reach the Sustainable development goal, the national roadmap designed eight principles to help priorities focus areas and direction for smart city initiatives (DOGA, 2016).

Almost every one of these principles is, in one way or the other relevant. However, this analysis will focus on three out of these eight principles: *Principle 3: Priorities climate and environment*, which is about linking smart city strategies to the SDGs and “consider how new technology, new business models and co-creation can accelerate the ‘green shift,’ while contributing to reducing the use of resources and making eco-friendly choices for people easier” (DOGA, 2016, p. 26). The main goal is implementing measures and adaptations that will reduce greenhouse emissions (DOGA, 2016). *Principle 5: Focus on next-generation business* engage in the importance of diverse and sustainable business development. This principle stresses the municipalities need to (1) function as a community developer in collaboration with local businesses and academia, (2) test new green business models, (3) use innovative procurements as a tool for development, and (4) “develop open, multidisciplinary innovation processes, pilot projects, and test arenas” (DOGA, 2016, p. 28). Lastly, *principle 7: Develop competencies and embrace change* which concentrates on internal competence development to accelerate transition and innovation. This principle highlights the value of a “unified organization with a high level of digital expertise that has the authority to coordinate smart city initiatives across all departments” (DOGA, 2016, p. 30). In addition, being open to change and the use of employee’s new ideas and knowledge and promoting the positive effects of the smart city initiative to the organization and citizens is considered key (DOGA, 2016).

5.1.6 Summary of smart city-related documents

The roadmap for the smart city Stavanger has a highly technological focus and sees new, smart technologies as the solutions for city-related issues. With their five focus areas, one of them focuses on climate and environment. The issues and solutions presented under that focus area are highly dependent on technologies and mainly cover electrification, energy, and business development. Going through the half-year reports, they are somewhat superficial, and the impression is that the department is addressing some focus areas at a time. An analysis of finished and ongoing projects shows that the smart city department has done several projects related to mobility and electrification. Additionally, several innovation and

workshop-based projects. Close to all their projects, are initiated and completed in cooperation with actors from different departments and sectors. However, many of the projects related to a climate and environment focus can appear not that tangible, and there is little reporting on the actual outcome of these projects.

The national roadmap for smart and sustainable cities has a higher degree focus on sustainability, and the whole document is anchored in the SDGs. It also has a greater extent, focusing on competence development and how municipalities can create innovation, transition, and sustainability in their region. Principle 3 in the national roadmap addresses the importance of bridging the smart city and climate and environment. With the smart city department in the forefront, Stavanger municipality, conducting and signing the “Stavanger Declaration” at the smart city conference Nordic Edge, shows a strong position in linking these two elements together. However, there is once again little reporting on the work done with this in the aftermath.

Principle 5 in the national roadmap addresses the importance of diverse and sustainable industry development. A highly relevant principle promoted by the smart city Stavanger is the transition from being highly dependent on oil and gas to facilitatin for new, greener industries. The smart city department is doing a good job promoting the importance of this, and they actively engage the local businesses, but the focus is big on energy and technology from the oil and gas sector and not that much on finding completely new solutions.

Principle 7 in the national roadmap promotes competence development as an essential tool for transition. The smart city department should contribute by helping the region become "smarter," both internally and externally, so that new solutions can become more sustainable and effective. The impression is that they are too technological-focused, which can be problematic when trying to engage others. It can be wise for the smart city department to see projects and ideas in a more holistic view and implement climate and environmental measures better, so they, to a higher degree, can function as good facilitators.

5.1.7 Climate and environment plan for 2018-2030

The city council adopted the climate and environment plan for 2018 – 2030 in November 2018. It is a 78-page long document explaining Stavanger municipality's strategy for sustainable development in interaction with society in general. These guidelines, therefore,

apply to the entire municipality, giving the municipality the role of authority, facilitator, and driving force to reduce greenhouse gas emissions and preserve the natural environment. The climate and environment plan, as a municipal sub-plan, shows how the goals and intentions in the municipal plan can be translated into action (Stavanger Kommune, 2018a, p.7). It is anchored in the SDGs and aims to promote measures that will help meet these goals. Also, making sure that good living environments and conditions for both the inhabitants and the business community is the basis, at the same time as making it easy to live environmentally and climate-friendly (Stavanger Kommune, 2018a, p. 3).

The plan states that the most important effort to reduce greenhouse gas emissions is urban development based on a coordinated area and transport policy. Through this work, we achieve, among other things, reducing the total need for transport in the municipality. The municipality contributes to other measures that build up under climate policy, such as energy solutions, parking standards, tolls, low-emission zones, cycling, walking, and public transport arrangements. Also, by setting high environmental standards when purchasing and setting requirements for suppliers to the municipality's businesses, the municipality can help to «mature» the market, for example, for emission-free vehicles and machinery on construction sites. The municipal plan also describes challenges related to restructuring the business community and society's vulnerability to climate change. Electrification of the transport sector and new renewable and local energy solutions provide opportunities to reduce greenhouse gas emissions and create jobs. "Smart solutions" can also contribute, in line with Stavanger's smart city initiative (Stavanger Kommune, 2018a, p. 7)

Of the 14 focus areas in the plan, six are especially relevant for smart city work and this analysis: *1. Transportation* – This focus area is the biggest polluter in the municipality, and around 52% of greenhouse gas emissions in Stavanger come from road traffic. The biggest transportation-related challenges in Stavanger are that a large proportion of transport is done by private cars and emissions of greenhouse gases from cars, buses, and goods transport and from air and ship traffic. The municipality considers the most important goal to reduce direct local greenhouse gas emissions from the transport sector by 80% by 2030 and by 100% by 2040. Among other things, it must be easier to carry out daily chores without a car in Stavanger to reach these goals. The increase in the need for transport should be covered by cycling, walking and public transport. The municipality, therefore, highlights some initiatives that can make this possible, like (1) facilitate for and maintaining several cycles and

pedestrian routes and collaborate with the county municipality on cycling and public transport initiatives in the region. (2) Expand the possibilities for charging electric cars and electric trucks, especially in condominiums and housing associations. (3) Contribute to the work for reduced emissions from ships. (4) Arrange for joint goods delivery in the city center. And lastly, (5) work for lower prices for public transport (Stavanger Kommune, 2018a, p. 13).

2. Use of energy and materials in construction - Around 11% of local greenhouse gas emissions in Stavanger originate from energy used for purposes other than transportation. The biggest local challenge related to energy and material use is greenhouse gas emissions from fossil energy sources. Therefore, the municipality's most prominent goals are to cut greenhouse gas emissions from buildings and construction sites by 80% by 2030 and by 100% by 2040 and increase energy consumption from local renewable energy sources. These goals will be reached by phasing out all fossil-based energy sources in municipal buildings by 2020 and on municipal buildings and construction sites by 2021. They are also creating stricter environmental standards for new, public buildings. Providing an overview of energy sources and consumption patterns throughout the city and collaborating with the owners of the buildings work to replace fossil energy with fossil-free or emission-free energy (Stavanger Kommune, 2018a, p. 21).

3. Air quality - Stavanger has periods during the winter when the air is polluted with gases (NO_x) and particles (airborne dust), which can be very harmful to the citizens. The main source of reduced air quality in Stavanger is pollution from road wear and particles and gases from car engines. Firing with wood stoves also produces particulate emissions. Stavanger needs to ensure that the inhabitants have an air quality that is not harmful to their health and that the limit value for the largest particles, called PM₁₀, is not exceeded more than seven times in one year. Concrete measures taken to ensure this are introducing taxes on the use of studded tires from winter 2017/18 and a subsidy scheme for residents who replace old, polluting wood stoves with new ones (Stavanger Kommune, 2018a, p. 40).

4. Climate adaptations - Because of the climate changes, one is now experiencing milder winters, more extreme precipitation, and higher sea levels in the Stavanger region. Therefore, the municipality must plan ahead so that it causes the least possible damage to people, nature, buildings, and technical facilities in the future. The municipality will investigate potential

consequences of climate change and create its own strategy and plan for climate adaptation (Stavanger Kommune, 2018a, p. 56).

5. *Citizen involvement* - The municipality stresses that they cannot do everything necessary to the municipality's climate and environmental objectives alone. Citizens, industry, organizations, and others are therefore important partners. The municipality will consequently actively invite citizens to cooperate systematically with others. To do so, they believe that an offensive, targeted and professional climate and environmental communication are needed (Stavanger Kommune, 2018a, p.57).

6. *The municipality as a driver for climate and environment concerns* – Lastly, the municipality can influence many of the inhabitants' choices and actions. Being a large workplace that buys many goods and services can influence citizens and businesses to make environmentally friendly choices. Firstly, the desired goals with the municipality functioning as environment and climate drivers are to increase environmental commitment among the inhabitants. Secondly, creating greater awareness of environmental choices when purchasing, both among municipal employees and suppliers. Third, ensure environmental management in all the municipality's businesses, and lastly, facilitate collaboration on measures and sharing of experiences through various networks (Stavanger Kommune, 2018a, p. 58).

5.1.8 Summary

Looking at the relation between smart city and climate and environment, both the smart city department and the climate and environment department have included each other in their plans. The smart city department naturally has a stronger focus on the technological aspects of becoming more sustainable in the municipality, such as using sensors and data to solve these issues. On the other hand, only one out of five focus areas in the Stavanger municipality roadmap touches upon climate and environment, compared to the national roadmap, where climate, environment, and sustainability seem to have a common thread throughout the whole paper. From going through the half-year reports from the smart city department, it seems like they are addressing some focus areas at one time instead of all at once. For example, focus area 3 – energy, climate, and environment had a strong footing in autumn 2018, but not that much autumn 2020. There can be several explanations for this, for example, a lack of employees, forcing the department to prioritize working with some focus areas at a time.

The municipality plan fronting “Green spearhead” as one of their three focus areas can be observed as very positive in how the municipality is working with their commitment towards climate and environment. Also, implementing the climate and environment plan as a sub-plan of the municipality plan sets a good standard for sustainable development in the municipality by promoting this as something that applies to everyone. Smart city can be placed under the green focus area by addressing the municipality's need to become smarter and adopt climate-smart solutions in the municipality plan. However, it needs to be mentioned that the municipality's smart city commitment wasn't mentioned in the plan, which can be considered a setback for the focus on smart city work. They are to a degree mentioned in the climate and environment plan, but it can be interesting to see if they will be included in the updated plan now that the municipality plan has set new guidelines. A question to be asked is why they are not mentioned, considering Stavanger municipality is the smart city Stavanger.

Sustainable industry development is anchored in all the above documents. The smart city department takes a strong point of view in their focus area 3, wanting to take an active role in solving the planet's energy, climate, and environmental challenges. They believe the region has great ability to do so with its existing expertise in the energy sector and a solid technological environment. The municipality plan also emphasizes evolving competitive businesses, as well as strengthening the city center. And as the smart city department points out, investing in energy, climate, and the environment in a smart city context will be positive for both industry development in the region and provide answers to the global energy, climate, and environmental challenges. Also, the whole municipality can function as a driving force for transition in the business community by setting standards and requirements to suppliers when purchasing, forcing the market to “mature.” “Smart solutions” are mentioned as opportunities that will both reduce emissions and create jobs.

5.2 Analysis of interviews

Ten semi-structured interviews were carried out between April and May 2021. The interview objects were for the most (6/10) employees working in different departments in the municipality. Two were from the smart city department, one from the climate and environment department, one working with green procurements in the procurement department, and two politicians from the city council.

The additional four interview objects were two from the smart city cluster Nordic Edge, one working in the non-profit makerspace Creator Makerspace. And lastly, one representative working in “Klimapartnere,” an organization rooted in the county municipality.

5.2.1 The smart and sustainable city

The interviews were started out by asking the interviewees what they believed a smart city to be. First, many associated it with technologies and data to solve problems and make more efficient solutions. Secondly, several mentioned the importance of citizen involvement and facilitating happy citizens who are safe, have a job and have a good foundation for living a healthy and good life. Third, some considered smart cities to be sustainable cities, facilitating the next generation, focusing on less consumption and more circularity. Finally, a smart city should consider all surrounding factors and plan to ensure future generations.

When the interviewees were asked if they considered climate and environmental measures in cities to be important for reaching the climate targets, everyone agreed that this was crucial. Some elaborate this with the importance of addressing the most prominent issues like transportation and mobility, urbanization, living and working in cities more sustainably, and emissions from industrial work typically located outside the city center. It was noticed that cities are often more regulated by local policies, whereas the market drives the industry. The interviewee, therefore, stresses the importance of politicians taking a more explicit position in the transition towards greener businesses.

Actors employed within the smart city field were asked how they work with climate and environment. The municipality's smart city department focuses on using climate-friendly technology, green mobility, doing deliveries to the climate and environmental department, and using sensory and data to analyze and predict what measures should be done to reach sustainability goals. The smart city cluster Nordic Edge stresses that sustainability is a matter of course in every project. First and foremost, they focus on finding new, more sustainable, and more circular solutions and business models. With a big focus on promoting start-up companies, they work with implementing these focuses into new businesses. They have also seen that the investors they are working with are especially interested in investing in companies with solutions to reach sustainability goals. There are differences in the cluster members and to what degree they are green, but Nordic Edge wishes to help them become

better. They note that they could be stricter with the members and make higher demands on the green focus.

When asking interviewees working with climate and environment how they work with smart cities, it became a bit harder to get concrete responses. The interviewee from the climate and environment department acknowledges the work that the smart city department does and has made great use of them in some projects but criticizes them for being a little too theoretically and not that practical. The actor working with green procurements does not have that good of knowledge on the smart city work in the municipality but has helped them in some procurement processes and have a good impression of their work. On the other hand, the last interviewee working with climate and environment and one of the politicians has in common that they wish to see something more tangible results from the smart city commitment. They wish to see solutions that affect people in their everyday lives. The actor from Klimapartnere has close dialogs with the head of environmental protection, which have never mentioned the smart city work as a driving force towards the green shift. The interviewee also misses seeing goals and actions related to concrete problems that the municipality needs to solve and worries that the smart city commitment can lose funds from the municipality if the politicians don't see the value or results from work in a more tangible way. This is particularly interesting, given that one of the politicians interviewed for this thesis stated a lack of results and was unsure what the smart city organizations were doing.

5.2.2 Stavanger municipality as a coordinated organization

The interviewees working for the municipality were asked how they feel about communication and transparency across departments and areas in the organization. The overall impression was good, but that there is always room for improvement. The smart city department feels they have a good connection to several departments and that most of them include them in relevant projects, but that they do experience some resistance. They think that they work well with the business department, politicians, and democracy advisers, promoting citizen involvement and challenging political processes. One of the interviewees from the smart city department, who has only been working in the municipality for a couple of years, acknowledges that it takes time to become totally included in the system, which can only receive the information people think is relevant.

The interviewee from the climate and environment department feels that communication and transparency are acceptable but that one should always strive to become better. It can sometimes be hard to keep track of what the different departments are doing, especially now during the Corona pandemic, but it sees the importance of seeking out other departments yourself. Having leaders who are keeping their employees well informed is also crucial. Further, the interview reports that a new plan program has been made to ensure that all plans and strategies across the different departments are gathered in one place. Here all departments must report whenever they make new plans or strategies. The goal of this scheme is to keep everyone updated on each other's work. The interviewee working with green procurements feels that the communication between departments is good, especially between the leaders.

The two politicians have a different point of view on the municipality organization, which is not that surprising considering them working differently compared to the others. As politicians, they adopt policies and sit on some committees, and they place the orders while other delegate and do the work. The first politicians feel that the municipality is doing measures to become better at information sharing, but experiences that many cases and projects take a long time before they can see the results and that they are bad at keeping the politicians updated along the way. The second politician says that the connections aren't good enough. They have both experienced adopted policies not being followed through or simply being overlooked if the municipality administration doesn't approve or disagree with them. They explain that this have led to difficulties when the politicians and the administration disagree.

When asking the different actors from the municipality if they often work and cooperate across departments, the answers are mostly positive. The smart city department often works with the "newer" departments, like the innovation and digitalization department. The impression is that the "newer," more forward-looking departments to a higher degree see the value off each other. They also have a closer relation to the private sector. And that heavy-professional environments in the municipality don't know the value of using the smart city department because they feel they are "smart enough" on their own. On the other hand, they highlight the climate and environment and park and roads departments as innovative and easy to collaborate with. They often make use of each other's competencies and collaborate on different projects. They stress the value of exploiting competence from different departments in projects. In that way, things don't need to be done twice, and the work becomes more

effective. The smart city department gets many inquiries from different departments, but they are also active in contacting others. They rarely have internal projects in the department and act more as a support device against other departments and their projects.

The climate and environment department says they now make great use of the smart city department and that other department's feel the same way. But that some departments are less transparent and feel they are "smart enough" on their own. These can be hard to cooperate with. This was also the mindset of several employees at the climate and environment department for some time ago. They didn't see the need for a smart city department and thought it was a waste of money. This resulted in the smart city department starting a lot of projects on their own, struggling a bit with finding their place. The interviewee feels that this mindset is changed and that the smart city department is now more concerned with working with other departments helping them become smarter. The interviewee working with green procurements works within all departments except for the construction department. However, they help in some individual cases within the construction and sometimes provide guidance for making greener procurements within constructions.

One of the politicians does, however, hold a very different interpretation of the way the departments work and feel that the departments are characterized by silo thinking. He uses the smart city department as an example here as an actor who should facilitate cooperation but fail to do so. It is also pointed out that many "small kings" are sitting on top, preventing decisions and projects because they want to do things the old way. The interviewee doesn't find the connections as good enough. The urban development department is mentioned as an example as they work a lot with climate and environment measures, but not so much with the climate and environment department. The other politician points out that they, as politicians, do not hand out the tasks; that is the municipality director's job. They function more as caseworkers and are therefore not that involved in the different department's work.

Lastly, the interviewees were asked if they felt a joint effort towards the green shift in the municipality, especially with a focus on smart city work. The smart city department stresses that by offering open data sets from sensors measuring air quality, sound pollution, water quality, and so on, they facilitate that the entire municipality can use this data in environmental and climate projects. One of the interviewees states that "one of the most important components in the toolbox for influencing climate and environmental work in the

future is that we have good control over data.” Through solutions like these, the smart city department often functions as a subcontractor in bigger projects but does acknowledge that it requires a lot on the competence side to apply these data sets and understand how to use them, which is something they are working on. Nevertheless, they feel that they are often invited to participate in climate and environmental projects, especially because of their technological competence. The Stavanger Declaration and the “Sustainability Promise” are mentioned as a driving force that has automated a sustainable focus in the municipality.

The climate and environment department interviewee confirms this and feels that the municipality has implemented climate and environmental measures in all sections through their official municipality plan. The interviewee working with green procurements also has a good impression and feels that the climate and environmental plan is implemented in the whole municipality organization but does acknowledge that there are always some exceptions and thinks that some departments can become better at enforcing the plan. The focus on the climate and environmental plan may disappear a bit depending on the current leader supposed to enforce it in his/her department. The interviewee states that it could have been better politically anchored what percentage of the environment should be weighted in procurements. In Oslo municipality, for example, environmental measures must be weighted at least 20%. In Stavanger, they are good at keeping it at 20% even 30%, but they are free not to weigh it at all. This can result in some employees not considering the environment and taking the battle every time to ensure the environment in the procurement process.

The actor from procurements works especially with competence development in the department with the aim to implement a climate and environmental focus in all procurements. The position was new with the interviewee, which says that the aim is that the position will eventually become superfluous as it will be natural for all buyers to think about climate and the environment in all procurements. It was previously mentioned that construction was the one department doing their own procurements, making me ask if that was a bad thing, considering construction sites are responsible for a lot of emissions. The interviewee then told that the construction department had hired their own climate and environment advisor working directly with construction.

One of the politicians stresses the importance of cooperation when working with climate and environmental measures in cities. This includes the citizens and that they should be better

implemented in the climate and environmental work in the municipality. Many of the politician's delivered tasks have been related to climate and the environment. There were, for example, a broad majority of the politicians to join the EU project "100 climate neutral cities". The first politician's impression is that the smart city department hasn't used that much time on climate and environment, but more on electrification and efficiency. The other politician feels that there has been too much focus on the climate, and too little on the environment overall in the municipality. The interviewee believes that the carrying capacity of nature should be laid as a premise for all projects and that the focus on environment and climate should be a matter of course by now.

The informant working in other organizations were also asked about their opinion on the municipality, both regarding transparency and cooperating and focus on climate and environment. The interviewees from Nordic Edge are very happy with the collaboration with the municipality. They work with several departments, often more than one at the same project. The contact network they have in the municipality is big, making it easier to find ways to start new projects. Stavanger municipality often makes great use of Nordic Edge's contact network with the private sector. It is, however, mentioned that Stavanger municipality is a big organization, and it is therefore sometimes easier to test the most innovative ideas in, for example, Gjesdal municipality. In addition, some departments are a bit stuck in their ways and don't see how they can use the smart city initiative. Regarding the green focus in the municipality, it is mentioned that they should think more holistically. Today they are very technologically focused without a clear direction on where they are going with the projects they initiate, resulting in inefficient work, one interviewee says.

The interviewee from Creator Makerspace is very happy with the collaboration with the municipality, especially with the smart city department and Stavanger Development. They haven't personally needed to work with a lot of different departments in the municipality but have through projects met actors from several departments linked into the projects by the smart city. It is also here a perception that some departments are less open to cooperation. Since Creator Makerspace is located at Forus on the outside of Stavanger, the different smart city departments and businesses in the nearby municipality have made use of the lab and meet up almost every Thursday (which is the dedicated "smart city day") to cooperate and share ideas and knowledge across sectors. The interviewee states that the smart city department in Stavanger has been a big contributor to creating the lab and facilitating knowledge sharing

and cooperation and its open data sets, making it possible to analyze and find solutions to climate and environmental problems.

The last interviewee from the public organization Klimapartnere has quite the opposite view compared to the rest and states that climate and environment plans and strategies are not well enough anchored in the administration. The interviewee believes that one of the solutions is implementing climate and environment in the top administration of the municipality. In that way, to a higher degree, one can ensure that climate and environmental measures are promoted at all times. The interviewee has the impression that each department runs its procurements and economy, which can be difficult considering departments often budget and save money. On the other hand, this statement doesn't match with the information retrieved from the actor working with procurements. The informant from Klimapartnere further states that to be able to accomplish results, the municipality needs to be better at communication both internally and externally and better inform all citizens how they can contribute to the green shift. Doing changes at the workplace can give excellent results. The municipality should focus on its own operations and find good solutions to make all its services more sustainable. The interviewee has the impression that the business department doesn't understand their position in the green shift and does much of the same as the clusters are already doing. It is also mentioned that the actor believes there is still a lot of silo thinking in the organization, resulting in, for example, the smart city department standing alone on the outside. The interviewee believes this to be due to them not being anchored in the entire organization, resulting in other departments struggling to understand how to use them.

5.2.3 Sustainable Industry Development in Stavanger

In the last section, the interviews were asked to shed light on the opportunities for sustainable industry development in Stavanger municipality. The interviewees had very different backgrounds in everything from economics and law to very technical backgrounds and oil and gas. They were asked if they often found themselves working with people from the oil and gas sector, whereas there were many mixed responses. Some had colleges that had until recently been working in oil and gas. Others rarely had anything to do with oil and gas people and competence.

Two main reasons for shifting from oil and gas to other sectors were mentioned: Declining oil prices which leads to people losing their jobs – which causes a lot of available human

resources looking for something new to do. In these periods, there has been experienced a lot of people lining up to work in existing companies outside of the oil and gas sector, as well as a rise in numbers of startup companies. The observed issue was that when the prices go up and the job positions in oil and gas (o&g) become available again, the majority return to their old jobs. The second reason that is mentioned in the interviews is changing jobs because of changed values. It has become more important for people to see value in their work, not just through money, but by giving back to the community and future generations. The climate and environmental challenges we are standing up against have led to reactions and a changed mindset, but most in the younger generations. Several interviewees believe that the transition from o&g to more sustainable industries will happen with the new generation, but some say they already see changes.

All the interviewees believe that technology and competence from o&g can be transferred to other industries. Many comments that o&g holds superior engineer competence that are crucial for us to use in the transition we are standing up against. In addition to having great data and analytical competence, very functional structures and systems for security, risks and health, safety, and environment (HSE), and a lot of experience within innovation projects. Because o&g companies have been desirable workplaces, they have acquired many of the wisest minds in recent years, leading to an innovative industry. Norwegian o&g workers are also leading in offshore competence, which several interviewees believe is something we should exploit. Here we have a competitive advantage in new energy technologies like offshore wind. One of the interviewees explains how a part of the smart city agenda is for the municipality to save money through more efficient solutions. The o&g industry has been through several processes where they have had to adapt to save money, experiences that can be helpful for the municipality.

Many associates transition to greener industries in Stavanger as the transition from nonrenewable energy to renewable energy and believe this transition to be crucial. However, some of the interviewees believe this to be incorrect, saying the technology from o&g is too industrial and rarely the root to the most decisive new technologies. Some believe there to be a lot of “dead meat” in the o&g industry, overconsumption because of big capital in the businesses, and too many who are unwilling to readjust. One also states that there has rarely been any use of o&g technology or competence in projects unrelated to energy. Data analysis

is a field where competence can come to use, but experiences that few are willing to readjust and work within other fields.

One of the interviewees finds it disappointing that the o&g industry now seeks to rebrand into a so much more fluid concept as energy. The big companies within o&g now start to focus on “energy” is not evolving, but states that we are standing still. To become the new energy capital should not be a goal, as it says nothing about goals and ambitions and will not create new industries we can depend on in the future. Our competitive advantage, which will save the Norwegian industry in the future, is not the offshore competence – that is just a small part of the whole picture. Our engineer competence, work culture, flat organizations, and working across sectors without creating big hierarchies will save us. The interviewee raises questions regarding how many workplaces we can generate from offshore wind. Further, the interviewee believes that we should start focusing on knowledge-based industries. These industries try to solve the societal challenges we are standing up against, like mobility, energy, food, health, culture, waste handling, and circular economy.

To be able to adapt from o&g to new industries, one of the interviewees believes a competitive labor market to be crucial to keep the young people and newly educated in the region. To make young people and adults choose greener occupations, companies must be both competitive and sustainable. Having a competitive and attractive labor market in the region will also lead to the municipality getting a higher tax money income. The younger generations are often highly educated and much more preoccupied than generations before with seeking meaningful work. It was implied that these generations would apply for jobs outside of the o&g industry, making Stavanger dependent on creating new, greener, attractive, and well-paid industries not to lose this competence to other cities.

Several of the interviewees believe that with the competence in the region, it is possible to adjust to new and greener industries. There is a lot of technology that will be needed in the future, and one can slowly begin seeing the evolution of these. It was also mentioned that big investor companies consider a green focus to be a competitive advantage and are much more willing to invest in companies with a green focus. This implies that more and more consider green to be the future, making the market forces greener. The interviewee from Creator Makerspace reflects on the effect of setting higher demands on sustainability when people use their facilities and if measures like that could help promote greener industries. Another

mentions that companies creating new projects, solving issues with funding through EU Green Deal or Horizon Europe can be used to move people's competence to new and greener industries without them even noticing it. And considers it a waste of resources if competent engineers are too busy building old structures and think that politicians have failed by being too ambiguous about protecting the industry. The interviewee also states that you are not being pushed to try new things when you are too protected. We also must think more internationally and create new export routes. Many international companies in Norway are now moving out, and we need to follow not to be left behind. There is still a long way to go, but the interviewee believes many future industries will come from entrepreneurs. We need big industries to take hold of them and invest in them and connect new ideas with old industry structures, the interviewee states.

The challenges mentioned are that there is a lack of idealists who are willing to change course. Of course, the economy is considered one of the biggest obstacles, especially considering o&g has a history of very well-paid positions. Several imply that the municipality must take a clear stand in green industry development, making it easier for people to adjust and change course. For the private companies, many have an impression that several are interested in climate and environmental projects, but that the threshold for starting such projects is high if one does not see a direct financial gain. A mix of climate and environmental arguments, financial gain, and a desire to improve their existing technologies are considered the most prominent reasons for transition in the private sector. Even though the municipality is standing a bit outside the private sector, they need to lead by example and show ambitions, set requirements, and push the private market forward into the green shift. The municipality believes that focusing on climate and environment in procurements contributes to changing the private market. Still, it could be interesting to see if the private market has the same opinion or if the transition is considered as a separate operation.

Interviewees from the smart city body have the impression that people will change work into new industries over time, mainly because they eventually will have no other choice. Therefore, the interviewees from Nordic Edge stress that it's essential for them to keep these people here in the region by creating new, well-paid jobs. We must be well orientated on the challenges we are standing up against because the new jobs lie in solving these challenges. The ambition is that numerous new companies will be established through the development of the smart city Stavanger. The smart city body in Stavanger must always involve others in their

projects, even though they can solve the problems themselves. Doing so will evolve industries and economic sustainability and facilitate business development. We have seen examples where o&g competence has come to great use in the health sector, so knowledge like data and sensory should be transferred into smart city projects. Forus, outside of Stavanger, holds a cluster of technology-heavy companies. One of the important measures to be made is making all these actors meet up and share competence and knowledge and make them together solve societal challenges.

6. Discussion

This discussion is conducted by systematically reviewing the gathered information and linking it to the different research questions. In this part of the thesis, the research questions will be answered consecutively before summing it all up to answer, *“To what extent are climate and environmental measures implemented in the smart city commitments in Stavanger municipality?”* The first research question will be answered by comparing the information gathered from the document analysis and interviews. The two following research questions will be using the same information and compared up against relevant theoretical frameworks.

6.1. Climate and environment in the smart city

It has been highlighted the importance and necessity of doing climate and environmental measures in cities. Therefore, it has been particularly relevant to investigate how climate and environmental measures is implemented in smart city work. Considering this research being a case study of Stavanger municipality it has analyzed the work of the smart city- and climate and environment commitments to observe to what degree these are jointed effort towards solving climate and environmental issues in urban contexts. There are observed several interesting findings during this research, which will be highlighted consecutively.

First is the interpretation of own and other department's work. There can be observed both differences and similarities. The smart city department considers their work to be very relevant concerning climate and environmental measures and highlights how technology like sensors and open data is crucial for the transition towards more sustainable cities. On the other hand, other interviewees are struggling to understand what the smart city department is doing. Meanwhile, when analyzing the documents, one finds a focus towards climate and environment when introducing the purpose of the roadmap for the smart city Stavanger, a focus that somewhat disappears when immersing into the different focus areas. Only one out of five of these focus areas addresses climate and environment measures, whereas most of these measures are linked back to industry development. To have an opinion of oneself that is somewhat better than people outside of the department itself, is not unnormal but should make the department reflect on what they can do differently. Reasons for this can be everything from how they work to the way they communicate their work. Having clear and comprehensive communication on the ongoing and finished projects is important to understand better what is accomplished. For example, in the interviews, several projects were

mentioned that there was no reporting of in the public documents and vice versa. This makes it difficult for outsiders to know what is going on in the smart city department.

The other way around, the climate and environment department can list several focus areas in their action plan that involve climate and environmental measures in urban areas. But projects aspiring from these focus areas are, from the interpretation of the interviews and public documents, not that many. With that in mind, the climate and environment plan are a sub-plan for the whole municipality, and it is, therefore, the entire municipalities job to work with these focus areas. One thing that could be clearer is who is responsible for what, which could make it easier for the different departments to solve the different issues listed under these focus areas. It could be an idea for the municipality to ensure that every department had at least one person responsible for following up and reporting on work related to the climate and environment plan.

Second, there are several findings related to how the departments are carrying out their work. There are very different approaches towards working with climate and environment, where the smart city department has an overall focus on implementing, testing, and facilitating the production of new and smart solutions and technologies, which is seen through most of their mentioned projects. On the other hand, several interviewees, like the one representing climate and environmental organization and one of the politicians, criticizes the smart city department for being too theoretical, causing their work and projects to appear less tangible. This was an observation that was made in the document analysis as well. In contrast, the smart city department seemed to be the initiator of several projects but not following them up. An example is the Stavanger Declaration which was adopted in 2019. There is little reporting on how projects developed and whether they resulted in anything tangible.

The smartt city department are also criticized for having a too technological focus, which can also be observed in the roadmap for the smart city Stavanger and from interviewees from the smart city department. Comparing the national roadmap up against the roadmap for the smart city Stavanger, a much greater climate, environmental, and sustainability focus in the former can be observed. The smart city Stavanger seems to have a strong focus on new, smart technology, which may be because the smart city initiative in Stavanger is developed from the energy and technology company Lyse. Having a strong foothold in the more technological industry can be positive in how it brings about innovation. Still, it can be more result-oriented

and considered the different project contributions to our societies. Comparing the climate and environment plan up against the roadmap for the smart city Stavanger, the former is more orientated with measurements and has clearer demands for what it wishes to accomplish. These are often rooted in tangible numbers of, for example, amounts of pollutions. The roadmap for the smart city Stavanger, on its side, has no measurable objectives. If there were set demands on reporting on amounts of increased emissions, it would be easier to understand the actual result of the projects in a climate and environmental context. Thus, creating a more effective and tangible way of working.

When looking at reported smart city projects, an overweight of projects related to mobility and electrification can be observed. The climate and environment department also highlights these projects when mentioning projects done in cooperation with the smart city department. This can, of course, once again be connected to the strong network in Lyse. The smart city department was often saluted for facilitating projects in cooperating with other departments in the municipality and across sectors working with academia and private companies. Looking at the part of the analysis addressing completed and on-going projects, compared up against the smart city departments projects ideas under focus area 3 – energy, climate, and environment, very few of these project ideas have been put to life. Some, like mobility and charging projects, have been started and/or completed. This can be that with the smart city department's network, and that it was the most straightforward project to implement. Another reason can be that the employees have a strong interest in these types of projects, and/or their competence lies in these fields. A solution for the smart city department could be to engage employees with other interests, especially with sustainability and social science backgrounds. Hopefully, helping the department better see the bigger picture in their projects and expand their horizon towards other aspects in the smart city segment. Also, make an updated version of the roadmap for the smart city Stavanger which to a higher degree promotes climate, environment, and sustainability in all their focus areas.

The **third** finding was to what degree commitments have implemented the UN Sustainable Development Goals (SDGs). The municipality plan, the climate and environment plan, and the national roadmap for smart and sustainable cities have rooted their focus areas in the SDGs. But one observation made was that the roadmap for the smart city Stavanger doesn't mention the SDGs at all. The national roadmap promotes linking all smart city strategies to the SDGs, stressing that doing so will lead to positive repercussions in society. By not using

the SDGs as a baseline for their strategy, the smart city department in Stavanger once again fails to see the bigger picture and address overall societal issues related to climate and environmental changes. Once again, doing an upgrade of their strategies and create new measurement parameters with a focus on sustainability would be favorable for the smart city commitment in the municipality, firstly, because it makes the results of their work more clear for outsiders. Second, it can result in more efficient work with concrete goals and ambitions that are better aligned with the other municipality plans. Lastly, it would help accelerate the green shift, reduce the use of resources, and making it easier for people to make eco-friendly choices.

The last and **fourth** finding that will be addressed under this part of the discussion is that the smart city seems to be missing out in the new municipality plans, which is an interesting but also alarming finding due to Stavanger being addressed as the “smart city Stavanger.” The new municipality plan focuses on climate, environmental, and sustainability measures and is anchored in the seventeen SDGs. However, the word “smart” in the plan is only used in context with finding climate-smart solutions. There can be several reasons why the smart city has been omitted from the new municipality plan. Firstly, Stavanger has gone from being a relatively centralized municipality with densely populated areas to a large agriculture municipality after the municipality amalgamation. This can result in the municipality seeing the need for reprioritizations and focus on the inclusion of the areas that extend the centralized areas of the municipality. Secondly, there can be a mismatch between the municipality's identity and the identity of the smart city department. The municipality is possibly looking towards a greener way of working, focusing on lowering emissions and consumption, and not that technology fixated as the smart city department. It can seem like the smart city department needs to take a more explicit stand regarding climate and environmental measures, taking a more active part in this agenda. A solution for the smart city commitment to become more relevant can be to take a more active role as the facilitator for finding climate-smart solutions.

This discussion shows some issues that need to be addressed regarding how it is being worked with climate and environmental challenges in a smart city context. There needs to be a more joint effort in these projects from both the smart city and the climate and environment commitment. There are many challenges regarding climate and environment in an urban context, and the department should start being more coordinated in plans and strategies. The

smart city department must better connect smart and sustainable and promote solutions and projects in line with the SDGs. Additionally, they need to become better at measuring and reporting to show what their projects are accomplishing.

6.2 Transparency, collaboration, and coordination in the municipality

As Pardo, Gil-Garcia & Luna-Reyes (2010) outlined, it is favorable addressing relevant societal issues through information sharing, thus creating a more holistic perception of the issue at hand. Both the smart city and the climate and environment commitments are broad efforts that address many societal issues in the municipality. It is therefore essential to have good communication, transparency, and coordinated efforts to make progress. Therefore, this part of the discussion will address the degree of communication, transparency, collaboration and coordination internally in the organization and externally with actors from other sectors, and coordination of efforts.

After evaluating communication and transparency in the municipality organization, the overall impression from the interviewees is that it is reasonably good. Stavanger municipality is a big organization with many employees, making it even more challenging to communicate across the organization. The new platform for plan programs in the municipality, which is meant to collect all information from different departments at the same place, is a good measure that makes it easier to share information. It is an example of how technology can be used to handle data and reduce duplicated data, improve situations through better information sharing, which can result in more efficient work and not several departments working with the same cases. It is, however, an interesting finding that only one out of six representatives from the municipality mentioned this new platform. This shows that the implementation of the initiative is not yet successful.

To achieve good communication across big organizations, it is essential to have good digital tools, especially in the current situation with the Covid-19 pandemic. Challenges related to the implementation of new technologies and lack of technical skills could naturally have a negative effect on the communication flow in the municipality the previous one and half years. It is highlighted that the impression is that communication between leaders is good, but it is also mentioned that if you are not very well implemented in the organization, it can be somewhat challenging to receive information, especially during the pandemic.

Challenges related to information sharing and integration are often associated with different stakeholders' diversity and political opinions. According to Gil-Garcia (2012), the most prominent challenges are related to political or institutional aspects. Politics or politicians can hinder co-operation through power relations, deciding how the governmental body and decision-makers work. In Stavanger, this seems to be the other way around, with the municipality administration overlooking adopted politics they disagree with. It was mentioned by the politicians as an issue that there was little and often very slow reporting on the progress on projects adopted by the politicians for the municipality. Additionally, they had experienced several cases where the administration has overlooked their adopted politics if they disapprove of them. These observations indicate that communication and transparency are somewhat good within and across departments, especially between leaders, but that the connections are failing between politicians and administration.

One of the interviewees from an organization outside of the municipality notices that the municipality should become better at communication internally and externally and better inform the citizens on their work, especially with the green shift. As the interviewee being an outsider above-average socially engaged, it is an interesting observation compared to the internal perception being so different. An explanation could be that the municipality organization is set in their ways and working in a restrained way without even noticing it. This can be related to (1) departments being way too focused on their own work, missing out on what the different departments are doing. (2) Bad reporting to both politicians and citizens. (3) Not being engaged enough and taking an active role in public participation, forgetting to involve citizens.

Concerning collaboration internally with other departments and externally with other sectors, the smart city department stands out. After reviewing both documents, projects, and interviews, there is a strong perception that the smart city department is highly concerned about working with other actors in their projects and often a combination of internal and external actors. The roadmap for the smart city Stavanger was, for example, created with involvement from over 250 contributors from both the private and public sectors. The smart city department works by using an extensive network and engaging themselves in internal and external projects. The work they have done with collecting and making available data is considered favorable in relation to innovation, information sharing, and efficiency.

However, some of the interviewees had an opposite view on this. One of the politicians highlights the smart city department as an actor who should facilitate cooperation but fail to do so. The interviewee from Klimapartnere considered the smart city department to be standing alone on the outside because the other department does not understand how to use them due to them not being anchored in the entire organization. It is a concern that there are such big gaps between the interpretation of the smart city department. There can be several reasons for this, like (1) the smart city department has a too technical focus, making it hard for outsiders to understand what they are accomplishing. (2) Some departments are a bit stuck in their ways and don't see how they can make use of the smart city initiative. (3) The sharing and implementation of smart city initiatives aren't good enough, and outsiders miss out on this information. (4) The actors from the private sector that have been interviewed for this thesis already have a good connection with the smart city commitment and hold that information that is lacking for the outsiders.

The same interviewees also highlight that the municipality is highly characterized by silo-thinking and fails to cooperate on the prominent issues concerning climate, environment, and sustainability. There are departments run by people who want to do things "the old way." A mentioned example is the urban development department that works a lot with climate and environment measures, but not with the climate and environment department. The climate and environment department is probably not good enough to collaborate with other departments. It has been mentioned that they struggled to see the use of the smart city department. This is interesting considering several of the focus areas in the climate and environment plan cover issues related to urban areas and should therefore be highly relevant to connecting the smart city department. Both departments are, for example, concerned with citizen involvement and should work together on this topic.

A solution to the problems mentioned above can be better coordination and more clarity of roles and responsibilities in the municipality. When looking at smart cities, there can be big gaps in focus from city to city, which is logical considering different cities having different challenges that need to be addressed. Therefore, it is favorable to have a clear intention on what the smart city department (and, of course, all other departments) should be working with. In that way, one can ensure that the same job is not being done twice, and it is easier to

map out who to cooperate with. These measures will result in more efficiency, reduced costs, a better quality of services, and better control and coordination.

There are, of course, challenges related to this, like not achieving deep enough integration of politics and culture in the organization. Also, employees can resist change and diverging motivations, priorities, and goals between different parts of the organization, which is extra challenging in big organizations like Stavanger municipality. The smart city department has been criticized for being too focused on technological aspects and not that much on climate and environment. This shows how different priorities can seem right in one department but wrong in another.

The new platform for plan programs can be considered a way of implementing a technical infrastructure to keep each other updated on their work. For now, it can seem like the municipality still have a long way to go considering coordinating tasks. As previously mentioned, the climate and environment plan is a sub-plan in the municipality plan and therefore applies to the organization. However, a more thorough description of which focus areas the different departments should work with would most likely lead the municipality to address the climate and environmental issues more systematically and effectively. Clarity of roles and responsibilities has been shown to increase effectiveness and performance in organizations. An example is that the smart city department facilitates open data using technologies and sensors, but no one analyzes or uses this data. The climate and environment department could, for example, have made use of data like these to predict and prevent damage in connection with extreme weather. Increased clarity in which departments that hold the competence and knowledge to address certain issues could therefore make it easier for other departments to understand who they can cooperate with and link up against different projects.

The climate and environment plan also highlights the importance of setting high standards for environmental awareness in procurement, which is yet to be implemented well enough by the municipality. It is still optional to what degree environmental awareness should be a considered factor when doing procurements. This is negative considering the municipality having a key role as climate and environment drivers, not only by buying lots of goods and services but also by influencing the citizens to make environmental choices. One of the interviewees mentioned that the impression was that the municipality business department

didn't understand their position in the green shift and was doing several of the same operations as the clusters in the region were already doing within their industry segments. This statement hasn't been investigated enough to have an opinion on if this is correct or not, but if it were to be true, one could again observe a need for better coordination of tasks in the municipality. A big organization like Stavanger municipality should also, to a high degree, focus on their operations and find solutions on how to make all their services more sustainable. This way, the municipality can go forward as a good example and motivate the private sector to take the same decisions.

Lastly, the organizational structure of the municipality and its formal and informal rules do affect interaction. The smart city department and the climate and environment department are, for example, placed under different service areas in the municipality organizational set-up. This possibly affects the communication between the two departments since they are naturally further away from each other. It can also affect the smart city department's focus being placed under the service area "Inhabitant and Social Contact" compared to being placed under "Urban Environment and Development" like the climate and environment department. Where a department is established in the organizational map will affect what mandate they have, which tools and methods are being used and which social tasks to address. This can be one of the reasons the smart city department isn't involved enough in climate and environmental work. However, the climate and environment plan is supposed to be implemented in the whole municipality organization. Therefore, the issue that possibly needs to be addressed is the coordination and distribution of responsibility.

6.3 Opportunities for green industry development

Sustainable industry development has been highlighted several times as one of Stavanger municipality's most prominent issues. Being a region highly dependent on revenues from a decreasing industry, the need to transform away from the region's oil and gas dependency to ensure a sustainable economy is considered crucial. Changing the focus over to greener industries is considered favorable for several reasons. (1) It will lead to finding answers for societal challenges related to climate and environment. (2) Finding these solutions will have positive effects on industrial and commercial development. (3) This will increase the region's competition for the best minds and productive, profitable enterprises. (4) All of this will make

it easier for citizens, industry, and commerce to make choices that contribute to a climate-neutral city.

As mentioned, the industry in the Stavanger region is dominated by big oil and gas companies. These companies look towards several regional industrial developments path to compete in the market. For example, several oil and gas companies invest in innovation and the production of new technologies to offer “greener” production of oil and gas. These kinds of initiatives are branched under what is known as path extension. For Stavanger, there are several challenges related to these types of industrial development, like the region itself being an old industrial region with few related industries, which makes it challenging to adapt from a declining industry to more dynamic once. By continuing to put resources into developing an already declining industry, instead of putting resources into developing new industrial paths, we are minimizing the chances to change course. Further, the region becomes a victim of oil price dependency, giving the whole region a significant setback in times of low oil prices. This has adverse effects on employment and amounts of means to use in investment towards the green shift. On the other hand, in periods of high oil prices, the industry can invest more in innovative, green projects, but also offer superior wages, resulting in other industries, like the once working with innovative and green solutions, not being able to recruit talents leaving them in a “lock-in.”

An interesting observation from the interviews was the effects of the substantial oil price drop in 2014. This incidence resulted in a sudden increase in the available labor force, and industries outside of the oil and gas sector observed highly educated people lining up to work for them. There could also be observed a boost in start-up companies, several of which wanted to produce new, sustainable, and smart solutions. Of course, how seeds of new path grow are much dependent on the context of where and when, and in times of high uncertainty and ambiguity, like the oil price drop in 2014, the regions need a diversity of ideas; seeds that may develop into new paths. But for the Stavanger region, a fundamental problem was a strong public culture-cognitive belief that the oil price would bounce back, resulting in the primary regional strategy still being path extension. And when the prices went up again, other industries saw that many of the employees went back to the oil and gas industry. The newly started companies, initiatives, and strategies were left behind.

However, the ambiguity and uncertainty related to the oil and gas industry have risen sharply due to environmental and climate concerns. And it can be observed a higher concern related to measures preventing climate change. The intended strategy of politicians seeking to transform from fossil energy to sustainable, renewable energy has become more prominent as well as climate and environmental measures. This shift can also be observed more rapidly with the younger generations, who are to a higher degree than before, informed and concerned with addressing climate and environmental challenges. Young people choosing jobs based on values is also increasing. This can be observed in the investment environments as well and inventing products and solutions with answers to climate, environmental, and sustainability challenges are considered a competitive advantage. Both investment companies and private persons are investing more of their money in these types of companies in comparison with others.

Nonetheless, oil and gas companies have successfully adjusted to a lower cost structure aligned with a low oil price. And they are still a competitive industry with the ability to offer high wages. Therefore, the region needs to do some regional industrial strategy changes to ensure sustainable business development, keep young talents in the region, and find solutions for the challenges we are standing up against with climate change. Therefore, the region must ensure that other, greener industries can offer competitive wages, especially to the newly educated. This is to secure that people will stay in the region, not just for high wages at oil and gas companies, but to take part in evolving the region's industrial development.

There have been mentioned two ways to develop the industry in the region. **First**, through moving the competence from the oil and gas sector into other industries. This is a solution promoted by the smart city department who believes much of the competence from the oil and gas industry can be used in a smart city context like it has proven to come to use in the health sector. To what degree it is possible to transfer that competence depends on factors like wage, willingness, and set of values, and how the public sector and industries in the region facilitate this transition. **Second**, large companies should actively develop the employee's competence and evaluate how their expertise can be used for more climate-friendly purposes. They can, for example, facilitate EU projects, engaging their employees in finding new, sustainable solutions, which will be favorable for the companies as these projects are mostly funded.

However, the region invests in energy as a significant part of the industrial development, aspiring to move from being the oil and gas capital to the energy capital. But the question is, how many jobs can be created from renewable energy in the region? Hydropower has already been implemented in the region for a long time and will probably not make many new workplaces; offshore wind can create some, but not nearly as many as already exist in oil and gas. To develop enough workplaces to cover the gap that can appear in the oil and gas sector, the region must look towards new energy solutions like hydrogen and solar power. However, Stavanger as a region doesn't hold any competitive advantage compared to other locations in the country. It would therefore be advantageous to commit to establishing new industries where the region can be superior. Finding solutions for the most prominent societal issues, like electrification, local energy, urbanization, food, handling waste, and circular economy, will provide opportunities to reduce greenhouse gas emissions and create jobs.

There are challenges related to implementing new industries, especially in very institutional thick regions like Stavanger, where there can be competition for resources and conflicting goals and activities. The oil and gas industry will most likely have conflicting goals and values with many new, environmentally focused companies, resulting in competition over scarce local resources such as skilled labor, private risk capital, policy support, or market shares. That can make it hard for new paths to grow unless additional resources are created. Such as launching new educational programs to increase the pool of skilled workers, public and private venture capital provision, public procurement, and other measures to enlarge the demand. Timing must also be considered when starting initiatives for new paths; there is a bigger chance of succeeding if the situation is optimal, like an urgent need in the society or a sudden opportunity-space like the oil price drop in 2014.

The smart city initiative is an example of an effort to create a new path in the region. This initiative was a joint effort between the industry and the municipality, strengthening the chances for success. This usually reflects that this is a needed initiative that both parts see value in. For the smart city initiative, it was good timing as well with the oil prices being low, and the region saw a need to act efficiently in an uncertain and ambiguous time. Through this evolution, a new path may evolve, a path that breaks with the past. For centuries, industrial paths in the region have relied on natural resources like fish, hydropower, wind, oil, and gas. The smart city strategy builds on human resources and digital technologies related to city development and citizens' wellbeing. It has aspired to become both public and private

initiative through the smart city department in the municipality, and Norway's official cluster on smart and sustainable cities, Nordic Edge.

What can be a setback for these efforts is if the expectations change over time, resulting in conflicting expectations between the different actors. Lyse, a big initiator for the smart city commitment, is an energy and technology company concerned with electrification and technology measures because it is profitable for them. Therefore, their expectations are most likely to have smart city initiatives highly committed to these types of initiatives. On the other hand, the municipality can have different expectations for the smart city or change their expectations over time towards a more sustainable focus in thread with the new municipality plan. Institutions can facilitate or block regional development paths; therefore, it is important to have clear expectations.

Institutions, like the municipality, will need to adapt to changing environments or take the lead as a driving force for the change if they want the region to stay updated and relevant and be a contributor to the green shift. The municipality can do so by influencing many of the inhabitants' choices and actions. By being a large organization that buys many goods and services, they can facilitate the evolving of greener businesses, creating greater awareness of environmental choices when purchasing, both among municipal employees and suppliers. This indicates that policymakers should work closely with private actors to make sure the market and government policies are well aligned to transform regions more efficiently.

6.4 Conclusion

This discussion has shown contrary opinions on the different departments' work, primarily related to departments' own opinion compared up against others. The smart city department has the impression that they work well with climate- and environmentally focused initiatives. However, interviews with other actors, both within and outside the municipality organization, seem to have different opinions. Many find the smart city department too technological and narrow visioned in their approach to smart city initiatives. The document analysis reflects this as well. The smart city department also needs to follow up and report on projects they have initiated, as many of their projects rarely result in anything tangible. However, this perception may be due to poor communication. In that case, the smart city department should do measures in their communicational strategy. The new municipality plan is highly concerned with addressing climate and environmental challenges and is anchored in the SDGs. The

roadmap for the smart city Stavanger on the other hand doesn't mention the SDGs at all, but the smart city commitment is also not mentioned in the new municipality plan. These observations can imply that the municipality has changed towards a greener focus and a focus that better addresses the needs of the merged areas. The smart city department should possibly evaluate their plans and strategies to better match this new focus.

Actors working in the municipality organization considered communication and transparency in the municipality to be good. However, outsiders believe that the municipality should communicate better, both internally and out to the citizens. The local politicians also felt the communication between them and the administration in the municipality didn't work very well. These divergent opinions may be due to too much internal focus, poor reporting, and little engagement of citizens. The smart city department seems better at collaborating internally in the organization and with external actors than other departments. But they are often working with the same actors. Reasons for this can be related to prejudices from departments feeling they are smart enough on their own and do not see what the contribution from the smart city commitment gives. The more prominent issue related to this topic is the failing coordination of responsibilities related to climate and environmental measures. A more thorough description of which focus areas the different departments should work with could result in the municipality addressing climate and environmental challenges more systematically and effectively. It could also make it easier for departments to get a clearer insight into which departments they should cooperate with on different projects. The organizational set-up of the municipality can harm the smart city department's focus on climate and environment, as these departments are placed under other service areas, which can affect how they work and which strategies are implemented in the service area.

For the Stavanger region, sustainable industry development has been addressed as one of the most significant challenges in the region due to great dependence on the declining oil and gas industry. The region has become a victim of oil price dependency, affecting employment, innovation, and other industries' ability to grow and thrive. Climate and environmental concerns have, over the last year, raised the level of uncertainty related to the oil and gas industry. There can now be observed, much in relation to the generation shift, a change in values. People are choosing greener occupations and investing money in green solutions and technologies. Renewable energy has been highly promoted in the region, and the region is looking to replace the name "the oil and gas capital" with "the energy capital." Though

questionable if renewable energy in the region can generate the same number of jobs as the oil and gas industry. To ensure sustainable business development, the region must facilitate new, greener, and well-paid jobs. These measures will secure young talent not leaving the region, a sustainable economy, growing region, and finding solutions to societal challenges. The smart city commitment can be perceived as an example of a new industry path in the region and one that can result in several additional paths.

After these evaluations, the conclusion is that the smart city and the climate and environment commitments in Stavanger municipality fail to coordinate their work. Although, they share several of the same focus areas with their related challenges. Their most prominent setbacks are their different set of values and approaches towards climate and environmental challenges. Further, the way of grasping on to this work. Lastly, both fail to report well on their projects and initiatives, both internally and to outsiders. However, the smart city commitment can facilitate the growth of new, green industries in the region, even though they should get a more holistic view of the subject. But this is dependent on the municipality promoting this initiative through policies and strategies.

7. Concluding remarks

With the background of cities holding a crucial role in decreasing greenhouse gas emissions and solving societal issues related to increasing urbanization, this master thesis has explored to what degree the smart city and the climate and environment commitment in Stavanger municipality are coordinated.

There can be observed a common mindset that solving climate and environmental issues in cities is important. How to address these issues are, however, not consistent. The smart city and climate and environment department fail to grasp how these issues are to be solved in connection with each other. The smart city department has a very technological mindset, seeing technology as the answer to most problems. And the climate and environment departments seem to be struggling to understand how these commitments fit together and how they can utilize each other. With such different ways to address the same issues, it results in very ambiguous ways of finding solutions. Therefore, the two commitments fail to have a joint effort in promoting climate and environmental measures in an urban context. When answering if the smart city commitment and the climate and environmental commitment in Stavanger municipality are initiated separately, even though climate, environment, and sustainability are common interests, the answer is ambiguous. On the one hand, the climate and environment plan addresses the smart city commitment as one of the answers to solving the cities climate and environmental issues. The smart city commitment consisting of both the road map for the smart city Stavanger, the smart city department, and Nordic Edge also believes that problems in cities related to climate and environment are crucial to address. But when it comes to doing the actual work, the strategies and solutions are much more separately addressed between these commitments.

The employees working internally in the municipality considered the communication and transparency between departments to be good. On the other hand, local politicians often feel uninformed and sometimes ignored by the municipality administration. Interviewees that are outsiders from the municipality organization experience the internal communication and transparency to be bad. The big gap between interpretations can be observed between “insiders” and “outsiders,” which may be due to a strong internal focus, bad reporting to politicians, external partners, and citizens, and too little engagement of actors from outside the municipality organization. These observations reveal that even though there are some communication and collaboration between the smart city and climate and environment

commitment, they struggle with communicating **how** they can collaborate and **how** they can make use of each other. Which will most likely result in less productive work between these two commitments. The municipality still has a long way to go considering coordinating tasks. Even though the municipality has the climate and environmental plan as a sub-plan to the municipality plan, thus making it apply to the whole organization, roles and responsibilities are unclear. A more thorough description of which focus areas the different departments should work with would most likely lead the municipality to address the climate and environmental issues more systematically and effectively. Lack of coordination between the smart city and climate and environment commitment can among other be traced back to the organizational set-up of the municipality and conflicting approaches towards the domain.

Sustainable and green industry development has been highlighted as one of the most prominent solutions for addressing societal and climate, and environmental issues in the Stavanger region. The declining oil and gas industry, in addition to greater awareness of climate and environmental changes, has made the region looking towards new solutions. However, the region seems to be stuck in the energy segment, and it was observed that the municipality is to a high degree promoting industry development through path extension and path upgrading, which has resulted in an extension of already known paths, instead of aiming towards new ones. The smart city commitment is addressed as a solution toward creating new industrial paths. The smart city commitment can facilitate the growth of new, green industries in the region, even though they should get a more holistic view of the subject. But this is dependent on the municipality promoting this initiative through policies and strategies.

A thorough analysis of the smart city work in Stavanger municipality was conducted, and the conclusion is that the predicting hypotheses to a high degree suit the results. The overall conclusion is that climate and environmental measures is to a low degree implemented in the smart city commitment in Stavanger municipality. To better solve societal issues related to climate and environment, it will be favorable for the smart city and the climate and environment commitments to be better aligned in the future. Several overlapping focus areas and potential for collaborations and synergies have been discovered, opportunities that need to be better exploited.

8. Further research

The topic of this thesis has to a higher degree been addressed with a focus towards the smart city commitment. Therefore, it could be favourable to extend this research by addressing this topic with focus on the climate and environment commitment. What are the opportunities from the climate and environment commitment to address climate and environmental issues in an urban context, and how can they improve their methods, strategies and work? Furthermore, it could have been highly interesting to make a more accurate analysis of how the municipality works with industry development by diving deeper into procurements and the business department in the municipality.

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