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Greener Trondheim: A 'Nudge' in the Right Direction?

A Socio-Material Study of a Public Innovation

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Science and Technology Studies

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LEARNING OUTCOMES

This thesis is part of the master's degree in Science and Technology Studies (STS). The student will be working with a company or an institution/organisation, and the thesis should be of relevance for the organisation. The thesis will provide the students theoretical and practical experiences of conducting Research and Development work.

The course Science and Technology Studies – Employment Oriented Master's Degree, at NTNU, provides students with modules on theoretical and methodological perspectives worth 45 credits. Moreover, the students will complete a work placement worth 15 credits. During this course, the student has completed a month-long work placement and the thesis is closely linked to the work placement and a topic of relevance for the organisation, and it is worth 37,5 credits.

The master's thesis is a result of an independent Research and Development work, and the student has been supervised by academic staff at NTNU. This course represents a further specialisation and knowledge building in relation to the student's bachelor's degree. The aim is to provide the student with skills to apply and practice the subject at a high level, as well as practical work experience.

A degree in Science and Technology Studies – Employment Oriented Master's Degree, provides qualifications to work in different sectors, such as teaching, public and private sector, media, information activities and consultancy, research and development work and strategy/policy development.

ABSTRACT

Climate change is a global problem that requires local action. Cities experience rapid population growths and it is necessary that they introduce sustainable city developing methods. Trondheim is no exception, and to tackle challenges posed by climate change, the city has introduced its own development package. This thesis investigates the shaping of city development in Trondheim by analysing the city's planning package 'Greener Trondheim'.

Methodologically, the thesis draws on a combination of four semi-structured qualitative interviews and document analysis. Theoretically, the thesis draws on the STS-concept of Actor-Network Theory, supplied by the New Public Governance framework. I actively use the actor-network theory to study how city ideas may translate between the international, national and local contexts. The thesis makes use of empirical observations to explain the complexity of the Greener Trondheim network.

Cities around the world are attempting to learn from better examples and engage in innovation transfer. Translations of knowledge are occurring between cities, and the Greener Trondheim case is an interesting example to study when thinking innovation transfer. Trondheim's planning package has received praise internationally, and the European Institute of Public Administration has cited the Norwegian city as a 'smart, safe and green' city. Additionally, statistics suggest that the city's inhabitants are increasingly supporting Greener Trondheim.

The actor-network theory conceptualises how it has been possible to bring heterogeneous actors into coherence by Greener Trondheim, and how Greener Trondheim was assembled as an "actor-network". Furthermore, this thesis investigates how Greener Trondheim facilitates for socialisation and public engagement through the development measures they introduce, and thus how it has been produced as a perceived 'publicly accepted' innovation. Thus, the thesis contributes to discussions in STS by exploring an actor-network as an on-going practice in society.

Keywords: Public Sector Innovation, Climate Change, Actor-Network Theory, Translation, Public Engagement

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TABLE OF CONTENTS

LEARNING OUTCOMES	I
ABSTRACT	II
ACKNOWLEDGEMENTS	III
OUTLINE WITH OBJECTIVE AND AIMS	V
1. INTRODUCTION	1
1.1 GREENER TRONDHEIM.....	1
1.2 PUBLIC SECTOR INNOVATION	2
1.3 LITERATURE REVIEW.....	3
2. THEORETICAL PERSPECTIVES AND FRAMEWORKS	6
2.1 THE ACTOR-NETWORK THEORY	6
2.2 NEW PUBLIC MANAGEMENT AND NEW PUBLIC GOVERNANCE.....	8
3. METHODOLOGY	10
3.1 CHOOSING A TOPIC AND A CASE.....	10
3.2 THE QUALITATIVE RESEARCH METHOD AND CASE STUDIES.....	11
3.3 COLLECTION OF DATA AND SELECTION OF INFORMANTS.....	12
3.4 METHODOLOGICAL CHALLENGES	14
4. ANALYTICAL CHAPTERS	15
4.1 POLICY HISTORY AND ENVIRONMENTAL AWARENESS IN NORWAY.....	15
4.1.1 <i>The Early Stages of Environmental Policy</i>	16
4.1.2 <i>The Current Understanding of Environmental Issues Takes Shape</i>	17
4.2 GREENER TRONDHEIM'S BEGINNINGS AND PUBLIC ATTITUDE CHANGE.....	17
4.2.1 <i>The Beginnings of Greener Trondheim</i>	18
4.2.2 <i>Attitude Changes Regarding Toll Roads In Trondheim</i>	19
4.3 SOCIALISATION AND PUBLIC ENGAGEMENT IN TRONDHEIM.....	21
4.3.1 <i>Socialisation and Engagement through Mobility Advisors</i>	22
4.3.2 <i>Objects and Technologies as Sites for Public Engagement</i>	23
4.4 A STABLE FUTURE OR A FUTURE WITH CHALLENGES?.....	27
4.4.1 <i>Is Socialisation the Key to Stability?</i>	27
4.4.2 <i>Future Stability and Potential Challenges</i>	29
4.4.3 <i>Social Injustice?</i>	30
4.5 TRANSFER VALUE – ARE LOCAL DOMESTICATIONS POSSIBLE?.....	33
4.5.1 <i>Car Free Zones in European Cities</i>	33
4.5.2 <i>Potential Transfer Value</i>	33
5. CONCLUDING REMARKS: WHAT COMES NEXT?	35
THE THESIS' FINDINGS	35
WHAT COMES NEXT FOR GREENER TRONDHEIM?.....	36
REFERENCES	38

OUTLINE WITH OBJECTIVE AND AIMS

The primary objective of the thesis is to explain how Trondheim's city planning package, Greener Trondheim, came about and how it currently operates. To reach this objective, this thesis has four main aims.

Firstly, the STS framework of Actor-Network Theory (ANT) is used to explain how Greener Trondheim was assembled as an "actor-network". The aim is to understand Trondheim's situation before the innovation was introduced, and thus to explain how it was possible for Greener Trondheim to be established. This part makes use of policy history, and describes how environmental politics shifted especially in Norway and also more widely shaping Norwegian local politics.

Secondly, the thesis aims to explain Greener Trondheim's recent development. At Greener Trondheim's introduction, a majority of the city's population were against the innovation and the reopening of toll roads. Currently, a vast majority of the population is favourable of Greener Trondheim. ANT is useful to explain how it has been possible to bring all the heterogeneous actors into coherence, and why it has been produced as a perceived 'publicly accepted' innovation.

Thirdly, the thesis aims to explain how Greener Trondheim attempts to create a socialisation process and facilitate for public engagement in Trondheim. ANT is used to provide an original perspective on citizen participation and engagement, and how citizens and objects are being enrolled into the network that is currently changing Trondheim.

In a final chapter, the thesis aims to discuss the Greener Trondheim network's current stability and potential future challenges. Furthermore, the chapter aims to discuss Greener Trondheim's transfer value. The discussion interprets the findings to evaluate Greener Trondheim's improvement potential and transfer value for other cities.

The thesis concludes to summarise the findings and observations of the analysis, and finally raises questions regarding what comes next in the life of Greener Trondheim.

1. Introduction

1.1 Greener Trondheim

In February 2020, Norway submitted an enhanced climate target under the Paris agreement. The country's new and strengthened target is to reduce emissions with at least 50 percent and towards 55 percent by 2030, compared to the 1990 levels (Regjeringen, 2020). The implementation of the measures included in this climate target (dubbed Klimakur 2030 by the Norwegian Environmental Directorate), will require considerable efforts from Norwegian municipalities, civilians and businesses (Miljødirektoratet, 2020). In what ways are Norway's municipalities contributing?

Directly translated from Norwegian, Miljøpakken means "the Environmental Package". For English speaking purposes, Trondheim's city council has dubbed the innovation Greener Trondheim, a term that is also being used throughout this dissertation. Greener Trondheim is a partnership between Trøndelag County Authority, Trondheim, Stjørdal, Malvik and Melhus municipalities (all located in Mid-Norway), and the Norwegian Public Roads Administration. Greener Trondheim has been established to facilitate sustainable transport. From 2010 to 2029, Greener Trondheim aims to invest NOK 55 billion in roads, facilities for pedestrians and cyclists, and public transport. According to Greener Trondheim's own website, "the aim is to reduce greenhouse gas emissions, congestion, traffic noise, and the number of traffic accidents through better traffic management and a greater share of transport on foot, by bicycle, bus or tram" (Miljøpakken, 2020a). Climate change is a global problem that requires local action, and is often linked with urban challenges, in that cities experience rapid population growths, the necessity of transport and energy consuming habits (Adah *et al.* 2017) (Hodson & Marvin, 2009). There is broad agreement between climate scientists that there exist a clear link between the consumption of fossil energy sources and global warming (Næss & Ryghaug, 2008). The energy supply sector, which includes transportation, industry and building, has in fact developed to become the largest contributor to global greenhouse gas emissions (Bruckner, 2014).

Since 2010, Greener Trondheim has developed to gain an increasing amount of support by the local inhabitants, and its accomplishments have received international recognition. The European Institute of Public Administration (EIPA) has published a comprehensive report that examines how seven European cities have successfully conducted local public management and governance. Trondheim is among the seven cities included, and the chapter highlights the city as a 'smart, safe and green city' (Bosse *et al.* 2013). The report presents stories of 'success', and aims to show how the selected cities have come up with 'creative' solutions to tackle current challenges such as reduced resources, growing populations and climate change. In order to meet the common European vision of 'smart', sustainable and inclusive urban development in line with the Europe 2020 strategy, cities have had to aim for high qualities of life and welfare, social cohesion and justice, and sustainable development (European Commission, 2010). Therefore, the challenge of local governments consists of developing attractive cities and turning these pressures and issues into assets where possible. The European Commission (2010) acknowledges an importance that cities continue to develop a holistic and sustainable

approach toward urban and public sector development, which is to focus on the citizens' and other local stakeholders' needs.

Greener Trondheim is frequently mentioned throughout the EIPA (2013) report, and cited as a reason why they believe Trondheim is successfully conducting local public management and urban development. This thesis analyses how different actors in Trondheim has taken action to tackle the emerging trends of climate change and local mobility challenges, through the Greener Trondheim initiative. Based on attitude surveys made by local authorities, the Greener Trondheim innovation tends to receive positive responses and Trondheim's inhabitants seem to be increasingly positive about the measures Greener Trondheim offers (Kringstad, 2017). In social scientific terms, this link made between policy measures and attitude change is not necessarily simplistic and it should not be taken for a given. The way in which Greener Trondheim has been performed as a successful policy and how this policy has performed 'convinced citizens' is an empirical question. The thesis examines how Greener Trondheim came to be configured via specific actor-networks.

Greener Trondheim has focused on visualising its contributions to the city, and introduced measures that the people are engaging with. To further develop Trondheim in a positive direction, Greener Trondheim must continue to consider such factors. New measures that are being introduced must involve the engagement of citizens. In other words, processes through which the inhabitants learn to behave in accordance with sustainability must be facilitated for. Therefore, Greener Trondheim must continue to facilitate for the materiality that the inhabitants may engage with, and thus become increasingly aware of the sustainability focus. These ideas lead to the research question for this thesis: *Is the mix of socialisation, public engagement and materiality the key to developing Trondheim as a sustainable city?*

1.2 Public Sector Innovation

Greener Trondheim is attempting to involve many actors in its innovation processes. The partnership acknowledges the fact that the public and private sectors complement each other. Greener Trondheim is in itself an example of a public sector innovation that systematically attempts to create public-private collaboration methods. In recent years, the public sector has increasingly been perceived as an innovative and proactive participant in an interdisciplinary interaction with knowledge institutions and private stakeholders, such as businesses and citizens. Within this model, the public organisation is usually considered an important stakeholder that can develop solutions by orchestrating collaboration methods and arenas for co-creation (Bugge & Skålholt, 2013).

In its modern meaning, innovations are new ideas and thoughts in a form of device or method, and often viewed as something that is being applied to meet new requirements and unarticulated needs (Maranville, 1992). Innovations that are originating from the public sector have not traditionally been granted much attention, and some researchers explain this by arguing there exist certain myths about this type of innovation. One influential belief is that the public sector does not produce anything, that it does not have markets or experience changes, and that it is the complete opposite of what the private sector is. Whereas the private sector is to be productive and innovative, the public sector

does not experience the equivalent amount of pressure to produce services (Ringholm *et al.* 2013). However, researcher Rannveig Røste (2013) argues otherwise and suggests that the public sector changes constantly and produces many different services to all citizens in society. Røste (2013) is in other words suggesting that innovation originating from the public sector is crucial for society to maintain high quality services, and therefore deserves more attention from other researchers, science, and the public in general. This thesis is inspired by these topics, in that Greener Trondheim is an innovation that is originating from the public sector on the city-level, created by initiatives from local politicians.

1.3 Literature Review

This section presents academic books and research articles that are relevant for the Greener Trondheim case and other studies on sustainability, which I have made use of during my research for this project. Why is it relevant to study Greener Trondheim, and which contributions can my project add to the current debate and further studies on this topic?

The books *Innovative Municipalities* (2013) and *Innovation Meets Municipality* (2019) are two examples of academic books written on the public innovation topic, and therefore highly relevant sources for this thesis. Compared with research made on the private innovation sector, there has been conducted less research on innovation coming from the public sector (Koch *et al.* 2005, as cited in Ringholm *et al.* 2013). Ringholm, Teigen and Aarsæther (2013) acknowledge the importance of researching this field and the different impacts the public sector may have on future innovation processes. These authors are therefore highly relevant for my thesis and contribute with valuable knowledge, as my paper examines a specific public innovation process. For instance, in the book *Innovation Meets Municipality*, Ringholm *et al.* (2019) argues that public innovation processes may identify a need for structural change, where private innovation is no longer necessary or relevant. This is a valid argument for this thesis' case. Since Greener Trondheim was initiated in 2009, different actors from the public sector have cooperated closely to reach certain goals.

Stephen Osborne's (2010) term New Public Governance (NPG) is being used to strengthen these arguments. NPG emphasises the importance of taking a collaborative approach within and across the public, non-profit, and private sectors in providing public services. The city of Trondheim has realised the importance of collaboration, and Greener Trondheim was established as a result of the partnership between different actors in the Trøndelag district (Miljøpakken, 2020b). The co-governance that Osborne (2010) discusses is an important element of actor-networks underpinning Greener Trondheim. Furthermore, the Greener Trondheim innovation may be one of Trondheim's answers to risks. The innovation attempts to find solutions to the difficulties posed by climate change and population growth. Cities need to redo how politics are being conducted, and risks needs to be disciplined, but active risk-taking is however a core element of a dynamic economy and an innovative society (Giddens, 1999, p. 29). The term 'risk society' is closely associated with several key writers on modernity, with Ulrich Beck and Anthony Giddens being two of the most influential authors on the field. There are many commonalities between Beck and Giddens, as both see society as entering a new stage, that of 'reflexive modernisation' and 'late modernity'. They both acknowledge risks and

argue that it is necessary to engage with new situations and to create policies and methods that could be beneficial for society (Caplan, 2000).

Ulrich Beck (1992) was a German sociologist who defines modernisation as society experiencing surges of technological rationalisation and changes in work and organisation. In his 1992 book *Risk Society: Towards a New Modernity*, Beck describes risk society as a "systematic way of dealing with hazards and insecurities induced and introduced by modernisation itself (1992, p.21). Furthermore, Giddens (1999) argues that although humans have always been subjected to risk, manufactured risks such as pollution and environmental issues are results of society being modernised. The risk society and emerging threats are matters Trondheim, and other municipalities, are aware of and emphasise in their policy-making processes. They are constantly searching for solutions and managing businesses to tackle the risk society. The national governments are still important actors in handling risks, but cities are being increasingly handed the responsibility to tackle challenges themselves (Beck, 1992). Greener Trondheim, and its contributions, is an example of how risks relating to the climate and modernity are being attempted tackled. The plan has been established with the aim to answer threats posed by climate change and mobility challenges.

In *Nye energiholdninger? Når komfortkulturen møter klimatrusselen*, Næss and Ryghaug (2008) note that today's common understanding of a good and comfortable life is closely tied with a high level of energy consumption. We are in other words living in a 'comfort society', a type of culture in which a comfortable life is expected and taken for granted. The Norwegian comfort-oriented energy culture is however challenged through the current threats of climate change, and we are constantly made aware of climate issues through sources such as the media and activists. Based on these assumptions, the authors conducted a research where several informants were asked about consuming habits in the Norwegian comfort-oriented energy culture. They found little to no evidence of habit change although the informants were aware of the threats of climate change. They argued that the political message was noncommittal. Recurring critique from the informants did in fact reveal that there exist little political will to highlight scientific research on climate change. While the themes differ, the final section in this thesis makes use of the conclusions in this research to discuss these assumptions in regards to attitudes in Trondheim. Greener Trondheim facilitates for socialisation and seems eager to show results and make Trondheim's citizens aware of their contributions to the society, which in turn seem to motivate the inhabitants.

Furthermore, Knut Sørensen's (2013) research is used to inspire this thesis. In 2002, Sørensen developed four concerns for studies of technology policy that should transcend its dominant economic framings: support for innovation, the provision of infrastructure, regulation and public engagement. Later, Sørensen (2013) creates links between the concepts of socialisation and domestication of technology. He argues that innovation, deployment of innovation, socialisation and domestication represent overlapping areas of concern. However they are also distinct issues that are to be considered separately. Firstly, the 'innovation' is about developing technologies that have economic and/or social significance. Secondly, the 'deployment' term concerns putting the innovations and technologies to use. Thirdly, 'socialisation' points to the activities that are needed to embed the new technologies in society. Lastly, 'domestication' focuses on the enactment of technologies in specific contexts (Sørensen, 2013). This thesis perceives Greener Trondheim as an innovation and a technology, which introduces measures and

technologies for users. Sørensen (2013) cites an observation made by Bijker and d'Andrea (2009), who argue that socialisation in most cases is given insufficient attention or even neglected. There may be systems already in place that cater to socialisation, and policy-makers may thus remain unconcerned about such issues. On the other hand, it is important to acknowledge the systems of socialisation when analysing technology policy practices (Sørensen, 2013). Therefore, Sørensen's framework makes for an interesting comparison and tool when attempting to analyse how Greener Trondheim is facilitating socialisation and the succeeding effects on society in Trondheim.

Lastly, debates about climate justice, which perceives global warming an ethical and political issue, have mainly occurred at the international scale. The debates usually focus on the rights and responsibilities of nation-states to either be protected from the effects of climate change or to take action to reduce emissions. In the article *Contesting climate justice in the city*, authors Bulkeley, Edwards and Fuller (2014) argue that it is necessary and productive to examine how climate justice is being pursued at the urban scale. This focus brings the need for attention to issues and challenges of recognition, as well as rights and responsibilities amongst civilians. I approach this 'climate justice' and produce important new understanding on it whilst examining the actor-networks and the public engagement with the Greener Trondheim programme.

My research's tools from STS and ANT will allow expanding the phenomenon of Greener Trondheim and its analysis considerably, by situating Greener Trondheim as an actor-network that is continuously assembled from heterogeneous actors (objects, citizens, and much else besides). In doing so, the thesis sheds more light on how Greener Trondheim is a new kind of site for engaging with the citizens, and how objects that are a part of the network have become sites for public engagement. Furthermore, my research produces important new understanding on ideas about "innovation transfer", in this case of city innovations to other cities. Municipalities all over the world are currently interested in "learning from each other" and copying innovation, but my ANT-informed approach will critically assess whether situated actor-networks, or their elements can ever be successfully developed in other urban development contexts and what work that involves. The following chapter explains the relevance of the STS field for this research project, and presents the ANT and NPG theoretical approaches.

2. Theoretical Perspectives and Frameworks

As a researcher within the field of science and technology studies (STS), the aim is to analyse how society and politics affect scientific research and technological innovation, and in turn how these affect politics and society. The STS field firstly emerged as a confluence of a variety of disciplines, and has developed an interest in viewing science, technology and innovation as socio-materially embedded enterprises (Bijker *et al.* 2012) (Orlikowski & Scott, 2008). STS, and related theories, is therefore an interesting field to make use of when analysing societal challenges relating to the climate, to transport, and urban development in general.

This thesis makes use of STS concepts to analyse the Greener Trondheim innovation that is currently under development. Many researchers are attempting to contribute to the study of social innovations and to understand how municipalities are working to affect and influence transitions and the restructuring of society. Social innovations, as new practices that aim to meet social needs in a better way than existing solutions, are frequently being studied and discussed (Howaldt & Schwarz, 2010) (Sørensen, 2013). This master thesis is a contribution to this development, in that it explains the emergence of Greener Trondheim, the co-creation of knowledge, inhabitant attitudes on how they perceive the policy package, and engagement of citizens as a result of collaboration between different actors in a Norwegian society.

There exists a precarious need for the public and private sectors to think differently about the forthcoming transition into a greener society (Ringholm *et al.* 2013). This thesis explains how this means that a combination of material and non-material factors, judicial factors, political factors, and economic factors will be necessary to solve issues relating to the green transition. The Greener Trondheim partnership, which has developed into a complex network of different actors, is an example of such combination. The STS framework of actor-network theory will therefore be used to explain how the innovation translates between the national and the local, and finally into the users' perspectives.

2.1 The Actor-Network Theory

Actor-network theory (ANT) is one of the most dominant frameworks within the STS field. It is an influential approach to understand people and their interactions with inanimate objects (Cresswell *et al.* 2010). In this dissertation's scenario, the actor is the groups and objects that are subject to and together form the relevant and always changing network of Greener Trondheim. Originally developed by Michel Callon, Bruno Latour and John Law during the 1980s (Latour *et al.* 1986) (Law *et al.* 1984), the actor-network theory holds it as a core assumption that society is an on-going achievement. In other words, the actor-network theory is an attempt to provide analytical tools for explaining the process in which society is constantly reconfigured (Callon, 2001).

The actor-network theory does its theoretical work in case studies. Law and Singleton (2012) explains this by analysing a certain case involving Norwegian salmon farming. They explain the heterogeneity of the farming networks, where the actors, both human and non-human, are entangled with everything else in that specific scenario. Fishing nets

and people, boathooks, oxygen meters and salmon, are all woven together and form a network. There exists significance of both humans and non-human materials. This is the actor network, and what is going on is essentially the involvement of materials of different kinds. However, the actor-network theory is also grounded. They further describe the actor-network theory as a set of sensibilities to the relations, which explores how matters get assembled more or less precariously for a moment (Law & Singleton, 2012). The central idea of the actor-network theory is to examine and theorise how networks come into being and to trace what associations exist within the network. Furthermore, the actor-network aims to investigate how actors are enrolled into a network, how networks achieve temporary stability, and why new connections may form from networks that are unstable (Cresswell *et al.* 2010). The translation model is an important contribution of the actor-network theory, and is being presented further on.

The translation model of the actor-network theory

According to Tomas Skjølsvold (2015), actor-network theory brought a new dimension to the studies of social sciences. The early stages of technology and science studies attempted to explain and understand how social powers and cultural phenomena were important factors for scientific and technological results. The actor-network theory, on the other hand, turned to the relation between the actors and began to study networks (Skjølsvold, 2015). The term 'translation' is important within the actor-network theory, which explains how ideas spread through translations of knowledge. Callon (1986) summarises the ANT process of translation as four phases:

- Firstly, the phase of problematisation defines the nature of the problem in a specific situation by an actor. For instance, an actor may acknowledge a challenge in society relating to the environment, and thus problematize it.
- Secondly, the phase of interessement highlights the challenge, attempting to make other actors interested in the problem. Thus, it locks other actors into the roles that were proposed for them in the main actor's program in order to resolve the issue.
- Thirdly, the enrolment phase defines and interrelates the roles that were allocated to the actors in the interessement phase. Thus, the actors have become 'members' of the network.
- Lastly, the mobilisation phase ensures that the supposed spokespersons for collective entities are properly representative of all members of the network that is supposed to act as a single agent. All the actors in the network are working towards the same goal.

As a whole, these four stages create the process of translation, which simply explained allows a network to be represented by a single entity. Moreover, this entity can itself be an individual or a network (Callon and Latour, 1981). Skjølsvold (2015) argues that the main point is to convince the scientists, or in this dissertation's scenario the actors, that they work with the same interest and for the same goal. For a project to become successful, the translation of knowledge, ideas and interests between the actors is extremely important (Skjølsvold, 2015). Furthermore, Bruno Latour, another significant STS theoriser and Callon's colleague, also noted the importance of the relations between actors. Latour (1987, p 104, as cited in Skjølsvold, 2015, p. 78) argues that an article or scientific research with a claim does not become significant if others do not pick up its arguments and later make use of them as facts. During the 1990s, organisational

research started to make use of the idea of spreading as translation, inspired by Latour and Callon (Myklebø, 2019).

When taking Callon's and Latour's arguments into account, it is clear that the STS field and its actor-network theory is highly relevant in regards to studying any controversy or case that involves relations between actors. For the purpose of this dissertation's political themes, a brief explanation of how the actor-network theory applies to politics is also required. Cresswell *et al.* (2010) explains the political essence of the actor-network theory. The authors use the example of organisations to explain the actor-network theory and politics. An organisation, which in itself is a network of heterogeneous materials and human actors, can become enrolled in a larger network of politics involving other organisations. Further on, other organisations and individual groups may also be enrolled into the network that is already established. The actor-network translation process is helpful when understanding and explaining how innovations can move and transfer in society, and therefore useful to examine the Greener Trondheim network.

Greener Trondheim is an example of how a city is thinking new. As new times and problems require new ways of thinking governance and development, the New Public Management (NPM) and New Public Governance (NPG) prove to be interesting frameworks to supply the actor-network theory and study Greener Trondheim. Throughout the history blocs and past steering paradigms, the public sector has sporadically attempted to solve societal issues. As society has changed, transitions have been necessary (Røste, 2013). In an article on road pricing written by Næss in 2000, the environment is being discussed. However, the term 'climate' is not being mentioned, and this is an example of how the focus and perceptions have changed. This thesis argues how Greener Trondheim currently attempts to think in the ways of NPG, a steering philosophy originating from the second half of the 20th century. Both the NPM and NPG are being presented in the following section.

2.2 New Public Management and New Public Governance

Simultaneously as the views on environmental politics in Norway changed throughout the end of the 20th century, the public steering philosophies of NPM and NPG emerged. This thesis makes use of these philosophies, as theoretical frameworks to better understand the Greener Trondheim partnership. The following paragraphs therefore present the origins and basics of the NPM and NPG philosophies.

In governance terms, the period from the 1940s until the 1970s is often characterised as a time of hierarchy and the era of public administration (Peck *et al.* 2008, as cited in Dickinson, 2016). Over time this mode was criticised for being ineffective serving the interest of public service professionals rather than those of the citizens. To solve these issues, many liberal economies introduced markets into some areas of the public sector and, in the process, 'hollowed out' the government (Peters, 1993, as cited in Dickinson, 2016). It was during the late 1970s that the western world experienced this significant shift in steering philosophy, when the NPM entered the stage. The original form of NPM is based on the idea that the public sector is supposed to make use of steering mechanisms from the private sector, such as economic incentives, privatisation and outsourcing. In other words, under the NPM public institutions were to be as free to act as private businesses. The debureaucratisation, which involves transfers of powers and functions

from the government to non-governmental organisations and the private sector, is therefore an important part within this steering paradigm (Lerborg, 2011). The government started to become more fragmented, meaning that a range of organisations needed to cooperate with one another to deliver public services. More complex processes of interactions between different partners that had a great deal of autonomy from the state emerged. This gave rise to a new form of governance, but one 'without government' where inter-organisational networks started to maintain their position in society (Dickinson, 2016).

During the 1990s, Edinburgh-based researcher Stephen Osborne therefore coined the term New Public Governance (NPG), which has a strong focus on collaboration and horizontal ties between individuals and agencies. Osborne argues that the steering and governing of public policy is increasingly being affected by co-governance. Different levels of democracy, local actors and citizens, or users, play a more frequent role in the process of knowledge production. NPG does in other words emphasise the importance of taking a collaborative approach within and across the public, non-profit, and private sectors in providing public services (Osborne, 2010).

This thesis argues that Greener Trondheim is a NPG way of thinking innovation. It is a collective solution for problems and interests originating from both the private and the public sector, as public organisations such as the municipality council, and private organisations such as Vegamot and AtB, are being involved in the Greener Trondheim network. The narratives and interests from the involved actors have traditionally been separated, but they have joined hands through the Greener Trondheim partnership.

This makes the STS concept of actor-network theory interesting when analysing this case. Different actors have been enrolled into one partnership with common interests. These ideas draw similarities to those of Bugge & Skålholt (2013), who present the network based steering as a third and final stage within steering philosophy. Within this model, the public organisation is usually considered an important actor that can develop solutions by orchestrating collaboration methods and arenas for co-creation. This new tradition is what Bugge & Skålholt calls network based steering, or networked governance. The co-creation implies the involvement of different actors and interests throughout the whole innovation process. Solutions are to be created together with, and not only for the users (Bugge & Skålholt, 2013). These theories and frameworks are being used to strengthen the arguments throughout the analytical chapters.

3. Methodology

In this chapter I will present the methods used to engage with and answer the thesis' objective and aims. To get insight and gather valuable information about my topic and case, I firstly conducted interviews with 4 informants, whom of all had professional roles relating to the Greener Trondheim partnership. Two interviews were conducted face-to-face, one interview on Skype and one interview on email. The information I have collected from interviews do however not make up for the major part of my empirical material, which instead is rather found in research articles, White Papers and news articles including public opinions.

I will explain why I chose to conduct a qualitative research. Furthermore, my research is inspired by the techniques used in a grounded theory study, which sets out to discover or construct theory from data that has been systematically obtained and analysed using comparative analysis (Tie *et al.* 2019). My analysis has been written as a result of comparative methods. Furthermore, the thesis is inspired by the abductive research approach. Thagaard (2013) writes about the abductive approach. Within this method, analysis of data is central to developing ideas, but the researcher analyse the data in the light of his or hers theoretical approach. Shows us that empirically based theory, or Grounded Theory, is being developed when the researcher categorises the empirical data and finds contexts. This approach works well for my project, in that there exists little similar research to the one I am conducting on Greener Trondheim and Actor-network theory. Furthermore, I have conducted a document analysis. The research work conducted based on documents differ from the data gathered by me during interviews (Thagaard, 2013). When I started to research the project and topic, I knew that the thesis would rely heavily on books, research articles and White Papers.

3.1 Choosing a Topic and a Case

With academic background from politics and international relations, I wished to write about a topic in which I would be able to benefit from my knowledge and skills. Originally, I planned to conduct research on the public sector and challenges relating to urban development in my hometown Moss, in southern Norway. The city is experiencing rapid growth in population, and starting 2020 the neighbouring municipality of Rygge merged with Moss to create a larger city called New Moss. As I was interested to collaborate with the public sector, I contacted people who are responsible for urban development and mobility planning in Moss during the summer of 2019. Thus, I was able to arrange meetings where we discussed issues relating to city planning, and I got to know more about plans for development. I was able to understand whether my proposed thesis topic was relevant and interesting enough to start collaboration. However, the fall of 2019 went by, the topic seemed more complicated, and collaboration with officials in Moss seemed more unrealistic. At this stage, I knew that my interests surrounded problems relating to cities, and I wanted to write a thesis on urban development and public innovation. Additionally, city planning and climate change are current topics of interest everywhere, and I knew from the start that I wanted to write a relevant thesis that would make me attractive for potential future employers.

Thus, I came up with the Greener Trondheim topic idea, which would ultimately combine my interests for city planning and sustainable development. It was worth studying Greener Trondheim, a partnership that was already gaining traction and I wanted to learn more about. My first impressions were that the Greener Trondheim innovation possessed many unique elements, that it was an interesting idea, and that I wanted to find out why it receives so many positive reviews by the local population in Trondheim.

Additionally I wanted to expand my own network and acquire contacts in a professional network. Therefore, I applied for the STS-ALMA internship programme, which offers internships for STS master students. In September 2019, fellow student Lena Wistveen and myself got the opportunity to month's placement at Miljøenheten, a section within the urban development field in Trondheim that focuses on environmental friendly methods. Like Moss, Trondheim is a city where a lot is changing on the city planning and environment fields, and there is a big focus on environmental friendly methods relating to mobility and urban development. The internship was a part of the STS course "KULT3399 Praksisopphold I bedrift/institusjon", which again is a part of the STS-ALMA programme. However, the tasks we were given at our internship were not relevant for my thesis topic. We assisted Miljøenheten in the planning phase of an event called Climathon 2019. Thus, we conducted a separate research project for the internship. However, the internship gave me relevant inspirations for the Greener Trondheim topic. We were able to see how the municipality conduct research and work, and also learn some things about how Greener Trondheim operates. Thus, I got more ideas of how I wanted to conduct my own research. These experiences would not exist if I had not undertaken the month's placement. I also hoped to acquire academic sources during the internship, which would give me deeper insight in my thesis' topic. The access to such documents was however limited. In the following section, I explain why I chose to conduct a qualitative research, rather than a quantitative one.

3.2 The Qualitative Research Method and Case Studies

I chose to conduct a qualitative research because it seeks to understand social phenomena, and emphasises significance and depth. I will only partly consider quantitative evidence, in so far as data on the evolution of attitudes will help me consider how the 'public acceptance' of Greener Trondheim may have changed and why. I will also consider the key financial indicators to explain how the actor-network was developing. Further on, the qualitative method is characterised by a flexible research process, in which the work with gathering data and analysing may take place at the same time as other parts of the process. There exist different kinds of qualitative methods, and I chose to combine data gathered from interviews with a document analysis. This method is suitable for a master thesis, which requires a large amount of information in a short amount of time (Thagaard, 2013).

Interesting for my case is Robert Yin (1994) explaining how case studies can be generalised to theory. He argues that there exists a common complaint about case studies, which says it is difficult to generalise from one case to another. The problem lies in the very notion of generalising to other case studies. The findings I have collected from interviews, white papers, newspaper articles and research articles, is being used to generalise my case that is Greener Trondheim, to my selected theories. The approach I

am taking is well illustrated by Jane Jacobs in her book, *'The Death and Life of Great American Cities'* from 1961. The book is based mostly on experiences from New York City; similar to the way my thesis is being based on experiences from Trondheim. However, Jacob's chapter topics cover broader theoretical issues in urban planning and are not restricted to New York City (Yin, 1994). This relates to my thesis as well, as I am focusing on Greener Trondheim as a case, while my findings may also relate to other cities when they have been generalised to the theories I am using. While this thesis focuses on one city, its policies do not operate in a vacuum considering other political and administrative levels.

From what I find in my research I am only able to argue about Trondheim. My interviews focuses in depth on Trondheim, and I have restricted myself to mainly read articles about urban planning in the specific city. However, my research opens up for other cases, and what I find in my case may also be transferrable to other cities. The actor-network theory does in fact make us as researchers able to analyse how a city conducts urban planning, based on that specific city's principles and preconditions. Another city may for example experience similar challenges to those of Trondheim, and my research findings may therefore prove themselves relevant for other cities. The final analytical part in this thesis examines these assumptions, and argues that local domestications (based on local preconditions) and construes of Greener Trondheim can make the ideas relevant for other cities.

3.3 Collection of Data and Selection of Informants

I interviewed a total of 4 informants. I interviewed one person from Greener Trondheim's Secretary, one person with a former position at Greener Trondheim, one person from Vegamot and one person from the Norwegian Public Roads Administration. To pick informants I have partly been using the snowballing method, described by Tove Thagaard (2013). By using the snowballing method, the researcher contacts persons with the desired qualifications or positions, who can thereafter provide with suggestions for further contacting of potential informants. ANT is not only a theory, but also a method as some of its developers have noted (Latour, 1999), and as I experienced in practice. I followed the advise of an actor, and was referred further on. A common issue relating to this method is that the selection of informants may consist of persons within the same network, which partly is the case for my research. I however considered it to be satisfactory, as one of the informants had left that working environment (Thagaard, 2013). The ethical guidelines for this type of research project involves respect for peoples' private lives, their anonymity, and the right to participate or not (Marshall & Rossmann, 2016). The research project about Greener Trondheim would not necessarily be a liability for the informants, but two of the persons wanted to be anonymous. As a formal requirement, I reported my project to the NSD (Norsk senter for forskningsdata), an application that was accepted a few days later. My project has not gathered any sensitive data. Some personal information, such as names and phone numbers have been collected, but will be deleted as soon as the project is finished.

	Name	Location	Role/Organisation	Communication
1	Heidi Fosslund	Brussels	Former leader of Greener Trondheim	Skype

2	Henning Lervåg	Trondheim	Head of Secretary Greener Trondheim	Face-to-face
3	Anonymous	Trondheim	Vegamot	Skype
4	Anonymous	Trondheim	The Norwegian Public Roads Administration	Email

I thought it would be interesting to speak to people with direct links to the Greener Trondheim partnership. During the early research process I therefore conducted two interviews with persons directly linked with Greener Trondheim's work. Through my academic network at NTNU, I was able to set up an interview with Heidi Fosslund, former leader of Greener Trondheim. Furthermore, I interviewed Henning Lervåg, Controller in Greener Trondheim's secretary, with whom I was recommended to interview by Fosslund. I hoped to acquire valuable information from someone who understands Greener Trondheim's system and objectives, which is the reason for choosing these two as informants. With hindsight, I should have contacted one or two more informants, to give the analysis and interpretations more fullness. I did not use the same interview guide for every interview. Although the thesis is written in English, the interviews were conducted in Norwegian. I have not been interested in language, and not interesting in interpreting feelings. I was however interested in what the informants wanted to say about Greener Trondheim, and rather made use of the informants as windows into the facts.

It is important to acknowledge the strengths and weaknesses relating to the different interview methods. Eye contact is largely absent compared with normal face-to-face interviews. Internet-connection may also play a factor in that disruptions can occur. There are also weaknesses relating to email interviews. There is a complete lack of dynamics. During email interviews it is not possible to build relations, which a personal conversation may build up to. I never met the informant whom I interviewed on email, and did not choose to send follow-up emails either. The email interview method does however give the opportunity to send follow-up emails if desired (Thagaard, 2018). Subsequently, I have recognised the value of asking follow-up questions, which I was able to do more frequently during the face-to-face interview and live video interviews. The email interview spared me time in that I did not have to transcribe, however at the expense of quality (Tjora, 2012). In the face-to-face and video interviews I was able to ask follow-up questions. Thus, I acquired more detailed information and nuanced comments during these interviews (Thagaard, 2013). Furthermore, the face-to-face interview gave me the opportunity to have a look into reports, and I was offered a copy of a Greener Trondheim report. During the live video interview with Vegamot I was also offered copies of a set of evaluation reports, which the informant sent me on email immediately after the interview. Although there exist weaknesses relating to such interviewing method, I would not have gotten access to these reports if I had not conducted that specific interview (Thagaard, 2018).

During all the interviews, I made audio recordings with my phone. Soon after, the work with transcribing the interviews started. The transcribing process was time consuming, but gave me a better understanding of the data. The transcribing was conducted as precise and literal as possible (Tjora, 2012). The audio recordings have been helpful as reassuring back up during the writing process, as I have been able to go back to re-listen and cite the informants correctly.

3.4 Methodological Challenges

Challenges and uncertainties are common for any researcher that is writing a paper. For the sake of my own credibility, I see the value of acknowledging the fact that I have met several challenges while writing this thesis.

It is challenging to maintain a neutral position during such research project. I chose my informants based on recommendations and relations, generally relating to the Greener Trondheim partnership in one way or another. Other informants may potentially have given other answers and thoughts than what I received from the ones I interviewed. For example, if I had contacted someone who openly criticises Greener Trondheim's work, the answers would maybe have been different. Furthermore, my selection of informants is not comprehensive enough to give enough certainty about some of the information I have gathered. The selection of informants is however comprehensive enough to cover the topics I personally wanted to discover.

Nevertheless, I primarily wished to speak to people with direct relations to Greener Trondheim to hear their versions of the story. This may be relating to a potential 'biasness' from my side. The thesis was supposed to be written in co-operation with Miljøenheten, when I participated in the internship in 2019. The internship was not relevant for the case, but I did however get inspirations for the Greener Trondheim case during the internship. Such co-operation with an external actor may have had implications on my view of Greener Trondheim. This relates to the term 'research bias', which explains how a researcher is trying to influence the methods and results to achieve a specific result (Smith & Noble, 2014). Furthermore, because of my interest in Greener Trondheim, I have sympathised and perceived the innovation to be successful from the beginning. I cannot be merely a neutral observant of Greener Trondheim, because I am a part of the 'actor-network' myself. What follows are the analytical chapters. The first chapter presents environmental policy history and the emergence of actor-networks on the international scale, to give an understanding of why and how Greener Trondheim was problematized on the local arena.

4. Analytical Chapters

4.1 Policy History and Environmental Awareness in Norway

Greener Trondheim is Trondheim's current understanding of how to successfully develop the city. It is a partnership where multiple actors have come together to share knowledge and work toward common goals. Different understandings of how to successfully develop cities and transport have frequently changed during the past few decades. Different periods of time and preconditions have required different sorts of solutions. Currently, the climate is an internationally acknowledged matter, and environmental challenges are often being taken into account when cities are planning urban projects.

There exist several reasons why climate policies and environmental focus has entered the political agenda in countries all over the world. Trondheim, and Norway in general, is no exception, and the Greener Trondheim innovation is Trondheim's attempt to answer the international environmental focus. This chapter focuses on history and explains the reasons why Greener Trondheim was ultimately assembled. The problematisation phase of the actor-network theory is particularly important when explaining the early stages of Greener Trondheim. The Greener Trondheim idea was at some point problematized, and a variety of different political factors were significant in the development of climate policies in the city.

To understand how and why the Greener Trondheim partnership was established, and how the partnership currently operates to create interest and enrol actors into the network, it is important to understand what happened on the political stage in Trondheim and Norway leading up its formation. In Trondheim, the climate became relevant in the mid-2000s, and the years 2006 until 2008 are therefore key for this thesis (Næss & Sørensen, 2007). During these years, politicians in Norway started to acknowledge the national and local problems relating to the climate, just before Greener Trondheim was initiated in 2009. However, to understand the emergence of local environmental awareness and policy, this thesis firstly examines the historical events of international environmental politics during the 20th century. History reveals an environmental platform that has been ruled by the bureaucracy, and periods of different steering paradigms have occurred in Norway during the 20th century.

Furthermore, in order to understand the actors and network that is involved with Greener Trondheim, it is important to understand where they came from. Although Greener Trondheim was problematized and worked out by local politicians in Trondheim, the idea and origins did not start from scratch. A history of networks and policy-making has laid ground for how Greener Trondheim came to be configured. These networks include policy networks, and networks of national and international legislation. Latour (2004) draws in ANT ideas to argue how collectives that involve both humans and non-humans form politics. In other words, ANT contextualises the way in which political agenda develops on the international and national stages, and how environmental policy becomes a part of these agendas. The next paragraphs examine how this occurred within Norwegian politics.

4.1.1 The Early Stages of Environmental Policy

The 19th century marked the beginnings of official environmental administration in Norway. An increasing politicisation of Norwegian nature brought the first wave of environmental policies to the political table. Between 1910 and 1965, the Church and Education department was in charge of administering laws relating to the environment, because scientists and bureaucrats believed that issues with nature were cultural problems (Dokken, 2013). However, in 1965 the responsibility was given to a newly opened section in the Municipal and Workers department, as the Norwegian government wanted to make use of natural resources. Further on, the responsibility for pollution cases was given to the Industry department, when the government saw pollution as a consequence of industry. In other words, issues relating to the environment have been handled by many different actors and departments, and remained bureaucratic for many decades. These are examples of how ANT contextualises how political agenda develops, in that different actors within organisations and policies form national political networks. The fact that responsibility for environmental preservation had been so widespread was problematic, and the government saw the need of coordination (Berntsen, 2011). Therefore, the Environmental Preservation Department was established in 1972, which marked the beginning of coordinated environmental administration in Norway (Andresen & Boasson, 2008). Between the 1970s and the 1980s, the new department took charge of many environmental matters that had earlier belonged to other departments (Berntsen, 2011).

During the 1970s, environmental awareness was emerging on the international stage. As issues relating to the environment were raised in the international public, the first global environmental conference took place in Stockholm in 1972. It was however toward the end of the 1980s that climate change issues significantly became a part of international politics (Dokken, 2013). The leading authority on climate science is the Intergovernmental Panel on Climate Change (IPCC), which released its first report in 1990, eventually leading to the UN Framework Convention on Climate Change. This example relates to how ANT explains the significance human and non-human actors in a collective, where organisations, computer models, research infrastructures, reports and conventions together form political agenda (Edwards, 2010). 166 countries signed the first convention, including Norway, and the first common international responsibility for climate issues was established (Dokken, 2013). Although standing in the paradoxical position of being highly dependant on oil, Norway did in fact become a pioneering country in influencing politics relating to the climate (Lahn, 2019). The Brundtland Commission, led by former Norwegian Prime Minister Gro Harlem Brundtland, released a report called *Our Common Future* in 1987. Many Norwegian politicians felt the responsibility for climate change, mainly because Brundtland led the UN Climate Commission at the time (Lie, 2012). The report promoted the term 'sustainable development', to emphasise the need to meet today's necessities, without impairing future generation needs (FN-Sambandet, 2019). Already in 1987, the Norwegian government stated that Norway's CO₂ emissions in 2000 were to be stabilised at the 1989 level. Furthermore, the Parliament adopted CO₂-taxes for the transport and petroleum industries (Dokken, 2013).

4.1.2 The Current Understanding of Environmental Issues Takes Shape

It was not until the mid-2000s that environmental-politics changed dramatically. While society has developed increasingly comprehensive environmental policies, economists, jurists and social scientists have been included in the drafting processes of international and national frameworks (Lidskog & Sundqvist, 2013). In the early 2007, the European Union launched a plan aimed at fighting climate change. The plan, dubbed *'The European plan on climate change'*, consisted of a range of measures taken by the EU member states, which focuses on emission cuts and renewable energy. The initial goals focused 13 years forward in time, and greenhouse gases emissions and energy consumption were to decrease by 20 percent by 2020. Although not being a member of the European Union, Norway is contracted through the EEA agreement and the single market, and implements EU legislation thereafter (St.meld nr. 5, 2012-2013) (Regjeringen, 2020). Norway has thus clearly been inspired by international awareness, in addition to having international obligations. In the light of ANT, these examples are interesting in that the theory explain how an international network takes shape and extends with human and non-human actors. The plan aimed at fighting climate change was at some point in 2006 problematized in the EU, and was further on translated (Callon, 1986) and adopted by the member states. Furthermore, the network includes Norway, which is not a member state in the EU, but follows legislation because of international obligations.

In a White Paper released in May 2007, the Norwegian Government presented the country's environment-political goals and ambitions. The White Paper reveals that the Norwegian Government wanted an increased focus on environmental politics, in that eight focus areas had been merged into four specific areas. The environment, consumption and sustainable area and transport planning are among the areas that were focused on (St.meld. nr 26, 2006-2007a). In another White Paper from later the same year, the Norwegian Government's Climate and Environment Department refers to the UN's climate convention, and stated that the country wanted to stabilise emissions on a level that averts a dangerous level of human impact on the climate. The White Paper contains a chapter on human made climate change, and focuses on the increase in global emissions (St.meld. nr 34, 2006-2007b). During the mid-2000s, international environmental awareness had clearly inspired Norwegian politicians, and the climate focus had entered the political agenda in Norway.

Building on the historical happenings covered in this chapter, the next chapter explains the establishing process of Greener Trondheim, and how it has been configured via specific actor-networks. The second chapter makes use of ANT to explain how and why Greener Trondheim was initiated in 2009.

4.2 Greener Trondheim's Beginnings and Public Attitude Change

To give an understanding of Greener Trondheim's current functionalities, this chapter aims to explain Trondheim's climate situation in the late 2000s, and what happened in the city just before Greener Trondheim was initiated in 2009. This chapter makes use of the actor-network theory to explain why and how the innovation came to be, and how it has developed since then, to become what is perceived stable and highly praised locally. Furthermore, the chapter introduces an attitude change phenomenon regarding toll roads

in Trondheim, and how network has expanded to involve a range of different organisational actors that are essential for its work.

4.2.1 The Beginnings of Greener Trondheim

Toll roads in Norway are political objects, in that people are obligated to pay a predetermined fee to pass them with a vehicle. Between 2000 and 2005, the toll roads in Trondheim were highly debated among local actors, and the city's politicians received a high amount of pressure from the inhabitants. The politicians had to decide whether the toll roads were to be discontinued by 2005, or be renegotiated thereafter. The city's mayor at the time, Anne Kathrine Slungård, said that the toll roads in Trondheim had to be taken down in 2005, like the voters had been promised (Næss, 2000). The politicians kept their word and the toll roads were taken down during December of 2005 (Kringstad & Thobroe, 2019).

However, Trondheim was growing, an increasing number of people were moving into the city and the traffic jams became increasingly severe. As a result, the city's greenhouse gas emissions were also increasing rapidly. Simultaneously, environmental awareness emerged on the national political agenda in Norway, like mentioned in the previous chapter. The increase in environmental awareness would later open up for new a focus and opportunities for urban development in Trondheim and other Norwegian cities (Regjeringen, 2014). As the climate issues relating to air pollution were growing in Trondheim, the city was in desperate need of new methods. Sometime during the year 2008 the Greener Trondheim idea was problematized on the local political arena.

In the interview with Heidi Fosslund, we discussed Greener Trondheim's beginning and main purposes. She says that the initial purpose with the partnership was to solve the challenges relating to car traffic and emissions in Trondheim. At one point before the establishment of Greener Trondheim, the city was in fact one of the worst in the country in terms of air quality and pollution. The Greener Trondheim idea was thus born from political hold, and local politicians from different parties established the platform that today is Greener Trondheim. The initial idea was to solve the mobility problems through a financing via toll roads. Thus, Trondheim wanted to reduce the amount of traffic, and collect money for city developing purposes at the same time.

Furthermore, the interview with Henning Lervåg also revealed facts about Greener Trondheim's origins. Lervåg draws links between the national climate agreement in 2008 and the establishment of Greener Trondheim. Since the toll roads had been taken down in 2005, there existed little money for city planning purposes. Lervåg mentioned a document written in 2008 that is called 'Miljøpakken', which is the fundamental paper politically including 10 goals. The document was the beginning of Greener Trondheim, and is the background of how the partnership functions today. Thereafter, Greener Trondheim was adopted locally in April 2008. The idea was from the beginning problematized and initiated by local politicians in Trondheim. When Greener Trondheim was officially established in 2009, it was a partnership between the Trøndelag county authority, Trondheim City Council and the Norwegian Public Roads Administration (Miljøpakken, 2020a). Drawing on ideas of the actor-network theory, these three actors were the first ones to be enrolled and formed the original Greener Trondheim network, after it had been problematized and initiated by the politicians. The network extended to

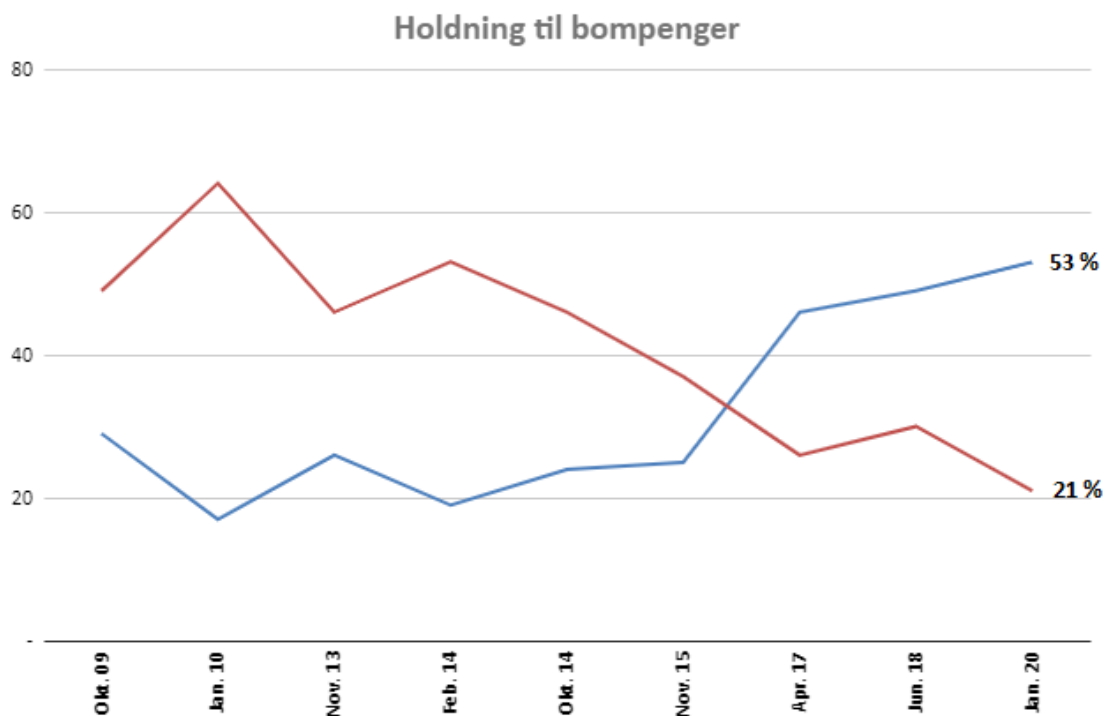
include the politicians, organisations, toll road and political papers. Furthermore, the Greener Trondheim idea would soon receive national interest, and in June 2009 the Norwegian parliament also adopted the program (Miljøpakken, 2015). Drawing on these findings, it is clear that the Greener Trondheim network started to expand from the very beginning.

Although Greener Trondheim received great interest both locally and nationally, it is worth mentioning that the program did not enrol all parties from neither local nor national governmental hold. Although a majority of the political parties in Trondheim supported Greener Trondheim, the Conservative and Progress parties were against financially investing in infrastructure through financed through toll roads. In an official White Paper (108 S, 2009-2010) released in 2010, it is revealed that a selection of Parliament Members, from the two mentioned parties, proposed a 100% governmental financing of transport solutions in Trondheim. They acknowledged that successful solutions in Norway's largest cities would be crucial for national wealth creation, and that it was to be financed by the government rather than local toll roads. The representatives argued that since Trondheim's inhabitants were not consulted through a referendum, Greener Trondheim was not democratically established. Therefore, both the local and national Norwegian Progress Party sections argued that the state was to fund transport and infrastructure projects in Norway's largest cities (108 S, 2009-2010).

Nevertheless, Greener Trondheim was successfully established and is currently functioning in a way where restrictive measures for car users are contributing to an increase in financial support from the Norwegian government. Trondheim went from not collecting any money for road developing purposes, to collecting 15 billion NOK during the first ten years of Greener Trondheim. The two most significant financial sources are regional toll roads, and the following government funding. Vegamot AS was enrolled into the network and mobilised to be responsible for the financial collection from toll roads. However, the amount of money collected from toll roads have decreased since 2010. The total share of toll road money in the Greener Trondheim partnership fell from over 80 percent in 2010, to under 50 percent in 2017. However, for each NOK collected from the toll roads, the city receives one extra NOK in support from the government (Kringstad, 2017).

4.2.2 Attitude Changes Regarding Toll Roads In Trondheim

There currently exist 25 tolls in the Trondheim area. Between 2010 and 2029, it is estimated that the toll roads alone are going to provide Greener Trondheim with a total of 10 billion NOK in financial support. The money is to be put into a frequent use, to improve traffic roads, public transport, bicycling roads and better facilities for pedestrians (Kringstad & Thobroe, 2019). Several attitude surveys regarding Greener Trondheim and the toll roads have been conducted regularly since the beginning. At Greener Trondheim's entry in 2010, 64% of the city's inhabitants were negative toward the city's toll roads, while 17% were positive. However, 7 years later and the attitudes had changed. In 2017, only 26% were negative while 46% were positive toward the district's toll roads (Kringstad, 2017). The clear shift in public attitude proves interesting:



Source: Miljøpakken, 2020c (<https://miljopakken.no/nyheter/flere-for-bompenger-i-trondheim>)

Lervåg argues that “the people of Trondheim’s attitudes have changed as they have experienced the positive measures, and see that the money collected from toll roads is being put to good use” (Kringstad, 2017). Statistics suggest an increasing trend in support, and that Greener Trondheim has managed to enrol a considerable ambiguity in the population, however with somewhat more positive than negative attitudes. For this example, ANT may explain how toll roads are non-human actors that may facilitate for material participation (Ryghaug *et al.* 2018). In other words, some people seem to be socialised into ‘accepting’ the toll roads in that they experience the measures that are being introduced. Greener Trondheim seems to successfully translate knowledge and gain support from the inhabitants in the city, as their ideas and contributions tend to receive positive responses. Examples of such contributions and measures are discussed in the following chapters.

The Greener Trondheim network is continuing to grow increasingly comprehensive. In the light of the actor-network theory, it is evident that the network has expanded continuously since the beginning. Firstly, the innovation was established as collaboration between the founding public organisations. Currently, Greener Trondheim explains the work as a “close and binding cooperation”. A program council, which includes the founding organisations, the railway directorate and Greener Trondheim’s own secretary, creates propositions for new projects. Greener Trondheim’s contact committee evaluates the propositions, while the City Councils and Trøndelag County Council finally approve the projects. Furthermore, national investments in Greener Trondheim are being processed and evaluated at the Norwegian Parliament (Miljøpakken, 2020b).

It is worth mentioning how this example shows how the network has expanded to include an increasing amount of organisational actors in the Trondheim area. Greener Trondheim's secretary and contact committee have been established with the purpose to make Greener Trondheim more efficient. On the other hand, the Norwegian Parliament examples also show how the network has expanded to include actors to the national level. This argument is however not meaning "networks" to be "networks of organisations" (Latour, 1999). In his 1999 article, *On Recalling ANT*, Latour stresses the importance of ANT not being a normal "network theory". It is important to establish this for the argument, because, like ANT explains, the Greener Trondheim network involves a range of different human and non-human actors. Furthermore, the Greener Trondheim example shows how the city is attempting to conduct city development in the spirit of NPG, in that public organisations are considered important actors in the orchestrating processes of collaboration methods to find solutions. Furthermore, by putting significance into such matters, the city is in many ways attempting to promote network based steering (Bugge & Skålholt, 2013).

Public organisations and people are not the only actors to be enrolled in the Greener Trondheim network. As mentioned in the theoretical section, ANT emphasises the importance of both human and non-human actors. The following chapter discusses how objects such as toll roads and bicycling roads represent sites for social participation, and the concrete material objects in them matter for how this participation happens. The chapter explains how social processes are occurring within the Greener Trondheim network. The chapter makes use of the actor-network theory to go into depth and analyse the complexity of the Greener Trondheim network. It explains how it currently involves a range of different human and non-human actors and objects, such as local businesses and organisations, parking spaces and roads for bicycles, and the toll roads surrounding the city of Trondheim.

4.3 Socialisation and Public Engagement in Trondheim

As the previous chapter mentioned, a large portion of Trondheim's citizens have somehow learned to accept, and sometimes even favour, the district's toll roads. Since the toll roads reopened as a part of Greener Trondheim on March 31st in 2010, the share of negativity has decreased notably (Nykvist, 2020). How has it been possible to turn things around, and make a vast majority of the inhabitants happy about something they used to be against?

Greener Trondheim has public importance because it affects the people, and an important contribution of this thesis, and the STS field in general, is to highlight the roles of citizens and public engagement. While users have traditionally been perceived as customers and passive market actors, they currently play a more significant role in the development of innovations through citizen participation (Ryghaug *et al.* 2018). This chapter firstly argues that Greener Trondheim's mobility advisors contribute with a socialisation process, where they attempt to engage with the citizens. Furthermore, this chapter analyses the complexity of the Greener Trondheim network, and argues that objects, such as the district's toll roads, have become matters of political contention, which means that the people can accept or reject them as a political choice.

4.3.1 Socialisation and Engagement through Mobility Advisors

An interesting example of how Greener Trondheim are trying to expand their network to translate knowledge and involve citizens, is by employing what they have named 'mobility advisors' (Mobilitetsrådgivere). This example shows how ANT opens up and explains how a network expands. Greener Trondheim has employed these mobility advisors to work toward changes in travel habits, and to achieve closer collaboration with local businesses. By the actor-network theory and Callon's (1986) translation process this idea makes for an interesting observation. The mobility advisors can in fact be seen as 'translators' of knowledge in the network, in that Greener Trondheim use them as a tool to promote environmental friendly methods, while they are simultaneously involving the citizens. Greener Trondheim uses the mobility advisors to incorporate the citizens into the network. The mobility advisors keep close touch with people who travel for work, school and leisure (Miljøpakken, 2019).

An interesting example of how Greener Trondheim's mobility advisors are conducting work in Trondheim, took place at the local Nidar chocolate factory in 2019. The advisors visited the factory and offered Nidar to borrow seven electric bicycles from Greener Trondheim, so that the employees could test ride the bikes (Kringstad, 2019a). Additionally, Greener Trondheim offered the Nidar workers bicycle services free of charge. The response from Nidar was ultimately positive. Greener Trondheim's measure resulted in Nidar offering any employee that wanted to buy an electrical bicycle the opportunity to pay for it over time with deductions from their salaries. The mobility advisors inspired the board and their employees to make use of electrical bikes rather than their cars for work travel.

While Nidar expected about 10 interested employees, 50 of the total 200 workers chose to make advantage of the offer, and those 50 will cycle to work rather than driving their cars (Kringstad, 2019a). The fact that Greener Trondheim has employed mobility advisors reveals a genuine desire of involving other actors and promoting citizen involvement. The mobility advisors represent transformations and translations (Latour, 1999). They show that relevant knowledge about the environment needs to be meticulously translated to citizens in Trondheim, which would require effort and grounding innovations to happen. The example shows how translations of knowledge occurred through the mobility advisors, and how the employees were enrolled into the network. Furthermore, the Nidar example also shows how the mobility advisors can work to achieve increased acceptance for the measures Greener Trondheim initiates. Sørensen (2013) argues that the public may want to be involved in innovation and deployment of new technologies, to feel informed to the extent that they trust the innovation and the people who are responsible for deployment. Additionally, the people may also want to understand and make sense of the practices they may develop individually from new technologies. Greener Trondheim's socialisation efforts through the mobility advisors are attempting to cater these needs. Furthermore, it is an example of how Greener Trondheim is attempting to create new ways of public engagement.

In the book *Leading Public Sector Innovation*, Christian Bason (2018) notes the importance of involving citizens in public innovation processes. He argues that there exists a potential of discovering new ways of generating value and producing knowledge that starts and ends with citizens and businesses. The Nidar example is evidence that Greener Trondheim values these ideas. It shows how cooperation between the mobility

advisors and a local business to some extent has produced knowledge travel preferences, another example that shows the dynamic nature of the Greener Trondheim network. The advisors are being used to disseminate information to the citizens. The example therefore makes for an interesting observation regarding the NPG framework. By employing mobility advisors that communicate with citizens, Greener Trondheim is attempting to conduct development in the spirit of NPG. In this example, they are attempting to create solutions with, and not only for the users, throughout the innovation processes (Bugge & Skålholt, 2013). It emphasises the importance of taking a collaborative approach in providing public services. In other words, the employment of mobility advisors is a method that Greener Trondheim uses in an attempt to involve people and expanding their network. Furthermore, the network has expanded to include many different non-human actors in Trondheim, which is discussed in the following section.

4.3.2 Objects and Technologies as Sites for Public Engagement

In the light of the actor-network theory, Greener Trondheim has worked to expand the network. It started with an idea from political hold, and currently involves a range of human and, but also non-human actors. City councils, citizens and businesses are not the only actors that are being involved in the Greener Trondheim network. STS researchers Ryghaug, Skjølsvold and Heidenreich (2018) have written an article on material participation, which elaborates on the study of citizen participation. The STS researchers argue that artefacts such as electric cars, smart meters and solar panels may become objects of participation and engagement. They focus on these technologies and how they become part of peoples' everyday lives, and thus how the actor-networks merge humans and non-human objects. The Greener Trondheim network's complexity is clear when building on the conclusions of these arguments. Objects such as toll roads, bicycle roads and parking spaces have become part of the Greener Trondheim network as sites for public engagement. The objects can be contested, accepted, or even engaged with, although they are not like the traditional sites where democratic processes happen, such as citizens voting in city elections. In other words, new types of participation by the citizens are happening around material objects in Trondheim, through the Greener Trondheim network that introduces the measures.

The introduction of a bicycle hotel is an example of how Greener Trondheim implement measures for the public to engage with. Greener Trondheim recently invested 3,8 million NOK to build a bicycle hotel with capacity for 50 bicycles (Trondheim24, 2020). Introduced in March 2020, Greener Trondheim would not yet know if there is an urgent need for such technology. However, people may want to make use of this bicycle hotel for safety reasons. If people are afraid that their bicycles are to be stolen or vandalised, the bicycle hotel is a safe option to prevent that from happening. This is another example of a non-human actor being enrolled into the network. Furthermore, the introduction of bicycle hotels is reveal a new approach in which Greener Trondheim is attempting to facilitate for more use of bicycles. A bicycle hotel may motivate people to make use of bicycles, as it offers safety and gives an extra experience, which the people can engage with. Furthermore, when people in Trondheim use such objects, they may start realising that they are a part of a political environment. The bicycle hotel cost money, but may prove useful for anyone who seeks better security for their bicycles. The same example is

relevant for bicycling roads, in that people may use them and understand that they will get them somewhere.

The many urban developing contributions of Greener Trondheim show the complexity of the current network. With support from toll road collected funds, Greener Trondheim has contributed with a variety of different measures. What follows is a selected list of infrastructure measures:

Public Transport

- Improved bus routes, lower ticket prices and more environmental friendly buses
- 24 kilometres of bus lanes

Cycling

- 31 kilometres of bicycling roads
- 8 bridges that shortens routes and binds populous areas in Trondheim together
- More than 300 new parking spaces for bicycles in the city centre

Pedestrians

- 17 shortened routes for pedestrians
- Two of the main streets in the city centre have been restructured, with a new bus terminal in Prinsenkrysset. The main square in city has thus become free of cars, only available to pedestrians and cyclists.

As earlier mentioned, Greener Trondheim consists of a network of organisations, policies and technologies. In the light of the actor-network theory, all these actors play important roles for the Greener Trondheim network. Greener Trondheim has policy-makers and people responsible for developing infrastructure, such as the technologies listed above. This examples shows what ANT would explain as policy-makers, people and infrastructures emerging together to be co-constituted. These different human-actors, combined with the technologies and the people who engage with them, make for an interesting observation. The network has developed into a complex situation, where all the actors are necessary for the partnership to operate.

Automatic bicycle counters are another example of political objects in the Greener Trondheim network. The counters reveal how many cyclists have passed certain checkpoints around Trondheim (Kringstad, 2015). Latour (1999) argues that artefacts are political, and the automatic counters example may in fact show how Greener Trondheim is attempting to govern the people. The automatic counters are an example were the governing of the people – in this case, to be rational users of bicycle transports – is accomplished by a mundane object that counts the numbers of bikers and therefore makes this figure public knowledge that can begin to affect their practices. Furthermore, by improving the bicycle lanes and introducing such technologies, it is a way in which Greener Trondheim is attempting to convince the people that they are actively investing the money for developing purposes, and that it is important that more people make use of bicycles. These examples also make the bicycles visible in new ways, and may have political implications in that people engage differently with bicycles. The examples of bicycle lanes, bicycle hotels and bicycle counters may thus have positive motivational consequences for the people to use bicycles, and thus Greener Trondheim's technologies, more often. It coincides with the fact that if bicycling conditions and technologies are

being improved in Trondheim, there may exist more motivation to make use of bicycles to benefit from the technologies introduced by Greener Trondheim.

While Greener Trondheim is attempting to facilitate for bicyclists, they are also attempting to reduce car traffic. However during 2019, car traffic increased by almost 2% on the toll roads in Trondheim. In a recent report, Greener Trondheim (2020) argues that the new highway at E6 along the district of Klett is the reason behind increased car traffic. Since it opened in the end of 2019, Trondheim is the only Norwegian city that has not achieved the zero growth goal. This example reveals recent negative development, and that the restrictive measures Greener Trondheim thus far has introduced was not enough to reach the national goal for 2019. To reduce the car traffic in forthcoming years, Greener Trondheim may need to implement other methods. In the same report, Trondheim also reveal that cycling in Trondheim increased by 4% in 2019, while the amount of people taking the bus also increased by 4% (Miljøpakken, 2020d). By including these numbers in the report about car traffic, Greener Trondheim is attempting to cover the fact that car traffic has increased and that the zero growth goal has not been achieved.

On the other hand, these numbers reveal an overall increase in transport, and Greener Trondheim's technologies may in fact stimulate increased mobility among the inhabitants. If Greener Trondheim had not focused on building bicycle roads and improving bus strategies, the results would potentially be different. The 4% increase in cycling makes for an interesting observation. For example, if Greener Trondheim had not improved the bicycle conditions in the city, some people would have driven their cars instead. Thus, the car traffic numbers would potentially have been even higher in 2019. This example also show how it is necessary for Greener Trondheim to continue their work with improving mobility conditions to maintain trend of increased sustainable transport. On the other hand, it also shows how it is necessary for Greener Trondheim to develop new car restrictive measures to work towards the zero growth goal.

Although increasing in 2019, overall private car use has decreased since the introduction of Greener Trondheim, and currently makes for half the journeys in Trondheim. Statistics reveal that car traffic in Trondheim was 16% lower in 2018 than in 2010 when the toll roads were reopened around the city (Kongsnes, 2019). Greener Trondheim has focused on investing in the city's bicycling roads. By introducing improved offers for cyclists, combined with toll road fees for cars, Greener Trondheim is trying to change the ways in which some citizens' decide to travel. However, Greener Trondheim understands how it is necessary for some people to drive cars. It may for example be necessary for people to drive cars to commute for work. However, the people that choose to drive cars may in turn knowingly pay toll road fees that are being used for environmental friendly purposes.

The maintaining of materials, such as toll roads and bicycle roads, are in other words a socialisation strategy, through which Greener Trondheim are attempting to facilitate sites for engagement. When drawing links to Sørensen (2013), it is clear that Greener Trondheim introduces innovations and deploys technologies that may have social significance. Technologies that are being introduced, such as toll roads and bicycling roads, facilitate the socialisation process and activities that make sure that they are embedded in society when people engage with them. In other words, Greener Trondheim facilitates materials, which again facilitates for how the citizens are enrolled into the

network. In other words, Greener Trondheim are mobilising inhabitants by facilitating objects they may engage with, such as toll roads and bicycle roads.

Larger projects are also facilitating socialisation processes in the city. For example, Greener Trondheim has introduced a new metro bus project in Trondheim, and during August 2019 project had their first departures. AtB, the current operators of public transport in Trondheim, regulates the new buses, and it is estimated that Greener Trondheim have invested 2,8 billion NOK in establishment costs for the project. It is a comprehensive project that has restructured the whole bus system in Trondheim (Bråten, 2017). The metro buses are hybrid and runs on electricity and biodiesel (Lysberg, 2019). Furthermore, Greener Trondheim is currently testing out Europe's first autonomous buses, in collaboration with Vy, AtB and Trondheim Municipality Council (AtB, 2020). These two examples shows how Greener Trondheim is thinking development and in terms of sustainability. The examples also show how the Greener Trondheim network is continuing to expand to involve a range of different non-human actors. Further on, the implementation of new bus systems also facilitates for enrolment of human actors. Trondheim's people are very much engaged with the new bus system. Per Erik Kufås, a local bus driver, writes a debate chronicle on the matter where he criticizes the new buses. He argues that the metro buses will have little, if any at all, facilitation for elderly people (Kufås, 2017).

Sørensen (2013) focus on domestication and notes the importance of analysing how technologies are enacted by society. Domestication is a term that has been developed to describe and analyse how technologies are being accepted, rejected and used (Berker *et al.* 2006). In Trondheim, the technologies that have been created by Greener Trondheim, such as toll roads, bicycle roads and buses are being accepted, rejected and used. Furthermore, the people are able to actively give feedback on the measures Greener Trondheim introduces. For example, with regard to the opening of several new bicycle roads, the citizens were asked to give thoughts on the cycling conditions (Midtbø, 2018). This shows how the citizens may engage with the technologies, and how they are able to comment and give feedback on online forums on Facebook. Such feedback may also provide Greener Trondheim with valuable information for future development of the city.

The technologies have been developed by Greener Trondheim in an attempt to make people engage with them. Greener Trondheim attempts to facilitate sites for public engagement, which currently contributes to the complex and dynamic situation that as a whole is the Greener Trondheim network. In other words, Greener Trondheim is trying to facilitate city development through an active participation policy. The introduction of 'city bikes' is an example of how Greener Trondheim is trying to facilitate an active participation policy. In 2019, 750 bicycles were stationed around the city, which the citizens are able to loan for 45 minutes through an application on their phones (Grøtte, 2018). The fact that Greener Trondheim are making the 'city bikes' loanable for the public is an example of how they attempt to visualise their projects. Furthermore, it shows that Greener Trondheim acknowledges the importance of tackling climate change, and how they are asking the people to participate. The 'city bikes' is also an example of how the people may engage with the measures that are being introduced, and which in turn gives Greener Trondheim the opportunity to see what works. These factors may also give Greener Trondheim potential development value, when they are looking to develop new solutions.

This chapter has explained how the Greener Trondheim network consists of a range of different actors in addition to the people and the organisations involved in the partnership. A main point of the actor-network theory is to describe the dynamic nature of networks, and how they may change over time. The politics of Greener Trondheim is not only about changing citizen behaviour. The network is also involving the dynamical enrolment of object such as toll roads, bicycle roads, new buses, bicycle counters and city bikes. Thus, they all become a part of the whole environmental political process. The following chapter discusses Greener Trondheim's current status and evaluates potential challenges for the future.

4.4 A Stable Future or a Future with Challenges?

In this chapter, the thesis discusses the current stability of the Greener Trondheim network. It argues that the on-going socialisation process is an important contributor to the current stability of the Greener Trondheim network. Furthermore, this section discusses the potentials of future challenges in the Greener Trondheim network. Population growth and people moving to Trondheim's suburbs may have future consequences for how Greener Trondheim operates. New trends will make new demands, and new roads, technologies and methods may be needed in the future. Some actors may leave the partnership, while some actors may come in to stabilise a potentially weak network. Thus, potential challenges are evaluated in this chapter.

4.4.1 Is Socialisation the Key to Stability?

The analytical chapters have so far examined the complexity of the Greener Trondheim network, which consist of a variety of human and non-human actors. It involves city councils, businesses, citizens, technologies and objects. All the actors are changing what the network is like and the effects that it has for the city of Trondheim. Greener Trondheim momentarily seems like a stable network, and the thesis has thus far established that many people locally are supporting the partnership. The previously discussed socialisation process may be an important factor to this matter.

In the research on the comfort society and energy consumption, which was mentioned in the literature review, the authors found little evidence of habit change, although the informants were aware of their own consumption and the threats of climate change. Noncommittal political messages and little political will were stated to be reasons behind these attitudes, according to the research (Næss & Ryghaug, 2008). They argue that when politicians do not implement concrete measures to tackle climate change, the people follow thereafter. Therefore it exist little motivation to change things among the people. In other words, if the politicians put forward climate knowledge in an appropriate way, the people may feel that they have an opportunity to make individual assessments (Beck, 1992).

In Trondheim people are made aware of Greener Trondheim's contributions, and may therefore take individual decisions based on the information they are offered. The automatic bicycle counters and road signs with information about Greener Trondheim are examples. Greener Trondheim has managed to make a vast majority of the local community positive about toll roads, something they used to be dissatisfied about. The

road signs that promote Greener Trondheim may be related to the tactic called 'nudging'. Nudging is about changing peoples' behaviour, and to lead them in a certain direction, such as acting more environmental friendly (Hærnes, 2018). Translations of knowledge (Callon, 1986) seems to be occurring through the objects in the Greener Trondheim network, in that people may ultimately change their behaviour and engagement with the technologies based on public opinion shown in attitude surveys and statistics. Additionally, a toll road is a way of penalising people for driving. However in Trondheim, the penalty for driving is being overshadowed by Greener Trondheim's contributions. The people are being socialised into using toll roads when Greener Trondheim visualises the succeeding effects on city development. Greener Trondheim is in other words facilitating their own increased acceptance, by focusing on making the people aware of their contributions to the city.

Furthermore, through road signs that promote the work and visualises the contributions, Greener Trondheim is attempting to nudge the public in a certain direction and make them act differently. Secondly, the public are being made aware that the money taken from toll roads are being used to fund innovations that offers environmental friendly opportunities for the city (Ramfjord *et al.* 2011). Additionally, other nudging examples reveal Greener Trondheim's desire to develop the city, such as messages that are painted on the ground. The messages are labelled "Greener Trondheim, thanks for walking" and "Greener Trondheim, thanks for cycling". By introducing such objects to the public, Greener Trondheim is attempting to increase the amount of people who walk and cycle, and it shows how they wish to change the travel habits of Trondheim's citizens (Kringstad, 2019b). Promotional signs and street labelling may also be attempts of increasing awareness and visualise the link between travel habits and climate change to the public.

Thus, the citizens may also become aware that their decisions are supporting the climate cause. Beck (1992) argues that there exist increasing demands that citizens' individually assess the risks they are up against, and make choices thereafter. In Trondheim people are frequently made aware of habit changes and Greener Trondheim's progress through attitude surveys and road signs. Therefore the people are capable of taking individual decisions based on the information they are given, which in the Trondheim case will support the climate cause. In other words, habits seem to have changed the attitudes in Trondheim, in that there is an increased positivity toward toll roads in the city. The many visible improvements of infrastructure in Trondheim may be an important factor for Greener Trondheim's reputation. Kato Nykvist (2020) calls the Strindheim tunnel, which opened in 2014, a gift to Trondheim's inhabitants, as it solved a handful of mobility issues. Furthermore, he argues that the people of Trondheim can clearly see how Greener Trondheim makes the city better (Nykvist, 2020).

Although early attitude surveys prove that the majority of Trondheim's population were negative toward toll roads (Kringstad, 2017), the atmosphere and attitudes regarding toll roads in Trondheim is currently different from what other Norwegian cities experience. Folkeaksjonen nei til mer bompenger (FNB) is a political party that was established in Stavanger in 2014. Directly translated to English, the name of the party means "*the people's action no to more toll road money*". At the Norwegian municipal elections in 2019, FNB was represented in all the major cities; Oslo, Bergen, and Stavanger.

Trondheim was however an exception. According to FNB's (2020) website, the party's main goal is to "remove the toll roads that are financing roads and public transport". Oslo, Bergen and Stavanger have all met strong public resistance and protests in regards to toll roads. In 2018, toll road protesters caused traffic chaos in Stavanger, as the resistance group decided to take to the streets to demonstrate (Evensen *et al.* 2018). It is interesting to raise the question why Trondheim's politicians do not experience the same amount of resistance as the other major cities in Norway. The on-going socialisation processes facilitated by Greener Trondheim may be an important factor. Examples, such as the earlier discussed mobility advisors, nudging and city bikes, show how Greener Trondheim is attempting to facilitate for engagement among the citizens. Furthermore, the visualising effects that Greener Trondheim introduces may have positive implications on these matters.

Furthermore, Kringstad & Thobroe (2019) argue that Greener Trondheim's efficiency is a key factor to the lack of resistance against toll roads. The funds collected from toll roads are being put to use consecutively, and Trondheim's citizens do not have to wait for the results. Objects in the network, such as improved roads, public transport options and bicycle tracks, are regularly being put into effect. Although the number of inhabitants is increasing, private cars currently make for half the journeys in the city, and Trondheim has become Norway's premier bicycling city (Kringstad & Thobroe, 2019).

4.4.2 Future Stability and Potential Challenges

The thesis has thus far established that Greener Trondheim seems to be relatively unchallenged in public and that the vast majority of Trondheim's population are in favour of the current framework. Collaboration within Greener Trondheim is currently functioning well and the network is stable. However, it is important to acknowledge the potential negatives. For instance, collaboration may not be as strong as publicly shown, and Greener Trondheim's functions can be problematic underneath. Therefore, the potential of failure needs to be evaluated. The network may in fact be fragile. For example, if one of the partners were to withdraw from the collaboration, the following consequences have to be taken into account. Is there a weaker partner in the actor-network that is Greener Trondheim? Internal power struggles may threaten the Greener Trondheim collaboration in the future. As both Fosslund and Lervåg argue, there currently exist on-going power struggles within the Greener Trondheim partnership. Fosslund (2019) argues that Greener Trondheim has been a successful innovation, but notes that there exist downsides. She argues that the public do not see power struggles that are currently occurring within the Greener Trondheim partnership. Furthermore, political disagreements about how Greener Trondheim operates could potentially affect the partnership.

Furthermore, Greener Trondheim also receives critique from the public. Licata (2020) lists a set of critical questions regarding different Greener Trondheim measures, while Tiller (2019) questions its financing policies. Future challenges may also depend on societal changes. The future of city development in Trondheim may demand that Greener Trondheim considers new movements and new needs for the inhabitants. The Greener Trondheim innovation has been established and successfully conducted development on many areas, but it has improvement potential. Greener Trondheim must consider the surrounding factors when thinking about future development. Social injustices, financial

unbalance, the amount of people making use of cars, and the amount of people making use of bicycles, are all examples of movements Greener Trondheim have to consider. The members and their status within the Greener Trondheim network may also cause future struggles. Fosslund (2019) argues that Greener Trondheim is dependant on other external actors to develop the city. Vegamot may be used as an interesting example. If Vegamot were to withdraw for one or another reason, Greener Trondheim would lose the actor responsible for financial collection from toll roads. Political shifts in the municipality councils may also cause unbalances with consequences for Greener Trondheim. Every single partner in Greener Trondheim plays an important role, and if one actor in the network were to drop out, the whole establishment could fall. However, if an important actor would leave the network, and dynamic nature of actor-networks argue that other actors may come in to take its position and adjust the situation. If Greener Trondheim considers such factors, the partnership and network may be developing in a positive direction, also for in the future.

During the interview with Henning Lervåg, we discussed further developing possibilities of Greener Trondheim. Lervåg (2020) says that it is at all times up to the parties to really want the collaboration to make it work. In the beginning it was win-win for all parties. The County Council received money for public transport purposes, the Norwegian Public Roads Administration received money for the development of state highways, and the Trondheim Municipality Council received money to develop many of the cities tasks, such as improving cycling roads. However, there currently exist more power struggle than it did in the early years. There exists a problem in that the government is the highest authority and may sometimes override Greener Trondheim. After a few years after Greener Trondheim's establishment a heavier tug of war for resources emerged. The Norwegian state is helping themselves to more resources for developing highways than it is set out in Greener Trondheim. For example, in 2014 Greener Trondheim came to an agreement on how to use the resources on public transport. However, the framework changed when the government set out their own conditions and how to distribute the funds. The government distributed more funds to highway development than what Greener Trondheim had done, and thus the other parties in Greener Trondheim received fewer resources for their purposes than initially planned. The government has the most authority, and their decision affect Greener Trondheim. Their measures do in fact overlap the ones from Greener Trondheim. This example also reveals how an actor that is enrolled into the network may have more power to affect city development than Greener Trondheim itself. There exists questions of power in the network, and opposing interests regarding Greener Trondheim's development may also become a challenge in the future. Potential future challenges may also originate from the inhabitants perspectives, which is discussed further on.

4.4.3 Social Injustice?

As mentioned earlier, the many visible improvements of infrastructure in Trondheim is important for Greener Trondheim's reputation, and a handful of mobility challenges have been solved. It is however important to note that there still exist those who are not in favour of toll roads in the Trondheim area, as earlier mentioned attitude statistics reveal.

For example, the toll roads do not make a distinction between poor and rich, and the fees can be financially demanding and heavy for many inhabitants. Although Nykvist (2020)

argues that there is reason to praise Greener Trondheim’s achievements based on its contributions, conditions may change and the city of Trondheim cannot take these achievements for granted. For instance, Greener Trondheim is closely linked with the zero growth goal, which is a very demanding goal considering the rapid population growth in Trondheim. Toll road prices in the Trondheim area need to increase heavily to limit the potential increase in car traffic, especially when peripheral neighbourhoods around Trondheim are being built to satisfy the growing population and housing demand (Nykvist, 2020). In a case where toll road prices increase in Trondheim, protest and political uproar may emerge, similar to the ones in cities like Bergen, Stavanger and Oslo. Thus, the toll road politically hostile FNB party could potentially gain local support in Trondheim as well, which in turn may threaten the Greener Trondheim partnership. Another potential issue relating to Greener Trondheim and the surrounding suburbs relates to the earlier discussed climate justice term and social matters. Attached below is an image that gives an overview of the toll road stations in the Greener Trondheim network, situated around the city centre:



Source: Vegamot.no (<https://www.vegamot.no/Kart-1.aspx>)

Greener Trondheim’s toll roads and their material politics may have different meaning to people living in Trondheim’s city centre, and for those living in the suburbs surrounding the city. The toll roads are usually situated around the main roads leading into the city, and to get there by car, passing toll roads are inevitable. Drawing on ideas from ANT, which explains the relations and involvement of materials of different kinds, this example is interesting to discuss. For people who commute to work in Trondheim, but live in suburbs such as Malvik and Heimdal, passing toll roads may be a necessary consequence. This may lead to financial consequences for the individual. As earlier discussed, some people may be satisfied by passing toll roads to support environmental causes that Greener Trondheim offers, and maybe also feel the ethical responsibility of local climate justice. However, the story may be different for people who must pass toll roads and that are obliged to pay fees. Therefore, the Greener Trondheim measures may also have different meaning for people who live in the suburbs surrounding Trondheim.

As mentioned in the literature section, climate justice may be taken into account in the Trondheim situation. The ethics and politics relating to climate change must also be understood at the urban scale (Bulkeley *et al.* 2014). Greener Trondheim has to a certain extent introduced climate justice to the city of Trondheim. Citizens seem to be aware and feel responsible as they are being offered knowledge on the climate. As environmental awareness and the local focus on climate justice may increase further, the amounts of money collected from toll roads may decrease. Fewer people may become willing to drive, and fewer cars may ultimately drive through the toll roads. Thus, the city of Trondheim will receive less money for city developing purposes.

On the other hand, the proposed benefits that have been born out of Greener Trondheim may not be beneficial for everyone. The climate justice term may be linked with the idea of toll rings in that they are political in this dynamic actor-network. Where some people may feel satisfied with driving as they can contribute to environmental causes by passing toll roads, others might feel ethically obliged to park their cars. On the other hand, some people might not be able to afford the toll road fees, and increases in prices may have social implications. Moreover, people who will not be able to afford the toll road fees might make use of bicycles and public transport on a larger scale, and thus feel the ethical responsibility posed by climate justice.

Greener Trondheim have contributed with bicycle roads and improved pedestrian streets with the intention to facilitate for different types of behaviour. However, the outcomes may be different than expected, and some people may engage differently with the technologies than expected. It depends on individual behaviour. If the citizens are willing to pay enough, they may also drive and pass the toll roads. Thus, the people may gain a type of ownership of the technologies. Participation is about ownership, like they are in the Ryghaug *et al.* (2018) article on solar panels and electric cars. The objects are political, and there are also questions of power involved with how the people in Trondheim engage with the technologies. Greener Trondheim owns the objects in the network, but the people may also acquire ownership of the technologies by engaging with them. As mentioned in the literature section, Sørensen (2013) argues that measures may stimulate ownership and use of cars. The toll roads may work as anti-socialisation strategies, as some people may choose to not drive. Some citizens may be environmentally concerned while others may be impatient consumers who are dependent on their cars. Some people may not make use of the bicycle roads, while others may not drive through the toll roads. It is necessary to explore the processes through which new technologies are embedded in society and how they are made sense of by users. Sørensen (2013) points this concern towards domestication theory, and how users manage cognitive challenges related to learning and understanding of different technologies. It is necessary that Greener Trondheim take private circumstances and opportunities the measures offer, when assessing the ownership and engagement with the technologies. Greener Trondheim may have a higher potential to develop in the right direction if the partnership acknowledges and considers the needs of the public, including potential societal shifts and political changes that are certain to emerge.

As earlier mentioned, city councils all over the world are preoccupied with finding solutions and developing sustainable and environmental friendly cities. The following and final chapter evaluates the potential transfer value of Greener Trondheim. What can be learned from Trondheim and the Greener Trondheim package? Furthermore, the final

chapter raises questions regarding what comes next and how Greener Trondheim can develop in the future.

4.5 Transfer Value – Are Local Domestications Possible?

Cities around the world are currently trying to learn from each other and engage in innovation transfer. This includes “exemplary” cities such as Trondheim, Tampere, Milan and Birmingham in terms of their sustainability (Bosse *et al.* 2013). This thesis’ findings will shed more important light to these innovation transfer efforts. Is Greener Trondheim strictly local and relevant for Trondheim, or can it be transferred to other cities?

4.5.1 Car Free Zones in European Cities

Climate change, air pollution and growing populations have made it necessary to reduce the amount of car traffic in city centres not only in Norway, but also elsewhere in Europe. How the cities are choosing to facilitate living and to organise activities have a great impact on the levels of greenhouse gas emissions (Skoglund, 2018). Many European cities are currently working toward car free city centres. During 2016, a selection of streets in Paris was made unavailable for cars as a part of a plan dubbed ‘Breathing Paris’. The plan was initiated following the release of a report from the French Health Directorate, which revealed that air pollution lead to 48.000 deaths in France annually (Elster, 2018). Within 2025, leaders from four city centre districts in Paris, including the city’s mayor Anne Hidalgo, want to make a part of Paris’ city centre completely free of car traffic. The Italian mayor Virginia Raggi, has made the same promise for Rome within 2024, and the German city of Munich have been working towards building car free areas in its city centre (Skoglund, 2018). Car restrictions in areas of Trondheim’s centre is also being debated, and 9 out of 10 are willing to travel sustainably into the city’s centre, according to a recent survey (Berge & Mørkrid, 2019). A car free town centre in Trondheim is therefore a realistic possibility. It is clear that there exist on-going discussions on how to solve future issues relating to the climate around Europe. How may lessons from Trondheim and Greener Trondheim’s accomplishments contribute to an understanding of how to successfully develop a city elsewhere?

4.5.2 Potential Transfer Value

As mentioned in the methodology section, this thesis focuses on the Greener Trondheim case and is based on experiences from Trondheim. The research may however open up for other cases, and methods and ideas taken from Greener Trondheim may have transferable value. The actor-network theory makes us as researchers able to analyse cities and their urban planning, based on the specific city’s principles and preconditions. According to Czarniawska and Joerges (1996, as cited in Myklebø, 2019), the translation of ideas is firstly about the discovery. The translation of an innovation or innovation ideas may be preceded by attention being drawn by an actor, for example a politician. The purpose of translation may originate from the wish to reproduce and copy an innovation, or from an actor wanting to gather ideas from an inspiration source (Røvik, 2007).

For instance, another city may experience similar challenges to those of Trondheim.

Therefore, my research findings may prove themselves relevant for other cities. If that is to happen, local domestications (Berker *et al.* 2006) of Greener Trondheim in the relevant cities are necessary. The actor-network theory, combined with domestication, may in fact be useful to study how the Greener Trondheim ideas may be transferred to other cases.

Greener Trondheim is an innovation that has been established by actors on the local arena. That fact alone makes the idea of Greener Trondheim relevant for other cities. The measures taken in Greener Trondheim may be possible to implement for the actors responsible for city development anywhere. Myklebø (2019) writes about how ideas may be interpreted based on local contexts, in that problems occurs locally and where the relevant actors may find solutions externally and solve problems thereafter. However, Røvik (2007) argues that organisations need to look for solutions when specific problems occur, and not explicitly adopt ideas because they are popular.

Thus, local interpretations are necessary. Technological, political, economic and geographical preconditions need to be taken into account locally for any city that wants to copy elements from either Greener Trondheim or similar frameworks. Heterogeneous actors may also form similar networks elsewhere, whether technological, political or geographical preconditions need to be taken into account. For example, geographical preconditions in other cities may be different, and the city may therefore not be able to build the same types of cycling roads or bus parking spaces as Trondheim has built. Other cities may have larger populations, different types of roads and other political systems. The cities therefore need to work with preconditions and possibilities locally.

The way in which Greener Trondheim is conducting city planning may contribute with valuable ideas for further understanding city development. The thesis has established that Greener Trondheim is a contested city package. However, the plan is increasingly gaining support from the public, and the trends of social acceptance reveal 'successful' elements of the Greener Trondheim partnership. On the other hand, the thesis has also established that complicated matters are necessary to reach this 'success', but these complicated matters are not unachievable. It is not impossible for a city to implement the same car restrictions and toll road regulations as Greener Trondheim have. It is not impossible for a city to facilitate improvements in infrastructure conditions for cyclists and pedestrians, to reduce the amount of car traffic. Communication and collaboration, in the spirit of NPG and such as Greener Trondheim is facilitating, may be key to conduct city planning in a positive direction. The actor-network theory shows that the translations of knowledge and collaboration methods that are occurring in the Greener Trondheim network play an important role in its positive development. Greener Trondheim may be argued to be a developing in a positive direction because many of the actors involved in the network currently perceive it a success.

Many different actors are involved and believe in the project, both human and non-human, and the network is currently expanding. The co-production of knowledge and engagement of citizens are important matters in Greener Trondheim. The mobility advisors example reveal how Greener Trondheim is actively attempting to reach out to the citizens, which may give them the opportunity to make up their own interpretations of Greener Trondheim's contributions. These examples may also occur in other cities, if preconditions and local factors are taken into account first. Local domestications and implementations of ideas from Greener Trondheim may thus be highly relevant for cities

elsewhere. An increasing amount of actors are in fact being enrolled into the Greener Trondheim network. The innovation is getting more popular, not only in Norway but also abroad. The positive national responses have made certain cities from Poland and Sweden curious, and they visited Trondheim to learn more about the ways in which Trondheim conduct city development, and to learn more about the Greener Trondheim partnership (Fosslund, 2019). In the light of the actor-network theory, this shows how the network is expanding, not only in Norway, but also abroad in that Greener Trondheim is gaining interest from foreign cities. Translations of knowledge from Greener Trondheim are in other words occurring also outside of Trondheim's city borders.

5. Concluding Remarks: What Comes Next?

The Thesis' Findings

The introduction of the thesis raised the research question that asks: *Is the mix of socialisation, public engagement and materiality the key to developing Trondheim as a sustainable city?* The thesis has shed light on how Greener Trondheim is a new kind of site for engaging with the citizens, and how objects that are a part of the network have become sites for public engagement. The network is continuously assembled from heterogeneous actors (objects, citizens, and much else besides), and the mix of socialisation, public engagement and materiality is key to developing Trondheim in a positive direction. However, to further develop the city in that direction, Greener Trondheim must indeed continue to consider such factors.

The analysis in this thesis has shown that the concept of ANT may help us understand how ideas, people and objects form an actor-network, and the empirical observations have demonstrated the complexity of the Greener Trondheim network. ANT has conceptualised how it has been possible to bring all the heterogeneous actors into coherence, and why it has been produced as a perceived 'publicly accepted' innovation. ANT has explained how Greener Trondheim was assembled as an "actor-network". The thesis has made use of policy history, and described how environmental politics shifted especially in Norway and also more widely shaping Norwegian local politics. Thus, the thesis was able to give an understanding of Greener Trondheim's formation, based on increased climate awareness both internationally and nationally.

The empirical examples have examined how Greener Trondheim is facilitating for socialisation and engagement to mobilise the citizens through the measures they introduce. The example of Greener Trondheim's mobility advisors explained how this socialisation process takes place, in the spirit of NPG. In the Greener Trondheim situation, the actor-network theory conceptualises objects, such as toll roads and bicycle roads, as sites that may provoke political debate, and as materials that can be contested, accepted or rejected by the people. Furthermore, in the spirit of ANT, the thesis' has explained the significance of both human and non-human actors, which are tied together in a socio-technical relationship in the Greener Trondheim network. The automatic bicycle counters and bicycle roads are ways in which Greener Trondheim are attempting to facilitate engagement and prove to the inhabitants that they are investing money for city development purposes. The thesis also argued that Greener Trondheim is attempting to govern the people, by introducing objects such as the automatic counters, which are

aimed at affecting peoples' practices. These points are also supported by examples, such as Greener Trondheim introducing new bus systems and attempting to steer the inhabitants through 'nudging'.

Furthermore, the thesis discussed potential future challenges for Greener Trondheim. Informant data has revealed that there may exist internal power struggles, and that the network is potentially fragile. Political shifts and changing conditions in Trondheim may also affect the Greener Trondheim network. Furthermore, Social injustices and financial unbalance are examples that may threaten Greener Trondheim's existence, and the thesis has argued that they must consider such factors when thinking development in the future. Greener Trondheim cannot take the achievements for granted, and a continuous focus on development is necessary. However, the thesis explained how the dynamic natures of actor-networks reveal how significant actors may be replaced to adjust a potential challenging situation.

Finally, the thesis evaluated the potential transfer value of the Greener Trondheim innovation. The thesis established that cities around the world are currently trying to learn from each other and engage in innovation transfer, and has argued that Greener Trondheim ideas may be transferred to other cities. However local domestications and preconditions must be taken into account to transfer ideas from Greener Trondheim. The thesis has established that Greener Trondheim is a contested city package. However, the plan is increasingly gaining support from the public, and the trends of social acceptance reveal 'successful' elements of the Greener Trondheim partnership. Communication and collaboration, in the spirit of NPG, and such as Greener Trondheim is facilitating, may be key to conducting city planning in positive directions also elsewhere.

In terms of sustainable development, the thesis has explained how Greener Trondheim is a 'nudge' in the right direction. The partnership has so far developed the city in a positive direction, which is accepted in many ways by the local population. New networks, social injustices and societal changes may however emerge to threaten the network.

What Comes Next for Greener Trondheim?

This thesis has told the story of how Greener Trondheim started as an idea on Trondheim's City Council, and how the idea was realised and further on developed to become a comprehensive network. The Greener Trondheim network is continuing to expand locally, national and internationally. Since its formation in 2009, an increasing amount of actors have become involved with its work.

Some stories are evidence of positive measures, while other stories suggest that Greener Trondheim is fragile and may encounter trouble. If the partnership is going to continue to develop in a positive direction, many factors must be considered. As earlier mentioned, social injustices and financial unbalances are examples Greener Trondheim may have to consider. Furthermore, societal changes and movements must also be considered. The Covid-19 outbreak has had a massive impact on society, politically and economically.

Recent research reports reveal an increasing intention by Chinese consumers to buy a car in response to the Covid-19 outbreak. The outbreak of the virus has caused mass disruption to public transport and raised concerns about safety. Furthermore, private cars

had jumped to the most favoured transport mode, with public transport falling (Polis, 2020). How will Covid-19 affect Greener Trondheim's work? During the Covid-19 crisis, public transport in Trøndelag has lost 17 million NOK. Recently, the County Council asked for support from the Norwegian government, in order to prevent reduced public transport offers after the forthcoming summer (NRK, 2020). As revealed in the analysis, private car use increased during 2019 in Trondheim. Based on the numbers from Trøndelag County Council, it is likely that these numbers will continue to increase, as a result of the Covid-19 outbreak. Thus, Greener Trondheim must consider challenges relating to increased car traffic. As mentioned, many European cities are currently banning cars in their city centres. Greener Trondheim may want to follow such examples, while facilitating for increased activity for bicyclists and walking.

However, increased use of cars mean more money collected for developing purposes in the Greener Trondheim package, and increased support from the Norwegian government. Thus, Greener Trondheim may be able to develop new methods and strategies, such as restrictive car measures, or technologies that may further develop the mobility potential in the city of Trondheim. If Greener Trondheim considers such factors, the way of adapting sustainability in city development may be taken one step further.

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