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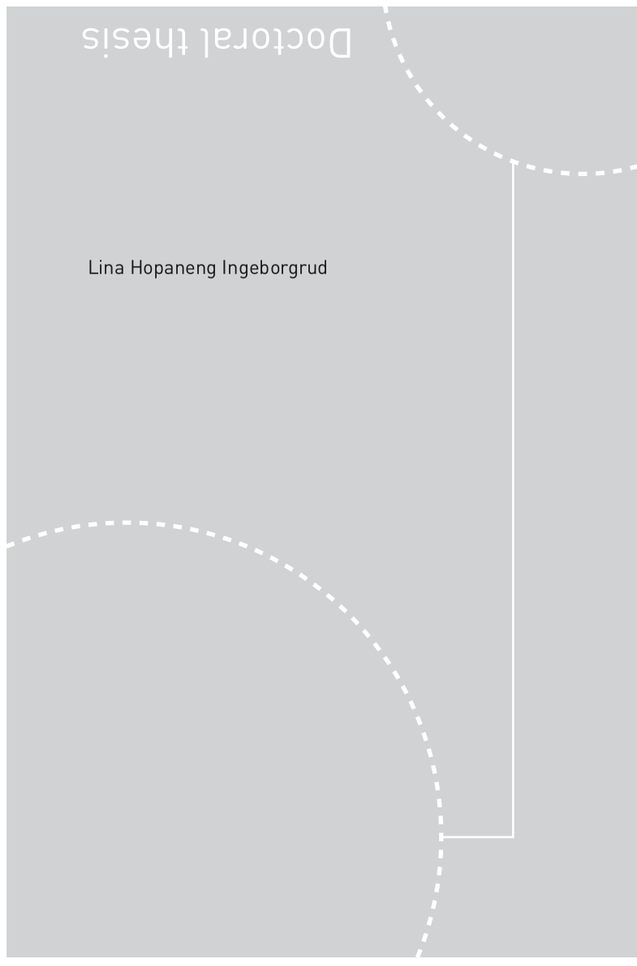
Lina Hopaneng Ingeborgrud

Learning urban sustainability

Making visions and knowledge for cities of the future

Doctoral thesis



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ISBN 978-82-326-3100-1 (printed ver.)
ISBN 978-82-326-3101-8 (electronic ver.)
ISSN 1503-8181

NTNU
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Science and Technology

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Doktoravhandlinger ved NTNU, 2018:155

Printed by NTNU Grafisk senter

Preface

So, this is it. When I embarked on this project in August 2014, I had recently delivered my Master's thesis in the same department, and had already spent five years studying at the Dragvoll campus. In spite of this, I knew little about what was going on in building 5 and 6, floor 4 (the previous location of the Department), and I did not know what to expect out of being a Ph.D. candidate. Writing this thesis has led me to places I would otherwise not have travelled and to people I would probably not have met. In other words, it is about time to give my deepest thanks to all of those who have given of their time and interest, read and commented, discussed, and in general been great people with whom to spend these years.

First of all, I am grateful to my two supervisors, Vivian A. Lagesen and Knut H. Sørensen, for your dedication, support and close supervision. Vivian, you let me know from the very beginning that this was something I could do. Your insights and enthusiasm have been important motivation and inspiration. Knut, you reminded me early on of the importance of having 'stamina'. You have patiently read and commented upon what sometimes felt like endless drafts, with an amazing ability to always find a solution (and by that, some problems too). A huge thanks also goes to Lucía L. Muñoz in the project team for being my guiding star into academia.

Further, I would like to thank my colleagues in the Department of Interdisciplinary Studies of Culture for creating such a pleasant working environment. I am particularly happy for our Agraphia writing group – thanks to Roger for initiating and managing the group, and to all of you who have sustained it. Kari Bergheim and Lotte Sæther, you always make the administrative work go smoothly, and I would like to thank you for the way you welcomed me to the department in 2014. And thank you so much, Ivana, for taking on multiple roles as discussion partner, critical reader, film-making and travel team, supporter, and friend. I look forward to continuing sharing office with you.

I would also like to give a big thanks to all my informants, especially those I shadowed in the planning agency in Bergen and Trondheim. Without you, I wouldn't have had much to write about. I am grateful for your time and your patience.

Lastly, I would like to thank my family and friends for your love and support. Some special thanks go to Torgeir for following me and this project around the world, but most of all for being there when I come home.

Trondheim, March 2018

Lina H. Ingeborgrud

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1. Creating sustainable cities for the future

> Los Angeles 2049: The city is covered in fog and rain. Skyscrapers are reaching for the sky, but you cannot see the top of them. Androids, known as replicants, transport themselves in flying automobiles. There are no trees left, no parks, and no children. The only colors in the city come from commercial screens on dark buildings.[1]

Images of future cities are present virtually everywhere: in popular culture, scientific reports, planning documents, advertising, and so on. A Google image search for 'Cities of the future' yields pictures of cities that look as if they were taken from the set of a science fiction movie. The vignette above describes a still image from the film Blade Runner 2049 depicting fatal environmental hazards, and serves as a warning of transformations to come. In this sense, visualizations of the future may be expressions of fears, desires or political statements. Such representations tell us stories about our current reality–what is, the way things are today—and what the future may hold. These visualizations, utopic or dystopic, underscore the idea that technological futures are value-laden (Jasanoff, 2015: 337). There is always a choice regarding which futures to make. Futures are thus the results of the everyday practices and inter-relations of humans and non-humans. This thesis carves out a space for the interpretation of cities as ongoing materializations of the future, of visions, politics and technological possibilities.

The principal question then is how to avoid the dystopic world portrayed not only in science fiction, but also in reports from the scientific community at large, like the one issued by the Intergovernmental Panel on Climate Change. For it is widely accepted that generating knowledge to improve urban sustainability is not necessarily a straightforward task. One reason may be that planning sustainable cities is a 'wicked problem' (Churchman, 1967; Rittel & Webber, 1973), that is, challenging to solve because the relevant actors do not necessarily agree on how to define the problem, and consequently how to solve it. A first step would be coming to an agreement on how to frame the issue of urban

[1] My description of a still image from the film *Blade Runner 2049* (Denis Villeneuve, 2017), the official trailer: https://www.youtube.com/watch?v=dZOaI_Fn5o4

sustainability. This work would involve, among other things, reaching consensus and achieving a common vision for the sustainable city of the future. In order to do this, it is important to study the negotiation of visions and the management of urban development.

This thesis focuses on how city actors in Norway 'learn' urban sustainability. That is, how they frame the issue, produce relevant knowledge, acquire the necessary expertise, and attempt to share relevant expertise. In other words, this project examines the ways in which city actors enact knowledge to improve sustainability in an urban milieu. To this end, it is important to study efforts made by local governments because they are responsible for several tasks related to sustainability. In Norway, this includes infrastructure and buildings (including water systems and sewage), transportation, power systems, industrial plants and climate adaptation. Scholars have pointed to the fact that Norwegian local governments often lack sufficient knowledge to handle environmental concerns (Aaheim et al., 2009; Harvold et al., 2010). Further, there often exist unclear responsibilities, lack of clear national guidelines and legislations (Aall et al., 2009). In a different perspective, Næss et al. (2011) argue that Norwegian municipalities lack the ability to domesticate knowledge, which entails attributing practical and symbolic meanings to knowledge in order to perceive it as relevant for application. These obstacles suggest that the problem of creating urban sustainability is not only a question of knowledge deficit among local government actors, but relates as well to challenges of organizing and translating experiences in meaningful ways to those responsible.

In order to investigate how city actors learn urban sustainability, I draw from theoretical and methodological approaches stemming from Science and Technology Studies (STS). Concepts from STS are well suited to study socio-technical issues like urban sustainability because the concepts underpinning the discipline focus on the ongoing shaping of technologies, knowledge and practices. My decision to study learning in the context of urban sustainability is not arbitrary. Cities produce around 75% of the world's greenhouse gas emissions, they are home to half of the world's population, and almost 80% of EU citizens will live in cities by 2020.[2] For several years, there has been a worldwide political push to transform urban areas into 'sustainable cities', positioning cities as key

[2] European Commission (n.d.) *EU Policy on the Urban Environment – Overview*. Last accessed 14.06.2017 from http://ec.europa.eu/environment/urban/index_en.htm

intervention sites for responding to challenges of climate change (Bulkeley & Betsill, 2003). For instance, speakers at the UN Climate Change Conference (COP21) in Paris 2015 stressed the importance of leadership from city actors to reduce climate gas emissions[3]. The question remains as to how city actors prepare for assuming a leadership role, and how such a role is implemented in practice.

Norway provides a relevant context to study urban sustainability. To begin with, between the late 1960s and mid-1970s increasing attention was devoted to environmental issues, giving rise to several environmental NGOs. For example, in 1967 'Natur og Ungdom' (in English 'Nature and Youth') was created and today represents the largest environmental youth organization in Norway. In 1974 'Framtiden i våre hender' (in English 'The Future in Our Hands') was founded, Norway's largest environmental NGO. And in 1970, Carlsen and Ystgaard discussed car-related problems such as congestion, pollution, noise and accidents in their book entitled 'Trafikkrigen' (in English 'The Traffic War'). The book clearly warned against 'American-like' car conditions in Norwegian cities (Carlsen & Ystgaard, 1970: 97).

Moreover, Norway has a long history of environmental governance. In 1972, Norway was the first country to establish a Ministry of Environmental Protection. Norway also led the World Commission for Environment and Development (known as 'the Brundtland Commission') that published the well-known report 'Our Common Future' in 1987, launching the term 'sustainable development' for the first time. Today there is consensus in Norway that industry must undergo a 'green' transformation (referred to as 'the green shift') in order to reach national targets of mitigation and become a low-emission society. This imperative is further reflected in the Climate Settlement of the Parliament, signed in 2008 and 2012 (White Paper 21, 2011-2012), and White Paper 33 (2012-2013). White Paper 21 (2011-2012: 177) states that planning decisions made today will have a significant impact in the long run.

While the call for sustainability in cities was already present in Carlsen and Ystgaard's 'Traffic War' from 1970, the national government took action in cities with several urban

[3] John Vidal 07.12.2015. *Feted by Hollywood, city mayors take starring role in Paris climate talks.* Last accessed 06.02.2018 from: https://www.theguardian.com/cities/2015/dec/07/hollywood-city-mayors-paris-climate-talks-di-caprio-redford?CMP=fb_a-cities_b-gdncities

development programs implemented during the 1990s: 'Miljøby' ('Environmental city') from 1993-2000, 'Samarbeidsforum for storbyutvikling' ('Collaborating forum for development in large cities') and 'Grønne energikommuner' ('Green energy municipalities') from 2007. Grønne energikommuner was particularly focused on renewable energy and energy efficiency in the participating municipalities (Aall et al., 2009: 11). The program became part of the pilot network 'Livskraftige kommuner' ('Viable municipalities') from 2006 to 2010 and was charged with establishing networks between the participating municipalities, with the objective that participants should learn from each other's experiences (Aall et al., 2009). All the aforementioned urban development programs involved collaboration between professionals and policy-makers in the national and local governments. The most recent program that built on previous experiences was called 'Cities of the Future' (2008-2014) from now shortened to 'CoF'.

CoF was first mentioned in White Paper 34 (2006-2007: 142), which emphasized that cities, as sites of high density, active economy and growing population, are important arenas to reduce greenhouse gas emissions and thereby contributing to healthier societies. The national government invited the largest cities (or city areas) into a partnership to develop more sustainable cities. White Paper 34 (2006-2007: 143) stated that the experiences from the CoF program would be disseminated and implemented in national climate policy, as well as in the cities that were not invited to CoF, making the dissemination of knowledge a crucial part of the program. To facilitate such knowledge exchange, the national government organized the CoF program as a collaboration between the national government[4], the 13 largest cities in Norway (by population)[5], the business sector[6] and the Norwegian Association of Local and Regional Authorities ('Kommunenes Sentralforbund'). The main goal of the program was to reduce the total level of greenhouse gas emissions from road transport, energy use in buildings, consumption and waste in the participating cities, and to improve these cities' abilities to adapt to climate change. The

[4] Four main ministries were involved, here referred to with their English names in 2017: Climate and Environment; Local Government and Modernization; Petroleum and Energy; and Transport and Communication.
[5] Thirteen cities/city areas were involved: Oslo, Bergen, Trondheim, Stavanger, Kristiansand, Tromsø, Drammen, Sarpsborg, Fredrikstad, Porsgrunn, Skien, Bærum and Sandnes.
[6] The business sector was represented by: The Confederation of Norwegian Enterprise ('Næringslivets Hovedorganisasjon'; NHO), the Enterprise Federation of Norway ('VIRKE') and Finance Norway.

secondary goal was to improve the urban environment in terms of ecological cycles, safety, health, experiences and commercial development (Ministry of Environment, 2012: 6).

The national government (Ministry of Environment, 2012: 10) expected the program to serve as an arena for coordination, collaboration, innovation and dissemination of experiences, including developing and disseminating new tools and strategies: for example, green nudging and climate gas accounting, contribution to policy documents like the national transport plan, and 'blue-green factor' (Rambøll, 2015: 4). The latter is a way of utilizing parks and streams/rivers in the city to deal both with storm water issues and improve the urban aesthetic environment. The national government also expected that the cities would facilitate a sustainable lifestyle for inhabitants by using campaigns to raise the level of awareness, and to guide energy saving and recycling practices (Ministry of Environment, 2011: 9). The new tasks in the CoF program came with additional costs to local governments. The national government contributed yearly with 1 million NOK (approximately 100.000 EURO) to all participating cities, and the cities could also apply for additional funding (Framtidens byer, n.d.: 11). According to regular procedures, the cities had to contribute as a minimum the same sum as they were allocated (Framtidens byer, n.d.: 12).

The Ministry of Environment was responsible for the management of CoF from the beginning, but was superseded by the Ministry of Local Government and Modernization from 2014, which stated the following vision for future sustainable cities in Norway on the CoF website:

> Cities of the future are densely built. This enable us to walk and bike instead of using cars, and we pollute less. Fewer cars also give space for more bicycle lanes and green parks. This will make the city more beautiful – and us healthier. In addition, parks are good tools for handling storm water, which we should expect and prepare for in the future (Ministry of Local Government and Modernization, 27.08.2014)

The national government stressed the importance of making visualizations, such as pictures and models of future cities as a tool to discuss development, and to foster dedication and

collaboration between organizations, the business sector, and the public (Ministry of Environment, 2011: 2). The CoF website also provided a tool and means for collaboration. The website, created by the program administration in CoF, contained information about the program, its goals, and a collection of pilot projects available to all participants and the general public[7].

All parties involved in CoF were required to sign a letter of intention. The mayors from the 13 participating cities, representatives from the four Ministries, and the Norwegian Association of Local and Regional Authorities signed the first letter of intention in 2008. This letter was superseded by an agreement between the parties in 2009, and the business sector committed through their own Letter of Intention in 2009 (Ministry of Environment, 2012: 10). The letters of intention stated that city government actors were to play a key role in reducing greenhouse gas emissions, but that they had to collaborate closely with national authorities. After signing the letters of intention, the cities developed goals, strategies and activities for the program in local action plans, which had to be politically enacted in each city.

The Ministry of Environment organized CoF as a network model. The program was divided into five thematic interdisciplinary networks: (1) land use and transportation; (2) stationary energy use in buildings; (3) consumption and waste; (4) climate adaption; and (5) better urban environment. The first four were chosen by input from the cities themselves, as these were areas on which municipalities had certain impact. The program administration of CoF expected the theme of a better urban environment to be a crosscutting topic of the other networks, but chose to make this an independent network from 2011. CoF was organized as a network to create an arena where participants could inspire each other, discuss knowledge, strategies and tools in order to reach the goal of the program (Rambøll, 2015: 12). In this respect, the program aimed to strengthen collaboration and coordination between participants (Rambøll, 2015: 7), both horizontally between the 13 cities, and vertically between the national and the local governments. The program's specific focus on

[7] The website changed during the course of the program. This is the version as of February 2018: www.framtidensbyer.no.

collaboration and coordination (at the time of its origin) reveals that these two areas do indeed pose a challenge to sustainable city planning in Norway.

Transport was one of the main thematic networks of the program. Local governments are responsible for transport and land use planning through the Plan and Building Act, and transport is thus an important domain local governments may target to reduce greenhouse gas emissions (White Paper no. 34, 2006-2007: 138). In the context of this research project, I am particularly interested in how city actors learn sustainable transport planning. Transport requires large investments, and some Norwegian cities, like Bergen and Trondheim, have organized sustainable transport work into a partnership between the state (represented by the National Public Roads Administration), the county and the municipality. In Trondheim, the program is called 'The Green Partnership Agreement' and in Bergen 'The Bergen Program for Transport'.

There is clearly a need to know more about how city actors frame problems in the context of urban sustainability, and not least how knowledge 'travels' between cities, and between cities and other actors, such as the national government. I draw on the CoF program as the basis for an exploration of how city actors learn urban sustainability in Norway. Hence, my empirical data derives from interviews and observations (shadowing) of city actors either directly involved in the program, such as the program administration in the national government, and/or city actors working with projects considered important within the program. This includes those working with public transport planning in Trondheim and Bergen. I will return to a description of methodological choices in section 7.

Rambøll Management Consulting conducted a follow evaluation of the CoF program from 2010 to the formal ending in 2014 to assess whether the program had reached its goals. Rambøll (2015: 44) concludes that it was difficult to evaluate whether the program led to a reduction of greenhouse gas emissions because it was limited to six years. However, the program succeeded as a tool to develop new knowledge as well as the cities' ability to act in the area of urban sustainability, and it also contributed to strengthening the coordination and collaboration between the parties involved (Rambøll Management Consulting, 2015: 45). It is not the aim of this project to evaluate whether the CoF program

was successful or not. Quite the contrary, my point of view is based on the relevant actors' understanding of urban sustainability and of how they considered the program. I use CoF to investigate learning in the context of urban sustainability work. My aim is to explore how city actors learn to make sustainable cities. This work is obviously knowledge intensive, but what interests me here is how is it performed and with what effects? How do city actors learn to enact what they consider to be sustainable practices in an urban milieu, what visions guide their work, and how do they share this knowledge?

The rest of this thesis is organized as follows: in section 2, I give a summary of the three papers that form the core of the thesis and identify central questions for further investigation. Section 3 gives a brief overview of previous research on cities. Here, I give a short account of how cities are understood in the existing literature, followed by a description of the increasing focus on cities as sites of experimentation and learning with respect to sustainability. Section 4 is dedicated to theories and perspectives on learning and knowledge. I do not go into cognitive learning theories, but rather, in line with STS theoretical perspectives, stick to practice-based approaches to learning in general, and sociomaterial perspectives in particular. The main question in section 4 is how to account for the ways in which city actors learn, enact and share their experiences among other city actors. I start out with a brief introduction of the management of innovation literature, and compare this to the literature on learning in organizations. This is followed by an introduction of sociomaterial learning perspectives, specifically the social learning of technology framework. I build on the insights from section 4 in section 5, which is a crosscutting analysis of the three papers. Here, I discuss the CoF program as consisting of several urban laboratories and their interrelatedness. The main part of the crosscutting analysis discusses three main aspects of social learning in urban sustainability, namely context, practice and outcome of learning. I wrap up the crosscutting analysis in a discussion and conclusion in section 6. Moreover, in section 7, I give an account of my methodological choices and reflections that occurred along the way. This section also includes a detailed overview of the empirical data, as well as how I have analyzed this material. Finally, I provide the three papers.

2. Summary of papers

The three papers that comprise this thesis all explore and discuss, albeit in different ways, processes of making, learning and sharing knowledge relevant to improving the sustainability of Norwegian cities. Paper 1 focuses on how the national and local governments in Norway envision the sustainable city of the future, paper 2 is concerned with urban planners' actual practices of enacting urban sustainability, while paper 3 discusses how public transportation projects are realized in two different city contexts, namely Trondheim and Bergen. In section 5, I will give a more thorough analysis of what can be learned from the three papers when they are read together as one story. The following section is limited to a short summary of each paper.

Paper 1: Visions as trading zones: national and local approaches to improving urban sustainability[8]

This paper examines national and local government actors' visions and expectations of sustainable cities of the future in Norway. The object of study is the multilevel governance program 'Cities of the future' (CoF), operating from 2008-2014 in Norway. The paper draws on interviews with planners and policy-makers involved in the program, newspaper articles and policy documents addressing urban sustainable development in Norway, and a one-month shadowing experience that took place within two planning agencies in Bergen and Trondheim.

The paper departs from the assumption that it is collective visions that guide urban development work. Previous literature on urban sustainability and multilevel governance stresses the importance of shared visions and goals between stakeholders. Drawing on the concepts of trading zones (Galison, 1996), scenarios (Callon, 1987), and the sociology of expectations (for instance Borup et al., 2006), I ask to what extent there actually was alignment in the visions and expectations of national and local government actors. I explore the notion of alignment in relation to three topics: 1) the content of a future sustainable

[8] Published as Ingeborgrud, Lina (2017). Visions as trading zones: national and local approaches to improving urban sustainability. *Futures*. Vol. 96, pp. 57-67.

city, 2) the distribution of responsibilities among different levels of governance, and 3) citizens' role in future sustainable cities.

Overall, national and local government actors possessed a shared understanding of the content of a sustainable city. This included, among others, the importance of creating a compact city with public transport, bicycle and walking infrastructure. The city actors at the level of local government, however, had to deal with complex and partly conflicting issues when translating the overarching goals into concrete plans and projects, issues that were overlooked or unaddressed by the national vision. Regarding the second topic, distribution of responsibilities, actors at the national government level presented local governments as the main actors of urban sustainability transitions, while viewing their own role mainly as that of funding provider. National government actors argued that the cities in question already had the necessary tools at their disposal. Local government actors contested this latter claim, arguing that the national government should take a more active and comprehensive role. Concerning the last topic, the role of citizens in future sustainable cities, actors at the national level expected citizens to adapt to an environmentally friendly lifestyle through a combination of legal measures and by raising their awareness of climate change issues. As citizens were thought to have quite predictable behavior patterns, they considered it a manageable task to engage citizens in urban sustainability efforts–it sufficed to make use of the right measures. To a certain extent, the local government actors also agreed that citizens would act in accordance with standards and regulations. Still, they voiced concern about public indifference, resistance or protest, and considered it difficult to predict the behavior of inhabitants.

The paper thus finds that the visions of national and local government actors were partially dis-aligned. From these differences, I identify two assemblages that I call 'the attractive city' and 'the complex city'. 'The attractive city' assemblage was a vision constructed by national government actors, re-assembled and diffused through newspaper articles, documents, and interviews. Its main constituents were ideas concerning the pleasant features of sustainable city life and beliefs that holistic city planning would help realize this ideal. 'The complex city' assemblage was a vision constructed mainly by city actors (including regional stakeholders), re-assembled and diffused from the same sources

as 'the attractive city'. 'The complex city' was comprised of the same general sustainability goals but included in addition several elements of concern.

Even though the visions were not completely aligned, participants at the national and local levels considered the Cities of the Future program to be a success, particularly due to the learning networks that emerged from the program, which enhanced collaboration between local government actors. An important conclusion that I draw from this analysis is that we must remain cautious and refrain from emphasizing the importance of consensus and shared visions in the realization of large sociotechnical projects. In the paper, I find that the processes of vision making fostered discussions about how to make and utilize experiences in urban sustainability work. I suggest that vision making enabled a sort of trading zone where the participants could discuss problems, solutions, and expectations concerning future directions in urban sustainability work. This points to the importance of opening up the scope of the study beyond the content of the visions to include the effects of visions in the process of making.

Although it was important for the participating cities to learn from each other in the horizontal networks, they still expressed a desire for stronger interest and involvement from national government actors. For instance, urban planners in local governments highlighted the importance of predictable long-term funding from the national government, particularly to operate public transportation. This observation would certainly be of interest to national-level policy-makers.

Paper 2: Social learning for urban sustainability: Transdisciplinary and translocal[9]

This paper studies urban planners' social learning within the context of a Norwegian program for urban sustainability called Cities of the Future (CoF). The paper draws upon a 'knowing-in-practice' approach and combines two concepts to analyze the dynamics of such social learning: transdisciplinary and translocal learning. The concept of transdisciplinarity (Gibbons et al., 1994) is used to highlight the way in which social learning emerges in the combination of different sources of knowledge, including experience, when

[9] Under submission. This paper is co-authored with Lucía Liste Muñoz and Knut Holtan Sørensen.

engaging in 'problem-solving in the context of application'. The concept of translocal learning (McFarlane, 2009), comes from social geography and studies of urban policymaking, and suggests the importance of learning through moving knowledge across localities. The paper draws on a one-month experience of shadowing two planning agencies in Bergen and Trondheim, interviews with planners and policy-makers in the national and local governments involved in the CoF program, and policy documents addressing urban sustainability in Norway.

Empirically, we find three main practices involved in the enactment of urban sustainability, namely 1) developing pilot projects, 2) creating narratives, and 3) carrying out site inspections. Pilot projects were a main pillar of the CoF program and were to serve as examples of 'best projects'. The pilot projects were experimental and innovative and presented opportunities for learning new ways to improve urban sustainability. The making of these pilot projects involved transdisciplinary social learning on the basis that they were expected to solve specific problems in an identified context of application. Further, the making of these projects involved a combination of several professions and disciplines, as well as experience from the actors involved. However, the actors involved in the development of pilot projects also brought in knowledge from cities both involved in the CoF program and outside the program. The knowledge that travelled between cities was as much a composite as the knowledge developed within the pilot projects. The pilot projects thus displayed both transdisciplinary and translocal social learning.

A further finding was that several forms of translocal learning occurred. We observed two main exemplars, narratives and site inspections. The urban planners shared narratives of best urban design, and we identified three types of narratives: promotional, expertise and measurement/tool narratives. Promotional narratives were mostly inspiring and motivating. They concerned the rationale for why a particular project was considered important and why it should be a model for initiatives in other cities. Expertise narratives were about how a project had been undertaken, how problems had been solved, and how such projects should be carried out based on new experience. Measurement or tool narratives focused on methods for assessing, e.g., climate footprints. One of the CoF program managers elaborated on the importance of sharing stories and argued that stories of successful pilot projects had been very important in the CoF program.

The other form of translocal social learning was based on a particular kind of movement of people, what in the context of CoF was referred to as a site inspection. Site inspections were visits to locations with achievements relevant to planning for sustainability with the intention of learning about the distinctive features of local designs. Here, the CoF participants sought inspiration and were presented with the opportunity to get 'hands-on' experience with a particular urban design.

One important conclusion in the paper is that transdisciplinary and translocal learning are twin concepts that capture different aspects of the knowledge-in-action processes related to the CoF program. Thus, we argue that the combination of these two concepts gives new insight into social learning of technology. 'Transdisciplinarity' highlights that diverse forms of knowledge are combined and how this occurs. 'Translocality' represents an emphasis on the displacement of knowledge. Employing both concepts help sensitize analysis to both processes of combining and displacing knowledge as enactments of learning. A more policy-oriented finding in the paper is the importance of facilitating horizontal learning networks between cities, as the interviewees stressed that this was the main success that emerged from the CoF program. Though local government did request more funding and active participation from the national government (as illustrated in paper 1), paper 2 shows that cities found much inspiration in visiting each other, and suggests that they are more interested in learning from other cities than from national authorities.

Paper 3: The shaping of urban public transport: two cases of alternative leading objects

In this paper, I explore the shaping of urban public transport by using the concept of technological frames (Bijker, 1995), which denotes relevant social groups' common interpretation of an artifact. I investigate what I call 'alternative leading objects' by comparing the Norwegian cities Trondheim and Bergen, which have chosen different public transport technologies, bus and light rail systems respectively. I focus on how the relevant social groups develop frames (framing practices), and the consequences of these frames for their further planning work. Empirically, I critically analyze the arguments put forth by the planners and policy-makers involved in sustainable transport planning in both cities. The paper draws on an observational study in the transport planning offices of

Bergen and Trondheim, interviews with planners and politicians in these cities, and analyses of newspaper articles and documents addressing sustainable transport planning in Bergen and Trondheim.

I begin the paper by pointing to that cities are recognized as promising sites to reduce emissions and that transport plays an important role in this regard. A major focus and challenge has been to achieve a modal shift from driving cars to the use of public transport. What kind of technologies are called for to achieve this shift and how are they framed? The paper pursues these questions by investigating the shaping of public transport in two of Norway's largest cities, Trondheim and Bergen. Trondheim has decided in favor of a new and more sustainable bus system, the metrobus, while Bergen has invested in a light rail system. The paper analyzes the arguments forwarded by local policymakers and transport planners regarding the relevant technological options and their navigation through these options when trying to increase the use of public transport. I use the notion of 'alternative leading object' to designate the technology that seems to dominate the local transport actors' ideas about public transport.

I take the relevant social groups, which in my case consist of local and regional transport planners and policy-makers, as point of departure for the analysis. I call the relevant social group favoring a bus technology in Trondheim 'the bus group' and the relevant social group advocating a light rail in Bergen 'the light rail group'. These groups developed what I call 'the bus frame' and 'the light rail frame', respectively. I find that the development of these frames, what I call framing practices, was complex and involved controversies regarding choice of alternative leading objects in both cities. The frames became a simplification and contributed to order various elements such as topography, demography, transport history, densification, expectations, financial opportunities, symbolic values and user configurations. The framing practices included above all engagement with the respective city identities, and the relevant social groups introduced their perceived problems of urban mobility into this identity. The bus group in Trondheim and the light rail group in Bergen developed similar problem definitions in which they emphasized issues of topography, demography, space scarcity, and in Bergen also local air pollution. Nevertheless, these groups chose different alternative leading objects, and I argue that was due to how they interpreted the city identities differently.

I claim that the bus group and the light rail group developed their reasoning of an alternative leading object simultaneously with an interpretation of their respective city identities. Both groups represented Trondheim as a small and circle-shaped city, in which a bus system was suitable, and Bergen as a rectilinear-shaped city in which a light rail was a good choice. The bus group in Trondheim also frequently pointed to the flexibility of a bus system and how economically beneficial the bus was compared to building a light rail. They also expected the proposed metro bus technology to help densify the settlement in Trondheim along the three expected metro bus lines. In this sense, the bus was also a far-sighted alternative leading object, which would make Trondheim more compact in the future. The light rail group promoted the light rail as in line with but also contributing to the symbolic identity of Bergen as a modern and international city.

The paper illustrates that the bus group and the light rail group's user configurations (Woolgar, 1990) were central in their frames. The bus appeared as a socially inclusive technology in the sense that the bus group highlighted how 'buses were for everybody'. At the same time, it was a technologically exclusive transport system, because the bus group did not plan for any other public transport technology in Trondheim. By contrast, the light rail frame appeared as more socially exclusive because the light rail group acknowledged that the light rail was only in theory an option for everyone. In practice, it was primarily for those living close to the lines. Moreover, the light rail was technologically less exclusive because the light rail group admitted that Bergen needed a complementary bus system because the light rail could not serve the transport needs of all inhabitants in Bergen. As I point to in the paper, 80% of all travels conducted by public transport in 2013/2014 were by bus and only 18 % by the light rail in Bergen.[10] Still, the light rail was the alternative leading object because it attracted the most resources and attention, and it represented the light rail group's ideas and expectations of an ideal public transport technology.

Though the relevant social groups stressed topographical and demographical arguments for their choice of public transport, I found that the choice was, in reality, more complex. For instance, the interviewees stated that none of the choices were obvious, but

[10] Bentzrød, S. B. (05.01.2018) *Bare knallharde bomavgifter får folk til å parkere bilen.* Aftenposten. https://www.aftenposten.no/norge/i/ar6vL/Bare-knallharde-bomavgifter-far-folk-til-a-parkere-bilen-Men-farre-parkeringsplasser-i-byen-og-flere-boliger-pa-knutepunkt-ma-ogsa-til

rather the outcome of lengthy debates among professionals and policymakers, mostly concerning buses, trams and light rails. Thus, I argue that the concept of technological frames can help understand how ideas about a technology and its potential achievements may guide the development of urban public transport. However, I also observe a need for further development of the concept, such as the importance of the physical space in which a technological frame is unfolding. Both the bus frame and the light rail frame emerged from topographical considerations. I argue that the stability of technological frames is always precarious. For example, the proposal of metro buses in Trondheim led to a reframing that included some light rail elements in the bus frame. In this regard, city identities are not stable entities, but subject to change. I suggest that technological frames need to be co-produced (Jasanoff, 2004) with a shared identity among the intended users. I illustrate this with how the light rail frame in Bergen became robust because it was made to resonate with the urban identity of Bergen's inhabitants.

When the three papers are read together, they consider ways of learning and materializing urban sustainability in different ways. Paper 1 explores the visions that set the agenda for learning and managing urban sustainability, and their processes of negotiation. This paper suggests that defining the content of urban sustainability is an ongoing process. Paper 2 is the key article to the overall topic of learning as it investigates through which practices city actors actually do learn urban sustainability. An important insight from paper 2 is that learning urban sustainability involves the combination of transdisciplinary and translocal learning. Moreover, paper 2 suggests that city actors need to interact with other city actors and urban technologies in the field and experiment with questions of design when they set out to learn urban sustainability. Paper 3 addresses how the relevant social groups' interpretations materialize in urban transport projects to improve urban sustainability in a given local context. The paper argues that framing practices (technological frames) are important for the realization of these projects, and this implies that the bus frame in Trondheim and the light rail frame in Bergen are two kinds of learning processes.

To summarize, the papers point out that learning urban sustainability takes place thanks to three interrelated processes, namely 1) generating visions and goals to establish the content of urban sustainability, 2) engaging in practices to acquire sufficient knowledge to enact this sustainability, including experimentation in the field, and 3) realizing what are

considered to be sustainable urban projects. Based on the aforementioned processes, I pose three main questions. First, how to understand and account for the ways in which city actors learn to make more sustainable cities? I have suggested that this learning is not individually oriented but may take place in communities that emphasize experimentation with urban sustainability. Urban sustainability in Norway largely depends on city actors being able to share experiences with one another. My second question is how to make knowledge travel (if at all) and what potentially happens to such knowledge when it moves from one location to another? Finally, my last question is related to the implications of the answers to the former two questions: what is important when organizing future urban development work in Norway?

I will answer these three questions systematically throughout this introductory essay. Urban sustainability is the issue at stake in this thesis, and I will begin by exploring how the city itself has been understood in the scholarly literature. I will argue for the value of technology studies in accounting for the complex relationship of social, cultural and technological aspects related to making cities, which leads to a section on the growing political and academic attention devoted to researching cities as particular sites to learn sustainability.

3. Perspectives on cities

In examining the question of how city actors in Norway learn urban sustainability, I study their practices of making and acquiring relevant knowledge, as well as the ways in which they attempt to share this knowledge with other city actors. Importantly, I do not assess the quality of what the city actors learn and exchange, but rather I map the practices and processes in which they perform knowing and learning. As a backdrop, I will first give a brief overview of how the existing literature has explored and understood the object at stake in this thesis, namely cities.

3.1 Shifting perspectives on the city: from stable object to urban assemblage

The scholarly interest in studying 'the urban' is longstanding, and it has attracted attention from various fields: urban studies, urban history, technology studies, geography, and governance studies, to name a few. Ignacio Farias (2009) gives a useful summary of some of the main scholarly perspectives on the urban. Since the early attempts of sociologists, historians, economists and urban planners to develop urban studies, the city has been understood as a stable object (Farias, 2009: 9). For example, sociologists affiliated with the so-called Chicago School, such as Burgess (1925), McKenzie (1926) and Park (1952) argue that cities constitute a finite spatial environment, within which the human urban community settles (Farias, 2009: 9).

The spatial perspective contributes with crucial insights into the relationship between neighborhoods, socioeconomic structure and segregation (Farias, 2009: 9). Moreover, this perspective suggests that the physical urban environment, what we may call the city's materiality or technology, shapes the social activity there within. Theoretical perspectives in STS suggest that this is a rather technologically determinist way of conceptualizing materiality, or 'the urban' influence on social activity. The role of technology in cities has been approached in similar ways. For instance, in 1979, the Journal of Urban History published a special issue on the city and technology, aiming to present studies of the effects of technology on the urban form (Aibar & Bijker, 1997: 5). The contributing scholars analyzed technology as a force at work shaping cities, but the

development of urban technologies themselves remained unexplored (Aibar & Bijker, 1997: 5).

The interest in the role of technology in cities is not surprising. The study of cities clarifies just how pervasive much urban technologies, such as roads, buildings, bridges, tunnels, transportation and communication systems are in our daily lives (Hommels, 2005: 324). However, after 1980, the 'social shaping of technology' approach gained prominence in urban studies as well as in technology studies (Hommels, 2005: 327). Scholars in the field of urban history started to analyze the social shaping of urban technologies, rather than the effects of technologies in cities (Hommels, 2005: 327). This orientation emphasized the role of politics, cultural norms and values in the shaping of urban technological systems (Aibar & Bijker, 1997: 7). In other words, technologies in the urban environment were mainly understood as shaped by socio-economic factors. From this very brief account, I have shown that work in urban studies has traditionally been characterized by two main scholarly tendencies: to explain how the city (as a spatial or material form) and/or urban technologies shape the social activities that take place in city space, or inversely, to demonstrate how social factors (culture, economy, politics) shape technologies in cities. Consequently, Hommels (2005: 19) argues that urban scholars have lacked proper conceptual tools to analyze the complex relationship between the social, cultural and material dimensions of urban change or obduracy.

To overcome such deficits, Aibar and Bijker (1997: 23) suggest that rather than viewing the city as a mere geographical locus for social or technical phenomena, we must consider the city as a powerful tool in building new boundaries between the social and the technical. In this way, the social construction of technology (SCOT) framework has played a role in the development of a research tradition serving as an interface between STS and urban studies (Hommels, 2005: 21). Research using the SCOT framework has recognized cities as technological artifacts in themselves, pointing out that cities can be understood with "the same conceptual tools that are applied to other technologies, such as bicycles, transport systems, and refrigerators" (Hommels, 2005: 21). As such, the SCOT framework conceptualizes the city as one giant technology.

A classic example is how Aibar and Bijker (1997) used the SCOT concept of technological frames (Bijker, 1995) to study historical controversies in the so-called Cerdà plan for the extension of Barcelona in the mid-nineteenth century. Here, the authors make salient the 'interpretative flexibility' of the Cerdà plan when read by three relevant social groups: architects, engineers and the working class. These groups attributed different meanings to and interpretations of the plan, which Aibar and Bijker (1997) interpret as the relevant social groups' technological frames. A given technological frame represents the shared cognitive frame of a social group and constitutes these members' common interpretation of an artifact. There were three competing frames in the Barcelona case, which ended with a compromise between the architect and engineer frames, contributing to the further shaping of the extension of Barcelona. The main lesson from this case may be that interpretations are important to the stabilization of a technology. Technologies are not chosen due to their inherent superiority, but rather how they are interpreted and made sense of in their local context.

In this respect, the SCOT framework recognizes the socio-technical relationship in urban planning. However, most of the SCOT-inspired studies do so in a retrospective fashion, as in Aibar and Bijker's (1997) Barcelona case. Farias and Blok (2017: 559) argue that another problem is that SCOT-inspired studies see the city as merely one artifact among others, which sidetracks the perspective of cities as unstable and messy objects. Hence, Farias and Blok suggest an actor-network theory (ANT)-inspired intervention in urban studies. One prominent approach to this end is the so-called assemblage urbanism (e.g. Farías & Bender, 2009; McFarlane, 2011; Blok, 2013).

The notion of assemblage has gradually come to reshape urban studies in terms of ANT principles of symmetry, flatness, and multiplicity (Farias & Bender, 2009). I will return to details concerning ANT in part 4. The book Paris: Ville Invisible (1998) by Latour and photographer Emilie Hermant was probably the first dedicated work to address the city on such terms (Farias & Blok, 2017: 569). The aim of the book is 'to wander through the city, in texts and images'[11] (Latour & Hermant, 1998: 1), and the book contains a photo series of ordinary objects in the city. The issue at stake in the book is how we make the city visible,

[11] Translated from French into English by Liz Carey-Libbrecht. Corrected February 2006 by Valérie Pihet.

through visual and textual representations, and how we may understand these perspectives. For instance, Latour and Hermant find themselves at the top of Samaritaine, a department store behind the Louvre, which promises to give a panoramic view of Paris. Latour and Hermant (1998: 410) argue, "no panorama enables us to 'capture all of Paris' in a single glance".[12] Rather, they use the metaphor of the oligopticon (from Greek 'oligo', meaning 'little') to illustrate that it is only possible to capture very small parts of the city, but then with great precision (Latour & Hermant, 1998: 32). The oligopticon stands in contrast to Foucault's panopticon, which represents a totalized overview imbued with a certain power of the gaze. Since we can only view the city from a limited perspective at any given time, Latour and Hermant's (1998) key claim is that there is not one Paris, which we may grasp in a total overview, but multiple Parises. In this respect, the city needs to be understood as a multiplicity that is simply impossible to totalize or to fix. This multiplicity of perspectives is precisely how urban assemblage theory challenges traditional urban studies (Farias & Blok, 2017).

While the works cited above are concerned with how to understand the city, the issue at stake in this thesis is urban sustainability; a topic in which has attracted much attention, but been pursued mainly through approaches other than SCOT and ANT. Rather, urban sustainability has been explored by scholarly efforts directed towards city governance issues (Bulkeley & Betsill, 2003; 2005; Lerch, 2008; While, 2008; While et al., 2009; Bulkeley et al., 2011). Homsy and Warner (2015) argue that despite the enthusiasm among scholars and practitioners for local policymaking, most cities do not take action to promote environmental sustainability. Instead, national governments often push or incentivize local governments to adopt sustainability policies (Homsy & Warner, 2015).

The multilevel governance approach (Bulkeley, 2010; Bulkeley & Betsill, 2005; Corburn, 2009; Homsy & Warner, 2013) recognizes that there is a need for the distribution of responsibilities among local, regional and national levels of government. Such governance extends vertically from international organizations to national, regional and local governments, and horizontally across networks of cities, including civil society organizations and businesses (Bulkeley & Betsill, 2005; Romero Lankao, 2012; Coutard &

[12] Translated from French into English by Liz Carey-Libbrecht. Corrected February 2006 by Valérie Pihet.

Rutherford, 2010; Puppim de Oliveira, 2009; Homsy & Warner, 2013). In a multilevel governance setting, national government might use incentives or regulations to establish broad goals, leaving local governments to decide upon the appropriate action to enact the goals (Homsy & Warner, 2015).

I see the Cities of the Future program as a multilevel governance initiative, as it aimed to foster a simultaneous vertical-horizontal collaboration, including a knowledge exchange between the parties involved. The focus on knowledge exchange raises the issue of how city actors learn from each other to enact urban sustainability. This learning may take place in relation to urban technology frames, urban assemblages and multilevel governance. However, learning is often neglected in work on urban politics and everyday life (McFarlane, 2011). One exception is the growing trend of transforming city areas into so-called urban laboratories, serving as a means to experiment with sustainability design, and perhaps learn sustainability.

3.2 Urban laboratories and new modes of knowledge production

Efforts to mitigate greenhouse gas emissions and adapt to climate change are increasingly taking place through particular urban experiments (Bulkeley & Broto, 2012). Scholars and practitioners often refer to these sites as urban laboratories to emphasize their experimental character. Evans and Karvonen (2014) suggest that the urban laboratory is a technique to experiment and generate relevant knowledge for urban sustainability. In particular, urban laboratories may change the production of knowledge in urban planning, and further formalize processes of innovation and learning (Evans & Karvonen, 2014: 413; see also Evans & Karvonen, 2010). To this end, policymakers, researchers and practitioners may draw upon experiences from these laboratories, and up-scale the lessons learned.

Evans and van Heur (2014: 380) explore the notion of urban laboratories. They ask whether the laboratory is simply a metaphor for ordinary urban development or if it suggests urbanization by different means. The authors turn to STS studies of laboratories and practices of experimentation in order to understand the significance of the urban laboratory. In what has come to be known as laboratory studies (see for instance Latour & Woolgar, 1979; Knorr-Cetina, 1981), social scientists studied practices in the traditional

scientific laboratory. Here, the aim was to study the production of knowledge, and the social scientists studied this through direct observation and discourse analysis (Knorr-Cetina, 1995). They were interested in the internal practices carried out within scientific laboratories, and found that the knowledge production depended on some crucial practices, notably inscription devices and persuasion strategies (Knorr-Cetina, 1995). One way to bring the insights of these laboratory studies to urban studies is to emphasize the importance of place, and in so doing, to analyze practices in situ (Evans & Karvonen, 2014: 182). In this respect, laboratories are specific places, which contribute to the process of knowledge production.

Evans and Karvonen (2014) warn against such a loose usage of the terms 'laboratory' and 'experiment' in urban studies, for it obscures the specific contribution of experiments to the production of knowledge. Rather than claiming that everything is an experiment, there is a need to adopt a more precise understanding of the practice of experimentation (Evans & van Heur, 2014: 383). By contrast, my aim is to explore what potential practices within these laboratories or experiments may enable city actors to learn and share knowledge related to urban sustainability. First – what kind of knowledge do urban laboratories produce?

A central requirement in urban sustainability work in general and the urban laboratories in particular, is to generate knowledge to solve specific problems. The pilot projects in the Cities of the Future (CoF) program had precisely such aim. The participating cities were to experiment with pilot projects with favorable outcomes and inspire other city actors to make similar design choices in their hometowns. I understand these pilot projects as instances of mode 2 knowledge (Gibbons et al., 1994; Nowotny et al., 2001; 2003). The basic premise behind mode 2 is the recognition that scientific knowledge is largely produced within a context of application in order to solve problems. Gibbons et al. (1994) argue that mode 2 characterizes a new research system, where knowledge cannot be limited to academic disciplinary contributions as in mode 1; rather, it must transgress the boundaries of disciplinary knowledge and engage with other types of expertise. The question is not only what kind of knowledge sustainable urban development requires, but also how local governments (politicians, administrators and planners) and other stakeholders (i.e. researchers, the business sector, public agencies) learn, combine and use this knowledge.

Consequently, many disciplines may be involved, but they may also be combined with other types of expertise, experience and actors (e.g. citizens and the business sector), and synthesized in meaningful ways. Gibbons et al. (1994) refer to this combination of knowledge as transdisciplinary knowledge.

The notion of mode 2 describes a way of organizing scientific knowledge production, and one question may be how urban laboratories relate to such production. One argument is that urban laboratories are often created by university-led partnerships (Perry, 2006; Krueger & Buckingham, 2009), sharing the same goals outlined in mode 2, to produce problem-solving knowledge in a particular context. Amdahl and Sørensen (2008) show how the notion of transdisciplinary knowledge also makes sense of problem solving among expert practitioners, in their case, consulting engineers. Hence, transdisciplinarity is a useful concept in analyzing knowledge production and learning outside the traditional scientific realm, in my case, among urban planners and policy-makers.

In this section, I have explored the existing literature that addresses how one can understand and conceptualize the city, in particular as sites to experiment and produce relevant knowledge for urban sustainability. Until now, studies of urban sustainability have been largely concerned with governance, including how urban sites may serve as laboratories of learning. According to Evans and Karvonen (2014: 427), the success of certain cities and failure of others in addressing climate change will depend on the cities' abilities to translate empirical findings into relevant knowledge. Put differently, it is crucial for city actors to domesticate sustainability knowledge, in order to perceive it as relevant and useful (see for instance Næss et al., 2011). Though urban laboratories may contribute to knowledge for solving issues of sustainability, they have some limitations. The concept of the urban laboratory does not, for example, account for how city actors acquire such knowledge, or how this knowledge may circulate outside these laboratories – from one city context to the next. My main research question is how to understand and account for the ways in which city actors learn, and how they share relevant experiences to improve the sustainability of cities. In the following section, I will explore the concepts of learning and knowledge sharing more generally as they are defined in existing literature on this topic.

4. Caution! Knowledge under construction (and on the move)

4.1 From knowledge management to knowledge as practice

Creating sustainable cities is knowledge-intensive work, with urban planners positioned as knowledge workers. Peter Drucker introduced the concepts of 'knowledge work' and 'knowledge worker' in contrast to manual and service work (Gherardi, 2006: 10). When knowledge becomes the planners' most valuable skill, it necessarily needs to be managed and organized in some way in order to become useful to those not immediately involved in the knowledge-making process. Sveiby and Lloyd (1987) first coined the term 'knowledge management', which is a strand of literature within organization studies. This orientation has been concerned with how to organize knowledge in organizations.

A JSTOR search for the term 'knowledge management' yields more than 2 800 hits. These results illustrate that this is indeed a broad field with several subentries: organizational learning, human resource management, computer science, system learning, education, marketing, and risk management, to name a few. Knowledge management has been studied in so-called knowledge-intensive service industries, where knowledge has typically been perceived as something that may be articulated, stored and transferred (Easterby-Smith et al., 2000). Knowledge management research has mainly been concerned with how organizations create knowledge, and how employees in these organizations acquire and share this knowledge to be more productive and innovative.

There have been numerous lively debates on how to understand knowledge and learning in organizations (Gherardi, 2006: xi). Debates of the 1990s were concerned with the definition of tacit versus explicit knowledge, and the gap between individual and collective/organizational knowledge (Håkonsen, 2007: 23). The 1990s also saw a shift in focus from 'learning' to 'knowledge' in organizations, in particular with Nonaka and Takeuchi's (1995) The Knowledge-Creating Company (Håkonsen, 2007). Here, the authors propose a theory to explain knowledge creation in organizations, defined as "the capability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in products, services and systems" (Nonaka & Takeuchi, 1995: 3). Nonaka and Takeuchi (1995) argue that individuals in companies initially create knowledge, but it becomes organizational knowledge once it is disseminated throughout

the company/organization. In their view, the employees' tacit knowledge can be made accessible (that is, turned into explicit knowledge) to the company (Nonaka & Takeuchi, 1995). In this sense, the employees do not only learn, but also create knowledge, and in so doing make the company innovative.

While the literature on knowledge management focuses on how to create, organize and share knowledge in organizations, the learning in organizations perspective takes on a constructivist view (Gherardi, 2006: 7). This literature is often associated with a practice-based approach to knowledge and learning in organizations. The so-called practice turn in social theory recognizes that "the social is a field of embodied, materially interwoven practices" (Schatzki, 2001: 12). This stands in contrast to social theory perspectives that make use of concepts like institutions, systems or structures to define and explain the social. The practice turn points towards practices as the site to investigate phenomena such as agency, knowledge, language, ethics, power and science (Schatzki, 2001: 22). In other words, practices constitute the social. There is, however, no unified view within practice theory. With scholars in STS attributing agency to both non-human and human elements, they further challenge that of which 'the social' consists (Schatzki, 2001). Concerning knowledge and learning, the practice approach sheds light on the processes of making knowledge rather than seeing knowledge as a ready-made product to acquire. In this sense, knowledge becomes a fluid concept, better understood as a process rather than a thing (Mol & Law, 1994). Moreover, the practice turn puts forward a view that knowledge is no longer the property of individuals, but instead a feature of groups and their material setup (Schatzki, 2001: 20).

Orr (1996) provides an illustrative example of how people create knowledge and learn in communities. He argues that work is seldom well understood because scholars do not focus on what people do to accomplish a given job. Orr (1996) studied the practices of technicians repairing photocopiers. The job manuals described the technicians' job as individual, but Orr (1996) found that the technicians formed communities to share problems and concerns and to offer help to one another. In doing this, the technicians became important resources for each other in the completion of their professional tasks. As sharing experiences played a prominent role in the technicians' professional context, storytelling became an important feature of these communities. The technicians told stories

of how they came to understand a given problem, and how they were able to solve it. Stories convey some general principles, which other actors may utilize in other contexts and for coping with different problems. In this respect, storytelling may provide a sort of knowledge travel from one context to another. In Orr's (1996) case, stories were central to learning and education. In engaging in storytelling, technicians developed a shared understanding of problems. They collectively developed knowledge to solve work-related problems, in contrast to Nonaka and Takeuchi's (1995) claim that individuals create knowledge and further disseminate it throughout the company.

The practice-oriented perspective put forward that workers learn by participating in communities (Lave & Wenger, 1991; Brown & Duguid, 1991; Cook & Yanow, 1993; Gherardi, 2000). The notion of 'communities of practice' (Lave & Wenger, 1991) has particularly attracted attention from scholars interested in practice-based community learning. Communities of practice are relatively stable communities of face-to-face interaction between members working in close proximity (Lave & Wenger, 1991). The main point is that people within practice communities improve their skills as a result of regular interaction, by helping each other, sharing information, and developing a shared repertoire of experiences, stories, and tools (Wenger, 1998). Thus, it does not make sense to talk about knowledge transfer between members in such communities. Rather, the communities collectively develop the knowledge: it resides in the practice, and is a 'decentered' knowledge (Lave & Wenger, 1991).

According to Lindkvist (2005: 1194-1195), the emergence of communities of practices as described above seems to involve significant face-to-face encounters and an extended period of local interaction among those practicing together. In this regard, he argues that the notion of communities of practice does not fit well with how many project-oriented organizations operate (Lindkvist, 2005; see also Lindkvist et al., 1998). Rather, project-oriented organizations consist of diversely skilled individuals, who have often not met previously, to solve a problem within a limited timeframe and for a cost (Goodman & Goodman, 1976; Lindkvist, 2005). As a result of the latter two constraints, these groups do not have the time to develop a shared repertoire of experiences, stories and tools. Lindkvist (2005) argues for a new terminology to account for how these highly specialized individuals operate, namely what he calls a 'collectivity-of-practice'. Members of practice collectivities

are highly self-organized (Lindkvist, 2005), similar to what Huysmans and de Wit (2004) call a 'second wave' within knowledge management. This second wave asserts that practitioners 'manage' their own knowledge, as they are in the best position to do so. To coordinate activity in these (somewhat loosely tied) collectivities, it is of great importance to have an explicitly stated project goal (Lindkvist, 2005), which serves as a kind of boundary object (Star & Griesemer, 1989). Boundary objects may be abstract or concrete objects, and they facilitate collaboration between people with different perspectives. Maps are an example of a concrete boundary object in urban planning: the planners may have different interpretations of the same map, yet the map coordinates collaboration, and represents a reference point for their planning work.

Much practice-oriented work concerning knowledge and learning in organizations focuses on learning in knowledge intensive firms (see for instance Amdahl & Sørensen, 2008; Håkonsen, 2007; Sørensen, Lagesen & Levold, 2007; Lagesen, 2008). I study learning in a somewhat different context by focusing on how those working in local governments learn to enact urban sustainability. Moreover, the perspectives on knowledge making, management and learning discussed so far do not, however, address the role of technologies in knowledge making and learning.

4.2 Learning technology – a sociomaterial perspective

Orlikowski (2007: 1435) argues that organizational studies either ignore or take for granted the role of technology, or have been predominantly concerned with technology adoption, diffusion and use. The problem with this focus on use is that organization scholars treat technology as a matter of interest only under particular circumstances (such as when a new communication technology is introduced), failing to grasp the insight that every organizational practice is always intertwined with materiality (Orlikowski, 2007: 1436). Orlikowski (2007: 1436) defines materiality from the visible forms — such as bodies, rooms, buildings, vehicles, computers, books and documents — to the less visible flows — such as data and voice networks, water and sewage infrastructure, electricity, and air systems. The notion of sociomateriality (Orlikowski, 2007; Orlikowski & Scott, 2008) offers a way to overcome the limitations of organizational studies because it aims to theorize how

technologies, work and organizations are constitutively produced (Orlikowski & Scott, 2008). Thus, a sociomateriality perspective emphasizes the close relationship between people and the way they use technologies. Technologies may shape people's practices, but it is people's practices that concurrently shape what the technologies will ultimately become. The social learning of technology framework also explores this relation, emphasizing how technology-related practices develop over time. There exist at least four kinds of learning technology: learning by doing, using, interacting and regulating, and Sørensen (1996) gives a useful summary of each type.

To begin, 'Learning by doing' (Arrow, 1962) focuses on how people, individually and collectively, develop more efficient ways of using technologies as they gain experience over time. The assumption is that people will gradually learn to use the technology more efficiently. In this perspective, people will learn to use the technology in line with the expectations of technology producers.

'Learning by using' (Rosenberg, 1982) describes the process through which a user (understood as a client or consumer) becomes familiar with a new technology and develops new skills and practices by using this technology. This perspective does not only concern how people learn to use, but also how people find new ways to use a technology. Learning by using acknowledges that people explore different ways of using technologies rather than learning how to optimize one particular type of use. Hence, people innovate technologies when they use it in creative and surprising ways. The main issue is that both learning by doing and learning by using depends on the relationship between users and producers (Sørensen, 1996). Producers depend on information from users, and vice versa, to innovate successfully, which is the basic idea underpinning the third perspective, 'learning by interacting' (Andersen & Lundvall, 1988).

Learning by interacting is a combination of the two former perspectives, and emphasizes the interaction between producers and users. Learning by interacting puts forward "the ability to learn from production and use of technologies and to communicate the outcome of such learning" (Sørensen, 1996: 17). Lundvall (1988; 2010) discusses learning by interacting in relation to national innovation systems, and the importance of close and persistent contact to foster interactive learning between producers and users.

Korsnes (2015) found in his study of technology learning in Chinese firms that the relationship between knowledge users and producers could be too close and actually hamper learning. On this basis, he concludes that Lundvall's (2010) theory of interactive learning, stressing the benefits of close and sustained interaction, requires more nuance to be able to account for an 'optimal' relationship in interactive learning (Korsnes, 2015: 169, quotation marks in original).

Learning technology does not only concern actors in research and development; it also concerns the relations between several actors in a national economy (Sørensen, 1996). Sørensen (1996) has added a final category to technology learning by emphasizing the importance of studying social learning in regulatory activities, namely what he calls 'learning by regulation'. Learning by regulation is a combination of learning by doing (how people learn to use) and learning by using (how people learn new ways to use). Thus, it is similar to learning by interacting, but it concerns how to regulate, and in so doing, enact learning. Learning by regulation suggests that technologies need infrastructure in order to work, and these infrastructures are often constructed on a national scale (Sørensen, 1996). Williams et al. (2005) interpret learning by regulation to involve actors that contribute to shape the wider learning context. In sustainable urban planning, these actors may be national politicians, governing and regulating documents, and city programs and agreements. Williams et al. (2005: 50) call these actors 'ordering actors', which aim to 'order' the field.

Learning by regulation points to the importance of both forward, backward and 'sideways' relations between actors, and it implies that there may be policy challenges to facilitate these relations (Sørensen, 1996). The Cities of the Future program is an example of an infrastructure to regulate and 'order' the learning context of urban sustainability. The program was also an attempt to facilitate the forward, backward and 'sideways' linkages between city actors, and between city actors and the national government. To this end, the program facilitated social learning by means of 'learning by regulation'.

The main deficiency of the social learning framework has been the lack of concern for how users may transform technologies through use (Sørensen, 1996: 6). This transformation does not only concern use by means of interaction with the technology, but also by means of how users attribute meanings to the technologies, to make them relevant

in the users' context. Hence, Sørensen (1996) integrates the concept of domestication (Silverstone et al., 1992; Lie & Sørensen, 1996) into the social learning framework. Briefly, domestication describes the process of making a new technology familiar and integrated into the routines of everyday life. This process consists of overlapping symbolic, practical and cognitive aspects (Lie & Sørensen, 1996). In this regard, social learning is not only about the acquisition of skills and knowledge, because such a limited perspective renders people's effort to domesticate technologies invisible (Sørensen, 1996: 13, 14). People need time to learn how to use a new technology, to develop routines and meanings to make sense of the technology. In this sense, people do not only learn but they also transform technologies, because they may develop new ways of using it. This does not mean, however, that people have unlimited possibilities with respect to using technologies, primarily because the producers themselves have ideas regarding how people will (or should) use the technology. The producers try to integrate these user patterns into the design – in this way, they 'script' the technology (see Akrich, 1992).

I understand domestication and social learning as an ongoing negotiation between people and technologies. People negotiate the script through use, making it impossible to predict exactly how they will use a given technology. The domestication perspective claims that technologies are not ready-made when they reach the users, primarily because users re-interpret the scripts. These perspectives put forward a relational understanding of technology use. To take this idea further, Lagesen (2008: 112) suggests that learning is a relational effect produced by a sociomaterial network. In such a perspective, learning is not a predictable outcome, but is an ongoing process that depends on the interactions among people and technologies. This argument is close to a 'method-theory' in STS called Actor-Network Theory (ANT).

The basic premise behind ANT is that society consists of networks of actors, all of which influence and are influenced by each other in the network. What is special with ANT compared to other social science theories is that it does not erect boundaries between humans and non-humans when studying the society. Latour (2005) uses the term 'actants' (borrowed from semiotics, see Greimas & Courtés, 1979) to emphasize the idea that human and non-human elements should be treated symmetrically (conceptually, not ethically) in the analysis of emerging networks. In my case, such symmetry suggests that non-human

elements – energy plans, national sustainability goals, bicycle lanes and maps, for example – are equally as important as the human elements – national politicians and urban planners, among others – in the making of sustainable cities. The importance lies in the relations between these actants – how they act upon each other and cause each other to act. In other words: how the actants make something happen.

ANT is useful as a framework to study how actants enroll (or become enrolled as) allies to create relevant knowledge, and which efforts are made to put this knowledge into action. In such analysis, it is key to follow the actors' practices, discursive as well as physical. In this perspective, the planner's practices are the glue that assembles and holds together the (sociomaterial) actor-networks. The Cities of the Future program is one example of an actor-network. However, it is not obvious what types of actants are involved, or how we may characterize the relations between them. The actants may have stronger or weaker relations to each other, and these relations must be empirically investigated.

The notion of sociomateriality and ANT offer a relational perspective as well as a more symmetrical view of the types of actors involved in learning. However, the literature discussed so far has mainly been concerned with (learning) practices within organizations/companies/communities etc. I am interested in how city actors learn in more broadly defined collectives, across organizations, such as in case of the Cities of the Future network. Sustainable urban development requires that urban planners and other stakeholders have the possibility to share and utilize experiences. This is primarily because not all local governments have the resources to experiment (and possibly fail) with sustainability projects. A central goal for the CoF program was precisely to foster the sharing of best practices/projects among Norwegian cities. How do the experiences and knowledge of making these best projects/practices travel, if at all, from one context to another?

4.3 Learning across localities

Perspectives in organizational learning point to obstacles that hinder knowledge from travelling from one location to another. For instance, Brown and Duguid (2000) argue that knowledge needs to have a 'knower' because it is embodied, which may complicate its

possibilities for travel. However, this idea of tacit knowledge (Polanyi, 1967) does not mean that knowledge travel is impossible. Collins (1974) followed scientists in Britain who were attempting to build copies of the so-called TEA laser (Transversely Excited Atmospheric Pressure CO_2 laser). He found that those who were successful in building the laser had visited laboratories that had also successfully built one. In this sense, the visitors had the chance to see the laser in its actual location, as well as benefit from informal, personal communication with the research teams. Thus, the visitors got the chance to embody the necessary knowledge required to build a TEA laser. Collins (1985; 2001a; 2001b) reflects on the TEA laser case as a matter of tacit knowledge. He defines tacit knowledge broadly as a skill or ability that may travel when people interact over time. In this view, tacit knowledge cannot travel by means of written instructions or verbal descriptions alone (Collins, 2001a).

The literature of policy mobility/policy tourism (González, 2011; Cook & Ward, 2011; McCann, 2011; Ward, 2003; 2006; 2011; Wood, 2014; 2016) has explored the idea that policy knowledge may travel by moving people from one site to another. The term policy mobility/tourism refers to practices in which policy actors from one city visit and learn from policy actors elsewhere (Ward, 2011). The main idea is that policy actors take these 'best policies' back home with them. The policy mobility framework then studies how policy actors carry policies from place to place and how these policies mutate as they move (McCann, 2011). This puts forward a social and embodied perspective of learning, similar to how the researchers in Collins case (1974) learned to build a TEA laser by visiting laboratories that were previously successful in the endeavor.

The policy mobility literature focuses on the social processes of circulating urban policies, policy models and policy knowledge (McCann, 2011). Åm (2016), however, has criticized studies concerned with such policy mobility for a lack of interest in the material aspects of this mobility. Though some scholars working in critical policy studies use the concept of translation, they do not take into account that this analytical concept 'comes as part of a bigger theoretical package that implies an important material aspect' (Åm, 2016: 249, emphasis in original). Åm (2016) suggests that critical policy studies could advance its own empirical and methodological project by drawing further from STS concepts. In line

with this idea, I do not limit my perspective to social processes of moving knowledge, but consider this latter as an ensemble of sociomaterial processes.

The policy mobility/tourism and Collins case (1974) suggest solving the 'problem' with tacit knowledge by facilitating on-site encounters. In this perspective, people learn by travelling and consulting relevant places and people. McFarlane (2009; 2011) is also concerned with learning as knowledge travel. He uses the concept of translocal learning to highlight that although learning is place-focused, it is not restricted to a single place. Lagesen (2008) takes on a more radical viewpoint, suggesting that learning and knowledge-making are fundamentally translocal activities. The term 'translocal learning' implies the mobility of knowledge, but the concept of translation in ANT (Callon, 1986) puts forward that knowledge and objects cannot remain unchanged when they move from one site to another.

To put it simply, translation describes efforts devoted to making, for instance, a knowledge claim or an artifact appear as indispensable. In the ANT framework, translation is the process of enrolling allies into one's claim to make a strong and powerful actor network. A powerful actor network will ensure that this claim 'wins', and perhaps become naturalized as what we perceive as a fact. ANT has primarily been concerned with translation processes between the laboratory and society (though these are not separated entities, see for instance Latour, 1988), and illustrates that a significant amount of work is required to make facts or to succeed as an innovator.

Translation describes, at the most basic level and according to everyday usage, a transfer of meaning from one language to another. In this process, the artifact transforms, or in Latour's words (2005), the artifact is re-assembled. Thus, it does not make sense to talk about knowledge transfer because artifacts change when they travel. I assume urban design also transforms when it travels between cities. In this sense, the travel contributes to innovation because the city actors must re-arrange the urban design to make it fit the local context. In my project, I focus primarily on the travels, not on the transformations. I am interested in how city actors make these designs travel: how they get inspired and attempt to inspire others to improve the sustainability of Norwegian cities.

In this section, I have discussed existing literature on how people make and acquire knowledge, how they learn, and perspectives on how knowledge may travel. I started by discussing two main strands of thought in organization studies, namely the knowledge management and the learning in organizations perspectives. Neither of these orientations have sufficiently accounted for the relationship between people, practices and materiality. To overcome these weaknesses, I introduced the notion of sociomateriality, and particularly the social learning of technology framework. Moreover, I suggested characterizing learning in urban sustainability as a translocal activity because city actors in the CoF program frequently visited other cities to draw inspiration for urban sustainability design in their own cities. How can these theoretical perspectives help understand the initial question I posed in this introductory chapter of how city actors learn to enact urban sustainability? More precisely, how to characterize the learning that took place among the participants in the CoF program? What type of learning initiative was CoF? Moreover, how can an analysis of learning in urban sustainability efforts contribute to broaden the perspectives on sociomaterial learning? I will go into these questions in the next section, which is a crosscutting analysis of the three papers in the thesis.

5. Crosscutting analysis: social learning in urban sustainability

I will now return to the three papers and discuss some main findings in light of the theoretical discussion outlined above. I will refer to the papers as paper 1,[13] paper 2[14] and paper 3,[15] which is the same order as they appear in the thesis.

5.1 Features of the urban laboratories of Cities of the Future

In section 3, I discussed the growing political and scholarly focus on the concept of the urban laboratory, which is a more or less precisely defined urban site, devoted to experimentation with innovative sustainability designs. The rationale behind the transformation of particular urban sites into urban laboratories is to initiate a change in the production of knowledge in urban planning and formalize processes of innovation and learning (Evans & Karvonen, 2014: 413; see also Evans & Karvonen, 2010; Karvonen & van Heur, 2014). With Cities of the Future (CoF), the national government turned the cities in the program into test sites that strongly resemble urban laboratories. For instance, the national government expected the CoF program to serve as an arena for coordination, collaboration, innovation, development, dissemination and transfer of experiences (Ministry of Environment, 2012: 10). When I juxtapose the three papers in this thesis, I see the CoF program as consisting of three main activities. First, the participants were expected to produce new knowledge and tools to improve the sustainability of Norwegian cities. Second, the program facilitated meeting spaces among the participants so they could learn from each other's experiences. Third, the participants were supposed to share these tools and insights with other city actors both within and (later) outside the CoF program. Thus, the CoF initiative pursues what I see as the same primary objectives as the urban laboratory, namely, to create knowledge, stimulate innovation and facilitate learning processes among those who engage in these laboratories.

The key idea behind the urban laboratory is to generate knowledge with aims to solve specific problems related to urban sustainability. Paper 2 indeed pointed to how the

[13] Visions as trading zones: national and local approaches to improving urban sustainability
[14] Social learning for urban sustainability: transdisciplinary and translocal
[15] The shaping of urban public transport: two cases of alternative leading objects

urban planners created what they refer to as problem-driven knowledge when they engaged in pilot projects in the context of CoF. The planners defined problem-driven knowledge as expertise that was relevant to solve a specific problem, and pilot projects were important sites to test this expertise. There were a total of approximately 45 pilot projects and these projects were the backbone of the CoF program. The pilot projects constituted the basis of the allocation of resources from the national government to the cities, and the program management of CoF prioritized proposals for pilot projects according to their economic viability and potential for sustainability gains. The pilot projects varied in duration and resources. For instance, Oslo and Bærum collaborated during the period 2013-2014 on making a tool they called 'bluegreen factor' both to handle storm water issues in cities and in order to make the urban environment more pleasant for inhabitants. This pilot project constituted a strategy to incorporate more bluegreen qualities – in particular, streams and parks – into future urban development projects.

Another pilot project was to build a new city hall in Sandnes within a project duration of five years. The city hall was expected to be a signal building with energy efficient and climate friendly solutions in accordance with passive-house standards. A larger and more ambitious pilot project of CoF was to transform the Brøset area in Trondheim into the first climate neutral city area in Norway. This included facilitating a lifestyle in which the 4000 estimated inhabitants would reduce their annual CO_2-emissions by 60-90% compared to the average Norwegians' CO_2-emissions in 2015[16]. Because the participating cities were encouraged to experiment with pilot projects to make innovative designs to improve the urban sustainability, and, furthermore, to inspire other city actors to make similar designs in their hometowns, the pilot projects were in many ways similar to urban laboratories.

In paper 2, we show how the pilot projects were instances of so-called mode 2 knowledge (Gibbons et al., 1994; Nowotny et al., 2001; 2003) due to their specific problem-solving dimension and for the ways in which the pilot projects required several types of expertise and experiences in order to be realized. For instance, the pilot projects involved

[16] The program management of CoF collected the pilot projects on the website: http://forbildeprosjekter.no/framtidens-byer (last accessed 05.03.2018, in Norwegian).

actors with diverse educational backgrounds like architects, engineers, planners, social scientists and economists. Moreover, the urban planners stressed that they often drew on their previous experiences with sustainability work when conceptualizing the pilot projects. Amdahl and Sørensen (2008) point to how the notion of transdisciplinarity can be helpful to analyze *knowledge production* outside the traditional scientific realm, but I will argue for its relevance in the analysis of *learning* as well. Thus, in paper 2, we make a shift from a focus on transdisciplinary knowledge (Gibbons et al., 1994) to an understanding of this knowledge production as also diverse learning processes among the participants. To this end, we show how the social learning that occurred in the pilot projects was transdisciplinary.

I have suggested that the pilot projects and the CoF program functioned much like urban laboratories, but there are some differences between them that should be mentioned. The pilot projects conformed largely to how the existing literature defines urban laboratories (for instance Bulkeley & Broto, 2012; Evans & Karvonen, 2010; 2014). The CoF final report described the pilot projects as 'small laboratories to practice the future' (Framtidens byer, n.d.: 26). The learning in these small laboratories was enacted by experimenting and trying out new solutions. In this sense, the small urban laboratories in CoF became instances of 'learning by doing' (Arrow, 1962).

In contrast to the laboratory model, however, the CoF program did not produce problem-solving knowledge directly. Rather, the program tried to coordinate the activity by establishing a set of meeting places where these small urban laboratories could communicate and exchange experiences. I will argue that the CoF program facilitated 'learning by interacting' (Andersen & Lundvall, 1988) because learning was an interactive process occurring between producers and users of the sustainability designs and urban policies, but it was also regulated by the national government. The participants in CoF learned by interacting with city actors in other cities in Norway and abroad, the national government, the business sector, local politicians, the media and the public. In this sense, the participants in CoF learned translocally, as we also emphasize in paper 2. The concept of learning by interacting also seeks to analyze such translocal learning experiences, in which knowledge may be 'translated' to make it applicable in other contexts (Williams et al., 2005: 224).

I propose to call the CoF program a 'meta urban laboratory' because it aimed to facilitate learning by interacting. I use the prefix 'meta' to illustrate that the CoF program served as a site where participants could reflect upon their practices and learning and in the process get new ideas for further work. This meta urban laboratory facilitated discussions about ongoing activities within the small urban laboratories of the pilot projects. The meta urban laboratory tried to gather and 'hold' these urban laboratories together, reminding the CoF participants that they were part of a larger community.

While papers 1 and 2 discuss learning activities within both the meta urban laboratory and the small urban laboratories, paper 3 may be read as an exception. Here, I explore the shaping of two public transport systems in the Norwegian cities of Bergen and Trondheim. The transport planners considered neither the light rail in Bergen nor the metro bus project in Trondheim to be experiments or laboratories. Moreover, these transport projects required funding and planning resources way beyond the budgetary and temporal constraints of the CoF program. Nevertheless, I consider these projects to function as 'large urban laboratories' primarily because the development of the Bergen light rail and the metro bus project in Trondheim were innovations in the context of localized sustainable urban development. Light rails and metro buses are not new technologies, but I do not see innovation only through the lens of making a new technology. Rather, to innovate also means to embed a technology in a new location. This is innovation in a translation (Callon, 1986) perspective because artifacts, like a metro bus, cannot move unchanged from one site to another. It must be transformed to fit a new context.

I have suggested conceptualizing the CoF program as a meta urban laboratory that held together the activities taking place in the pilot projects, in which I have called the small urban laboratories. These constituted the backbone of the CoF program. The meta urban laboratory also had some thematically but more loosely attached large urban laboratories, like the Bergen light rail and the Trondheim metro bus. These three types of urban laboratories were related, but how did learning take place within and between these different laboratories? To begin the discussion, I will first go into what I will call the features of the context of learning, which depict how the actors working in the urban laboratories decided upon the goal and content of urban sustainability.

5.2 Features of the context of learning

One of the first tasks required of the participants in CoF was to come up with a shared understanding of the content and characteristics of a sustainable city, and above all, to determine what efforts it would take to create such a city. Paper 1 discusses how the national government initially tried to shape this learning context by imparting visions of desired sustainable cities, which they expected that the city actors in the local governments would process and adapt to their unique local context. By establishing visions, the national government interpreted urban sustainability in a particular way, and endeavored to translate this interpretation into the dominant one. In other words, they tried to construct a sociotechnical imaginary (see Jasanoff & Kim, 2009; 2015) of future sustainable cities. In paper 1, I give an example of a vision for Norwegian cities in 2020 that was presented by the Minister of the Environment in 2007:

> "We will walk to our work place and get healthy, filling our lungs with fresh air from the city. There are no cars in the streets, but playing children. The city center has become the grand hall with beautiful buildings, cultural heritage sites and green areas, which make citizens proud of their city."[17]

Overall, the national government envisioned future cities as green and compact as well as attractive and healthy places to live. Paper 1 finds that national and local government's visions of the content of sustainable cities were quite similar. This is not surprising. When the national government established the CoF program in 2008, they instructed the cities to revise or make local action plans for handling environmental issues and mitigating greenhouse gas emissions. Thus, the local governments operationalized the national government's main sustainability goals. Some of the participating cities had action plans before 2008, and those who did not have a plan looked to others for inspiration. Therefore, the visions travelled in written and verbal articulations from the national to local governments, and between the participating cities. In the end, the CoF participants reached an agreement that Norwegian sustainable cities should be compact, but still have multiple green areas, and should have a well-developed public transport system, as well as ample

[17] Vestheim, T. M. F., & Sømme, A. (25.05.2007). *Slik blir framtidens miljøbyer* (This is how future sustainable cities will look like). Dagsavisen.

infrastructure for walking and cycling. This shared vision of the future sustainable city was an important feature in creating a context of learning.

However, there was a lack of consistency between the national and local governments' expectations of how to make and manage sustainable cities, in particular concerning the role of citizens in this task. The city actors at the local government level had to deal with complex and partly conflicting imperatives in the process of translating goals into plans and projects, and the national visions overlooked these difficulties. Paper 1 illustrates this controversy through two visions, or assemblages, with noticeable differences. I call these assemblages 'the attractive city' and 'the complex city'. 'The attractive city' assemblage was a vision constructed by the national government, and it was characterized by its ideas about pleasant features of future sustainable city life and beliefs that holistic city planning would help realize this vision. 'The complex city' assemblage was a vision constructed by city actors in local governments with roughly the same general sustainability goals, but with a more extensive inventory of elements of concern. For instance, this assemblage included the complexities of urban planning and the difficulties involved in translating general goals into local actions. Drawing upon insights from ANT, all artifacts, discursive or material, are relational effects produced by sociomaterial networks. Thus, artifacts change in line with changing relations in the network. A changing relation may be for instance a new Minister of Environment or the introduction of a new sustainability technology. The context of learning in urban sustainability – what to learn – will also necessarily change as new artifacts are incorporated into the network. The main point is then that the learning context never settles, but is perpetually produced and negotiated by the relevant actors.

Paper 1 shows that despite the dis-alignment of visions between national and local stakeholders in the CoF program, the program kept running during the intended period from 2008 to 2014. Interviewees from the national and the local governments agreed that it was a success. I interpret this to be due to the practice of vision making, because vision making enabled a kind of trading zone where the participants could exchange problems, solutions and expectations regarding the sustainability of Norwegian cities. Even if the learning context was the object of constant negotiation, and thus generated controversies, these negotiations also contributed to keeping the program alive. The participants learned

about urban sustainable development by trading and negotiating potential futures. Here, they could try out new futures not in a physical sense, but as mental constructions. Thus, the participants learned by negotiating a context of learning.

Paper 3 explores the shaping of public transport systems by using the notion of technological frames (Bijker, 1995, 2001; see also Aibar & Bijker, 1997). In paper 3, I focus on how the relevant social groups developed frames, which I refer to as framing practices, as well as the consequences of these frames. Here, I will interpret these framing practices as a means to establish a context of learning with respect to sustainable urban mobility. Paper 3 finds that planning for sustainable mobility was complex and involved controversies over choice of alternative leading object. The frame was a simplification of this process and contributed to ordering elements such as topography, demography, transport history, existing infrastructure, densification, expectations, financial opportunities, symbolic values and user configurations. The relevant social groups assembled these elements in two city identities – the bus frame and the light rail frame. I argue in paper 3 that the frames contributed to guiding and shaping further city and transport planning in Trondheim and Bergen. The relevant social groups also contributed to shaping their context of learning concerning public transport planning by frequently referring back to one another's frames in the comparison of city identities (primarily aspects of topography and demography) as either suitable or unsuitable for a bus or a light rail system. This process of exchange suggests that the frames travelled between what I called the bus group in Trondheim and the light rail group in Bergen. Put differently, these groups translated (Callon, 1986) the frames to make them appear as more solid, and in so doing, legitimized their choice of alternative leading object.

Bijker (1995: 193) points out that technological innovation (which in paper 3 concerns the shaping of a bus and a light rail system) is a learning process, and that economists have identified forms such as learning by doing, learning by using and learning by interacting (Dosi et al., 1988). According to Bijker (1995: 193), learning by using and learning by interacting are directly applicable to the broader concept of technological frames because such frames need to be sustained continuously by the relevant social groups' actions and interactions. In paper 3, the frames were not fixed entities, but were under

construction through the relevant social groups' ideas and interpretations concerning sustainable mobility and relevant technological options.

Similar to the visions explored in paper 1, the technological frames also shaped contexts of learning in the way that they carried expectations of a certain sociomaterial outcome – namely that of a light rail or a bus system. While the visions in paper 1 shaped a context of learning within the meta urban laboratory (the CoF program), the technological frames in paper 3 shaped a context of learning within what I referred to above as the large urban laboratories. The large urban laboratories were not part of the pilot projects in the CoF program, but they were nonetheless concerned with the quintessential urban laboratory activities of making, learning and sharing knowledge to improve urban sustainability. The frames were (like the visions) mental constructions in the sense that they offered a space in which ideas could be tested. However, while the visions articulated by the national government actors tended to be general, the technological frames were more goal-oriented because they were context specific and were to be implemented in a specific urban context. In addition, the frames had implications for the transport planners' practices: the sites they selected for field visits and consequently the choice of alternative leading object. In this regard, the frames were important features of the context of learning for public transport planning.

To summarize this section, the participants in the CoF program and the transport actors in Trondheim and Bergen shaped the context of learning in urban sustainability work by generating visions and technological frames. They made these visions and frames travel, and therefore shape what kind of expertise the city actors needed to fulfill the content/expectations carried by these visions and frames. The participants' relation to expertise raises a new question, that of how the actors working within the meta, large and small urban laboratories developed and deployed expertise to make sustainable cities. I will explore this question through what I call the practice of learning.

5.3 Some elements of the practice of learning

In this section, I will discuss the practices through which the participants in CoF learned to make cities more sustainable. Paper 2 points to how frequently the urban planners undertook site inspections and field visits, and I will explain the significance of these two activities more in detail. The site inspections were an activity meant to familiarize urban planners with the area they were about to regulate. During the site visits, they were able to explore whether the ideas and designs to be implemented in the actual location were feasible. Thus, site inspections were a goal-oriented activity and the planners seldom travelled far from their planning offices. This activity represented a sort of 'learning by doing' (Arrow, 1962) because the planners gradually learned to perform this type of regulation work, including familiarization with technical standards and requirements, and to maneuver within the administrative and political system.

The planners did not always move physically to perform such site inspections. Often, they went on digital inspections by using Google maps – at least in the beginning to get an overview of the area and to sort out problems. I participated in several digital site inspections, and observed that those who had physically visited the area prior had a greater impact in settling discussions than those who had never been on the site. No matter how long the planners spent on digital inspections, they often had to visit the location to get a firsthand experience. I interpret this as the need to 'embody' a certain expertise (see for instance Brown & Duguid, 2000) by physically interacting with the given location. In addition, having been in the actual location themselves gave the planners a rhetorical advantage when discussing geographically specific regulation possibilities with other colleagues.

Field visits, by contrast, were a more open-ended and exploratory activity in which city actors went to other cities to gain inspiration and learn how to integrate a specific urban sustainability design and/or insight into an innovative planning strategy. Field visits facilitated a comprehensive form of learning because the participants had the opportunity to experience an innovative urban design in its local context and to discuss with the stakeholders involved. Field visits allowed planners to engage with each other's 'tacit' knowledge, somewhat similar to how the researchers in Collins' (1974) study went to other laboratories to learn how to build a TEA laser. The actors in CoF moved knowledge by

moving people around to see and experience an urban design at its original production site. Thus, the urban planners considered field visits as important to the development of their expertise with respect to creating innovative sustainability designs.

I have argued that learning is a sociomaterial practice. I am therefore interested in how the city actors developed expertise in interaction with people as well as technological artifacts during these field visits. I participated in a field visit related to the future construction of a rail line for the light rail system in Bergen. Here, all the participants (the Bergen light rail planning team and a hired consulting firm) used maps to engage with and discuss opportunities in the area. The participants domesticated (Lie & Sørensen, 1996) these maps differently and had to negotiate these interpretations with the other actors. In this respect, the maps were boundary objects (Star & Griesemer, 1989) because they coordinated collaboration and constituted a reference point in the planning work. I will suggest that these participants learned by interacting (Andersen & Lundvall, 1988; Sørensen, 1996) with the other actors, places and maps.

The CoF program was concerned with how to facilitate the mobility of expertise and 'best projects/practices', allowing them to travel from one location to another. Some interviewees in the program administration actually pointed out that 'sharing' had become a sort of mantra within the CoF program. Thus, the actors engaged in making pilot projects also engaged in the activity of sharing their experiences of creating these pilots. This dual experience of making and sharing is what we refer to as translocal social learning in paper 2. The use of field visits was one strategy to this end and examples can be found in the design of the Bergen light rail and the Trondheim metro bus that I discuss in paper 3. The transport actors in Bergen described the Bergen light rail as literally a combination of German engineering and French design. The transport actors in Bergen had thus re-assembled in Bergen a light rail inspired by the extensive experiences of Germany and France with light rail construction. Likewise, the transport actors in Trondheim explained that the metro bus concept was inspired by a similar design implemented in the Swedish city Malmö, and the specific infrastructure for the metro bus was inspired by a design originally from the Swedish city Lund. The urban planners in Trondheim had been on field visits to both these cities.

Another strategy to make 'best projects/practices' travel was to construct enticing narratives about these projects/practices to attracted interest from other city actors. We give an example in paper 2 where an interviewee explained that a civil servant from Porsgrunn municipality went to Drammen to learn more about the passive-house schools and kindergartens built there. When the civil servant returned, he argued that the new school in Porsgrunn should also have passive-house standard, and he subsequently obtained approval. The interviewee said based on his experience he believed that stories were of great importance in the CoF program because stories may convey some general principles applicable to other sites. In a similar manner, Brown and Duguid (2000: 107) claim the value of stories lies not only in their telling but also in their re-telling. By constructing compelling narratives, the participants in CoF made the idea of a project travel from one context to another, raising awareness among other actors as to the possibility of certain designs. Thus, while the literature on policy mobility (for instance Cook & Ward, 2011; Ward, 2011; Wood, 2014) has been almost solely concerned with the articulation of policy narratives, we extend this focus in paper 2 to include narratives of urban design as well. The narratives served to frame specific urban designs in a particular way, and this framing has similarities to the technological frames of urban mobility that I discuss in paper 3. To this end, the framing practices in paper 3 were also a way to develop and deploy expertise concerning urban sustainable transport.

The participants in CoF performed the narratives in breakfast meetings and seminars often organized by the program management (in the national government) of CoF. These meetings reached out to national and local politicians, administrative employees, and sometimes the public in general. The narrators had to know their audience and adapt the narrative accordingly. The participants in CoF considered what we in paper 2 call promotional narratives as the most important because they could potentially influence politicians with decision-making authority. In this regard, the narratives were also translation strategies because they aimed to incite other allies to support and/or get inspired by a particular urban design. In paper 2, we point to a tight relationship between doing field visits and constructing narratives because those inspired by an enticing story of an urban design often would need to see the actual design and engage in discussion with those who built it. In paper 2, we argue that narratives and field visits represented two types of

translocal social learning in urban sustainability. We also argued that the social learning was transdisciplinary due to the ways in which the urban planners combined several types of expertise and experiences. In sum, the CoF program was a meta urban laboratory aiming to facilitate both transdisciplinary and translocal learning among its participants.

I have discussed how the participants in CoF and the transport actors in Trondheim and Bergen established a context for learning and how they developed and deployed their expertise. In fact, each paper in this thesis discusses practices with aims to create more sustainable cities. Paper 1 points to vision-making, paper 2 discusses the making of pilot projects, narratives and going on field visits, and in paper 3, the actors make technological frames of urban mobility. I consider these practices to be sociomaterial enactments because the actors enacted their expertise through their practices. The practices were sociomaterial because the actors interacted with both human and non-human elements. However, I have not yet discussed the outcomes of these sociomaterial practices. In the next section, I will look more closely at what I call the outcome of learning in my thesis.

5.4 The outcomes of learning

The outcomes of the learning included tangible artifacts, such as a light rail, flood maps, action plans and bicycle paths; alternatively, the outcomes could be discursive, such as visions, frames and narratives. Hence, the outcomes of learning were visible within the meta, large and small urban laboratories. The most visible outcome of the learning was the small and the large urban laboratories (pilot projects and public transport systems). Perhaps a less visible yet equally significant outcome of learning was the meta urban laboratory – the CoF program itself. In an ANT perspective, the CoF program was not the cause but an effect of the participants' practices, because the program did not 'exist' prior to its enactment by participants. An early instance of enactment of the program took place in 2008 when the participants signed a letter of intent, which stated that all parties had to actively engage in and commit to the program. One of the assignments was that the 13 cities had to make their own action plans for handling local sustainability issues. The participants further enacted and materialized the CoF program through a set of meeting places where they discussed ongoing work to improve the sustainability in the 13 cities. In

this process, the participants had to negotiate the context of learning – the content and goals of urban sustainability – as well as how to enact these goals.

National and local government actors considered the CoF program a success, and emphasized particularly how the program facilitated valuable meeting places to discuss urban sustainability work in Norway. The participants were especially excited by what I call the horizontal learning networks in CoF – the networks of city actors working in the local governments. The city actors enacted the horizontal networks by visiting other cities and exchanging ideas, experiences and concerns. The city actors state that these exchanges were very useful to them. It was more challenging to establish such exchanges between the local government actors and the national government. In paper 1, I show that several actors in the local governments complained about a lack of commitment and engagement from the national government. I interpret this as a deficit because the national government and the 13 local governments could potentially have enacted a vertical learning network in the CoF program.

My papers focus on exchanges of ideas and experiences in both the horizontal and the (partly lacking) vertical networks in CoF. It was clearly easier to enact the horizontal network or networks. This does not mean that national government actors were absent within the CoF program. On the contrary, they initiated the program and facilitated collaboration between the other parties. For instance, the national government led the annual political and the administrative meetings in CoF, and had the overall responsibility for activities in the five thematic networks. In this respect, the national government engaged in social learning by means of 'learning by regulation' (Sørensen, 1996) because they provided an infrastructure to regulate urban sustainability work in Norway. This infrastructure required several 'ordering actors', which are elements that attempt to order a field (Williams et al., 2005). In CoF, these ordering actors were primarily national politicians, the letters of intention, and the local governments' action plans.

To summarize, I will suggest that the outcomes of learning was the enactment of three types of urban laboratories intended to make Norwegian cities more sustainable. These were the pilot projects, which I consider to be small urban laboratories, the public transport systems, which I explained functioned as large urban laboratories, and finally the

CoF program itself as a meta urban laboratory where results and experiences from the small urban laboratories would be assembled and circulated.

In this crosscutting analysis, I have discussed what I consider to be three related aspects of social learning in urban sustainability. First, the features of the context of learning concerned making both goals towards and content for urban sustainability. This context was not stable, but the result of ongoing negotiations, primarily between the national and local governments. Second, the elements of practice of learning considered especially the CoF participants' but also the relevant social groups' (working in the large urban laboratories) practices to develop and deploy their expertise. Third, in the outcome of learning I argue that the participants in CoF enacted three types of urban laboratories to make Norwegian cities more sustainable. The context, practice and outcomes of learning are related because they all concern the making, learning and sharing of experiences to improve the sustainability of Norwegian cities. Importantly, the outcome of learning did not represent an endpoint, but rather produced new contexts and practices of learning through the city actors' constant negotiations. I understand the enactment of urban sustainability to occur through this continuous process. Figure 2 below illustrates the relation between the context, the practice and the outcomes of learning.

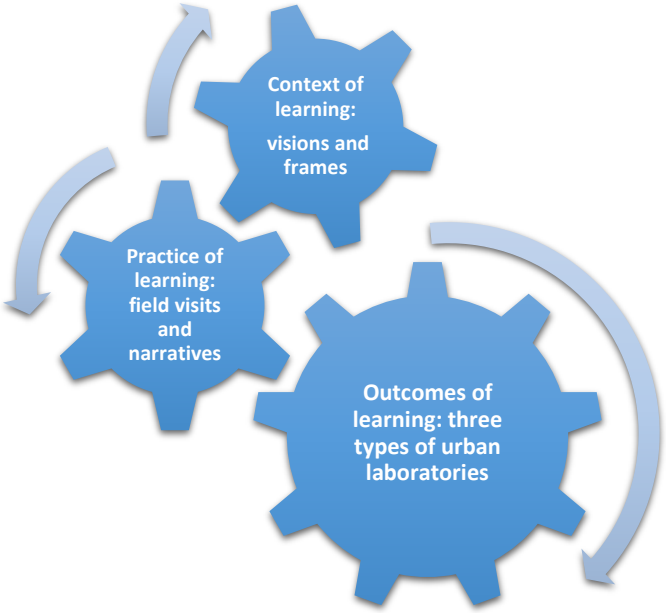

Figure 2: The content and relation between the context of learning, the practice of learning and the outcomes of learning.

The figure above illustrates the ongoing enactments of 1) the context of learning by creating visions and frames, 2) elements of the practices of learning, by going on field visits and constructing narratives, and 3) the outcomes of learning represented by the three urban laboratories. In the following section, I will elaborate on the findings from this crosscutting analysis by discussing what kind of learning that took place within the CoF program and what kind of learning initiative it was.

6. Discussion and conclusion: learning by transacting in a learning economy

The actors in the 13 participating cities learned by interacting with other city actors, places, tools and objects. This interaction, which I have called the horizontal learning networks, was highly appreciated by the city actors. The participants in CoF engaged in reciprocal relationships, making it challenging to distinguish between those who learn and those who teach. Thus, the participants could take on both the role of producers and users of urban design knowledge. The interaction between the national and the local governments, what I refer to as the vertical learning network in CoF, mostly concerned the exchange of ideas and visions. The national government managed the program by orchestrating meetings and allocating resources. Beyond that, there was little interaction in the vertical network. To account for both these types of interaction, close and distant, that took place within the CoF program and to highlight the dimension of translocal learning, I propose to use the term 'learning by transacting'.

Economists have used the concept of 'learning by transacting' (see for instance Zheng et al., 2010; Wong, 1992; 2001) to describe economic models. I use learning by transacting in a new context, namely to account for how actors working to improve sustainability in cities interact and learn. The prefix 'trans' calls attention to how the city actors learn across disciplinary fields and urban sites – attention to what happens 'in-between'. By this I mean that social learning takes place between several types of expertise including experience-based knowledge, what we in paper 2 refer to as transdisciplinary social learning, but also between several sites and actors, as we illustrate through the notion of translocal social learning in paper 2. The notion of 'learning by interacting' also includes translocal learning. However, I will argue that the term 'transacting' accounts for this more explicitly and is suited to account for the learning activities that I observed in the context of urban sustainability. The notion of '*learning by transacting*' contributes to the understanding of sociomaterial learning precisely by highlighting learning as a relational activity that exceed disciplinary and site specific engagement.

I use the verb 'transacting' instead of the noun 'transaction' to emphasize the practice of learning – that the actors in the CoF program learned by engaging in practice. Learning by transacting denotes the practices by which actors transact ideas and relevant

experiences in stronger or weaker relations. I found that there were strong relations within the horizontal learning networks, but weaker relations in the vertical network. The participants in CoF learned by transacting within the program, but also outside CoF, as in the large urban laboratories like the Trondheim metro bus, or in urban laboratories abroad. In this way, the city actors learned by transacting with a greater community of stakeholders working with urban sustainability.

By contrast to the concepts of 'trading' and 'exchange', learning by transacting points to a goal-oriented type of sharing ideas and experiences, in which learning is the goal of the process. Learning by transacting is not to be confused with ideas coming from the management literature concerning the idea that knowledge travels unaffected from site to site, enlightening those it meets on its way. When artifacts start to travel it is impossible to predict exactly where and how they will end up. Learning by transacting acknowledges the main idea of translation theory as put forward by Callon (1986), namely that artifacts necessarily re-assemble, or transform, during travel. Thus, learning by transacting also involves innovation because artifacts re-assemble when the city actors embed them in new locations.

I have called the CoF program a meta urban laboratory consciously set up by the national government's previous experiences with urban sustainability work in Norway. This meta urban laboratory served as *a learning machinery* for exchanging and processing ideas and experiences between the small urban laboratories in the 13 participating cities. To this end, the CoF program depended on the learning transactions occurring within these urban laboratories in order to be successful. Likewise, the urban laboratories depended on the meta urban laboratory for funding and coordination, making the laboratories interdependent. This brings me to the question of what kind of learning initiative CoF was, and to answer this, I will briefly revisit some concepts on community learning introduced in section 4.

The CoF program was not a community of practice (Lave & Wenger, 1991) because this framework emphasizes that learning takes place among participants working in close proximity over time. This learning is limited to a local context within a stable community. By contrast, the participants in CoF worked in a translocal setting. In addition, the

community of practice framework explains the acquisition of expertise as a process in which members of the community move from peripheral legitimate participation into full participation (Lave & Wenger, 1991: 37). The national government did not set up CoF as a hierarchical learning network, but rather treated participants as equal learners. In this regard, the CoF program may have more similarities to Lindkvist's (2005) 'collectivity-of-practice', which points to how specialized individuals operate in project organizations. However, learning in Lindkvist's collectivities takes place among a group of expert practitioners in a specific field. The CoF program was innovative exactly because it aimed to facilitate learning among different types of actors, such as the national government, local politicians, urban planners and industry. CoF was a transdisciplinary (Gibbons et al., 1994) learning program, and included several types of expertise, experiences and actors.

As a more appropriate alternative, I propose to use the concept of *a learning economy* (Lundvall & Johnson, 1994; Lundvall, 1996) to describe the CoF program. The term learning economy denotes a community in which the success of individuals, firms, regions and national economies depends on their capability to learn (Lundvall, 1996: 2). A fundamental characteristic of a learning economy is the formation of local and cross-national knowledge-based networks (Lundvall, 1996: 11). However, learning economies depend on the related national systems of innovation (Lundvall, 1988; 1992; Nelson, 1993) because innovation does not only occur in the learning taking place between producers and users; it also relies on how the national government facilitates and coordinates this learning. The CoF program was a part of the national innovation system in Norway because it initiated and coordinated the transactions of ideas and experiences between the urban laboratories connected to the program. Thus, the national government in Norway tried to construct a particular learning economy through the CoF program. This learning economy comprised ongoing learning by transacting among actors working to improve the sustainability of Norwegian cities.

While the concepts of learning by transacting and the learning economy are not new, I use these in a new context – that of improving the sustainability of cities. With these concepts, I have developed ways to understand and account for the learning activities that take place in different types of urban laboratories. I have suggested distinguishing between the small urban laboratories aiming to make transdisciplinary and translocal social learning

in pilot projects and the larger urban laboratories making public transport systems, and last but not least, the meta urban laboratory, which coordinates the activities in the other laboratories. The CoF program appears to have developed mechanisms to generate a learning economy. Thus, the implementation of the meta urban laboratory was perhaps the greatest innovation in its ability to facilitate learning among city actors in Norway. While Lundvall (1996) argues that modern societies already are learning economies, I will suggest that being a learning economy is not a stable condition. Rather, it has to be constantly upheld by means of learning by transacting.

I have suggested that the CoF program aimed to create a learning economy in the field of urban sustainability by means of learning by transacting. This may at first glance seem like a predominantly theoretical contribution, but it also has some policy implications for urban development work in Norway. Discussions on urban sustainability often cite the lack of knowledge among those responsible as the main barrier of progress. With such an understanding of the problem, the obvious solution seems to be to raise the level of knowledge in the field. Surely, there were some areas, for instance, climate adaptation, in which the city actors had less experience and needed to learn. However, the city actors pointed out that they often knew what to do, and to some extent also how they could do it. The problem was that they had limited time and resources, and that they lacked the capacity to coordinate all these tasks. Thus, the city actors faced two types of challenges in their work to improve the urban sustainability: limited experience with certain sustainability tasks, and a lack of sufficient tools and coordination capacity.

The CoF program aimed to solve these challenges by helping the participants to gain more experience, primarily through the creation of pilot projects and by coordinating the activity among the actors. The participants in CoF established new boundary objects, tools, routines and practices that contributed to knowledge making, learning and sharing. However, the participants in local governments clearly expressed that the learning activity within what I have called the horizontal network worked significantly better than the activity within the vertical network. For instance, the city actors pointed to a lack of coherence between the national goals of urban sustainability and the tools provided by the national government.

The national government plays a crucial role in facilitating urban sustainability. As I illustrate in paper 1, the greatest controversy in urban development work in Norway concerned the distribution of responsibility between the national and local governments. Though there is a growing discourse that cities must take on greater responsibility in sustainability concerns, they remain dependent on clear guidelines and sufficient funding from the national government to take on this role. For instance, lack of coherent long-term funding from the national government was a barrier to building and operating public transport systems.

The participants in CoF considered the program as an efficient tool to build and facilitate coordination between several stakeholders working with urban sustainability. Despite the positive outcome, the national government decided to discontinue the program when it formally ended in 2014. This decision caused confusion and frustration within the professional planning community, who wanted to continue the network collaboration. By now, there is no equivalent program, no meta urban laboratory, to continue coordinating activities to improve sustainability in Norwegian cities. It takes time to develop and sustain learning by transacting. The CoF program was a start in the right direction, but it remains to be seen how absence of a similar kind of institution will affect the learning economy of urban sustainability work in Norway.

I will end my discussion of the papers here. So far, I have emphasized the practices of the actors involved in the CoF program. In the next and final section of this introductory and overview essay, I will reflect upon my own practices concerning my dissertation research, including an account of why my project group chose to investigate the CoF program, and what types of methods I or we used to gather and analyze the empirical material.

7. Methodological reflections

This thesis is situated within a constructivist research tradition. By this, I mean that I do not view my research findings as discoveries of the world I have studied. I have not 'captured' any reality of urban planning in the three papers, for methods are not, and can never be, innocent or purely technical – they do not 'report' on a given reality (Law, 2004: 143). Rather, methods are performative – they help to produce realities (ibid). I see my findings as constructed, similar to the ways in which the social scientists of the laboratory studies concluded that knowledge production depended on some crucial practices (see Knorr-Cetina, 1995 for an overview). In other words, my research findings are co-constructions that emerge from my interpretations, opinions and interests, the people with whom I interacted during fieldwork, discussions with colleagues, my supervisors in particular, the sites I or we visited and tools such as my computer, audio recorder, research articles, reports, etc. The list goes on, but I have made my point.

Further, my thesis is inspired by research principles articulated by actor-network theory. Latour (1999) argues that despite its name, actor-network theory (ANT) does not count as a theory, because it is not predictive, nor does it offer any social laws. Latour (2005) calls it an empirical philosophy – a kind of experiment designed to describe the world in new ways. In this perspective, ANT is more of a methodology and tool-kit for thinking about and studying the social (Law, 2008). Law and Singleton (2014) argue that ANT is also a critical sensibility both analytically and politically, and a way of undoing otherwise taken-for-granted assumptions. To this end, ANT represents a political project (see Latour, 2005) because it challenges traditional ways of categorizing for instance 'the social', 'nature' and 'culture'. No matter how ANT is defined, it remains an approach with a strong commitment to empirical descriptions, requiring the social researcher to closely follow the actions, understood as both physical and discursive, undertaken by the actors in a field.

Donna Haraway (2015) claims that it matters which stories tell stories, and in this part, I will tell a story about what I have done during these three years of thesis writing. Certainly, this story is not the only possible one, and my project could have taken other directions. The choices I made along the way were informed by what I, at each point, found

to be a reasonable way to explore my questions; they were also, of course, guided by significant pragmatic considerations. I will start by giving an account of why we chose to investigate the CoF program. This is followed by an overview of how I collected data, and how I analyzed this material. Afterwards, I will reflect upon the fieldwork itself, focusing on the method for data collection referred to as 'shadowing', which was new to me at the time. I will end the section with a description of what I see as the limitations of the thesis and some final remarks.

This thesis is part of a research project called BREV – Bringing Environmental Knowledge into Action. When I was recruited to this project in August 2014, the ambition was to study so-called environmental knowledge management in Norwegian local governments. The project's objective was based on the observation that knowledge management had previously been studied in knowledge-intensive service industries (Easterby-Smith et al., 2000), and the BREV project aimed to apply this set of approaches to local governments' work with environmental issues. The concept of environmental knowledge management involved studying how local government actors acquired knowledge to improve urban sustainability, which tools and systems they used, how they brought this knowledge into the formation of more concrete plans and strategies, and how they enacted it. The project also explicitly stated a need to know more about how environmental knowledge travels within local government as well as between municipalities and other actors.

The BREV project aimed to investigate the efforts of city actors working to improve urban sustainability in Norway. The project team selected the Cities of the Future (CoF) program as a strategic site to this end. This program had a clear dual focus on learning and knowledge sharing among the national and local government actors, and on the importance of coordinating this knowledge. Furthermore, it had an explicit environmental emphasis concerning efforts to improve the sustainability of Norwegian cities. In addition, CoF focused on a geographical distribution (involving the 13 largest city areas in Norway) concerning the production and dissemination of knowledge to help improve sustainability. Thus, the program presented the opportunity to study the interplay between several actors and sites.

Transport planning is an important area with respect to urban sustainability, and the CoF program chose this area as one of their five thematic networks. Due to its importance, I wanted to explore transport planning more thoroughly. I chose to follow Bergen's and Trondheim's transport planning work because these cities have been recognized as successful in planning and facilitating sustainable transport. I was particularly interested in how the urban planners enacted sustainable transport development, how they dealt with potential controversies that arose, why the cities chose different public transport systems, and the city actors' reflections on these choices.

My main research question for this thesis is how urban planners and policy-makers in Norway learn to enact intended urban sustainability. It struck me quite early that this was a very open question: was I interested in all types of learning practices? I did not want to narrow the research question too much, and in line with ANT principles, I did operate without any clear hypotheses from the start. Jasanoff (2004: 276-277) advises researchers to complicate the 'why' questions of cause and effect, which have formed much social science research, and rather add questions of 'how' to their agenda. In the three papers in this thesis, I ask what the actors actually do and how they do it, rather than try to uncover why they do so and examine the immediate output of their actions. I have tried to follow the actors – quite literally when I shadowed urban planners – and make thick descriptions of my experiences in the field.

Due to my focus on how the relevant actors learn urban sustainability, I adopted a qualitative research design to arrive at an in-depth understanding of the actors' practices, experiences and interpretations. Briefly stated, I have combined various qualitative methods such as shadowing, interviews, and analysis of policy documents and newspaper articles. In the following, I give an account of how I gathered and analyzed this data material. Morse (2007) points out that data collection and data analysis should be carried out as one concurrent process. I do agree with this view, but I have separated the data collection and analysis process here for analytical purposes.

7.1 Data collection

To begin the investigation of how city actors in Norway learn urban sustainability, we (the BREV project team) had to get in contact with those working in the field. We arranged a full-day workshop in November 2014 with relevant stakeholders[18] to learn what these actors considered important, challenging and desirable in questions of urban sustainability. The aim was to identify stakeholders' knowledge needs and initiate an ongoing dialogue with them. At the workshop, we discussed challenges facing cities and their ability to deal with climate change issues. The participants raised issues such as how to balance efforts between greenhouse gas mitigation and climate adaptation, the importance of handling local air pollution in the largest city areas, and the persistent lack of coordination of activities in urban sustainability work.

The workshop served as a focus group and provided valuable input for further data collection. For instance, several of the participants discussed their visions of desirable future cities. The program name 'Cities of the Future' taps into imaginaries and expectations of future cities as well. As a source of visions and imaginaries in the media, I chose newspapers as my primary source. I wanted to explore visions of future cities and urban transport as represented by the media, and simultaneously gain perspective on the associated controversies and debates. Newspapers have a wide circulation and large readership in Norway (Østbye, 2008), and they represent an important arena of information and public debate. It was my aim to explore this public debate with respect to urban sustainability.

I started by collecting newspaper articles from the online database Retriever. I used the name of the program 'Framtidens byer' (meaning 'cities of the future') to search for publications from national, regional and local press during the program period from 2008 to 2014. This resulted in more than 500 articles, including letters to the editor and feature articles written by public contributors such as Norwegian politicians, researchers and the public at large. The written press served as an important source to learn more about the

[18] Participants were local planners in Trondheim municipality, representatives from The Ministry of Local Government and Modernization, the Norwegian Association of Local and Regional Authorities, the Norwegian Agency of Environment, the Norwegian Public Roads Administration, SINTEF, the Eco-Lighthouse foundation, as well as urban studies and STS scholars.

Cities of the Future program, but also about general discussions on urban sustainability in Norway.

I subsequently collected newspaper articles addressing sustainable transport in Bergen and Trondheim from the same online database. Both cities have organized their urban transport work into a three-party collaboration between the state, county and municipality. In Trondheim, the program is called Greener Trondheim, and in Bergen, the Bergen Program for Transport. I used these transport programs as points of entry into the written press analysis. My aim was to identify how sustainable transport, in particular the new bus project in Trondheim, the metrobus, and the light rail in Bergen, was framed and debated in these cities' regional newspapers Adresseavisen and Bergens Tidende.

In addition to the project manager and my main supervisor, Professor Vivian A. Lagesen, I collaborated with postdoctoral researcher Lucía Liste Muñoz on parts of the data collection and analysis. We examined relevant national and local government documents, including White Paper 34 (2006-2007), where the CoF program was introduced for the first time, the website of the Cities of the Future program, and the first-generation action plans for all 13 cities participating in the program. We chose the cities' action plans to examine how the cities had operationalized the national governments' visions and goals and adapted them to their local city context. Further, I examined the National Transport Plan for 2014-2023, Bergen's and Trondheim's second-generation action plans, as well as the website of the Greener Trondheim program and the Bergen program for transport.

As we wanted to explore the practices of those involved in the CoF program, we had to engage in conversation with the relevant actors. We started by identifying relevant actors in the CoF program by searching on the program's official website. It often struck me how easy it was to obtain access to the field. Nearly all of those we contacted for an interview confirmed their willingness to participate. We sent requests by email, in which we introduced the BREV project briefly, explaining that we were interested in the potential interviewees' experiences and impressions of the CoF program. By the time we conducted the interviews the CoF program was finished. Fortunately, the network appeared to be relatively transparent, and the interviewees were able to recommend other key actors in the program. We interviewed civil servants (13 in total) participating in the program at the local,

regional and national administrative levels. We chose representatives from Oslo, Bergen, Trondheim and Drammen. The first three are the largest cities in Norway, and we chose to include Drammen because it has been recognized as particularly successful in improving urban sustainability over the past decade. We conducted the interviews in February and March 2015. We conducted ten face-to-face interviews and three interviews by phone.

Liste Muñoz and I conducted eight of the interviews together. I had no prior experience with co-interviewing, but I think this enriched the interview situation because there were two of us responding to the interviewees' stories and generating follow-up questions. It was, however, sometimes a bit challenging as well because the postdoctoral fellow and I occasionally had different interpretations of the interviewees' stories and hence different plans for the subsequent direction of the interview. We solved this problem by assigning a main interviewer in each situation, leaving the other to take notes and follow up with questions in the end.

The next interview round took place in a planning agency in Bergen in May and June 2015. Here, I interviewed four employees working with sustainable transport planning. I selected these employees partly due to their different areas of responsibility, from bicycle to light rail planning, and partly due to their accessibility. I conducted the third and final interview round in a planning agency in Trondheim in November and December 2015. As in Bergen, I also interviewed employees involved in sustainable transport planning, in particular those working with projects in the Greener Trondheim program. Since regional governments ('fylkeskommunen') in Norway are responsible for operating public transport, I also sought insights from regional transport actors. I interviewed a regional politician and a leading regional transport stakeholder in both Sør-Trøndelag and Hordaland County (in which Trondheim and Bergen are the main cities, respectively). I conducted these interviews between November 2015 and January 2016, two of which by phone.

The interviews with participants in CoF focused on these actors' reflections on the successes and challenges of the program, interdisciplinary knowledge, learning, and collaboration between the national and local governments. The interviews I conducted in the planning agencies focused more on the city actors' practices, as I wanted to explore more closely what sustainable urban development looked like from their point of view. In

both occasions, I began the interviews with an open question such as 'tell me about the CoF program', or 'tell me about what you do during a working day'. I brought an interview guide with me to ensure I covered all the topics. I followed this guide in the first interviews, but after a while I let the interviewees speak more freely, supplementing their responses with follow-up questions.

While interviews were designed to help us arrive at how the relevant actors describe, explain and evaluate urban sustainability work – their discursive actions – they were less suited to gaining insight into what these actors actually do at work. I realized that many of the interviewees in the planning agencies found it challenging to talk about their everyday practices. For instance, if I asked: tell me about a regular working day, I often got the answer: all my working days are different. Me: ok, tell me about any day, what do you do at work? In this case, most of the interviewees started summarizing their main tasks and articulated what goals they aimed to achieve. In the beginning, I felt a bit upset: couldn't they just tell me what they actually do? By contrast, the same planners and policy-makers who had trouble formulating what they actually did during a given day did not find it hard to describe their knowledge sources: discussions with colleagues, reviewing planning documents, reading handbooks of planning or reports describing urban experiments, or first-hand experiences from site inspections. I realized that their actions with these knowledge sources served as a fruitful means to explore how they enacted their expertise.

I wanted to explore the practices of making sustainable cities and needed an additional set of methods. I chose to spend one month on shadowing two planning agencies in Bergen and Trondheim (roughly two weeks spent in each agency). When I got out in the field shadowing and spent several days with the planners, I realized that their working days depended largely on whichever tasks came their way. They might open their e-mailbox in the morning and find an urgent matter, suddenly changing what they had planned. They were therefore more eager to tell me about what kind of problems they were out to solve, rather than how/if they opened their e-mailbox, went to meetings, discussed with colleagues, went to lunch and so on. In this way, shadowing proved to be a more fruitful method than interviewing for studying actions.

Czarniawska (2007) calls the method of shadowing 'a fieldwork on the move', because the researcher follows the shadowed person closely. In this light, shadowing takes the ANT principle of 'following the actors' literally. Shadowing as a method is not to be confused with being invisible, or a fully participating researcher, but focuses on what happens in routines, which are often so familiar to those being shadowed that they are difficult to articulate (Czarniawska, 2007). The method lies somewhere between doing observation and participant observation. I clearly separated my particular work and the tasks of the employees in the agencies. Still, I was present in the urban planners' internal meetings and meetings with external parties, public meetings, in field visits and during lunchtime. I recorded my fieldwork in a written diary, on an audio recorder, and with a go-pro camera.

I conducted a total of eight interviews with the transport planners in Bergen and Trondheim at the time I was shadowing the agencies. This experience of shadowing and interviewing in close succession gave me the opportunity to compare what I observed these planners doing at work with how they described their working day to me. It is important to state that my task was not to 'reveal' any gap between what the planners did and what they said they were doing (and I had to point this out several times). My aim was to explore how urban planners enacted sustainable transport planning, particularly how they make (use of) knowledge and how they learn to do this type of work. I sought to study the urban planners' ongoing and situated practices during their workdays. The interviews and the method of shadowing gave a complimentary picture of what sustainable transport planning consisted of.

7.2 Data analysis

It is tempting to say that I sampled and analyzed the data using grounded theory methods, which is a systematic coding procedure recognized by social scientists as a way of communicating the process of gathering and analyzing data. Grounded theory has been explained as the most widely used qualitative interpretative framework in social sciences (see Denzin & Lincoln, 1994). To put if briefly, Glaser and Strauss (1967) first introduced grounded theory as a method to develop theory from empiricism. The basic premise is that rather than applying existing theories to the data, theories emerge from the data itself. The

approach has subsequently developed in several directions and somewhat diverging from its traditional inductive approach towards a more abductive orientation (see for instance Strauss & Corbin, 1990; 1994; Charmaz, 2006). Grounded theory methodology does not fit within established research paradigms, such as positivist, interpretative or postmodern, but should rather be seen as a general methodology (Holton, 2007). The grounded theory methodology has been helpful to me in the analysis of the newspaper articles, interview transcriptions and my field diary. I will give a more thorough account of how I did this.

I analyzed the newspaper articles with several levels of detail. The first phase was rather superficial and involved reading a great number of newspaper articles about the Cities of the Future program concerning the aim of the program, how it was established, and the actors involved in this process. In the second phase, I selected what I considered the most interesting articles focusing on visions and expectations of future cities in Norway, and/or controversies in urban sustainability planning. From this selection, I ended up with a total of 70 articles that I read closely. The newspaper articles comprised reportages, chronicles and letters to the editor. I did not explicate these differences because I was more interested in the content rather than potential intentions and motivations behind the newspaper texts. In this way, it is more precise to say I did a content analysis of newspaper articles rather than a media analysis. I made open analytic codes of pieces of text, which I further grouped into categories (for example, 'the vulnerable city' and 'the human city') that I compared and explored. I collected these coded text pieces in a table, and translated them from Norwegian into English, as in the example below.

Table 1: Example of open coding of newspaper articles

Content	Codes	Category
What values do we want future residents to possess? Should citizens of tomorrow contribute by creating a society where terms like sustainability, holistic views and ecology are familiar terms? We must, according to the program *Framtidens byer*, change our consumption routines as well as re-launch 'close values'. The society sketched by *Framtidens byer* is a society longed for by every cell in our bodies. This society is sustainable and people are the most important part of it.[19]	*Citizen participation *Close values *Human sustainable cities	**The human city**

Liste Muñoz and I analyzed the interview transcriptions from CoF participants by using two overlapping strategies. One strategy was to make situational maps inspired by Clarke (2005) in order to identify empirical elements involved in the program. Here, we sorted out human as well as non-human elements described as important by the interviewees. We then grouped and categorized these elements. The other strategy was to make summaries of all the interview transcriptions. From these summaries, I identified empirical findings and listed them as bullet points. The two strategies of map-making and summary writing helped to open up the material and explore the variety of elements involved in sustainable urban planning. These strategies contributed to ordering the elements into categories and further empirical findings. We attempted to code some of the summaries and interview transcriptions together, but this turned out to be challenging because we wanted to make different types of codes and had different perceptions of the content in these codes. We decided to code the data separately and discuss the codes and findings afterwards.

I do not want to underestimate my own pre-understanding of the data considering that I was present during the interviews: I remember the small talk prior to the interviews, the interview situations, if some parts were humoristic or ironically meant and so on. Moreover, my pre-understanding of the topic also has been important to the analysis. When I analyzed the newspapers, I did not know what to expect, but when I conducted the

[19] Robberstad, S. (2010). Framtidens innbygger. Stavanger Aftenblad.

interviews and analyzed the transcriptions, I knew more about the CoF program, urban sustainability efforts and controversies in Norway. This knowledge concurrently influenced my expectations of what to find.

In line with principles of grounded theory, I prepared memos of the interview transcriptions. Memos are theoretical notes about the data and the conceptual connections between the categories (Holton, 2007). Holton (2007) suggests writing memos to develop ideas that emerge from the data material. Clarke (2005) describes memos as the researcher's conversation with and about the data. I have recorded several of such conversations in a personal log I have kept over the past three years. The greatest gain in writing this log has been the ability to immediately go back three years to see how my thoughts about the project have developed.

The main data from shadowing the planning agencies were field diaries, and I analyzed these by making codes and categories. In the end, I had four versions of the diary. The first version was unpolished with 'raw' empirical descriptions, including my own personal reflections and ideas. In the second version, I focused on overall categories and attached quotes to them. In the third version, I followed some of the main categories I found most interesting. The fourth and final version was a short report (about five pages) which I sent back to the agencies. These reports contained empirical descriptions of how I interpreted their work with urban sustainable transport, including some perspectives upon which they could reflect in their further work. To summarize, Table 2 gives an overview of all the data, including how I collected and analyzed it.

Table 2. Overview of data collection, source and methods of analysis.

Data collection method	Data sources	Analysis methods
Newspaper articles	**Search terms and timeframe** "Framtidens byer" (01.01.2008 to 31.12.2014) "Miljøpakken" (01.01.2007 to 31.12.2014) "Bybanen byggetrinn 3" (01.01.2013 to 01.01.2015) "Superbuss Trondheim" (open timeframe)	Grounded theory/content analysis
Online sources	**Websites** Framtidensbyer.no (Cities of the future) Miljopakken.no (Green partnership agreement) Bergensprogrammet.no (Bergen program for transport) Bybanen.no (Bergen light rail)	Content analysis
Documents and reports	**Policy documents** White paper 33 National Transport Plan 2014-2023 and 2018-2029 National cycling strategy 2014-2023 Norwegian National Travel Survey 2013/2014 11 action plans (first generation) Bergen action plan for cycling 2010 Trondheim bicycle strategy 2014-2025 **Reports** Evaluation of Cities of the future (Rambøll, 2015) Cities of the Future main report 2008-2014 Status report Cities of the Future 2012 **Agreements** Letters of Intent Cities of the Future	Thematic analysis/content analysis
Stakeholder Workshop	Thematic discussion/focus group	Observation and notes
Semi-structured interviews	Seven city contacts in Cities of the future Three program managers in Cities of the future Two network leaders in Cities of the future Five representatives from regional government Seven urban planners/architects in the planning agencies One employee Norwegian Public Roads Administration	Situational maps, summary writing and grounded theory inspired analysis of full transcriptions
Shadowing	Four versions of field diary from Trondheim Four versions of field diary from Bergen	Grounded theory inspired analysis of field diary

7.3 On being a chameleon: reflections on fieldwork

> Fieldworkers often have to transform themselves into something quite distinct from people's initial assumptions, often occupying many different persona in order to work with many different kinds of people. I will shift from being young, old, male, female, comic and serious all the time (Miller, 2007, cited in Czarniawska, 2007: 40).

Miller (2007) captures the experience of researchers who must play several roles, transform and adapt when doing fieldwork. He emphasizes that, as a researcher, he has to become a person with whom those he observes like to spend time with. He does not see this transformation of the self as manipulative, but rather as a responsibility to make the experience more comfortable for the people giving their time and information (Miller, 2007). Though Miller (1998) did an ethnography of shopping and I shadowed urban planners working with sustainable transport, I can identify with this description, and I found that such a 'chameleon approach' was sometimes challenging. On the one hand, I tried to play down my academic position and ask open and 'naïve' questions, but on the other hand, I had to appear as knowledgeable enough to engage in interesting conversations about urban planning.

Urban planning was a new field to me, with foreign practices, languages, terms and jargon. It took me a while to become familiar with the terms and certainly with the political and administrative processes involved. I think it was clear to my interviewees that I was not an expert in urban planning, and as a result, they took time to explain the basics to me. During an interview with a transport stakeholder, the interviewee had the following reaction to one of my questions: 'are you asking me because you want to test me or because you don't know'? In some of the interviews, I felt I had to prove myself in the field by showing that I was familiar with at least some important terms. For instance, when interviewing the program management and the city contacts in the CoF program, I could refer to goals of the CoF program, and when interviewing urban planners, let them know I was aware and up-to-date on controversies in urban planning.

The interviews lasted between 45 minutes and one and a half hours, and I or we conducted the interviews at the interviewees' workplace. Thus, I/we usually spent in total a maximum of a couple of hours on the interview situation, including small talk and a short introduction of the project prior to the interview and a short de-brief with the interviewees after. By contrast, when I shadowed in the planning agencies, I spent several working days among the planners. Thus, the challenge of taking on the 'chameleon approach' was most pressing during my stay in the planning agencies. On my first day in the agency in Bergen, I accidentally mentioned that I was going to shadow the agency, and this was stuck with me the whole period – I was from that time often referred to as 'the shadow'.

Shadowing was a new method to me, and I constantly wondered what to look for during shadowing, and what to do if the person I was shadowing, my 'shadowee', got tired of me. However, the role played by luck should not be underestimated in research: my shadowees were more than willing to discuss urban planning with me and invite me to relevant meetings. Moreover, I wondered to what extent the employees should be involved in my findings. Czarniawska (2007: 39) problematizes this as well, referring to Bakhtin (1981) who claims that the world of the scientist and that of the informants are likely to differ. For instance, it was difficult to explain the aim of my research project to the interviewees, as my focus on knowledge practices seemed a bit distant to their pragmatic problem-solving work culture.

The reality was that I had to deal with being the outsider in the planning agencies. I came from, in their minds, a foreign discipline, practicing a different type of work, and was therefore likely to ask some uncommon questions. It was important for me to keep an open dialogue with the planners regarding the purpose of my stay and my expectations of the fieldwork. In cases where I did not fully explain who I was, I experienced a certain mistrust and skepticism. I constantly had to remind them that I was interested in learning how urban transport planning was practiced, and that I did not intend to evaluate their work. I became a very visible shadow, especially during the first couple of days in the agencies.

The 'outsider' role was to some extent also an advantage because the urban planners did not take for granted that I was familiar with their points of view, and took their time to explain what they did, how and not least why. Czarniawska (2007) stresses that researchers

should actually strive to obtain such outsider status. Inspired by Bakhtin (1981), she says that an observer can never know better than actors in the field, but observers can see different things than actors (Czarniawska, 2007: 21). I did not find it hard to adopt the role of the outsider. For instance, I knew little about routines for site inspections, and this became very clear during my stay in Bergen. The agency had hired a consulting engineer firm for planning a new line for the Bergen light rail, and representatives from the planning agency invited the firm to a site inspection of the planned line. Since I was the shadow of one of these representatives, I was welcomed to join. This site inspection happened at the beginning of June, and I dressed in a light jacket and non-waterproof shoes. The other participants showed up with woolen sweaters, gloves, and full protective gear. Luckily, they had an extra set for me. It was (as often is) raining heavily in Bergen that day, and we were out for seven hours. When I finally got back to my room in the afternoon, and placed my soaking wet shoes in the bathroom to dry, I wrote in my field diary: 'I know nothing about site inspections'.

7.4 Final remarks

I have used several types of sources to collect data for this thesis: interviews, shadowing, stakeholder workshop, newspaper articles, reports, online sources and printed documents. Moreover, I have used several types of methods to analyze the data: grounded theory inspired analysis, situational maps and content/thematic analysis. I believe the combination of these methods has provided a rich picture of the main question pursued in this thesis, which is how city actors in Norway learn to enact intended urban sustainability.

However, time is always a limited good. In the end, I was left with plenty of descriptions of practices in urban sustainability work. Obviously, much of the empirical material did not fit into the topics of the three papers. Nevertheless, these descriptions have been important in the writing process as I could go back and re-experience, for instance, my time of shadowing in the agencies. In addition, the audio-visual material (pictures, recordings, video clips) that I produced during shadowing has also helped me to remember. At the very least the audio-visual material contributed by making my research presentations richer and, hopefully, more interesting to the audience. If I had more time I would have

written a paper focusing on how the transport planners seamlessly switched from being bicycle planner experts in one moment to bicycle users in the next. I found this role mixing between 'learned' and 'lay' in sustainable transport planning fascinating. In future work, it would have been interesting to also investigate maps and the planners' digital field visits as boundary objects to negotiate planning issues.

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Paper one: Visions as trading zones: national and local approaches to improving urban sustainability[20]

Abstract

Making cities more sustainable is high on the agenda in many countries, but a major challenge is the identification of which actors should contribute, and how. This paper departs from an assumption that visions may guide urban development work, and examines and compares national and local governments' visions of future sustainable cities in Norway. The object of study is the urban multilevel governance program 'Cities of the Future'. Previous literature on urban sustainability and multilevel governance stresses the importance of shared visions and goals between stakeholders. However, the paper finds that, in the context under investigation, visions were partially dis-aligned between national and local stakeholders. Nevertheless, participants from both national and local governments considered the Cities of the Future program as successful. This was especially due to the learning networks facilitated by the program. The paper critically discusses the assumption of alignment and suggests a shift of attention from the content of vision to the processes of *vision making*. By this, we may understand visions as possible trading zones for the negotiation of future directions in urban sustainability.

Keywords: Future sustainable cities; vision making; trading zones; national governments; local governments; actor-network theory

Highlights

- Diverging visions of future sustainable cities, the distribution of responsibilities, and the perception of citizens between national and local stakeholders
- Despite dis-alignment of visions, the program was considered as successful
- The process of *vision making* may be more important than the actual content of the visions
- Vision making enabled trading zones for negotiating possible future directions in urban sustainability

[20] Published as Ingeborgrud, Lina (2017). Visions as trading zones: national and local approaches to improving urban sustainability. *Futures*. Vol. 96, pp. 57-67.

1. Envisioning a future sustainable city

Visions play a vital role in efforts to enroll actors in agendas relating to urban sustainability. It is important to study these visions to analyze what issues that are considered crucial in these agendas, how the related goals are to be achieved, and the extent to which they are shared by relevant stakeholders. This paper studies vision making to compare the way in which national and local governmental actors in Norway present issues of urban sustainability, and the extent to which these presentations are aligned.

Williams (2010) stresses that there are two main challenges related to urban sustainability: first, there is the question of what a 'sustainable city' is; second, there is the issue of how one should *do* sustainability in cities. To begin, 'sustainability' is used in many ways, often to characterize efforts to improve environmental, social and/or economic conditions. However, such definitions meet with problems. For example, Campbell (1996) argues that conflicts between these three aspects are unavoidable in what he calls a battle over growth, the environment and social justice. In a different vein, Shove and Walker (2007: 766) fear that the concept of sustainability works as a legitimizing discourse, while Skjølsvold (2012: 40) shows that terms such as 'sustainable' and 'climate friendly' are relational and consequently negotiable within a given collective. While the sustainability of cities is a frequently shared goal, one cannot take for granted what such a goal means. Consequently, this paper departs from the studied actors' own understanding of sustainability to describe their visions of sustainable cities, and not any scholarly definition. Thus, I analyze the actors' articulation of the main goal – urban sustainability – and how they engage with it.

Much academic research on urban responses to climate change has been concerned with governance. Bulkeley (2015) summarizes some of these efforts. She finds that the main research questions have been why cities should take leadership with respect to climate change adaptation and mitigation, what kinds of actions should be prioritized, who should be responsible, and which institutional factors facilitate or prevent climate change action in city governments (Bulkeley, 2015; see also Hoffmann, 2011). The focus has primarily been on mitigation efforts, but issues of urban resilience, vulnerability and adaptation have also been on the agenda (Bulkeley, 2015: 7). Scholarly efforts often articulate so-called multilevel

governance contexts. This research has explored interactions extending vertically from transnational organizations to nation states, regions and cities, and horizontally to civil society organizations, businesses and other non-state actors (Bulkeley & Betsill, 2005; Coutard & Rutherford, 2010; Puppim de Oliveira, 2009; Romero Lankao, 2012).

These research efforts promote multilevel governance as a promising framework for the management of urban sustainability. The central idea within this is that efforts are coordinated and aligned between governance actors, presupposing shared visions across multiple levels. This paper critically discusses this assumption by exploring the visions made by national and local (city) actors participating in an urban multilevel governance program called 'Cities of the Future' (CoF). It investigates and juxtaposes the visions articulated by the national and city government actors in the program. What visions were expressed, and to what extent were they aligned among the participating stakeholders? In the next section, I discuss previous research on the role of visions in sociotechnical projects, such as efforts intended to develop more sustainable cities.

2. Understanding sociotechnical visions

Envisioning future sustainable cities is a sociotechnical effort in the sense that such visions combine social and technical elements. There are several approaches to explore vision making and the potentially performative aspect of sociotechnical visions, including concepts like trading zones, scenarios, and the sociology of expectations. To begin, Dierkes, Hoffmann and Marz (1996) explain how a vision may give actors who otherwise do not collaborate an opportunity to develop a shared goal and direction. In their opinion, visions may contribute to simplify complicated issues, in this case urban sustainability, and thus make it easier for non-experts to engage in the debate. This directs attention towards the content of the vision, seeing visions as an outcome of some actors' specific views. According to Dierkes et al. (1996), several actors must share a vision if the vision is to be more than an individual idea. In this sense, visions express an already achieved idea or consensus among the actors involved. As such, visions are consensus-building tools that enable actors from different fields and areas of expertise to cooperate (see also Jasanoff, 2015).

Gjøen (2001: 31) argues that Dierkes et al.'s (1996) understanding of visions as consensus-building is similar to Peter Galison's (1996) concept of trading zones, and the "work" that trading zones do. He developed the trading zone concept inspired by anthropological studies of how people from different cultures are able to exchange goods, despite differences in language and culture. Galison used the concept to analyze innovation processes in science, focusing on how computer simulations of the hydrogen bomb contributed in assembling and coordinating actors from different disciplines. He defined a trading zone as "an arena in which radically different activities could be locally, but not globally, coordinated (1996: 119, emphasis in original). Other scholars have picked up the concept, employing it for a variety of purposes. For example, Kellogg et al. (2006) use the concept to explain coordination of cross-boundary work in interactive marketing organizations. Collins et al. (2007) explore the evolution of trading zones, with a particular emphasis on interactional expertise, and provide some ideal types to explain how trading zones may work. Gorman et al.'s (2004) pilot study on collaboration between a material scientist, a social psychologist and a graduate student explore the societal dimensions of nanotechnology as a trading zone, and the division of labor within this collaborating team. Saporito (2016: 45) shows that the trading zone concept has been used by communicative planning theorists to provide practical tools and interpretative framework to guide participatory action (see also Balducci & Mäntysalo, 2013). In this paper, the concept is used to analyze processes of making visions related to urban sustainability.

Visions produced in some kind of trading zone, as defined by Dierkes et al. (1996), may be understood primarily as tools to make actors with otherwise different views, expertise, values and interests, to assemble and collaborate. The actor's views may be exchanged but also challenged in a trading zone. As such, the enactment of a trading zone does not necessarily depend on shared ideas, interests, or norms. This makes the concept of trading zone useful in exploring how actors negotiate the objects at stake. Following this line of thought, Gjøen (2001: 31-32) suggests that visions do not have to be consensus-building tools but may rather provide latitude for trading and negotiating ideas about the future. Thus, her use of the trading zone concept points to the processes of making visions, rather than seeing visions as outcomes of certain ideas, as suggested by Dierkes et al. (1996). For instance, Gjøen (2001: 170) finds that the making of visions of future buses running

on nature gas did not contribute to consensus about the future transport system. Rather, this vision making contributed in clarifying the actors' perceptions regarding the distribution of responsibilities with respect to this system. This suggests that there may be disagreement as well as consensus about future directions within such vision-making trading zones without disabling decision-making (Gjøen, 2001).

Berkhout (2006) argues that the primary role of visions may be to frame disagreement rather than to generate consensus about the future. The perception of visions as instances of established consensus is therefore a barrier to an understanding of visions as in the making (Gjøen, 2001: 31–32). Thus, stakeholders involved in sociotechnical projects do not have to choose between ready-made interpretations of the future. They may contribute by trading interpretations in the making of visions (Gjøen, 2001: 309). Accordingly, my analysis focuses particularly on the process of trading visions.

Another useful contribution is Callon's (1987) introduction of 'scenario' to describe the process by which a leading actor tries to mobilize interest in and support of a desired future, and to distribute roles to other actors in this process. Callon emphasizes that scenarios become strategic tools to enrol necessary allies to reach a goal. The so-called 'sociology of expectations' (Borup et al., 2006; Brown & Michael, 2003; van Lente, 2012) develops this view further by putting forward the idea that visions are performative because they are wishful enactments of a desired future (Borup et al., 2006: 286). Thus, expectations become important for realizing new sociotechnical options. In this process, expectations attract the interest of necessary or useful allies (such as actors in innovation networks, politicians, investors, users, etc.). Furthermore, expectations define roles and build mutually binding agendas among participating actors, similar to the processes that Callon (1987) sees as part of the work involved with scenarios. In particular, it seems important to have a shared, though flexibly interpreted, cluster of guiding expectations (Borup et al., 2006).

Other features of actor-network theory (ANT) may be helpful for analyzing complex sociotechnical processes, like sustainability city efforts. In particular, Latour's (2005) focus on controversies related to the sociotechnical work of assembling human and non-human elements is useful. Employing this framework, I consider relevant empirical objects as 'actants', like letters of intention, interview statements, bicycle paths, newspaper articles and

so forth. Latour uses the term actant to emphasize that human and non-human elements should be treated symmetrically in the analysis of emerging heterogeneous networks. Callon's (1987) emphasis of scenarios and the ensuing strategic enrollment efforts also illuminates how relevant stakeholders may and need to be assembled. However, ANT does not make assumptions about the outcome of processes of assembling human and non-human elements. Rather, it suggests how we may analyze such processes by focusing on controversies regarding the efforts of assembling elements. What actors are involved, what kind of controversies emerges, and what elements are party to the assembling process? These questions imply a focus on the evolving controversies and the efforts made to resolve these and achieve stability (Latour, 2005: 249). However, the importance of resolving controversies in order to make durable actor-networks has been contested. Singleton and Michael's (1993) study of General Practitioners involved in the UK Cervical Screening Programme illustrated for instance how ambivalence towards one's own and others attributed roles in a network may contribute to reinforce a network, rather than to threaten it. As such, trading (ambivalent) visions may be ways of un-blackboxing important elements of negotiation involved in urban sustainability work.

It is important to explore vision making as taking place in trading zones to understand the dynamics of complex projects such as urban sustainability and to observe how relevant actors exchange and negotiate ideas about future developments. This includes to study shared as well as controversial views and to assess the multilevel governance perspective by focusing critically on the interaction between multilevel actors in cities' sustainability projects. To do so, this paper build on observations of expectations of sociotechnical outcomes of sustainable cities but also analyses the proposed division of labor among main actors to reach sustainability goals. Moreover, according to Hunt and Watkiss (2011), local governments can mobilize different publics by linking climate change dynamics to local impacts. Bulkeley (2015: 7) stresses that citizens may find it easier to establish clear channels of communication with local governments than with regional or national governments. In line with this, the paper also focuses on actors' ideas about how to engage citizens in the development of sustainable cities.

To summarize, the paper will pursue the following research questions: How may 'the sustainable city' be envisioned and negotiated by national and city stakeholders? What

assemblages are constructed in the process, and how are roles distributed in them? How are citizens' engagement perceived? To what extent are national and local visions aligned, and with what consequences?

3. Methods

This paper juxtaposes and studies the visions of national and local authorities with respect to urban sustainable development through 'Cities of the Future' (CoF) – a program initiated by the Ministry of the Environment to promote sustainable development in Norwegian cities, in particular reducing greenhouse gas emissions. The program ran from 2008 to 2014 and aimed at producing a partnership between four ministries (Climate and Environment; Local Government and Modernisation; Petroleum and Energy; and Transport and Communication), 13 cities, invited industry stakeholders, and the Norwegian Association of Local and Regional Authorities. The agreement underlying the program stated that city governments should be key actors in reducing greenhouse gas emissions, but in close collaboration with national authorities. The program emphasized that success would depend on the participation of citizens. Finally, CoF was organized as five thematic interdisciplinary networks: (1) land use and transportation; (2) stationary energy use in buildings; (3) consumption patterns and waste; (4) climate adaption; and (5) better urban environment.

CoF reflected the autonomy of local authorities. Norwegian local governments have considerable space for independent decision-making, also with respect to local efforts of sustainable development. This means that national authorities in many areas do not instruct city governments but employ general policy instruments that are open to interpretation. CoF was meant to facilitate learning and innovation in Norwegian cities' sustainability transition efforts. This involved development of visions that could guide national and local initiatives. Moreover, the program name directed attention towards visions and expectations about city futures. Thus, the program is an interesting place to explore vision making with respect to urban sustainability as well as the relationship between the scenarios of national and local authorities.

I have employed a qualitative research design to gain in-depth knowledge of stakeholder accounts to illuminate the issues, using a broad set of sources: interviews with CoF participants; official documents from national and local authorities; shadowing two city planning agencies; and newspaper articles. First, in order to learn about urban development debates in Norway, I collected newspaper articles using the online media base Retriever. Newspapers are widely read in Norway (Østbye, 2008). Thus, they are an important arena of information and debate as well as of the construction and negotiation of visions. I used the term 'Framtidens byer' (the Norwegian program name, in English 'cities of the future') to search for publications from national, regional and local newspapers between 2007 and 2014. This resulted in more than 500 articles, including letters to the editor and feature articles written by public contributors such as Norwegian politicians, journalists and scientists.

The second source was public documents such as White Paper 34 (2006-2007) 'Norsk klimapolitikk' ('Norwegian Climate Politics'), the National Transport Plan (2010–2019), CoF reports, the CoF website, and the Energy and Climate Action plans of two of the largest participating cities – Bergen and Trondheim. I examined these documents to map the visions made by national but also local stakeholders.

Third, I conducted, in collaboration with Lucìa Liste, 25 interviews with administrators and politicians in national, regional and local governments between February 2015 and January 2016. We used a semi-structured guide and interviewed CoF actors from the participating Ministries and the cities. The main topics included participants' reflections on CoF, including its successes and challenges, what knowledge they had gained, and their experiences of local–national collaboration. City government interviewees came from Oslo, Bergen, Trondheim, Drammen and Bærum. The interviews lasted between one and two hours, and they were recorded and transcribed in verbatim. In this paper, the interviewees have been anonymized.

Fourth, I spent one-month shadowing (Czarniawska, 2007) at two local planning agencies in Bergen and in Trondheim, the second and third largest cities in Norway with 275,000 and 185,000 inhabitants. Both cities have invested substantially in public transport – Bergen in a light rail system and Trondheim in buses and bicycle infrastructure. During

the fieldwork, I observed meetings, discussed with planners and participated in on-site inspections. I kept a fieldwork diary, which has served as a backdrop of the analysis and to check findings from other sources.

The analysis was inspired by grounded theory, with an emphasis on coding of and developing categories to make sense of the data (Charmaz, 2006). I developed open analytic codes, then combining similar codes to provide categories (for example, 'the vulnerable city' and 'the green city'). They were further compared and explored by coding pursuing visions of future sustainable cities as well as how relevant actors argued regarding the realization of these visions.

Three topics dominated the discourses about urban sustainability in the newspaper articles: (1) visions of the future sustainable city; (2) the responsibility for fulfilling these visions; and (3) management and mobilization of citizens. I use these topics to organize the analysis into three sections, where I accordingly outline, compare and discuss the visions of national and local stakeholders.

4. National and local stakeholders' visions of future cities

The Ministry of the Environment initiated the CoF program in 2008. A sequence of Ministers acted as prominent vision-makers, even before the Ministry formally launched the program. We may understand this public vision making as a way of kick-starting the program. A typical example is the following excerpt from a talk given by Helen Bjørnøy, Minister of the Environment in 2007, presenting her city vision for 2020:

> "We will walk to our work place and get healthy, filling our lungs with fresh air from the city. There are no cars in the streets, but playing children. The city center has become the grand hall with beautiful buildings, cultural heritage sites and green areas, which make citizens proud of their city."[21]

[21] Vestheim, T. M. F., & Sømme, A. (25.05.2007). Slik blir framtidens miljøbyer (This is how future sustainable cities will look like). *Dagsavisen*.

Bjørnøy focused on car-free cities in the future. Accordingly, the official CoF website[22] stressed the need to improve public transportation in cities and to restrict car use. In order to develop such green cities, the national authorities proposed a holistic mindset, which should lead to a so-called suitable city planning. An interviewee from the national government explained that they introduced the fifth thematic network, 'Better urban environment' with the goal of improving health and well-being in the city:

> "In CoF, first we focused a lot on mitigation efforts, but we also have a goal of improving the urban environment, so we have to work with how to shape an attractive city to live in. What I find inspiring is the possibilities of developing win-win solutions, like climate adaptation. Here, you can design nice aesthetic green areas and parks for citizens, which also help to manage challenges with storm water in the city" (CoF ministry officer).

Overall, the national government envisioned future cities as green and dense as well as attractive and healthy places to live. The visions were general and optimistic. The main strategy proposed to realize them was to use the CoF program as a tool to mobilize local actors to take responsibility for the development of more sustainable cities. The goals concerned cities' physical qualities, such as their green areas, but not local politics, which was black-boxed. To what extent did the city governments that participated in CoF share these visions?

In the initial phase of CoF, city governments were obliged to produce action plans to articulate concrete, local, climate goals. To do this, they had to translate national climate goals in order to align them with local resources and needs in proposed projects. In addition, the plans had to be politically embedded and adopted by the city administration. Thus, the action plans reflected their interpretation of the overall aims and visions addressed in the national documents. The cities expressed similar general concerns regarding climate change mitigation and densification efforts. Further, they agreed about the importance of knowledge and learning and the need for collaboration between administrative levels. Typically, the plans addressed the five main topics highlighted by CoF

[22] Cities of the Future website: https://www.regjeringen.no/en/topics/municipalities-and-regions/by--og-stedsutvikling/framtidensbyer/cities-of-the-future/id548028/.

national management (land use and transportation, stationary energy use in buildings, consumption patterns and waste, climate adaptation, and better urban environment). However, each action plan also addressed other issues that the respective cities considered important. For example, Bergen's action plan stated that:

> "The long-term goal of Bergen is to become a climate neutral city. Bergen wants a sustainable, safe and efficient transportation system, with interplay between historical structures, heritage sites and shared features."[23]

Clearly, working towards climate neutrality and sustainable public transportation was in line with national visions. However, Bergen faced controversy relating to the clash between the cost-efficiency of its transportation system and the protection of the city's heritage sites. The action plan reflected this. It exemplifies how local governments and planners had to deal with greater complexity and controversy than originally envisioned by national documents and stakeholders.

The CoF program provided 1 million NOK (approximately 107 000 Euros) to each participating city every year during the program period. The cities could also apply for additional funding for specific projects, in total 12 million NOK (approximately 1.3 million Euros) every year, to be distributed among the 13 participating cities. The cities should contribute at least the same amount of money as provided by the national government. Rambøll Management Consulting was hired to do a running evaluation during the program period. They concluded that the funding opportunities were relatively modest (Rambøll, 2015: 5-7). Rather, they emphasized the importance of CoF as facilitating cities' sustainable development efforts (ibid). In general, the interviewed city planners argued that the funding provided by the national government to urban development projects to be insufficient. For example, a bicycle planner in Trondheim stressed the importance of maintaining bicycle infrastructure and considered such maintenance an indispensable part of a sustainable city. National stakeholders were willing to help fund the construction but not the maintenance of such infrastructure. In such ways, national and local actors understood the challenges of sustainable transport differently. Another example was provided by a regional politician

[23] Bergen kommunes handlingsplan (2008). *Framtidens byer. Byer med lavest mulig klimagassutslipp og godt bymiljø*. Bergen kommune.

who claimed that the national government did not really comprehend the operation of public transport:

> "National politicians believe it is possible to actually profit from the operation of buses. However, such operation involves immense costs for the county. We have tried to convince the Ministry of Transport to see the complexities of public transportation operation, but there is a lack of understanding."

Table 1 briefly summarizes main content of the national and the local visions of the future sustainable city. Overall, national and local actors shared the main, general objectives. However, when these goals were translated to fit the local context to guide local action, this produced differences. The interviews showed that city actors felt they had to deal with complex and partly conflicting issues in the process of translating goals into plans and projects, issues that the national visions overlooked. Consequently, local visions tended to be more reticent than those of national actors, like we see in Table 1. It juxtaposes a straightforward national vision and a more complex vision assemblage of the city actors. Above all, the difference is due to local actors being more concerned than national actors about the realization of the visions. Did this also lead to diverging views regarding the distribution of ensuing tasks and responsibilities between national and local actors?

Table 1: Main understanding of the concept of a sustainable city in the visions

Vision maker	**Actants part of the vision assemblage**	**Main objectives in the vision of sustainable cities**
National government actors	National politicians and administrators Letter of Intent CoF program and website Newspaper articles	Sustainable cities will be low-emission and attractive places to live. They are to be green, clean and beautiful.
City government actors	Local and regional politicians and administration Planners Transport infrastructure Newspaper articles	Ideally, future cities are to become dense, green and energy efficient, with environmentally friendly transportation and facilitating cycling and walking. However, city planning is complex and challenging, often with conflicting interests and concerns.

5. National and local actors' view of the distribution of tasks and responsibilities

A main goal of the CoF program was to instigate a dialogue between national and local authorities. There was an expectation that CoF participants should meet regularly to discuss challenges, share experiences and develop new policies, knowledge and methods. The Letters of Intent[24], which all participating cities had to sign, articulated this mode of working. This mandatory (and symbolic) signing of the agreement represented an important governance tool:

> "In previous urban development projects, we learned that both Ministries and cities had to commit in order to accomplish what we wanted. If not, there would be nice words, but no action. So, when we got both the cities and the Ministries on board, then we started to believe in this program" (CoF ministry officer).

The quote suggests that national stakeholders considered collaboration between national and local actors to be important. However, several prominent national politicians argued in newspaper articles in favor of greater local responsibility in urban development. According to them, urban policy-making should mainly be a city government concern.[25] Local actors protested this view. In an open letter to the Prime Minister[26], two city mayors involved in CoF complained that local governments faced many difficult issues related to urban sustainability. They claimed that cities were unable to deal with such issues on their own, like challenges related to the existing legal framework of urban sustainability efforts. For example, the mayors argued that city governments needed a statutory authority to impose parking restrictions and more generally that they lacked the legal means to reduce local car traffic.

[24] Norwegian Ministry of Climate and Environment et al. (2009) Letter of intent. Oslo, Norway. https://www.regjeringen.no/globalassets/upload/subnettsteder/framtidens_byer/moter/avtale_naeringslivet_underskrevet.pdf. Last accessed 06.04.16.

[25] Roux, E. (18.06.2008). Statlig pengedryss til miljøflinke byer (National funding to environmentally friendly cities). *Stavanger Aftenblad;* Sanner, J. T., & Sundtoft, T. (21.10.2014). Uenighet må løses tidligere (Disagreement has to be solved early). *Aftenposten*; Vestheim, T. M. F., & Sømme, A. (25.05.2007). Slik blir framtidens miljøbyer. (This is how future sustainable cities will look like). *Dagsavisen*.

[26] Ravn, L. (08.06.2012). Miljøanklager fra ordførere. (Environmental accusations from local mayors). *Telemarksavisa*.

Several interviewees expressed similar views. A planner in Trondheim requested stronger national intervention in city infrastructure planning, including an update of regulatory frameworks. Interestingly, national and local actors interpreted the present legal framework differently. For example, the central government considered the Plan and Building Act as an effective tool for local administrations to protect green areas and design high quality densification.[27] However, some interviewees challenged this. A county mayor argued that:

> "There is a clear mismatch between the pleasant rhetoric from national politicians about the importance of high quality densification on the one hand, and what the legal framework enables us to do through the Plan and Building Act, on the other. This Act makes requirements regarding outdoor spaces, parking norms – everything we do! National governments must change this. It is very frustrating to have these great visions of future sustainable cities, and a legal framework, which does not support it."

National government representatives argued that the Plan and Building Act enabled city governments to reach sustainability goals. The quote represents widespread perception among local actors that the Act constrained their ability to act.

As mentioned, allocation of money from national to local governments was an essential part of the CoF program. Some funding was available to the participating cities to support action plans and projects. However, they had to apply. The Minister of the Environment presented a main criterion in an interview in 2008: "[C]ities that make good action plans and also dare to use unpopular, but necessary, measures will be rewarded."[28]

Cities that were innovative and radical should gain from economic and symbolic incentives. According to the Minister, cities proposing ambitious environmental instruments would receive positive attention from the media and politicians. Without such goals, city governments should expect to lose money and reputation and, eventually, voters

[27] Solheim, E. (22.01.2009). Grønne lunder under press. (Green lungs under pressure). *Aftenposten.*

[28] Roux, E. (18.06.2008). Statlig pengedryss til miljøflinke byer. (National money-sprinkling to environmentally friendly cities). *Stavanger Aftenblad.*

supporting the governing political parties.[29] However, this strategy met with skepticism from several local and regional stakeholders. For example, the county mayor quoted above said that she feared such measures would lead to unfortunate competition between cities.

Thus, we observe that national and local actors disagreed about the distribution of responsibility regarding the realization of the visions and the appropriate governance tools. National actors expressed considerable optimism about city governments' ability to improve the sustainability efforts of their urban planning. In this sense, the national government gave the participating city governments the main responsibility for implementing sustainability measures, using better reputation and funding to entice them to take on this role. Of course, considering the discourse of cities as key intervention sites of sustainability, this effort was not surprising. However, a more interesting finding was the way in which city representatives tried to redistribute responsibility back to national actors. City representatives made efforts of re-assembling accountability to enroll national government actors to share a more complex and concern-oriented vision of urban sustainability. As noted, city government actors said that they experienced legal challenges as well as unfortunate competition between cities through the funding system of CoF. They wanted the national government to engage much more actively in resolving these issues.

Table 2 provides an overview of national and city government actors' visions of the distribution of responsibility with regard to making future cities become sustainable. The difference is clear-cut. The national government actors presented city governments as the main actors of urban sustainability transitions, seeing their own role mainly as providing some funding. With respect to other policy measures, they argued that the cities already had the tools they needed at their disposal. City government actors contested this latter claim. They argued that the national government should take a more active and comprehensive role.

[29] See note 8.

Table 2: Perceived distribution of responsibility in the making of visions

Vision maker	Actants that were part of the vision assemblage	Perceived distribution of responsibility in the vision of future sustainable cities
National government actors	National politicians and administrators Letter of Intent The Plan and Building Act Funding system Newspaper articles	Local knowledge and responsibility is very important, and local governments should have the main responsibility for implementing urban sustainability goals. They have the best tools to do so. However, the national government will contribute funding.
City government actors	Local and regional politicians, administrators and planners Public transportation Letter of Intent The Plan and Building Act Funding system Newspaper articles	Urban sustainability should not be the responsibility only of local governments. There is a need for national guidelines, updated regulatory frameworks, allocation of more resources, and a stronger will to collaborate from national government actors.

The perception of the process of implementing urban sustainability efforts seems to have produced the differences observed in Tables 1 and 2. National actors argued that implementation should be a straightforward issue, while city actors were concerned about complexities and challenges. As we shall see in the next section, these disagreements also emerged from the perceived engagement of citizens.

6. Envisioning the role of citizens: supporting or resisting urban sustainability?

National government actors acknowledged the importance of enrolling citizens as part of sustainability transitions. However, they tended to believe that their visions of future sustainable cities would be attractive to the public. For example, a CoF manager in the national government stressed the importance of developing what he called 'human cities', and explained these as cities constructed with respect to the wellbeing of citizens. This was in line with the previously quoted vision of the former Minister of the Environment about 'car-free streets full of playing children'.

The CoF management funded three surveys to learn more about the views of citizens. These were questionnaires conducted in 2010, 2012 and 2014, and asked citizens about their expectations regarding governmental efforts to achieve urban sustainability.

Based on the results of the first survey, a large regional newspaper wrote that 'Norwegian people dream about green cities'.[30] According to the article, citizens wanted their local government to facilitate an environmentally friendly lifestyle. Were citizens seen as prepared to make efforts to reach such goals? Several national governmental interviewees stressed the importance of educating citizens to raise awareness of environmental issues. However, a CoF manager employed by the Ministry of Local Government and Modernisation expected citizens' attitudes to be a greater challenge than their lack of knowledge. According to him, people in Norway were aware of climate change issues. The challenge was to get them to change their practices. He also argued that laws could be efficient tools forcing citizens to change their practices:

> "A great example is the effect of the Tobacco Act in Norway. While many were highly skeptical of this Act in the beginning, attitudes towards smoking changed after a while because of forced change of practices. I think this also applies to for instance a ban of private cars in city centers. I guess that first, there will be a lot of protests, but after a while people will adjust to the fact that they cannot drive in the city anymore" (CoF Ministry Officer).

Some interviewees in the national government wanted to educate citizens while others proposed to introduce new standards and regulations. Yet others argued that mobilizing citizens mainly was a local government responsibility. This line of thought echoes Bulkeley's assertion (2015: 7) that citizens may find it easier to establish clear channels of communication with local than with regional or national governments. How did city government actors respond to this?

Some city representatives used legal options to change citizen practices. For example, a CoF city representative decided to shut down parking spots in the city center and justified this by arguing that citizens would eventually appreciate the idea.[31] A city planner presented a similar view, emphasizing that a mix of education and governmental coercion strategies was a successful recipe for changing citizen practices. Such forms of

[30] Weisser, A. (18.03.2010) Alle vil ha grønn by. (Everybody wants a green city). *Adresseavisen.*

[31] Refvem, F., & Lien, S. U. (31.03.2011). Nå blir Nytorget bilfritt. ('Nytorget' becomes car free). *Stavanger Aftenblad.*

top-down governance echo what we heard from national government actors. However, some projects expected citizens to initiate projects on their own, without governmental instigation. An example was a city government initiative aimed at reducing CO_2 emissions by facilitating low-emission household practices. This encouraged citizens to inspire each other to engage with new practices by 'spreading the happy message about the green lifestyle to friends and family'.[32]

Overall, the city government actors tended to articulate a more complex relationship with citizens than the national stakeholders. Despite the advice given through CoF of keeping an open dialogue about climate change issues with citizens,[33] the interviewed planners told that they did not find the time or resources to consult directly with citizens. One city government employee stressed that citizens would likely perceive efforts of changing their practices to become more sustainable as an additional burden in their busy daily life. However, another city representative working with climate adaptation pointed out that city governments could communicate with citizens about these issues indirectly:

> "I think there is a strong communicative effect of climate adaptation measures. When citizens see that their local community is gearing up towards extreme weather, like building flood embankments, this gives strong signals about future challenges, such as sea level rise. We should not underestimate the communicative effect of this" (City government employee).

Table 3 summarizes the findings regarding the envisioning of citizens and their role in sustainable urban transitions. National government actors expected citizens to adapt through a combination of information and legal measures; considering citizens as predictable – or at least quite malleable. These actors considered it as a manageable task to enroll citizens in urban sustainability efforts when the right measures were used. To some extent, city government actors agreed that citizens would act in accordance with standards and regulations. Still, they expected citizens to engage in bottom-up initiatives. Thus, city

[32] Moi, H. (15.05.2013). Snakk med naboen og dyrk salat i hagen. (Talk with your neighbor and grow salad in the backyard). *Stavanger Aftenblad.*

[33] Bache, K. (02.03.2013). 10 bud for god byutvikling. (10 commandments for a good urban development). *Østlandsposten*.

government actors were concerned about public indifference, resistance or protest. They argued that the public could be critical towards sustainability initiatives, considering their actions difficult to predict.

Table 3: Perceptions of citizens

Vision maker	**Actants part of the citizen assemblage**	**Perceptions of citizens**
National government actors	National politicians and administrators National regulatory frameworks/laws The Tobacco Act Newspaper articles	Citizens will adapt in line with education, information, laws and regulations. They are predictable. It is mainly up to local governments to enroll and educate citizens.
City government actors	Local and regional politicians, administrators and planners Concrete projects Newspaper articles	Citizens may respond positively to national legal changes and initiate projects bottom-up. However, enrolling citizens may be challenging because citizens are unpredictable and may resist changes.

7. Diverging visions between national and local city actors

The strong interest in cities as transition actors is rooted in a perception that city governments are best suited to enact national goals of sustainable urban development. Since local governments in Norway have considerable autonomy in their decision-making, it would definitively be helpful if national and local actors shared visions and goals, not least the conditions for realizing them. This paper set out to analyze how national and local (city) stakeholders envisioned and negotiated 'the sustainable city' and what kind of assemblages they constructed in the process. Table 4 summarizes the main findings by combining Tables 1-3. What we see are two visions where important aspects were shared but also with noticeable differences overall. I call them 'the attractive city' and 'the complex city', respectively.

Table 4: Vision makers, assemblages and visions of sustainable cities, responsibilities and citizens

Vision maker	**Assem-blage**	**Visions of the sustainable city**	**The distribution of responsibilities in the vision**	**Perceptions of citizens**
National government actors	**The attractive city**	Future cities are 'human'. They are green, clean and beautiful, and their sustainability can be achieved through holistic planning	City governments should have the main responsibility for sustainable urban development. They are best suited and have the tools they need to achieve change	Citizens will adapt when exposed to education, information, and new standards and regulations. They are predictable. City governments should be able to enroll and educate citizens
City government actors	**The complex city**	Future cities are ideally dense and energy efficient, with sustainable transportation. But city planning is complex, and the proposed actions are often controversial	Urban sustainable development should not be singularly a local responsibility. There is a need for national guidelines, update of regulatory frameworks, allocation of more resources and more collaboration between national and local stakeholders	Citizens might respond positively to national legal regulations and initiate local projects. However, enrolling citizens may be challenging because they may unpredictably resist changes

'The attractive city' assemblage was a vision constructed by national government actors and re-assembled through newspaper articles, documents, and interviews. Its main constituents were ideas about pleasant features of future sustainable city life and beliefs that a holistic city planning would help realize this. Such holistic planning would consider every important aspect, such as reducing local pollution, improving citizens' health, providing green areas and facilitating efficient public transportation, expecting that these would mutually reinforce each other in a seemingly harmonious fashion. National governments delegated the main responsibility for fulfilling this vision to city governments, which they assumed to be sufficiently empowered to implement necessary changes. Included in this vision was the

view that citizens would become environmentally friendly through appropriate measures like education, information, incentives, and legal instruments.

'The complex city' assemblage was a vision mainly constructed by city actors (including regional stakeholders) and re-assembled from the same sources as 'the attractive city'. It comprised mainly the same general sustainability goals but included more elements of concern, like the complexities of urban planning and the implementation difficulties emerging from the translation of general aims into local action. For example, how to balance densification efforts with protection of heritage sites? While citizens in general were represented as supporters of urban sustainability measures, they were also considered to be in constant need of negotiation and persuasion. Potentially, citizens could be indifferent to or protesting proposed initiatives.

Clearly, there was dis-alignment of visions between national and local stakeholders but this was not seen as a critical problem. The CoF program was kept running during the intended program period from 2008 to 2014, and overall, the evaluation was positive (Rambøll Management Consulting, 2015). Many interviewees from national and local governments agreed that it was a success. A CoF manager employed by the Ministry of the Environment provided an example:

> "The CoF program improved the internal collaboration in the local administration in the city of Tromsø. Through the climate adaptation network [set up through CoF], people from different city agencies got the opportunity to meet and to know each other's work. Actually, many cities in CoF reported such outcomes – that the program stimulated an interdisciplinary and inter-sectorial collaboration within the city administration."

A city representative in CoF noted that the program had provided new knowledge:

> "CoF has contributed to improve the knowledge of how climate change may affect cities. We started from scratch in the climate adaptation network, and the 13 participating cities are now more aware what climate adaptation means. They have started to implement this in regulatory frameworks and strategies, as well as some specific projects."

These quotes illustrate that the CoF program provided constructive contributions to urban sustainable development. This was above all in terms of learning, with respect to improved horizontal collaboration among the participating cities. However, the program did also contribute by means of more "hands-on" projects, described in the final evaluation report by Rambøll Management Consulting (2015: 28-29). For instance, the program developed systems to quantify the effects of projects aiming to reduce climate gas emissions in the municipalities. Moreover, the CoF program developed methods to map flooding roads in cities and to visualize crisis scenarios of future sea level rise. As mentioned, all participating cities in CoF had to develop an Energy and Climate Action plan to clarify local goals and measures, and these plans worked as important outputs of the program to steer the project development. In the end, the CoF program contributed to the development of more than 300 exemplary projects that covered all the five thematic networks of the program. These projects have been included in an online database, which is open to the public.[34]

8. Conclusion: Making visions work – vision making as trading zones

This paper has investigated visions of the sustainable city of the future among national and local stakeholders in the Cities of the Future (CoF) program. I asked to what extent there were alignment of visions among relevant stakeholders, what assemblages they constructed in the process, how they distributed roles in the resulting assemblages, and how they perceived citizens. I identified two assemblages: 'the attractive city' and 'the complex city'. By juxtaposing the assemblages, I have identified diverging aspects of these visions about future sustainable cities among national and local actors. While the desired, general sociotechnical outcomes were similar, they disagreed about how to achieve these outcomes and about the role of citizens. Perhaps the most pressing controversy was about the distribution of responsibility for urban sustainability. National government actors argued that city governments should be in the driver's seat, while the city actors demanded greater effort and commitment from the national government. This finding questions the prevailing view in the research literature stressing the need for alignment between government levels to achieve urban sustainability. As shown, CoF was not a failure because the program provided a space for horizontal learning among the participating cities as well

[34] See http://forbildeprosjekter.no/framtidens-byer1?page=0 (in Norwegian).

as an opportunity to get funding for urban sustainability initiatives. This made the lack of alignment a lesser concern.

According to Latour (2005), it is important to resolve controversies in order to achieve stability and ensure further action. This did not happen between the governance levels in CoF, but the participants still, as I have shown, considered the program as successful. This finding is in line with Singleton and Michael (1993) and suggests that ambivalence may contribute to the construction and continuation of actor-networks. Following Gjøen (2001), this further suggests that the process of vision making is more important than the actual content of the visions. The vision making encouraged city governments to engage more strongly with urban sustainability issues. In addition, city actors found this process to provide a space for learning and negotiating about local enactment of environmental concerns. The vision making thus enabled a kind of trading zone where the participants could exchange problems, solutions, and expectations. This made national government actors into backstage performers, probably to a larger extent than they had anticipated. The main outcome of CoF was the construction of horizontal networks among the city participants where visions were developed and debated. These networks facilitated the exchange of concerns, knowledge and experience that the city government actors experienced as very useful.

As noted, the analysis in this paper emphasizes the importance of being cautious about the need to have fully shared visions across levels of government when working to realize large sociotechnical projects like urban sustainability. Still, the lack of alignment shown in Table 4 is a concern. The CoF experience shows that dis-aligned visions may co-exist with efforts to improve urban sustainability. However, some controversies need to be resolved in future urban sustainability projects. In particular, the different perceptions of the effectiveness of available legal provisions should be worrisome to national government actors because they may inhibit necessary local action. Here, the interpretation of national government actors may be correct, but that does not help if city governments have a different view. In this sense, vision making should be an ongoing process where negotiations, e.g., with respect to the effectiveness of the existing legal framework, need to be continued. It might have been a weakness of the CoF program that the horizontal networks became too dominant, sidetracking the exchange between national and local

actors. Although it was important for the participating cities to learn from each other, they still wanted more involvement from national governmental actors. Thus, the claim of the research on multi-level governance regarding the importance of alignment may be important in the long run.

Acknowledgements

I am grateful for the valuable comments and insights of Professor Vivian A. Lagesen and Professor Knut H. Sørensen on earlier drafts. I would also like to thank the two anonymous reviewers for their comments that contributed to improve this paper. Finally, I want to thank Dr. Lucía L. Muñoz for her contribution in collecting and ordering the data.

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Paper 2
Ingeborgrud, Lina H. ; Muñoz, Lucía Liste and Sørensen, Knut H.
Social learning for urban sustainability: Transdisciplinary and translocal.

Is not included due to copyright

Paper 3: Ingeborgrud, Lina. The shaping of urban public transport: two cases of alternative leading objects.

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Appendix

Sample of interview guide[52]

Previous experience

- Have you worked with environmental issues before working with Cities of the future? Can you describe your experience? (what was the aim of these projects?)
- What kind of knowledge was necessary for carrying out these projects? From where did you get knowledge?
- To what extent were those projects successful? What worked well/not so well?
- What kind of challenges did you face when working which these projects?

Cities of the future program

- What do you think about the Cities of the future program?
- When did you become involved in Cities of the future? How did that happen?
- What has been your role in the project? Were you involved in the design or initial development of the project?
- What were the concerns that Cities of the future was supposed to change or solve?
- Do you feel that the project achieved the goals that were set? Why/why not?
- What was the most successful outcome of the project? What could have worked better?
- Have there been any surprises in the project? If so, which ones and why?
- What areas do you think were the most important in the project? Why so?
- Can you describe how a normal working day within the Cities of the future program was?
- What are your thoughts on the future of Norwegian cities now that the project is over?
- In what ways was Cities of the future different from previous or other urban development projects?

[52] This interview guide sample is with participants in the Cities of the future program. The interview guide is translated from Norwegian into English. All interviews were conducted in Norwegian.

Collaboration

- Can you describe how the collaboration worked in Cities of the future?
- What kind of actors were involved? Have all actors been equally involved? If not - why and in which ways?
- Have there been any conflicts of interest in the collaboration? If so, how those were resolved?
- Did any area within the program receive more attention? If so, which one and why?
- What types or forms of collaboration did Cities of the future enable? How was this collaboration organized?
- How did Cities of the future contribute to urban development? (Means, meetings, seminars, study tours, arena/meeting space)?

Relationship with other administrative levels

- How did you collaborate with the ministries/local governments in this project?
- Were there coinciding interests or any different aims and expectations from the local governments and the ministries involved?
- Did Cities of the future help municipalities with urban development? In which ways?

Environmental knowledge and learning

- How do you understand the concept of environmental knowledge (miljøkunnskap)? In what ways is such knowledge important?
- What role did research play in Cities of the future? How was it used?
- What kinds of expertise do cities need and how did the Cities of the future program provide/help to acquire it? (for example professional input?)
- What were the most important skills and knowledge for those working with Cities of the future? What kind of competence did they need and how did Cities of the future help to develop or acquire that?
- Do you know where and how this knowledge is obtained?
- Was there any type of knowledge/expertise you consider important but did not have access to?
- What kind of strategies and tools have been adopted to realize the Cities of the future goals? (for instance climate energy action plans)

- There are many reports and evaluations of the program – were these relevant to your work in Cities of the future? How?

Users

- Do you have any thoughts about how people will live in Norwegian future cities?
- Are people committed to live in an environmentally friendly way - why/why not?
- Do you think that it is important to engage people in sustainability issues? In which ways or why?
- How do you think inhabitants in the Cities of the future cities perceived the program? Did you receive any feedback from citizens?
- What kind of knowledge do citizens need in order to live in future sustainable cities?

Wrapping up

- Is there anything else you would like to talk about?
- Whom would you recommend we talk to next?