



Doctoral Thesis in Planning and Decision Analysis

A Shift in Urban Mobility and Parking?

Exploring Policies in Relation to Practices

FREDRIK JOHANSSON

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Abstract

The transport sector is associated with many environmental challenges, including carbon dioxide (CO₂) emissions. Research indicate that CO₂ emissions should decrease by at least 50 % per decade in order to be in line with the Paris Agreement, and the transport sector is highlighted as a particularly challenging sector. Sweden, which is the case study in this thesis, has a goal of reducing CO₂ emissions from the transport sector with 70 % between 2010 and 2030. This target is, however, not likely to be met if current trends continue. New technology will probably not be enough to reach the target, and car ownership and car travel will probably also have to decrease. Furthermore, many households do not have access to cars, and do not benefit from policies that facilitate car use and car ownership. The purpose of this thesis is to critically analyse policy measures on parking and mobility in metropolitan areas in Sweden with the aim of being in line with the CO₂ emission goals set by the Paris Agreement, as well as investigating how the aims of the Paris Agreement can be met with a backcasting study. All studied policy measures highlight the need to shift focus from physical infrastructure to accessibility. In each case, however, current practices and conditions render a transition more difficult.

The first paper in the thesis studies the Swedish Transport Administration (STA) mandate to finance different measures. The STA states the importance of reducing the need to travel and making more efficient use of existing infrastructure, and stipulates that these types of measures should be considered before new infrastructure investments. However, the STA has a limited mandate to finance measures with the aim of reducing the need to travel, which results in ambiguous signals to, and frustration among, regional STA officials. This paper demonstrates that making the STA's mandate more function-oriented would facilitate a transition in line with the sustainable mobility paradigm.

The second policy measure discussed in this thesis is the shift from minimum parking requirements, where developers are obliged to build a minimum number of parking spaces in order to obtain a building permit, to flexible parking requirements, where the number of parking spaces provided depends on the local context, and where other mobility services may replace the need for parking. The second paper in this thesis follows two blocks of flats built with flexible parking requirements. Car ownership has decreased in both blocks of flats, and car use has decreased in one of the blocks of flats. Furthermore, car sharing membership and use have increased considerably. However, the process of leaving a car dependent social practice is slow and the conditions (e.g. the technology; and ways of finding, booking, and paying for services) need to be relatively stable for the practice to grow. Other policies may also be needed for emerging social practices to grow. Some of these policies have been implemented in Stockholm (e.g. congestion charges, on-street parking fees, extension of public transport and bicycle infrastructure). However, there is also a trend in the opposite direction; such as new urban highways. Future interventions could be made open to residents in adjacent properties, if more people are to be attracted to the mobility services.

The third paper in this thesis discusses the feasibility of using a new parking management tool; "Parking Benefit Districts", in a European context (Stockholm, Sweden). In a Parking Benefit Districts program, on-street parking charges are implemented, increased or extended, and the resulting revenues are returned to the areas where the charges were imposed. Citizens, or other stakeholders, then participate in deciding how to use these

revenues. The underlying intention is to increase acceptance of parking charges, as on-street parking charges may be considered necessary by city planners but are unpopular among citizens and other stakeholders. This thesis shows that there are no legal barriers to implementing a Parking Benefit District programme in Sweden, but there are some limitations as to how revenues can be used. Moreover, Sweden does not have this planning tradition and the programme may not be perceived as legitimate. Another important issue is equity and participation, e.g. it is important to consider who to include and how to include them.

The fourth paper is a target-oriented backcasting study. The paper depicts a future image for parking and mobility for the city of Stockholm that is in line with the CO₂ emission goals in the Paris Agreement, and then examines how to plan for parking and mobility in order to steer towards this future image. The paper points out that current parking standards (the flexible parking standard discussed in Paper II) is far from being in line with the Paris Agreement, and emphasizes the necessity of a different planning approach. The paper also presents a path of development thought to be in line with the Paris Agreement.

Sammanfattning

Transportsektorn bidrar till många miljöproblem, inklusive koldioxidutsläpp. Forskning tyder på att koldioxidutsläppen behöver halveras varje decennium för att vara i linje med Parisavtalet, och transporter pekas ut som särskilt utmanande. Sverige, som studeras i den här avhandlingen, har som mål att minska inhemska koldioxidutsläpp från transporter med 70 % mellan 2010 och 2030. Det är emellertid inte troligt att detta mål kommer nås om nuvarande trender fortsätter. Ny teknologi kommer troligtvis inte vara tillräckligt för att nå målet, och bilinnehav och bilresande måste sannolikt också minska. Många hushåll har dessutom inte tillgång till bil och drar därmed inte nytta av policys som underlättar bilanvändning och bilägande. Syftet med den här avhandlingen är att kritiskt analysera åtgärder för parkering och mobilitet i storstadsområden som ska styra mot Parisavtalet, samt undersöka hur Parisavtalets mål kan uppfyllas med en backcastingstudie. Alla studerade åtgärder belyser behovet av att flytta fokus från fysisk infrastruktur till tillgänglighet och mobilitet. I samtliga fall försvårar dock nuvarande praktiker och förhållanden en omställning.

Den första artikeln i avhandlingen studerar Trafikverkets (TRV) mandat att finansiera olika åtgärder. TRV lyfter fram vikten av att minska behovet av att resa och av att utnyttja befintlig infrastruktur mer effektivt, och betonar att denna typ av åtgärder bör övervägas före nya infrastrukturinvesteringar. TRV har dock begränsat mandat att finansiera åtgärder som minskar behovet av att resa, vilket leder till tveydiga signaler och till frustration bland regionala tjänstemän. Den här artikeln visar att ett mer funktionsorienterat mandat skulle kunna bidra till en omställning till hållbar mobilitet.

Den andra åtgärden som diskuteras i avhandlingen är skiftet från miniminormer för parkering, där byggaktörer måste bygga ett visst antal parkeringsplatser för att få bygglov, till flexibla parkeringstal, där antalet parkeringsplatser beror på den lokala kontexten, och där andra mobilitetstjänster kan ersätta behovet av bilparkering. I artikel II följs två flerbostadshus som byggts med flexibla parkeringstal. Bilägandet har minskat i båda husen och bilanvändningen har minskat i ett av husen. Dessutom har medlemskap i och användning av bilpool ökat markant. Processen att lämna en bilberoende social praktik är emellertid långsam och förutsättningarna (t.ex. tekniken och sätten att hitta, boka och betala för tjänster) måste vara relativt stabila för att praktiken ska kunna växa. Andra åtgärder kan också behövas för att nya sociala praktiker ska växa. Vissa av dessa åtgärder har genomförts i Stockholm (t.ex. trängselskatt, parkeringsavgifter på gatan, utbyggnad av kollektivtrafik och cykelinfrastruktur). Det finns dock också åtgärder som går i motsatt riktning, till exempel nya urbana motorvägar. I framtiden skulle delade mobilitetstjänster även kunna erbjudas boende i angränsande fastigheter, om fler ska byta ut egen bil mot delad mobilitet.

I avhandlingens tredje artikel analyseras genomförbarheten av en ny parkeringsåtgärd, ”Parking Benefit Districts” (PBD), i en europeisk kontext (i Stockholm, Sverige). I ett PBD program införs, höjs eller utvidgas parkeringsavgifter på gatan, och intäkterna återförs till de områden där avgifterna infördes. Medborgare, eller andra aktörer, deltar sedan i beslutet om hur intäkter ska användas. Syftet med PBD är att öka acceptansen för parkeringsavgifter. Parkeringsavgifter på gatan anses ofta vara nödvändiga av stadsplanerare, men är ofta impopulära. Artikel III visar att det inte finns några juridiska hinder för att införa PBD i Sverige, men att det finns vissa begränsningar för hur intäkterna kan användas. Vidare visar

artikel III att Sverige inte har den här planeringstraditionen och att angreppssättet därmed kanske inte uppfattas som legitimt. Det är även viktigt att ta hänsyn till jämlikhet och delaktighet när ett PBD program ska införas. Det är viktigt att överväga vilka som ska bjudas in och hur de ska inkluderas i processen.

Den fjärde artikeln är en backcastingstudie. Artikeln målar upp en framtidsbild för parkering och mobilitet i Stockholm som är i linje med Parisavtalet och undersöker sedan hur kommunen kan planera för parkering och mobilitet för att styra mot framtidsbilden. Artikeln visar att den nuvarande parkeringsnormen (flexibla parkeringstal som diskuteras i paper II) är långt ifrån tillräckliga för att styra mot Parisavtalet och hävdar att en annan planeringsstrategi är nödvändig. Artikeln presenterar också en väg som bedöms vara i linje med Parisavtalet.

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Thank you!

List of papers included in the thesis

Paper I

Johansson, F., Tornberg, P. and Fernström, A. (2018). A function-oriented approach to transport planning in Sweden: Limits and possibilities from a policy perspective. *Transport Policy*, 63, 30-38. [10.1016/j.tranpol.2017.11.006](https://doi.org/10.1016/j.tranpol.2017.11.006)

Paper II

Johansson, F. and Henriksson, G, Envall, P. (2019). Moving to Private-Car-Restricted and Mobility-Served Neighborhoods: The Unspectacular Workings of a Progressive Mobility Plan, *Sustainability*, 11 (22): 6208. <https://doi.org/10.3390/su11226208>

Paper III

Johansson, F., Henriksson, G. and Åkerman, J. (2017). Parking Benefit Districts – The transferability of a measure to reduce car dependency to a European context. *Transportation Research Part D: Transport and Environment*. 56. [10.1016/j.trd.2017.08.004](https://doi.org/10.1016/j.trd.2017.08.004)

Paper IV

Johansson, F., Åkerman, J., Henriksson, G., Envall, P. (forthcoming) A pathway for parking in line with the Paris Agreement, *Submitted manuscript*.

Comments on my contribution to the papers

Paper I: FJ and PT contributed to the article to a similar extent. They planned and designed the study together and performed similar numbers of interviews and participatory observations (AF also carried out some interviews). Two researchers participated in most interviews. The interviews on the cases were split equally between PT and FJ, and FJ was responsible for the literature review and the interviews with national representatives (with assistance from AF). PT was responsible for the theoretical framework (in discussion with FJ). PT and FJ planned the article together. The introduction and research questions were written together. FJ wrote the methodological part (section 3) and the section on the STA's mandate (section 4).

Paper II: FJ was the main author. FJ and GH designed the investigation together. FJ designed the survey and conducted most of the interviews. GH and FJ carried out field visits and informal interviews together. The article was written together by FJ and GH, with FJ writing a slightly larger portion of the text. PE provided administrative support and scientific feedback during the course of the investigation and contributed shorter paragraphs in the introduction and conclusion of the paper.

Paper III: FJ was the main author of this article. He was responsible for the research design and the literature review, and conducted all the one-on-one interviews. Focus group

discussions were conducted together with GH. FJ wrote most of the article, with GH contributing some text. JÅ provided scientific feedback during the course of the investigation.

Paper IV: FJ was the main author of this article. He was responsible for the research design, methodology, data collection (together with JÅ), and for the development of the image of the future¹ and the pathway². FJ performed all the interviews by himself and workshops together with JÅ. FJ did the analysis together with GH (FJ was responsible for ch. 7.2. and GH for ch. 7.1). FJ wrote most of the article (except ch. 3 by JÅ, parts of ch. 1.3 by PE, parts of ch. 6.2 on parking levies by PE and ch. 7.1 by GH). The future image and pathway were discussed and analysed at meetings attended by all authors.

¹ 'Image of the future' or 'future image' is used to highlight that different futures are possible (see e.g. Robinson, 1998)

² The term 'pathway' is used to describe a path from today towards the future image.

List of abbreviations

SCM:	Strategic Choice of Measures (Åtgärdsvalsstudie).
Four-step principle: (Fyrstegsprincipen in Swedish)	A planning principle used by the Swedish Transport Administration. The idea is to consider measures that reduce the need to travel (so -called step 1 measures) and measures that use existing infrastructure more efficiently (step 2 measures) before larger reconstructions (step 3 measures) and new infrastructure investments (step 4 measures).
PB:	Participatory Budgeting
PBD:	Parking Benefit Districts
SPT:	Social Practice Theory
STA:	Swedish Transport Administration (Trafikverket)

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1. Introduction

Passenger travel and freight transport are associated with many environmental challenges, including carbon dioxide emissions, extensive land use and air pollution. According to the International Energy Agency transport is responsible for 24 % of greenhouse gas emissions from fuel combustion in the world (IEA, 2020). In the case of Sweden, which is the focus of this thesis, the Swedish Environmental Protection Agency's calculations indicate that domestic transport accounts for about one third of Sweden's carbon dioxide emissions (Swedish Environmental Protection Agency, 2020). There is also research on the emission reductions needed to reach the terms outlined by the Paris Agreement, i.e. limiting climate change to a maximum of 2 degrees Celsius and striving for 1.5 degrees Celsius. Rockström et al. (2017) estimate that carbon dioxide emissions need to be cut by 50 % every decade if the terms of the Paris Agreement are to be met. Other researchers (Larkin et al., 2018; Anderson, Broderick and Stoddard, 2020) argue that the emissions must be cut at a significantly higher rate in high-income countries, such as Sweden, if the transition is to be fair³, and if negative emission technologies (NETs) do not have the impact assumed in IPCC scenarios. Anderson, Broderick and Stoddard (2020) estimate that Sweden's CO₂ emissions should decrease by over 12 % per year in such a scenario. This means, according to Larkin et al. (2018), that high-income countries like Sweden need to put more focus on measures that reduce carbon dioxide emissions in the short term.

Reducing CO₂ emissions from transport is considered particularly challenging (Climate Policy Council, 2019), and Sweden, therefore, has a specific CO₂ emission target for the transport sector. The goal is for CO₂ emissions from domestic transport (excluding aviation) to decrease by 70% between 2010 and 2030, and for Sweden to have net zero emissions by 2045⁴ (Climate Policy Council, 2019), which is roughly in line with the roadmap outlined in Rockström et al. (2017) (to halve emissions every decade)⁵. Data from the Swedish Transport Administration indicate that CO₂ emissions from domestic transportation have not decreased fast enough to be in line with the 2030 target, and Swedish authorities estimate that the 2030 target is probably not attainable under current policy (Climate Policy Council, 2019; Swedish Transport Administration, 2020; Kågeson, 2019)⁶. Furthermore, new technology will probably not be enough to reach the 2030 target (Swedish Transport Administration, 2020; Persson et al., 2019). According to these reports, car travel must also decrease to reach the 2030 target.

Car travel and car ownership is also linked to land use and urban sprawl, as cars take up a lot of space, both when they are used and when they are parked. Estimations indicate that there are 3 to 5 parking spaces for every car in Sweden (Envall, 2019) and parking is estimated to take up more space than residencies (on average about 50 sqm per vehicle, Fastighetsägarna

³ In Larkin et al.'s (2018) scenario countries with low rates of CO₂ emission can increase their emission for some time (for some countries emissions peak in 2030). High emitting countries thus have to reduce their emission at a faster rate.

⁴ The goal is to reduce emissions by 85 % and compensate for the remaining 15 % via compensatory measures.

⁵ If negative emission technologies do not have the impact assumed in IPCC scenarios, or if emissions from other sectors decrease at a slower pace, emissions for the transport sector need to be cut at an even faster rate to be in line with the Paris Agreement.

⁶ CO₂ emissions from the transport sector have decreased by 22 % between 2010 and 2020, and the Swedish Transport Administration estimate that emissions will decrease 40 % between 2010 and 2030 under current policies.

et al., 2020). More spread-out cities and longer distances between activities further increase the relative attractiveness of personal vehicles.

Even though parking for cars takes up large areas, many households still do not have access to a car (c.f. Nicolas and Pelé, 2018; City of Stockholm, 2015). These households do not get increased access to cars, or to mobility, when the municipality demands more parking spaces near residences. Research however indicates that those who do not own a car often pay a part of the costs for parking through rent or fees (Andersson et al., 2016).

There is an ongoing debate in parking about shifting focus from physical parking spaces to accessibility and mobility options, which, according to proponents, can both lead to a reduced need for parking and to improved accessibility for those who do not own a car. This debate is linked to a broader debate on changing planning paradigms in transportation (cf. Banister, 2008; Litman, 2013). Banister proposes a shift from what he calls 'a conventional approach', where vehicles and traffic flows are in focus, to a 'sustainable mobility paradigm', where people and accessibility are in focus. This paradigm shift focus to, for instance, accessibility rather than mobility, visioning rather than forecasts and see streets as space rather than roads.

1.1 Research context

There is growing literature on parking linked to urban planning and sustainable mobility. Many cities in the US and in Europe use so-called 'minimum parking standards' in new developments and re-developments. With minimum standards, municipalities require that at least a minimum number of parking spaces are provided before giving a developer a building permit (e.g. one parking space per flat). Shoup (1997) have described the use of minimum standards in the US and Per Lundin demonstrated how Sweden copied minimum parking standards from the US in the 1950s (Lundin, 2008), and how the city of Stockholm was adapted to the emerging car traffic.

Minimum parking standards have been criticized by many researchers. Several researchers have demonstrated that large numbers of parking spaces are correlated with high car ownership and rates of car travel (e.g., Millard-Ball et al., 2020; Christiansen et al., 2017; Weinberger, 2012; Guo, 2013a; Guo, 2013b; Manville, 2013). Other studies show that minimum standards lead to increased construction costs and higher living costs (Shoup, 1997; Franko, 2020), that those who do not own a car pay a part of the cost of car parking (Andersson et al., 2016) and that parking standards contribute to increased land use (Fastighetsägarna et al., 2020; Marsden, 2014). Liljenström et al. (2015) also show that garage parking gives rise to significant CO₂ emissions during construction, and Schreine et al. (2008) show that parking leads to more impermeable surfaces, which in turn lead to an increased risk of flooding. Thumm et al. (2020) claim that there is a consensus among researchers regarding the problems associated with minimum parking standards, and that proposed solutions are often linked to market mechanisms.

Much of this research is quantitative, with researchers employing statistics to calculate whether car ownership and car use are lower in properties with fewer parking spaces. Christiansen et al. (2017), for example, use the Norwegian National Travel Survey, together with geographical data, to study whether fewer parking spaces are correlated with lower car ownership, when controlling for other variables. The conclusion is that fewer parking spaces at home is correlated with lower car ownership, and that car use decreases with longer walking distances to parking spaces. Millard-Ball et al. (2020) use data from San Francisco's

affordable housing lotteries and show that lottery allocation of housing is almost random, which means that they can check for self-selection bias. This means that researchers can explore whether lower car ownership is due to the fact that flats with fewer parking spaces are more attractive to people without cars (and that this is the reason for low car ownership) or whether the limited number of parking spaces is the reason for the low car ownership. They conclude that more on-site parking spaces increase the likelihood of owning and driving a car. The purpose of these studies is to find quantitative cause-and-effect relationships. The research focuses on isolating the studied variables from other factors. This research tradition often recommends studies with control groups (cf. Sprei et al., 2020), which in this case would mean that similar studies are carried out with people who move to a block of flats with few and with many parking spaces, respectively. The results from these studies should then be statistically generalizable to other contexts.

These quantitative studies are important and provide high quality empirical data. However, critics argue that quantitative research has too dominant a position in transportation research, and that qualitative research, which seeks to understand the decision-making process in depth in a specific context, is neglected (cf. e.g. Marsden and Reardon, 2017). In addition, the quantitative research described above is not suitable for major system changes (cf. Marsden et al., 2014; Rikinen, Shove Marsden, 2020). Forecasts are useful in order to understand what is likely to happen if current trends continue, and may be a wake-up call, but are less useful when changes in practices are needed. Cause-and-effect relationships in these studies are often assumed to be stable and continue into the future, which makes it difficult to break with the status quo. Furthermore, there is a risk that the scope of possible action is limited to a few variables, and that alternative development paths are neglected (see for instance Witzell, 2020). In this thesis, preferences, activity patterns and practices are seen as dynamic and capable of changing in the future (see Chapter 2.1.1). Instead of assuming that practices are stable over time, it is also possible to study conditions under which specific goals can be achieved (cf. Paper IV) as well as the mechanisms that contribute to the stability of practices and what enables them to change (cf. Paper II).

There are fewer qualitative and interpretive studies on parking and sustainable mobility (two examples are Antonson, Hrelja, Henriksson, 2017; Selzer, 2021). There are, however, some studies in related areas. These studies have focused more on shared mobility than on parking (e.g. Berg, Henriksson and Ihlström, 2019; Smith, Sochor and Karlsson, 2019; Börjesson and Henriksson, 2014). Some studies have also focused on “car-free areas” (Smith, Sochor and Karlsson, 2019; Baehler, 2019; Melia, 2014). There is furthermore, to my knowledge, no backcasting studies focusing on parking and mobility.

This thesis intends to fill this research gap and contribute with interdisciplinary, normative and, above all, qualitative research. This thesis is interdisciplinary in the sense that it combines different research traditions and it is normative because it contributes with research on how important sustainability goals can be achieved. The purpose is to consider people in context, what their activity patterns look like and how they integrate different transport modes into these activity patterns. The focus is also on examining how practices change when the number of parking spaces is limited and people have access to shared mobility. The purpose is thus not to obtain pure cause-and-effect relationships, but to contribute to the discussion with context-specific knowledge that includes an analysis of the relationship between parking and mobility conditions on one hand, and residents' travel patterns (and social practices) on the other. This enables reflections on how practices that are

currently marginal in scale can grow. The idea is not to predict what will happen if these policies are implemented in other places, but to try to understand processes that can contribute to the maintenance of existing car dependent practices as well as processes that can facilitate the growth and spread of new sustainable practices.

1.2 Aim and research questions

The purpose of this thesis is to critically study policy measures on parking and mobility in metropolitan areas. The measures under review are in line with a Sustainable Mobility Paradigm (where mobility and accessibility have a more prominent role, see Banister, 2008). The research questions are:

- Why is it difficult to implement policy and governance reforms with a purpose of steering towards a Sustainable Mobility Paradigm?
- How are mobility practices affected when car parking is restricted and other mobility services are offered within the residence?
- What can a pathway with parking and mobility strategies in line with the CO₂ goals of the Paris Agreement look like?

2. Theory and method

2.1 Theoretical framework

This thesis is situated in a constructivist and interpretative research tradition, which means that I see social practices and institutions as socially constructed. This means, for instance, that people's preferences are not seen as merely individual and fixed, but rather influenced by the social practices people participate in. It also means that they are dynamic and can change in the future. The approach is to analyse how mobility practices and governance institutions are enacted in specific contexts, rather than trying to analyse cause-and-effect correlations between variables. Each theoretical framework used is discussed in brief below.

2.1.1 Social Practice Theory

Social Practice Theory (SPT) is used as theoretical framework for Paper II. Social Practice Theory derive from sociologists such as Bourdieu (1984) and have been developed by several researchers in sociology and philosophy (e.g. Reckwitz, 2002; Watson, 2012; Shove et al., 2012; Hargreaves, 2011). Several authors argue that research with a focus on individuals as decision makers has not been efficient in reducing car traffic, and that focus should rather be on *“economic, social or cultural conditions which frame individuals' travel possibilities and practices”* (Marsden et al., 2014, 72). Social Practice Theory thus aims at directing analytical focus on the socially shared practices, which are the underlying reasons for travel demand, rather than focusing on the individual as in the so called “ABC” (attitude, behavior, choice) model (Rinkinen, Shove and Marsden, 2020; Shove, 2010; Hargreaves, 2011). Attention is also paid to bundles and complexes of practices that are distributed in time and space (Cass and Faulconbridge, 2016; Shove et al., 2012; Shove et al., 2015). For instance, Shove, Watson and Spurling write that *“[...] the extent to which driving has become integral to the conduct of an increasing range of social practices, including shopping, commuting and getting to school”* (2015, p. 275). The argument is that daily activities may be distributed in space and temporally sequenced in a way that make car travel more or less indispensable (collective coordinated in space and time) (Shove, 2002).

Shove, Watson and Spurling (2015) furthermore argue that infrastructure should also be seen as important elements of a practice. Infrastructure, they argue, has been constructed within a paradigm, and with the purpose of facilitating certain ways of living. In Shove, Watson and Spurling's words *“These systems do not arise by accident. As we show, past and present practices of planning, normalized metrics and methods, taken-for-granted understandings of welfare and well-being and sometimes contested local and national politics are also important. In exploring these connections and in considering them from different points of view we catch sight of how patterns of energy demand are made in practice, and how they might be changed”* (2015, p. 276) and that *“[...] infrastructures embody and carry historically specific ideas about normal and appropriate ways of living, effectively transporting these from one generation to the next”* (2015, p. 280). The way in which a city is planned thus carries meaning and affect the spatial distribution of activities. For instance, a city with plenty of urban highways and extensive areas of surface parking tend to be more sprawled and the distance between activities tends to be longer, and this infrastructure signals certain lifestyles as ‘normal’.

⁷ According to the ABC model *“[...] social change is thought to depend upon values and attitudes (the A), which are believed to drive the kinds of behaviour (the B) that individuals choose (the C) to adopt”* (Shove, 2010, p. 1274)

However, such a view of materiality should be seen as far from deterministic. Infrastructure has been planned with a certain meaning, but this meaning changes as practices are performed in new ways. This means that infrastructure can signal what a good lifestyle is, and shape what is seen as comfortable, but at the same time the practice depend on people's every day activities. As they travel, or use the infrastructure, in new ways, the meaning changes. A practice is therefore dynamic and changing. There is thus a relationship where influence is seen in both ways in SPT, on the one hand, the practice constrains and enables people to act in certain ways, and on the other hand, the practice changes as people act in new ways.

A practice is not merely dependent on related practices and infrastructure. Shove et al. (2012) have proposed a conceptual model for SPT. A practice can be seen as constituted by different elements: material elements, competencies needed to perform the practice, and the meaning associated with the practice. For instance, to car share people need cars, parking spaces, roads, an app to book the car, etc. Car sharing is also based on certain competencies, such as booking a car, driving skills, the ability to schedule car sharing into daily activities, etc. Finally, car sharing carries collectively shared meanings; for instance, the idea that car sharing is unreliable or that it is cheap and convenient (and this meaning is dynamic and changing) (see Svennevik et al., 2020 for a discussion on car sharing practices). The idea is that material aspects, shared competencies, and meanings together constitute the car sharing practice, together with infrastructure, rules, legislation, taxes and bundled practices/complexes of practices⁸. SPT thus focus the attention on daily performances and on the socially shared practice (rather than looking at individual choices and behaviours).

Planners and policy makers are often seen as actors that can steer a practice through planning, legislation, and taxes (Shove, Watson and Spurling, 2015). Planners, for instance, use certain procedures for planning infrastructure that facilitate certain ways of living. However, Shove, Watson and Spurling (2015) argue that planners and policy makers are not acting outside of the practice, but are rather part of the practices they are trying to steer. The ideas associated with vehicle sharing, cars, bicycles and public transport are also shared with planners, and the measures discussed and implemented may be reinforcements of already existing trends and ideas. This means that there is also a dynamic relationship between planners/policy makers and the practice itself.

Therefore, one focus of this thesis has been to critically examine whether emerging social practices (e.g. vehicle sharing) change when planning standards are altered and residents are offered a selection of mobility services. The studied measures should be seen as an intent from planners to "steer" mobility practices, at the same time that they are a part of the same practice.

2.1.2. Futures Studies

Paper IV was written using a futures studies⁹ approach that was target oriented/normative and used to present one possible future image where the climate targets are met. The starting point is the question of what decisions regarding parking need to be taken in the near future to steer us towards such an image. Practices that are marginal today (e.g. vehicle sharing) are seen as seeds that can grow (given favourable material and legislative conditions), and private car use is regarded as a practice that is losing practitioners. The underpinning

⁸ See Shove et al. (2012) for further explanation of the concepts

⁹ The research field is called futures studies, to illustrate that there are many possible futures.

objective is to open up imaginative capacity, and to come up with ideas on how to provide favourable conditions for a future in line with climate objectives to materialize.

Futures studies are often categorized as either predictive, explorative, or normative scenarios (Börjesson et al., 2006). When studying the future through forecasts (predictive scenarios), estimations are made about the future based on trends and causal relationships observed in the past. By assuming that these trends will continue and that causal relationships are stable, predictions about the future can be made. Predictive scenarios can also include sensitivity analyses to test the robustness of the forecasts if one parameter changes. For instance, if the prediction assumes a correlation between economic growth and traffic growth, a sensitivity analysis can be made with lower economic growth. The future images created by predictive scenarios represent one possible future, a future where current trends (or cause-and-effect relationships from the past) continue. However, transition studies (Geels, 2012) show that new technology and institutional arrangements often are disruptive and may entirely change the rule of the game. Predictive scenarios are ill-suited to account for these trend breaks. Furthermore, if the future image depicted with predictive scenarios is not in line with stated goals, predictive scenarios may not be the most appropriate approach (Höjer and Åkerman, 2006). Predictive scenarios may also delimit the scope of actions that are perceived as possible (given the limitations of the variables in the model). For instance, Kågeson (2019) argued in a report that the only way to reach the Swedish climate objective for the transport sector (a reduction of CO₂ emissions by 70 % between 2010 and 2030) is by doubling fuel prices. There may, however, be other ways to steer towards the climate target.

Another possible approach is explorative scenarios (see e.g. Carlsen, Dreborg, Wikman-Svahn, 2013) where different possible futures are elaborated. The idea behind explorative scenarios is to depict different possible futures in order to be prepared for unexpected events. The idea is no longer to predict the most probable future, but rather to depict different possible futures.

Finally, normative scenarios can be used (e.g. Höjer and Åkerman, 2006; Hickman and Banister, 2007; Soria-Lara and Banister, 2017). The idea behind these scenarios is to set targets and to depict future images where these targets are met. Normative scenarios can also be used to construct pathways to different future images. These scenarios are especially useful when radical change is needed to reach targets. The objective is not to identify the most probable future, but rather to illustrate possible futures where targets are met. These scenarios do not depart from past trends and may involve changes in preferences and social structures. As the objective in this thesis is to depict futures where greenhouse targets are met, normative scenarios are deemed to be the most pertinent approach.

There are different types of normative scenarios. These scenarios can be expert-driven (e.g. Höjer and Åkerman, 2006; Hickman and Banister, 2007), where the researcher (or research team) develop future images where the targets are met, or participatory (Soria-Lara and Banister, 2017), where a range of different stakeholders are involved in developing the future visions. Both approaches have their advantages and drawbacks. Participatory scenarios have the advantage of involving different stakeholders and their perspectives in the scenario-building process. Input from different stakeholders can give more nuanced future images than those depicted by researchers alone, as more perspectives are involved and a broader range of possible measures are considered. Involving stakeholders in the decision-making process may also result in more committed stakeholders who may be more likely to integrate the findings from the scenario exercise in their daily work. However, participatory scenarios

also have a certain number of drawbacks. It may be hard for invited stakeholders to imagine goal-fulfilling futures (especially if the targets require radical changes) and non-negotiable targets may thus not be met. Another challenge is representation; some stakeholders' perspectives are represented whilst a range of other stakeholders are excluded from the process.

2.1.3. Collaborative planning

Papers I and III were written from a governance perspective. Healey (1998) argues that planning traditions have shifted from a more hierarchical tradition, where central authorities plan with a 'top-down' approach, towards a more decentralised approach. This decentralised approach can be defined as a network structure where other stakeholders and citizens should be involved in decision making (Sager and Ravlum, 2004; Powell, 1990). This planning tradition argues that structures in European society have shifted in ways that reduce the power of central authorities, and that they therefore need to cooperate with other stakeholders (Healey, 1998). Sager and Ravlum (2004) argue that co-operation between stakeholders, rather than competition, is important in such networks.

In the context of these changes, Healey proposed a theoretical framework; 'collaborative planning', which is characterized by intersubjective understanding, i.e., that participants' preferences are not fixed but can change in dialogue with others. By inviting different stakeholders into the planning process, it is possible for participants to understand each other's perspectives and consequently to change preferences. Healey argues that the planning process is a social practice, created by stakeholders interacting with each other.

Healey (1998) furthermore underscores the importance of creating institutional capacity. In other words, norms, values, discourses, expectations, rules and routines need to be developed to enable collaborative planning. For actors in a network to collaborate they need to be committed. According to Mayer and Allen (1991, see also Tornberg, 2012) stakeholder can be committed because they want to do something, are required to do something or that they feel morally obliged to do it.

Collaborative planning has been criticized for not sufficiently accounting for power structures. The critics argue that these theories derive from Habermas' "ideal speech" (Purcell, 2009; Flyvbjerg, 2009). In the words of Purcell:

"That ideal requires that all participants transparently articulate what they really believe; that power differences between participants be neutralized for the purposes of deliberation; that all participants affected by the decision participate in it meaningfully; that everyone has an equal chance to participate in deliberation; that each must be willing to empathize with the arguments of others; and that everyone aim to achieve the good of all rather than their particular self-interest" (Purcell, 2009, p. 149).

These authors criticize the strive for ideal speech situations. They argue that there will always be power relations that affect how the questions are framed, who is perceived as having knowledge etc. Purcell (2009) argues that the strife for consensus reduces marginalised people's ability to defend their rights. In Paper III, I discuss how a Parking Benefit District program can be designed. When designing such a program it is important to take into account power structures and to be aware that consensus also can lead to inequality.

2.2 Method

The research in this thesis is interdisciplinary with an emphasis on qualitative methods. The research is interpretive and explorative. It is primarily about interpreting different phenomena and discussing target-oriented policy measures. The purpose of the research is not, as described in Chapter 1.2, to produce generalizable cause-and-effect relationships, but to understand events in their context.

Furthermore, the research is based on several cases, and is thus similar to case study methodology. Johansson (2005) claims that case studies are based on an interdisciplinary methodology where different methods are used to see events from different perspectives. Flyvbjerg (2006) also claims that case studies are necessary to become an expert and to deepen knowledge in an area.

A number of complementary methods have been used in the research. Each method is briefly described below.

2.2.1 Interviews

Semi-structured interviews have been used in all papers and are the most important method for collecting and creating data. The interviews were mostly open and similar to a conversation, even though they were structured around certain themes. In Paper II, the interviews departed from the informants' everyday lives. Each informant was asked about what activities they had carried out the previous day, and based on these reports, questions were asked about which means of transport they used. Other interviews were conducted to shed light on certain phenomena, e.g., short interviews with those who sold their car in connection with the move (Paper II) or about the Swedish Transport Administration's mandate to finance step 1 and 2 measures (Paper 1).

In Paper I, interviews were conducted with 21 informants. These interviews were iterative, e.g., some of the informants were interviewed several times and findings in one interview were often used to formulate questions in subsequent interviews. Some of the interviews were conducted to shed light on a particular question, while others were more open-ended. The interviews were used to understand how different actors interpreted and perceived different issues, and they were documented with extensive notes. All the quotes in the final manuscript were checked and approved by the informants.

In Paper II 38 interviews were done in two waves. The purpose of the interviews was to understand mobility practices and how informants made sense of the everyday mobility conditions in which they found themselves. A new technology or service (for instance car sharing) should be understood in terms of how these measures were appropriated by the informants—for instance, how they were linked to other practices that facilitated or constrained a change in mobility practices. The purpose was also to understand how possible changes occurred, e.g., understanding the process of selling a car, how people adapt, where they park their cars, and how these decisions affect their daily life and perceptions of their residence.

In Paper III, 7 interviews were conducted with various planners in the city of Stockholm. Six of the interviews were recorded and transcribed. One interview with a deputy mayor was conducted over the phone and was documented with extensive notes. All quotes in the final manuscript were checked and approved by the informants, except for the interview with the deputy mayor due to his lack of time.

In Paper IV, 3 interviews were conducted with different actors. The actors were selected after the workshops and literature reviews to find out more about ongoing initiatives in parking and mobility. The interviews were conducted with planners in the city of Stockholm, a secretary of an ongoing state inquiry, and with participants in a related research project.

The interviews in Papers II and III were transcribed and read by the researchers. Subsequently, analytical themes were created with the use of the theoretical framework (see section 2.2.6), which were discussed within the research group. The analysis of the interviews was guided by the analytical framework and results were interpreted and put into theoretical context.

2.2.2 Document analysis

Literature reviews (Papers III and Paper IV) and document analyses (Paper I) were also used to collect/create information. The results of these analyses were used to formulate research questions and to compare and contrast the findings in the documents with the views and interpretations of different stakeholders. The document analysis in Paper I was conducted on official documents with instructions and directives regarding the use of step 1 and step 2 measures in national transport planning. The wordings in these documents were compared with regional and national officials' interpretations. The analysis included the following documents:

- Government decrees on national and regional plans, co-financing and instructions to the STA
- Relevant government bills, assignments and related inquiries.

The literature review in Paper III was conducted to collect/create information about existing PBD programmes. As there is little academic literature on PBD, most of the documents reviewed were grey literature. The idea was not to review all existing literature, but rather to identify key aspects of PBD programmes and to use the findings to formulate interview questions and to consider possible designs of PBD programmes in a European context.

The literature review in Paper IV was made to identify ideas on parking and mobility measures. Much of the review was of grey literature to identify policy measures in different cities. We also made a review of car sharing literature, which was used as a scenario element in the scenarios.

2.2.3. Focus groups and workshops

Focus groups and workshops were used in Paper III and Paper IV. In contrast to semi-structured interviews, the aim with focus groups is interaction between participants (Kitzinger, 1994).

The focus group discussion in Paper III was held after the literature review and semi-structured interviews. The idea was to bring up issues raised in the interviews and let participants discuss and reflect upon these topics together. Informants were gathered to discuss and reflect upon how a PBD program could be implemented as a group.

Two series of workshops were carried out in Paper IV. The first workshop was carried out with researchers. It was a brainstorming workshop with the purpose of coming up with new ideas. The theme and background of the research project was introduced by me and my co-researcher, and participants were then divided into two groups. The results from this

workshop were analysed and developed by the researchers (see section 2.2.6). The second workshop was carried out with stakeholders and planners. The results from workshop 1 was sent out to the participants at beforehand. The results from the workshops were used as inspiration when constructing the Pathway.

2.2.4. Questionnaires

Questionnaires were used in Paper II. Apartment buyers were surveyed using questionnaires in two waves, before and after the move. Both questionnaires were conducted at the same time of the year (October/November 2017 and 2018) to increase comparability of the results. The objective of the questionnaire was to obtain information on vehicle ownership, parking, and travel patterns (i.e., modes of travel used in the day and week prior to the survey) before and after moving into the apartments, and to assess changes that had occurred. Furthermore, data was collected from the mobility service providers (e.g., the numbers of car share users). We chose to ask about travel patterns the week before filling in the survey, as it is often easier to remember activities under a specific period than travel modes normally used.

2.2.5 Participant observation and field visits

We also did participant observations and field visits in Paper I and Paper II. In Paper I researchers participated in the workshops of two Strategic Choice of Measure studies. We observed and took notes of the issues discussed at the workshops. The participant observation also enabled us to better understand the issues discussed and helped us to establish contact with informants.

In Paper II the developers were part of the same research project, and we discussed the cases regularly at meetings. We also participated in moving in events and information meetings before the move and visited the block of flats to undertake informal interviews on a few occasions. These visits helped us to get a better understanding of the context and helped us to get into contact with informants (that did not answer the questionnaires). We also made an inventory of the on-street parking situation around the two blocks of flats. All this information helped us when making interviews and when interpreting results.

2.2.6 Analysis of the material

The analysis of the material was done with iterations between the theoretical framework and the material. The theoretical framework was used to ask questions to the material and structure the results. At the same time, we were careful to not squeeze the finding into already pre-defined concepts.

In paper I, we used governance theory and collaborative planning as a theoretical framework, together with theories on commitment (Meyer and Allen, 1991; Tornberg, 2012). Three themes were defined that guided the data collection and analysis, namely:

- The STA's formal mandate to finance different measures in the four step principles
- Whether this mandate was perceived to be clear by the informants
- The perceived consequences the mandate has on the implementation of measures

We used this framework to identify analytical themes and identify follow-up questions to the informants. Governance theory, and especially different forms of commitment (what the actors want, are formally and morally obliged to do) was used to pose questions to the material. The analysis of the material was an iterative process between the theory and the material.

In paper II we used Social Practice Theory as the theoretical framework, which both influenced the design of the interviews and the analysis of material. The idea was to understand the elements that kept car dependent practices stable and to understand how marginal practices could grow (e.g. car and bike sharing). The questionnaires and the data from mobility providers were first summarized to assess changes in car ownership, travel patterns and use of mobility services. Two types of analyses were made. First, data from everyone who answered both waves of questionnaires (before and after the move to the new blocks of flats, segment 1) was analysed. Then some questions were analysed using only the respondents of the second wave of the survey (regardless of whether they answered the first wave or not, segment 2). The interviews were then used to understand the changes observed in the questionnaires. The analysis of the interviews were guided by Social Practice Theory, and especially how people organized their everyday activities. We also used SPT to analyse different elements of their mobility practices by posing questions to the material. Informants were chosen to illustrate different occurrences, such as people who have used sharing and not, people who own car/ not own a car etc.

In paper III we used participatory planning and collaborative planning as a theoretical framework (Healey, 1998). The analysis of the data was done in an iterative way between theory and material. The literature survey was analysed according to five themes:

1. How the PBD programme is designed
2. How much of the revenues are returned to the community
3. How the community is involved in the programme
4. What measures were financed with the revenues
5. Possible key factors for successful implementation

The interviews were also analysed around four themes:

1. Benefits and drawbacks the informants perceive with a PBD programme
2. Problems the informants perceived a PBD programme could address
3. Possible designs of a PBD programme
4. Institutional barriers that render implementation difficult

While the literature survey collected information regarding existing PBD programmes, the purpose with the interviews was to understand how the informants perceived the possibility to implement a PBD programme. The results were first structured according to the themes mentioned above and then analysed in an iterative way with questions from the theoretical framework.

Paper IV was written with a futures studies inspired theoretical framework. The literature review, workshops and interviews were used as brainstorming to gain new ideas. The development of the pathway was an iterative process between academic literature, examples from other cities and input from workshops and interviews. The process started with input from parallel research projects and academic literature on parking. This was followed by a workshop with researchers on parking and mobility-as-a-service. The workshop highlighted several problems with current parking policies and discussed some possible proposals. I took the results from the workshop and developed the results into a scenario element draft, with the use of examples from other cities. The draft was sent out to stakeholders from municipalities, developers, mobility service providers and consultants, and they were asked to read the draft before participating in a workshop (workshop II). The workshop started

with a discussion of the draft, and the participants discussed the potential and drawbacks with the proposed measures. In the second part of the workshop the participants were asked to propose new ideas and proposals. The results from the workshop was then developed into a pathway where the goals of the article were met. In futures study terminology, the paper is an expert driven study with input from different stakeholders. In the end of the paper we analysed the pathway in terms of equity, acceptance and feasibility with the use of literature.

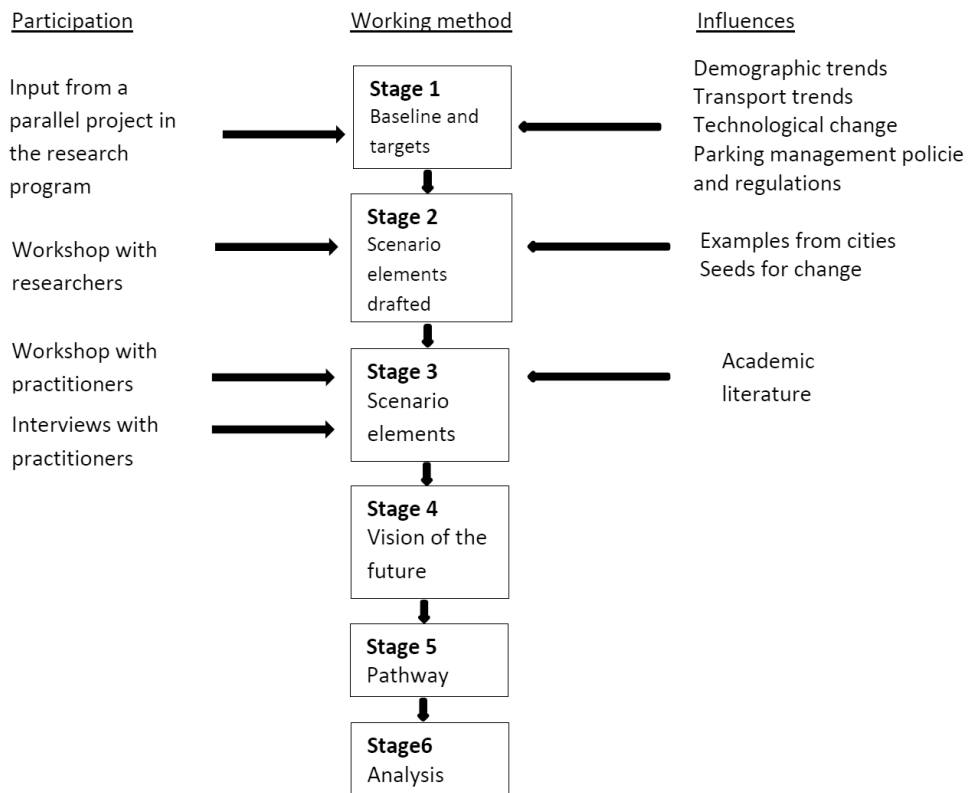


Figure 1. Scenario building process (presentation inspired by Hickman and Banister, 2007), (Paper IV, p. 6)

2.2.7 Methodological reflection

Many studies in the field of transportation research strive to determine causal relations between specific variables. The idea is to understand, for instance, how much a 10 % increase in parking fees affects car ownership, independent of other variables, or how much a car sharing vehicle in the residence affects car ownership, independently of other variables. This is not the approach taken in this thesis. Instead, I use a situated approach, where I try to shed light on how, for instance, the availability of car sharing affects car ownership and mobility practices in a specific context. In this approach, I do not try to isolate variables, but rather to understand how different variables interact. This means that findings in one context cannot be transferred directly to another context and be assumed to have the same effect. The same line of argument applies to self-selection bias. Many studies discuss the problem of self-selection bias (e.g., Handy, Xinyu, Mokhtarian, 2005). The question is whether residencies

with relatively few parking spaces and who offer mobility services attract the type of person more interested in these services. If this is the case, the results cannot be assumed to have the same effect on a larger population. I acknowledge this problem, but the objective of this thesis has been to understand how mobility practices are formed and change in a specific context.

The methods used in this thesis are inspired by ethnology and anthropology (cf. Ehn and Klein, 1994). This means that I, and my co-researchers, recognize that the results are to a certain extent affected by subjectivity. More concretely, this is reflected in the way the interviews were carried out. The interviews resembled a (structured) conversation around specific themes, rather than a set of fixed questions. For instance, in Paper II, the interviews started with the informants relating their daily activities and travel modes the previous day, last weekend, on last holiday etc. Follow up questions thus depended on the interview and the issues brought up by the informant. This means that both questions themselves and the order of the questions depended on the interview. The idea of this methodology was to understand how travel patterns are enacted in the informants' webs of activities. The researchers also participated in meetings and information events (in a participant observation sense). For instance, in Paper I, my colleague and I participated in several workshops in different Strategic Choice of Measure studies. Even though we did not actively participate in discussions, our presence and conversations may have affected the discussions. However, these activities were crucial for our understanding of the context, the issues discussed, and the dynamics at the workshops.

Anthropologists argue that one should reflect on how one's values may affect the results. The purpose of the research projects in this thesis was to study policies that could contribute to a sustainable transport system. The research projects were also transdisciplinary (take, for instance, Paper II), with participants from developers and municipalities. These stakeholders did not actively influence the research design, but the discussions at meetings may have framed what is seen as important (e.g., how mobility services work). Similarly, the researchers in the project were interested in whether mobility services and restricted numbers of parking spaces led to more sustainable transport patterns. All this influenced the themes we choose to highlight and how we decided to make sense of the informants' web of activities and practices. To highlight that the data is not something that exists and can be collected objectively, we have used the term data that is "collected/created" in the thesis (cf. Ehn and Klein, 1994).

I have been careful to protect individual integrity when collecting data. All the informants have been informed about the purpose of the interview before the interview. When the interviews were recorded, I asked for permission to record the interviews. In Papers I and III I checked quotes with the informants before publication. All data have been anonymised before they are shared with anyone outside of the research team. Similarly, the web questionnaires started with an introductory text explaining the purpose of the project and how the collected data is to be used.

3. Summary of papers

3.1. Paper I. A function-oriented approach to transportation planning in Sweden: Limits and possibilities from a policy perspective¹⁰

Paper I studies Sweden's national transport policy and whether this policy is in accordance with the 'sustainable mobility principles'. A guiding principle in Sweden's transportation planning is the so-called 'four-step principle', which stipulates that measures affecting the need to travel (step 1) and measures aiming to use existing infrastructure more efficiently (step 2) should be considered before engaging in larger reconstructions (step 3) and new infrastructure investments (step 4). These principles seem to be very much in accordance with the 'sustainable mobility principles'.

Paper I shows some institutional changes introduced around 2010 that are in line with the principles above. For instance, the Swedish Transport Administration (STA) stated that it is a 'society developer' (Swedish Transport Administration, 2015) and no longer an 'infrastructure builder', which seems to indicate a broader planning scope. The STA also developed a new method for early feasibility studies with the objective of changing the focus from infrastructure to desired functions/identified problems. This method for feasibility studies, Strategic Choice of Measures (SCM), is intended to be used before any new investments are made in infrastructure. The SCM study involves a range of stakeholders, who collectively define problems to be solved and objectives to be reached. The idea is to challenge taken-for-granted solutions and to investigate whether there are other, more pertinent, solutions and measures, with step 1 and 2 measures being highlighted. However, early evaluations of SCM studies indicate that step 1 and 2 measures tend to be neglected (Odhage, 2012).

The objective in Paper I was to determine why step 1 and 2 measures tend to be neglected, with a particular focus on the STA mandate. The results show that the STA has a formal mandate to work with all steps of the four-step principle. However, according to officials at STA's central administration, this means that the STA can finance measures at state infrastructure levels. Measures at the infrastructure level of other authorities (unless a formal mandate is given in governmental assignments) are regarded as co-financing and can only be granted to physical measures. As many step 1 and 2 measures are intangible, and not directly linked to state infrastructure, they are dependent on actors other than the STA to be implemented. Furthermore, Paper I shows that many regional planners at the STA find their mandate to finance certain step 1 measures unclear, especially the measures regarding information and mobility management.

Paper I also shows that this uncertainty gives rise to exaggerated caution among many planners, i.e. they tend to not finance certain measures to be on the safe side. STA central administration has sent out communiqués to reduce these uncertainties, where they state that regional planning authorities may have to issue refunds if they have financed measures for which they did not have mandates (Fernström et al., 2016). Process leaders interviewed at the STA reported feeling frustrated over the STA's inability to finance certain measures that

¹⁰ This section is, to a large extent, similar to the summary of the same paper in the licentiate thesis (Johansson, 2019)

they deem suitable. As many step 1 and 2 measures lie within the responsibility of actors other than the STA, it is up to these actors to implement them. The role of the STA, according to the findings in Paper I, is to then foster commitment to these measures among actors through the SCM study. However, some measures may not clearly fall inside any single stakeholder's responsibility and may thus risk 'falling between the cracks'.

The results in Paper I indicate that the SCM study may strengthen stakeholder trust in the STA, as they are involved in the process, which according to the literature is an essential component in network governance (Powell, 1990; Sager and Ravlum, 2014). However, the results also indicate that the SCM study can damage trust in the STA. The STA emphasises the importance of step 1 and 2 measures, but at the same time does not have the mandate to finance these measures. This may result in ambiguous signals being sent to other stakeholders and may cause some of stakeholders to doubt STA intentions. Paper I concludes that *"the conditions among the actors the STA is dependent on for cooperation are therefore at risk if such relational qualities are reduced"* (Paper I:35). In the words of one interviewee:

"The parties [involved in an SCM] find it strange that the state cannot take responsibility over step 1 and 2 measures aimed at, for instance, influencing transport demand, i.e. mobility management. Now it is their [the other parties] responsibility. We [the STA] take responsibility for the planning, but then they should be responsible for the measures, even if the largest benefit is for the facility the STA is responsible for. When it comes to our infrastructure, we do [things] the other way around. Then we want local and regional parties to co-finance if it is in their interest, but when it is the same for their infrastructure, we cannot do the same" (Paper I:35).

As a result of these problems, a recommendation is made in Paper I to change the STA's mandate from financing measures tied to state infrastructure to a function-oriented approach where measures contributing to STA goals (including the climate objectives) can be financed. This would facilitate a shift towards a 'sustainable mobility paradigm'.

3.2. Paper II. Moving to Private-Car-Restricted and Mobility-Served Neighborhoods: The Unspectacular Working of a Progressive Mobility Plan

Since the 1950s, Sweden has had minimum parking requirements for new buildings, meaning that developers must provide a minimum number of parking spaces in order to obtain a building permit. Paper II studies a policy reform where minimum parking standards are replaced by flexible parking standards. Instead of requiring a minimum number of parking spaces, the parking standard is set in dialogue between developers and the municipality, and the developers can choose to substitute some of the parking spaces for other mobility services. The city of Stockholm implemented a new parking policy in 2015, which is in line with the flexible parking standard principles (City of Stockholm, 2015).

Paper II follows a case where two housing companies have built two blocks of flats that are run as homeowner associations (HOAs). These blocks of flats were given building permits with flexible parking standards. The HOAs are located in the Stockholm region, one in Älvsjö in the southern parts of Stockholm and one in Haninge municipality south of Stockholm¹¹. Both blocks of flats were built with a limited number of parking spaces and residents were instead offered different mobility services.

The aim of Paper II was to study: 1) how relatively marginal practices of vehicle sharing developed when these services were made available and promoted to new residents and 2) What the process of leaving car-dependent practices behind might look like in connection with the implementation of such measures.

The questionnaires indicate lower car ownership among households in both blocks of flats after the move to the new flats, as well as a decrease in the frequency of car travel in one of them. The number of cars among people responding to the surveys decreased from 19 to 13 cars in HOA Elvsjö and from 14 to 10 cars in HOA Haninge¹² (see table 1)

Table 1. Access to cars at homeowner associations (HOA) Haninge and HOA Elvsjö: pre- and post survey (paper II, p. 6)

Unit: Number of People	Access to a Car		Access to One Private Car		Access to Two or More Private Cars		Sum of Private Cars	
	before	after	before	after	before	after	before	after
HOA Haninge: sample 1 (pre- and post-survey)	12	12	9	11	2	0	14	10
HOA Haninge: sample 2 (everyone in the post-survey)		33 out of 40		28 out of 40		2 out of 40		32
HOA Elvsjö: sample 1 (pre- and post-survey)	21	17	10	7	4	3	19	13
HOA Elvsjö: sample 2 (everyone in the post-survey)		51 out of 85		29 out of 83		4 out of 83		33

¹¹ The HOAs under study are called HOA Elvsjö and HOA Haninge in paper II.

¹² This figure concerns people who answered both the survey before and after the move to the new building.

Furthermore, people who moved to the two HOAs are using car sharing much more frequently than before (see table 2). For instance, in HOA Elvsjoe, 1 out of 29 respondents were members in car sharing prior to the move, and 24 out of 29 respondents were members after the move (N.B: that membership is free), and many households are using car sharing. Furthermore, there are 17 people on a waiting list for parking in HOA Haninge (as of 26 March 2019) and 35 people on a waiting list in HOA Elvsjoe (as of 23 May 2019).

Table 2. Membership and use of car sharing prior and after moving to the flats (Paper II, p. 8)

Unit: Number of People	Sample 1 from the Survey		Sample 2 from the Survey		Data from the Car Club Providers	
	Members before moving Oct/Nov 2017	Members after moving in Oct/Nov 2018	Users of the car club Oct/Nov 2018	Users of the car club who did not have a private car Oct/Nov 2018	Users of the car club Spring 2019	Members of the car club Spring 2019
HOA Elvsjoe	1 out of 29	24 out of 29	18 out of 84	16 out of 18	27	70
HOA Haninge	0	8 out of 13	4 out of 40	2 out of 4	11	32

The causal relationships behind changes in mobility practices are complex and influenced by a variety of factors. Residents were interviewed to understand how mobility practices were influenced when people moved to these blocks of flats. The first observation is that mobility practices are mostly stable. People mostly still travel to the same destinations as before and use the same transport modes, which is understandable as people's activity patterns largely remain the same. However, as mentioned above, there are some changes in car ownership and car use. Some people sold their car when moving to the new flat and decided to do so before the move. Others had the intention of selling the car, but kept the car to see whether car sharing worked in practice, and had not tried the car sharing at the time of the interviews. Yet others had to wait for a parking space and tried out mobility services during that time. When offered a car parking space, the interviewed informant realized that he did not need their private car.

The results indicate that current mobility practices are sustained by a range of bundled practices in which people engage. However, restricting parking and offering mobility services seem to offer alternatives to private car ownership. The process of leaving a car-dependent practice is, however, slow and conditions (e.g., technology, and ways of finding, booking, and paying for services) need to be relatively stable for the practice to grow. Other policies may also be needed for marginal practices to grow. Some policies aimed at this direction are implemented in Stockholm (e.g., congestion charges, on-street parking fees, extension of public transport and bicycle infrastructure). However, there is also a trend in the opposite direction (e.g., new urban highways). Furthermore, future interventions could be open to residents in adjacent properties if more people are to be attracted to mobility services. Furthermore, changes in car ownership can come from disruptive events (such as no longer having access to a company car).

3.3. Paper III. Parking Benefit Districts – The transferability of a measure to reduce car dependency to a European context¹³

Parking Benefit Districts (PBD) is a concept that has been used in several cities in the US (Kolozsvari and Shoup, 2003; Shoup, 2004, 2005, 2016) but, to my knowledge, it has not been used in a European context. Paper III investigates the transferability of the principles behind PBD to a European context (Stockholm) and whether such a programme could contribute to reduced car use and thus also to environmental and social sustainability.

PBD is a concept where revenues from on-street parking charges are returned to the area where the charges are imposed, and stakeholders (either citizens living in the area or other stakeholders) are involved in decisions as to how to spend the revenue. The concept has generally been used to increase acceptance for on-street parking charges by involving stakeholders in the decision-making process and by showing them what the revenues are used for. In some cases in the US, PBD has been a key factor in creating acceptance for on-street parking charges (cf. Kolozsvari and Shoup, 2003).

In many cities, including Stockholm, on-street parking charges are seen as an important component in integrated policy packages aimed at improving accessibility, reducing land use for parking and contributing to a more sustainable transport system. On-street parking charges are tightly linked to parking in new housing developments, offices and commercial areas. Informants in Paper III worry that if on-street parking is free and unregulated, people may decide to park on the streets rather than in off-street parking facilities, which may be a problem as cities may want to use street space for purposes other than curb parking. However, stakeholders (residents, business owners, etc.) tend to oppose on-street parking charges. The idea behind PBD programmes is to return revenue from parking charges to the community and involve stakeholders in the decisions on how to use the revenue, and thus increase acceptance. Consequently, these programmes tend to focus on the stakeholders most likely to oppose the charges (e.g., residents in a neighbourhood, but not visitors) (Shoup, 2005).

In Paper III, a link is made to other similarly direct democracy programmes that focus on the benefits of participation for its own sake, like participatory budgeting (PB). These initiatives have been launched in an attempt to deepen democracy, increase transparency, increase trust in government, help build communities etc. (Secondo and Learner, 2012). A PB programme follows a similar procedure as a PBD programme, with the exception that funds generally come from the central treasury and not directly from on-street parking charges. Paper III argues that as PB and PBD programmes resemble each other, it is likely that a PBD programme could have similar effects. However, the design of a PBD programme should vary depending on its underlying purpose (e.g., participation).

Paper III shows that there are no legal barriers that render a PBD impossible in Sweden, but there are some barriers that need to be considered. First, on-street parking charges cannot be implemented with the sole purpose of raising revenues. The purpose should, according to legislation passed in 1957 (regulated in law 1957:259), be to manage traffic. Second, the decision to implement on-street parking charges must be taken by the city council, but stakeholders can give recommendations to the city council. Third, Swedish municipalities must follow a so-called ‘principle of equal treatment’, which means that they cannot give

¹³ This section is, to a large extent, similar to the summary of the same paper in the licentiate thesis (Johansson, 2019)

certain individuals or other stakeholders specific benefits. This means, in more concrete terms, that municipal spending cannot be earmarked for specific individuals (e.g., subsidised public transport cards for certain individuals). This formal legal framework indicates that it is possible to use PBD principles in a Swedish context, although with some limitations. Interviews with city officials indicate that a PBD programme would entail a new way of planning to which the Swedish planning tradition is not accustomed. Informants found the principles of PBD interesting and in line with the city's social sustainability policies, but were hesitant regarding whether it will work in Sweden:

“The principle is very exciting, very interesting. And I think it is very exciting as a way to get commercial actors or property owners or even individual citizens to be interested in charging for on-street parking. It could come as a citizen initiative instead of from the municipality. But I also think the potential it gives to local organizations of commercial actors or property owners to take more ownership of their street would be interesting. To remove the need that the municipality needs to come and fix things, and that we can fix the things we need to fix instead. That it will be as we want it to be, this is very interesting. But I wonder how open Sweden is to these things. One expects a lot from the municipality and from the state. But it would be interesting to know if these measures could work in Sweden”. (Chief Strategy Officer for Transport & Streets, City of Stockholm)

“[...] it feels like it is very much in line with the policies the new deputy mayors in Stockholm are interested in. They are really interested in human rights, social sustainability and such things. We have a social sustainability commission, we have quite a lot of these tasks. [...] This direct focus seems to fit quite well [with the social sustainability goal]. But Swedish municipalities are not used to working with such measures”. (Strategic Traffic Planner 1, City of Stockholm)

Swedish municipalities are accustomed to more centralised planning, and, as is indicated by the above quotes, officials interviewed wonder whether Sweden is prepared to use these new concepts. Some of the informants were worried that PBD-inspired planning may be viewed as policy where the municipality is avoiding its responsibility, instead of policy where different stakeholders are empowered. If this is the case, the policy's legitimacy may be compromised, at least in the short term.

Another important issue is equity. Several informants pointed out that there is a higher concentration of affluent people in more central areas of Stockholm, and in central areas there tend to be more visitors and parked cars. Therefore, if implemented on a larger scale, a PBD programme might result in revenue distribution to more affluent areas of the city, which may not be politically desirable. A solution to this could be to use allocation keys for revenues, i.e., situations in which revenues from parking charges are not returned directly to the area where they are imposed, but distributed to areas according to specific indicators (e.g., population, higher shares to more marginalised areas, etc.) With allocation keys, a PBD programme could lead to revenue redistribution from affluent to more marginalised areas. However, such a policy may reduce the direct link between on-street parking charges and revenues in the area. Another possibility is to only use a PBD programme in marginalised areas as a way of empowering citizens. Yet another possibility is to use PBD with commercial actors (e.g., in city centres) as a way of gaining acceptance for parking charges.

The participation rate in participatory schemes (such as PBD) tends to be low and skewed (only certain groups of people participate), and participation rates in local elections tend to

be considerably higher. Given this, there is a risk that a PBD programme will only give voice to certain groups and to their concerns, which may be undesirable and may undermine the programme's legitimacy. Considerable attention should therefore be paid to participation and to how to enhance participation among groups that have tended not to participate.

However, a PBD programme may also contribute to increased legitimacy and trust in public institutions, empower citizens (which tends to be one of the main objectives in PB programmes) and increase participation in local elections. If people see that their proposals, or the proposals they vote on, are actually implemented in their community, they may gain trust in public institutions, which may also increase their likelihood of participating in other democratic forums.

Finally, experience from PBD programmes in the USA indicates that it is a good idea to start by implementing some of the chosen measures in connection with the PBD process and not wait until sufficient revenue has been collected. Otherwise, the link between parking revenues and PBD measures may be weakened.

3.4. Paper 4. A Pathway for parking in line with the Paris Agreement

Paper IV is a futures study that depicts a future image for parking and mobility services for the city of Stockholm that is in line with the Paris Agreement, using backcasting methodology. Recent reports indicate that the terms of the Paris Agreement for the year 2030 are unlikely to be met merely with new technology and fossil free fuels (Swedish Transport Administration, 2020; Persson et al., 2019). These reports highlight that car ownership and car travel most likely also must decrease if the terms of the Paris Agreement are to be met. A city with fewer cars also needs fewer parking spaces, and space dedicated to parking can be freed up for other purposes. On the other hand, if parking spaces in line with today's car ownership are offered and car ownership drops, property owners will have costly parking spaces that go unused, which may increase housing costs, and provide incentives which continuously stimulate car use.

This paper assumes an image of the future where the terms of the Paris Agreements are met, and studies how parking can be changed to achieve this image. The paper estimated how much greenhouse gases should decrease in order to be in line with the Paris Agreement, and estimated how much car ownership and car travel need to decrease. The estimations indicate that car ownership should decrease by 30 % and car trips by 25 % between 2018 and 2030 (based on the Swedish Transport Administration, 2020; Persson et al., 2019). Next step was to estimate if these targets are likely to be met under current parking standards. The estimations in the paper indicate that Stockholm is likely to build around 30,000 new parking spaces for 80,000 new apartments under current parking standards. At the same time, around 70,000 parking spaces should be removed in order to be in line with the goals of the future image (assuming one residential parking space per car). These figures indicate that a different planning approach is needed to be in line with the Paris Agreement. Paper IV presents one possible future image where these terms are met and discusses possible planning policies that will steer towards this future image.

The pathway in the paper presents a parking and mobility policy where focus has shifted from physical parking spaces towards accessibility and access to mobility services, both for people living in existing and new flats. The paper presents a policy package with measures to ensure good availability of car- and bike-sharing vehicles, together with parking policy measures (such as a cap on the number of parking spaces in the city, on- and off-street parking fees, and separating parking spaces from residential buildings). Finally, there is a policy for financing mobility measures and for citizen participation.

This pathway is analysed in terms of equity, acceptance, and feasibility with the use of academic literature. The conclusion is that many of the mobility services can benefit all groups in society. Car ownership levels are lower in low-income households, which could indicate that these households can improve their transportation accessibility with the proposed measures. However, there are low-income households that are dependent on cars (for instance for their employment). For the transition to be equitable it is important to ensure that these households still have good accessibility to transportation. This can, for instance, be done by offering mobility services that are more suitable for them (e.g., with cheaper vehicles and deductibles).

This policy is considered feasible, as many of the proposed policy measures are implemented in other cities, but it may encounter opposition from affected groups. The policy proposes a reduction of 70,000 parking spaces in Stockholm between the year 2018 and 2030 and there

may be groups in society that oppose such changes. The citizen participation scheme may be one way to increase acceptance. In line with other research, this paper argues that it is important to start implementing attractive mobility services early, and remove parking spaces as car ownership drops. Other research also indicates that acceptance for removing parking spaces can increase if the space is used for something perceived as positive.

4. Discussion

In this chapter I will discuss each research question briefly, before discussing future research. The research questions in this thesis were:

- Why is it difficult to implement policy and governance reforms with a purpose of steering towards a Sustainable Mobility Paradigm?
- How are mobility practices affected when car parking is restricted and other mobility services are offered within the residence?
- What can a pathway with parking and mobility strategies in line with the CO₂ goals of the Paris Agreement look like?

Each of these three questions are discussed below.

4.1 Policies and practices that makes a transition more difficult

In this thesis I have shed light on institutional barriers that make a transition in line with climate goals more difficult. In Paper I, I discuss that there are different regulations, and interpretations of these regulations, which make national funding of measures that reduce the need for transport more complicated. I propose that the Swedish Transport Administration should be given a mandate to finance measures that contribute to national transport policy goals (which includes climate goals), regardless of whether they are physical measures or not. The Swedish Transport Administration has today a limited mandate to finance non-physical measures on other parties' infrastructure. There are policy initiatives in line with this recommendation in other countries. For instance, Norway has a zero-traffic growth target for larger cities, and national funding is tied to these targets (c.f. Tennøy and Hagen, 2020). Sweden could introduce similar urban environmental goals as a condition for national funding via the national transport plan. This is something that is discussed in Paper IV.

Other policy barriers are identified in the other papers in the thesis. Paper III shows, for instance, that legislation passed in 1957 makes it difficult to charge on-street parking fees with the purpose of steering toward climate goals (on-street parking fees may only be charged with the purpose of managing traffic). Furthermore, Paper II and Paper IV examine how minimum parking standards render a transition in line with the Paris Agreement more difficult. Paper II shows that a shift from minimum standards to flexible parking standards can contribute to reduced car traffic and car travel, but that the transition is a slow process, and Paper IV shows that these standards are not sufficient enough to be in line with the Swedish climate goals. Other policy obstacles discussed in Paper IV are the possibilities of municipalities setting requirements for mobility services, levying tax on off-street parking and reserving parking spaces for car sharing vehicles on the street.

There are thus a number of policies that make a transition in line with climate goals more difficult. These policies have been developed during a time when the goal of transport planning was to build a car-based society (cf. Lundin, 2008). Laws and planning practices with the purpose of promoting car traffic have been developed for a long time and make a transition aimed toward climate goals difficult. Some measures considering climate goals are being implemented, but as Isaksson, Antonson and Eriksson (2017) show, there are also measures that encourage increased car use. According to Isaksson, Antonson and Eriksson

(2017), there is no integrated policy that steers us towards sustainable mobility in line with climate goals.

The Papers in this thesis furthermore show that the transition is not merely rendered difficult by current legislation, but emphasizes the importance of planning practices. Paper I discusses how officials at the Swedish Transport Administration interpret directives and regulations, and Paper III shows that officials at the City of Stockholm have expectations regarding what is acceptable and possible to implement. It is not always enough to just change instructions, laws, and regulations for a change to have an impact. New skills and new ways of looking at planning may also need to be developed, which takes time. In the case of Paper I the STA need to cooperate with other stakeholders and create commitment among them to implement measures, and in Paper II urban planners need to develop skills to plan for accessibility instead of car parking. This challenge is accentuated by the need to decrease CO₂ emissions in the short term.

In Paper IV, the results from Papers I to III are used as inspiration for a future image in line with climate goals. The future image shows a possible future where governance at national and municipal level are interconnected and complement each other. The future image also depicts how current marginal mobility practices can grow and spread.

4.2 How are mobility practices affected when car parking is restricted and other mobility services are offered within the residence?

The choice to study socially shared practices rather than individual behaviours means that the focus is on elements and bundled practices that keep current mobility practices in place, and on how current marginal practices (e.g. vehicle sharing) can grow. In Paper II, I have therefore examined everyday practices and asked how these practices are affected when apartments with a limited number of parking spaces and access to a selection of mobility services are constructed.

The parking standards in the city of Stockholm give developers the option of reducing the number of parking spaces by 10–25% if they provide other mobility services. Municipal officials often ask for cause-and-effect relationship – i.e. how much car ownership decreases if different mobility measures are implemented. The effect is also assumed to be rather immediate. However, my research suggests that it may take time for a mobility practice to grow. In Social Practice Theory terminology, certain material elements have been provided; fewer parking spaces for cars, car and bicycle sharing, secure and easily accessible bicycle parking, try-out offers on public transport and information initiatives. The results from Paper II showed that mobility practices are relatively stable (because activity patterns have not changed) but that some changes have taken place. The use of, and membership in, car sharing increased considerably, but interviews indicate that people forget that car sharing exists when they need it. Some informants, who are positive towards car sharing in principle, are sceptical and worried that cars will not be available when they need them. Furthermore, results indicate that some informants, who for various reasons have been without a car for a few months, have realized that they are doing well without a car. One informant changed jobs and got rid of his company car. The informant was on a waiting list for parking and postponed buying a car until he was offered a parking space. After a few months, when he was offered a parking space, he had realized that he did not need his own car. Public transport worked well and when he needed a car he utilized car sharing. Another informant had parked his car at his partner's parents place for a few months and realized that they were

doing well using public transport and car sharing. It was cheaper to use car sharing than to own a private car. The results suggest that it may take some time to learn to live without a car, but if people bring their own car when they move, they may not test car sharing and other mobility services. One hypothesis, which we will follow up with in a new research project, is that car sharing use increases and car ownership decreases over time (as households without a car do not acquire a car, or by people not replacing the car they sell). When more people use car sharing, and they have a good experience with it, car sharing practices could spread. If this hypothesis is correct, car ownership will gradually decrease over time. This means that municipalities should accept that there will be people on a waiting list for parking, at least initially, before car ownership has decreased. Municipalities should also consider regulating the supply of parking spaces in the area surrounding the residence if they wish to steer towards reduced car ownership (Antonson et al. 2017). Another observation is that mobility practices are maintained by the other practices of everyday life. To make it easier to replace private cars with car and bicycle sharing, changes should also be made in other parts of the city. For example, by regulating the availability of free (or cheap) parking in the area around residences (cf. Antonson, Hrelja and Henriksson, 2017), at work and other places. Cycling infrastructure could be improved (so that even inexperienced cyclists can feel safe), and the amount of car parking spaces in the city could be reduced. Employers could also change the rules for company cars and make it easier to commute without a car. During the Corona pandemic, for instance, web conferencing and teleworking have increased markedly, and employers could facilitate the continuance of these practices. In Paper IV, I propose a future image in line with these ideas.

The blocks of flats in Paper II are followed for another five years in the new research project “Flex P”. An observation from this research project is that bicycles in the bicycle sharing have been stolen, without being replaced, in both properties. There is a structure for administering a car sharing, but the same structure does not exist for bicycle sharing.

4.3 To explore strategies for parking and mobility that are in line with the Paris Agreement

I studied various policies that could steer us towards climate goals in Papers I, II and III. All studied policies steer in the right direction, but they risk only contributing to marginal goals. In Paper IV, I take a different approach, and depart from the Paris Agreement goals and describe what a future in line with these goals could look like. Then, my co-authors and I discuss what measures can be taken in the near future to steer towards these goals. The City of Stockholm's new guidelines for parking are estimated to lead to around 30,000 new parking spaces between 2018 and 2030, while 70,000 parking spaces should be removed to be in line with the climate goals. A new approach is needed, where policy measures at national, municipal and local levels are combined into a coherent cooperation strategy. In Paper IV, we have sketched out what such a package of measures could look like.

The purpose of Paper IV is not to describe the most likely development, but to describe what parking and mobility may look like in a possible future in line with the climate goals. The method makes it possible to enquire about possibilities outside existing structures and seek new solutions. Many governmental reports (e.g. Swedish Transport Administration, 2020; Kågeson, 2019) tend to see economic variables and new technology as the only way to reach climate objectives. I believe that a backcasting methodology can reveal new solutions. For instance, municipalities use flexible parking standards, where a part of the parking requirement can be reduced if developers provide other mobility services. This is generally

seen as a measure to reduce car use and car ownership, and thus also CO₂ emissions. However, with the use of a backcasting methodology, paper IV shows that this is probably far from being in line with the climate objectives. The decrease in car ownership in paper IV implies that the total number of parking spaces need to be reduced in Stockholm, and that existing car parking spaces need to be unbundled from the residence. The paper also describes how mobility services can be offered to the whole city, including older residencies. This future image is not the only possible future where the targets are met, but it illustrates the scale of change needed, and can be used as a tool to come up with new ideas. This finding is consistent with other research. For instance Witzell (2020) shows that the Swedish Transport Administration tend to marginalize alternative futures. Witzell also shows that the forecast models used by the Swedish Transport Administration cannot assess radically different futures. This is also in line with what Lyons and Davidson (2016) call regime-compliant versus regime-testing pathways. One of the main advantages with the backcasting methodology is thus to open up for new and innovative ways of planning. The ideas in themselves are not entirely new in Paper IV, but the assemblage of the policy package is new and highlights the scale of change considered to be necessary.

It is also worth noting that larger transformations may be needed if for instance negative emission technologies are not as efficient as assumed in IPCCs scenarios or if high income countries reduce their emissions at a faster rate than low-income countries (cf. Larkin et al., 2018; Anderson, Broderick and Stoddard, 2020). It is therefore important to plan with flexibility, and facilitate for future conversion of parking spaces.

4.4 Research gaps and further research

There are a number of issues that I did not have the opportunity to study in this thesis, which I think should be highlighted in future research. Some of these are issues that I will study in recently acquired research projects.

How mobility practices change over time. The studies in Paper II ended shortly after the move to the new flats (the research ended less than year after the move). However, it can take time for car and bicycle sharing use to grow and replace privately owned cars. The results from this thesis show that certain new skills may be needed and that the view of vehicle sharing may have to change. If more people get a good experience of vehicle sharing, more people are likely to be attracted to and start using vehicle sharing. Car sharing may also reduce the need for households without a car to acquire a car, or postpone car ownership until later. If this happens, car sharing could lead to a slow and gradual decline in car ownership. Developers have only guaranteed that mobility services will remain for five years in these blocks of flats. However, what will happen after these five years have passed remains uncertain. Data in my research have even shown that mobility services, like bicycle sharing, has been dismantled prematurely. To study these issues, the new research project “Flex P”¹⁴ will follow the HOAs with interviews and questionnaires until the end of 2023.

Parking and mobility services in already existing buildings. The research in paper II was on new blocks of flats built with flexible parking standards. However, to be in line with the Paris Agreement a transition is also necessary in older blocks of flats. Paper IV shows that parking spaces probably need to be removed and/or transformed in already existing neighbourhoods. I am participating in the research project “MoBO III”¹⁵, where parking

¹⁴ Financed by the Swedish Transport Administration

¹⁵ Financed by the Swedish Energy Agency

facilities in a neighbourhood are to be removed and converted into a mobility hub with different mobility services. The purpose with this research project is to study how mobility services can be extended to older residential buildings and how parking spaces can be converted into mobility hubs. The backcasting approach used in Paper IV was used at a workshop in the project to discuss how to plan for parking and mobility in the area.

Distributive effects and mobility justice. In Paper II, no analysis was made of travel patterns and vehicle ownerships for different socioeconomic groups, and whether there are any differences between low- and high-income households. Other research indicates that high-income households travel more by car than low-income households (Nicholas and Pelé, 2018). In a future study, it would be interesting to examine whether there are any differences in how different income groups adapt their travel patterns. There are several studies that indicate that car ownership is on average lower among low-income households than high-income households (e.g. Nicholas and Pelé, 2018). Theoretically, the restriction of parking spaces and the provision of mobility services could reduce unequal access to mobility (as more people can access a car). However, these aspects need to be studied in more detail. Who uses the mobility services and why/why not? Is car sharing membership too expensive or is the deductible too high? There are people who depend on cars to cope with their daily activities (e.g., to commute to work). How are they affected? Bourdieu (1984) also argue that taste and preferences differ between different classes, and it is possible that some measures (e.g. car sharing) appeal more to one class than another. I would like to study this using an interdisciplinary method with questionnaires and interviews. The results are important for understanding how a change in line with climate goals could be done equitably.

Parking and mobility services outside large cities. Both homeowner associations in Paper II are located in the Stockholm region, but the conditions for reduced car ownership and car travel are different in smaller cities. Therefore, I would like to carry out studies similar to Paper II in smaller cities. This is something we will do in the new research project “Kombo P¹⁶”, where we will select and follow 10 blocks of flats with flexible parking standards in Sweden.

Parking Benefit Districts and Participatory budgets. Paper III is a study that examines how a Parking Benefit District program could be implemented in Sweden. I would like to test the concept in practice to investigate whether and how a PDB program could contribute to sustainable mobility. In the study, I would like to enquire whether a PDB program could contribute to changed mobility practices and vehicle ownership and examine if participation for its own sake has a positive impact on people (and may reduce social exclusion, cf Schwanen et al. 2015). Together with colleagues, I am participating in a new research project (BikeableCity¹⁷), where we will test a mobility fund in a district in Järfälla municipality (in the Stockholm region). There will be a pilot project where the municipality allocates SEK 500,000 that residents can decide how to distribute.

4.5 Concluding remarks

To conclude, this thesis has showed that car-dependency exist both among planners at different levels (at the STA and in municipalities) and in people’s everyday practices. This is for instance illustrated in the Swedish Transport Administration’s inability to finance measures that reduce the need to travel. The STA have taken some steps towards a

¹⁶ Financed by the Swedish Energy Agency

¹⁷ Financed by Vinnova

‘sustainable mobility paradigm’, at the same time as planning for car-dependent practices continue in parallel (cf. Isaksson et al., 2017). The STA assumes that car traffic will continue to increase and have difficulties constructing alternative scenarios (see also Witzell, 2020). The thesis also shows that transport planning resembles a network, where no actor has the sole mandate over all possible measures. The STA thus need to collaborate with other actors, and get them committed to implementing measures. Paper I argues that the STA should be given a broader mandate to finance measures that contribute to national goals (including the greenhouse gas emission target), and thus also be able to finance measures that reduce the need to travel. This would both reduce the risk of measures ‘falling between the cracks’ and could increase the commitment among other actors to implement measures.

Similar structures are present at a local level. Municipalities in Sweden, as well as in Europe and the USA, have historically used minimum parking requirements for new buildings, which has led to urban sprawl and higher car dependency. There is now a trend to move towards flexible parking standards, where the parking requirement can be reduced if developers provide other mobility services. Paper II concludes that flexible parking standards can contribute to lower car ownership and use. However, the process of leaving a car dependent social practice is slow and the conditions (e.g. the technology; and ways of finding, booking, and paying for services) need to be relatively stable for the practice to grow. Parking restrictions in the surrounding area may also be necessary, as well as changes in bundled practices.

Even though flexible parking standards constitute a step towards more sustainable mobility, these policies are far from being in line with the goals of the Paris Agreement. Developers are still required to build parking spaces, and new residencies only account for a small part of all residencies. Paper IV depicts a future image where the terms of the Paris Agreement are met, and outlines a pathway towards this image. The paper argues that a shift away from parking standards towards mobility standards is necessary. The total amount of parking spaces probably also need to decrease in the city, and the parking spaces that already exist should be shared between residents. Parking spaces need to be unbundled from residential buildings in order to achieve this, and mobility services should be guaranteed and offered to everyone in the city. This is one possible future image in line with the climate objective. Even though other future images also may be in line with the climate objectives, the paper shows that planning for parking and mobility need to radically change. A challenge with this transition in line with the Paris Agreement is to obtain public support and to make the transition equitable.

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