Master's thesis for the

M.Sc. Environment and Society Studies programme

with the title

"The development towards a diffusion of station-based electric carsharing in urban neighborhoods in the City of Hamburg:

Which combination of institutional, bounded rationality and niche management factors is of importance?"

Jan Timo Walter

Nijmegen School of Management

Radboud University Nijmegen

February 2018

Author: Jan Timo Walter

Student number: 4771109

Address: Hinterm Teich 28
21217 Seevetal
Germany

Date: 19th February 2018

Degree: M.Sc. Environment and Society Studies

Specialization: Local Environmental Change and Sustainable Cities

1st Supervisor: Dr. Sietske Veenman
Radboud University Nijmegen

2nd Supervisor: Maria Kaufmann, PhD.
Radboud University Nijmegen

Institution: Radboud University Nijmegen
Nijmegen School of Management
Thomas van Aquinostraat 5
6525 GD Nijmegen
The Netherlands

© 2017

DE-21217 Seevetal

All rights reserved, in particular the right of duplication, distribution and translation. No part of the work may be reproduced in any form or distributed via electronic systems without written permission. The permit must be obtained from Radboud University Nijmegen.

Preface

I would like to express words of appreciation for Ms. Ursel Lünsmann-Pielke of the Ministry of the Environment and Energy in Hamburg for introducing me to both the topic of electric carsharing in urban neighborhoods in Hamburg and to various actors and institutions, including the head office for electro mobility in Hamburg, the *hySolutions GmbH*. I would also like to express my thanks to its managing director, Mr. Peter Lindlahr, for allowing me to scientifically analyze the 'e-Quartier Hamburg' project. In the same vein, I really appreciate the constructive support from Dr. Thomas Prill and Mr. Daniel Kulus of the *HafenCity University Hamburg* who gave me important content and scientific support and introduced me to further project stakeholders. I appreciate the latter and the other interviewed stakeholders in the City of Hamburg for providing me with significant and interesting input for my thesis and for making the City of Hamburg every day more sustainable. My highest appreciation goes to my first supervisor of this thesis, Dr. Sietske Veenman, who always supported me scientifically with her scholarly insights as well as on a human level, and motivated me to do well. I would also like to thank Radboud University's Ms. Maria Kaufmann for her scientific and Dr. Fariya Sharmeen for her content support. Last but not least, I would like to express gratitude to my parents for their ongoing support as well as to my friends. In particular, I would like to mention Christian Wolfram, whose supportive conversations were always highly appreciated, as well as Crystal Garcia and Laurie Kerr for taking their time to analyze my thesis and for giving me constructive feedback.

Executive summary

A wide range of intractable problems are persistent in urban areas. A major issue is our current transport system, which causes a variety of economic, social and environmental impacts, such as polluting emissions, noise impacts and resource depletion. Largely, these negative externalities are caused by the widespread diffusion of internal combustion engine (ICE) vehicles, which may be considered unsustainable in many respects. To combat this, a change towards a more sustainable transport system is needed. However, due to the rather incremental movement towards the latter, more radical transitions are required. Carsharing (CS) and battery electric vehicles (BEVs) are perceived as new innovations that could contribute to such transitions and offer various solutions to relive urban issues; where electro mobility mostly adresses CO2, air pollution and noise issues, CS challenges to a large degree the concepts of space and car ownership. Both in combination – in form of electric carsharing (e-CS) – and integrated in urban residential neighborhoods, offer interesting synergy effects that contribute to solving the given issues in urban areas. However, e-CS as of yet represents a niche innovation and has not yet become mainstream. This thesis deals with the City of Hamburg as a case study and addresses this issue by focusing on the enabling and constraining factors that influence the development towards the diffusion of station-based e-CS in residential neighborhoods. Based on neo-institutional theory, the cognitive and normative institutions as well as bounded rationality of the housing sector and CS organizations (CSOs), and the regulative institutions of the local government are analyzed. This is carried out with a view of understanding how institutions and actors influence the development towards the diffusion of e-CS. Furthermore, the project 'e-Quartier Hamburg' is investigated, which ran from 2012 to 2017, and focused on the integration of e-CS in urban residential neighborhoods in the City of Hamburg. Strategic Niche Management theory was adopted to analyze this project based on the existence of a protected social actor network, in which co-evolutionary learning takes place and expectations about e-CS are voiced. Empirical evidence is based on qualitative data from 17 in-depth interviews with key actors from Hamburg. This data was triangulated with quantitative data from two online surveys, carried out with CSOs and housing cooperatives in Germany.

Findings from neo-institutional theory indicate that a few enabling, but mostly constraining institutional and organizational factors exist that need to be overcome. On a cognitive level, as of yet, no uniform concept of e-CS exists, which the actors that deal with e-CS in urban neighborhoods can understand and apply. This means that on an infrastructural level one can perceive differing developments for the integration of e-CS in urban neighborhoods. Furthermore, mobility does not represent a core business area for housing companies and cooperatives, which in turn makes them uncertain about their involvement. This is reinforced by differences between mobility as a fast-changing topic and the rather slow developments of houses, which influence the cognitive routines of the housing and CS actors. Cognitively, electro mobility is perceived as an interesting new innovation which, however, entails various unsolved issues such as low charging infrastructure coverage, high pricing, low distance range, and low user demand. As a result, the housing sector and CSOs have mixed feelings towards BEVs. This leads to limited action on an operational level. For CS, only few public parking spaces exist in the city and a focus of the local government and users is put on free-floating CS (picking up a car and returning it in a relatively large business area and not to specific stations), instead

of on station-based CS. On basis of bounded rationality, CSOs and the housing sector are rather unwilling to provide resources, particularly charging infrastructure for electro mobility. In addition, CSOs currently offer few BEVs and make various demands for their involvement in urban neighborhoods, including an increased participation of the housing sector. However, the latter is reluctant to become involved to a large degree and steer CS and BEV developments. Moreover, on a regulative level, one can perceive unregulated legal issues in various legal areas concerning the integration of e-CS in urban developments.

In the 'e-Quartier Hamburg' project a difficulty existed insofar that no interfaces between the participating actors existed and that they did not know how they related to each other; a situation resulting from the fact that the actors had previously not worked together. In addition, e-CS is perceived as an "add-on" topic by the market actors and no leader steered the project. This is because the project is influenced by institutional circumstances and suffers from actors' boundedly rational interests, which are focused on financial aspects. Despite these issues, the actors got to know each other, and were able to learn about various important areas, such as users, technology and infrastructure. However, only few changes of the actors' cognitive attitudes towards e-CS in urban neighborhoods took place. As a result, CSOs did not adapt their business models and the housing industry could not be emotionalized, meaning they did not see e-CS as a topic they wanted to advance. This might also be related to the fact that little practical "learning by doing" took place. The latter was hampered by difficult regulative and infrastructural circumstances that influenced the implementation of e-CS stations in the urban neighborhoods as well as a long period of gaining theoretical knowledge about e-CS in urban neighborhoods. In addition, the expectations of the market actors were focused on new business opportunities, whereas non-market actors focused on research and the replication of methods. Generally, the given expectations did not result in a clearer picture of the potential of e-CS, besides its environmental potential.

Table of contents

Preface ..... **IV**
Executive summary ..... **V**
Table of contents ..... **VII**
List of figures ..... **X**
List of tables ..... **XI**
List of abbreviations ..... **XI**
1. Introduction **13**
1.1 Current state of research and existing knowledge gaps 14
1.2 Case selection 17
1.2.1 German electro mobility developments 17
1.2.2 Hamburg case study 18
1.3 Research objectives and questions 19
1.4 Scope and outline of the thesis 21
2. Theoretical foundations and conceptual framework **22**
2.1 Institutional theory 24
2.2 Neo-institutionalism 25
2.2.1 Formal regulative institutions 26
2.2.2 Informal cognitive and normative institutions 26
2.2.3 Bounded rationality and boundedly rational interests 27
2.3 Strategic Niche Management 27
2.3.1 Social actor network 28
2.3.2 Co-evolutionary learning 28
2.3.3 Articulation of expectations 29
2.3.4 Protective measures 29
3. Research methodology **30**
3.1 Research design and strategy 30
3.1.1 Qualitative research strategy 30
3.1.2 Explanatory case study approach 30
3.2 Data collection and analysis 31
3.2.1 Secondary data 32
3.2.2 Primary data: Qualitative expert interviews 32
3.2.3 Primary data: Quantitative online surveys 33
3.2.4 Data analysis and analytical operationalization 34

3.3 Research philosophy 35
4. Policy, regulatory and infrastructural conditions in Hamburg 36
4.1 Carsharing 37
4.1.1 Number of vehicles and types of carsharing 38
4.1.2 Electro mobility in carsharing 39
4.1.3 Parking space issues 40
4.2 Electro mobility 41
4.2.1 Tools for electro mobility promotion 41
4.2.2 Number of electric vehicles 42
4.2.3 Charging infrastructure issues 43
4.2.4 National level influencing factors 44
4.3 New mobility forms in urban neighborhoods 45
4.3.1 Existing measures to promote sustainable mobility concepts 46
4.3.2 Examples of the application of sustainable mobility concepts 47
5. Cognitive-normative institutions and bounded rationality in Hamburg 48
5.1 Boundedly rational interests, cognitive routines and normative aspects 48
5.1.1 Carsharing organizations (CSOs) 48
5.1.2 Housing companies and cooperatives 50
5.2 Cognitive perceptions of users' preferences and behavior 52
5.3 Cognitive tacit knowledge and perception of the need for collaboration and advice 54
5.4 Boundedly rational interest in resources provision 56
5.5 Cognitive perceptions about the current development phase 58
6. The niche project 'e-Quartier Hamburg' 59
6.1 Social actor network 60
6.1.1 Quality of and possibilities for collaboration 60
6.1.2 Types and power of stakeholders 61
6.1.3 Willingness of resource provision 61
6.1.4 Existence of leadership 62
6.1.5 Involvement of relative outsiders 62
6.2 Co-evolutionary learning 63
6.2.1 Development of theoretical foundations 63
6.2.2 Single-loop learning 63
6.2.3 Double-loop learning 64
6.3 Articulation of expectations 64
6.3.1 Expectations about the project 65

6.3.2 Expectations about the potentialities of electric carsharing 66
6.4 Protective measures 67
6.4.1 Geographical spaces 67
6.4.2 Public relation measures 67
6.4.3 Financial incentives 68
7. Conclusion and recommendations 69
7.1 Research contributions based on neo-institutionalism 69
7.1.1 Cognitive and normative institutions 69
7.1.2 Bounded rationality and willingness of resource provision 70
7.1.3 Regulative institutions 71
7.2 Research contributions based on Strategic Niche Management theory 72
7.2.1 Social actor network 72
7.2.2 Co-evolutionary learning 72
7.2.3 Articulation of expectations 73
7.2.4 Protective measures 74
7.3 The interrelation of structure and agency in the conceptual framework 74
7.4 Scientific recommendations and avenues for research 75
7.4.1 Neo-institutionalism 75
7.4.2 Strategic Niche Management 75
7.5 Policy implications and practical recommendations 77
7.5.1 Regulative institutions 77
7.5.2 Cognitive and normative institutions 78
7.5.3 Bounded rationality and boundedly rational interests 79
7.5.4 Niche developments 79
7.6 Critical reflection on the limits of the research results 80
Bibliography 81
Appendices 100
Appendix 1: Research framework 100
Appendix 2: List of interviewed experts 101
Appendix 3: Analytical framework 102
Appendix 4: Expert interview guide 103
Appendix 5: Housing cooperatives questionnaire 104
Appendix 6: Carsharing organizations questionnaire 106
Statutory declaration 108

List of figures

Figure 1: Modal split in the City of Hamburg. Own representation based on infas – Institut für angewandte Sozialwissenschaften GmbH; DLR – Deutsches Zentrum für Luft- und Raumfhrt e.V. (2010): Mobilität in Deutschland 2008. Ergebnisbericht: http://www.mobilitaet-in-deutschland.de/pdf/MiD2008_Abschlussbericht_I.pdf Accessed on: 20.08.2017 & Streit, T.; Chlond, B.; Weiß, C.; Vortisch, P. (Karlsruher Institut für Technologie) (2015): Deutsches Mobilitätspanel (MOP) – Wissenschaftliche Begleitung und Auswertung. Bericht 2013/2014: Alltagsmoblität und Fahrleistung: https://mobilitaetspanel.ifv.kit.edu/downloads/Bericht_MOP_13_14.pdf. Accessed on: 20.08.2017 18

Figure 2: Representation of the conceptual framework. Source: Own representation 22

Figure 3: Map of the City of Hamburg. Source: Google Maps (2009): https://www.google.de/maps. Accessed on: 13.11.2017 36

Figure 4: A free-floating CS vehicle in Hamburg. Source: car2go Deutschland GmbH (n.d.): http://www.hamburg.de/carsharing/. Accessed on: 13.11.2017 37

Figure 5: CS vehicles per 1,000 inhabitants in German cities with more than 50,000 inhabitants. Source: bcs (2015): https://carsharing.de/sites/default/files/uploads/uebersichtstabelle_staedteranking_2015.pdf. Accessed on: 22.06.2017 39

Figure 6: Electro mobility charging station in Hamburg. Source: Stromnetz Hamburg GmbH (n.d.): http://www.hamburg.de/bwvi/elektromobilitaet/. Accessed on: 13.11.2017 42

Figure 7: Public charging infrastructure for BEVs per 10km² urban area in European cities. Source: Bundesverband der Energie-und Wasserwirtschaft, Hamburger Senat, DriveNow (n.d.): http://www.nahverkehrhamburg.de/wp-content/uploads/Diagramm_Auto_Elektromobilitaet_Ladepunkte_Staedtevergleich_Copyright_Christian_Hinkelmann-730x474.jpg. Accessed on: 24.07.2017 44

Figure 8: e-CS employed in an urban residential neighborhood in Hamburg. Source: ecomento UG (2017): https://ecomento.de/2017/01/20/oekostrom-e-mobilitaet-und-carsharing-wie-hamburg-das-quartier-von-morgen-denkt/. Accessed on: 23.06.201 45

Figure 9: Interest of CSOs in offering BEVs. Source: Own representation 49

Figure 10: Existing CS offer in housing cooperatives. Source: Own representation 51

Figure 11: Perception about the possiblity to offer CS in the future in housing cooperatives. Source: Own representation 53

Figure 12: Perception about necessary support for housing cooperatives to offer CS. Source: Own representation 55

Figure 13: CS stations of the project ‘e-Quartier Hamburg‘. Source: hySOLUTIONS GmbH (2015): http://elektromobilitaethamburg.de/wp-content/uploads/2016/10/E-Quartier-digital.pdf. Accessed on: 15.05.2017 59

Figure 14: Representation of the employed research framework. Source: Own representation 100

List of tables

Table 1: Cognitive, normative and regulative institutions 26

Table 2: List of interviewed experts 101

Table 3: Analytical framework in form of a list of indicators 102

List of abbreviations

AG	Aktiengesellschaft (in Germany a 'public limited company')
bcs	Bundesverband Carsharing e.V. (Federal association Carsharing)
BEV	Battery electric vehicle
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BMVBS	Federal Ministry of Transport, Building and Urban Affairs
BMVI	Federal Ministry of Transport and Digital Infrastructure
BUE	Ministry of Environment and Energy Hamburg
BSW	Ministry of Urban Development and Housing Hamburg
BWVI	Ministry of Economics, Transport and Innovation Hamburg
ca.	circa
CBA	Cost-benefit assessments
CO2	Carbon dioxide
CS	Carsharing
CSO	Carsharing-Organization
e-CS	Electric carsharing
e.g.	exempli gratia ("for example")
e.V.	eingetragener Verein (in Germany a 'registered association')
EmoG	Elektromobilitätsgesetz ('Act on Priority Use of Electronic Vehicles' in Germany)
EEA	European Economic Area
etc.	et cetera
EU	European Union
FHH	Free and Hanseatic City of Hamburg
GHG	Greenhouse Gases
GmbH	Gesellschaft mit beschränkter Haftung (in Germany a 'company with limited liability')
HCU	HafenCity University Hamburg
HI	Historical institutionalism
i.e.	id est ("that is")

ICE	Internal combustion engine
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ITF	International Transport Forum
km	kilometers
MLP	Multi-Level-Perspective
NEPE	Nationaler Entwicklungsplan Elektromobilität 2009 (National Development Plan Electromobility 2009)
NOW	Nationale Organisation Wasserstoff
NPE	Nationale Plattform Elektromobilität (German National Platform Electro Mobility)
OECD	Organization for Economic Cooperation and Development
OEM	Original Equipment Manufacturer, here: Car manufacturer
RCI	Rational choice institutionalism
SI	Sociological institutionalism
SME	Small and medium-sized enterprises
SNM	Strategic Niche Management
UBA	Umweltbundesamt (German Federal Environment Agency)
UN	United Nations
UN DESA	United Nations Department of Economic and Social Affairs
VCD	Verkehrsclub Deutschland e.V. (Road Club Germany)
VNW	Verband Norddeutscher Wohnungsunternehmen e.V.

1. Introduction

It is estimated that by 2050 around 66% of the world's population will live in urban areas. The rapid urbanization rate of the next couple of decades is expected to lead to an increased demand for energy, water and personal mobility, among others (UN DESA 2013; UN DESA 2014). This will cause increasing challenges, which are related to the environmental and social sustainability. Urban areas are already seen as the epicenter where various environmental and social issues originate and manifest themselves (Elgström et al. 2014); they consume about 70% of the world's resources and contribute significantly to GHG emissions. This is a result of the current intensity of economic and social activities, large populations, and the largely inefficient built environment (Bibri and Krogstie 2017).

A major issue is our current transport system, which causes a variety of economic, social and environmental impacts, and may be considered unsustainable in many respects (Nykvist and Whitmarsh 2008). Urban transport is responsible for around 26% of overall CO2 emissions in the EU (EEA 2017), and is considered the only sector where CO2 emissions continue to rise (Keichel and Schwedes 2013). They could increase worldwide 60%-fold by 2050 (OECD/ITF 2017). Besides CO2 emissions, noise pollution, exhaust emissions, road traffic congestion (Nanaki and Koroneos 2016), and parking space pressures represent further challenges. These put pressure on the quality of peoples' lives and on the environment (Schwer and Timpf 2016). As a significant amount of mobility takes place in the cities, most of the impacts are also noticeable in the cities themselves (Rothfuss et al. 2011).

In general, an increasing demand for mobility is visible in many European cities (Nanaki and Koroneos 2016). To a large extent these negative externalities are caused by the widespread diffusion of internal combustion engine (ICE) vehicles (Xue et al. 2016) – even though these stand unused 95% of the time (Barter 2013). In Western countries, the transport system has been characterized by these individually owned ICE vehicles (Späth et al. 2016) and urban areas are based on them (Lorimier and El-Geneidy 2012). This means that the societal context is adapted to the ICE through various lock-in mechanisms (Geels 2004). This includes a corresponding development of road infrastructure, fuel supply systems, traffic rules, maintenance services, user patterns, lifestyles and regulations (Markard et al. 2012; Geels 2012). In Europe, the ICE amounts to 73.7% of all private inland transport inside the EU (European Union 2012); an amount that is still set to grow (Hildermeier and Villareal 2014). Worldwide it is estimated that the general motorized mobility will double between 2015 and 2050 (OECD/ITF 2017).

There exists an increasing awareness of the consequences of transport on human health and on the environment (Truffer et al. 2017; Banister 2008). This is coupled with a general interest to make urban areas more sustainable and resource-efficient (Elgström et al. 2014). The EU stipulated the so called '20-20-20 targets' which set the objective for 2020 to achieve a 20% reduction in GHG emissions, as compared to 1990, increase the share of renewable energy sources to 20% of its energy mix, and improve the energy efficiency by 20% (European Commission 2014). Moreover, the intention to achieve a more sustainable transport system forms part of the EU transport policy design. The 'European White Paper for Transport' designates the goals for a resource-efficient transport system, including, among others, a reduction in transport-related CO2 emissions by 60% by 2050, and a reduction in ICE vehicles in urban areas by 50% by 2030 (European Commission 2011). Additionally, regulations will require the average CO2 emissions to be reduced to 95 g/km by 2020 (Dijk et al. 2013).

Although some policies discourage the use of cars and encourage sustainable alternatives in urban areas, the majority of applied measures are traffic management and congestion charging (Geels 2012). These are accompanied by measures that allow to increase the efficiency of the ICE (Nykvist and Nilsson 2015). Both do not deal with ICE ownership issues in transport in a holistic manner (Geels 2012; Glotz-Richter 2016). The requirements of climate protection, the finiteness of fossil fuels (Lambrecht et al. 2013) and the not foreseeable decrease of the ICE pose great challenges for the transport sector. They call for a rethinking towards a more sustainable, energy-efficient and climate-friendly transport system (Beckmann 2013). To make this possible, the transport sector has been identified as an area, in which a "sustainability transition" has to take place (Späth et al. 2016). This involves fundamental, long-term processes on multiple dimensions through which an established system shifts to more sustainable modes of production and consumption (Markard et al. 2012).

Generally speaking, three rather broad approaches exist to tackle the perceived unsustainable issues in the transport sector: 1. improving efficiency and reducing the impact of vehicles through improvements of existing, and the development of new vehicle technologies; 2. using more sustainable modes of travel, such as public transport; 3. lowering the mobility demand by fostering more sustainable lifestyle changes. To date, policy measures that are based on the third option, e.g. through congestion charging, have had little effect concerning the growth in vehicle demand (Nykvist and Whitmarsh 2008). In addition to that, many scholars and policy-makers perceive the first option as significant in order to achieve a more sustainable mobility paradigm (Mol 2009). However, more efficient cars, such as electric cars (BEVs), are still based on the private passenger car and do not put into question the paradigm of individual car ownership (Hildermeier and Villareal 2014). In general, purely technological improvements are not seen as able to transform the deeply rooted cultural image of automobility (Canzler and Knie 1994). Based on the assumption that mobility is not necessarily dependent on individual car ownership (Kent and Dowling 2013), policy-makers have put forward a new way of using cars. It is based on a collective, intermodal[1] and flexible use of cars, such as carsharing (CS), and forms part of an efficient urban transport system (Hildermeier and Villareal 2014; Canzler and Schmidt 2003). Based on this idea, a number of holistic mobility concepts for urban areas have emerged in recent years (Vallée 2013; Klinger 2017). These concepts, in combination with BEVs, are now politically wanted (Proff et al. 2016) and their amount is growing (Shaheen and Cohen 2013). They are seen as promising solutions to the current issues at hand (Seign and Bogenberger 2012).

1.1 Current state of research and existing knowledge gaps

With regard to new and efficient technologies in the transport sector, electro mobility represents the most prominent option (Altenburg et al. 2016). In recent years it has gained importance in the public media (Ajanovic and Haas 2016). In addition, nowadays a political agreement exists concerning the need to deploy BEVs (Nykvist and Nilsson 2015), driven by significant economic and environmental challenges (IPCC 2007; IEA 2010). The latter particularly represent issues associated with climate change and declining fossil fuel reserves (Canzler et al. 2011; Høyer 2008). Electro mobility is seen as a promising option regarding decarbonization, energy security concerns and improved air quality in

[1] Intermodality is a principle in policy and planning with the aim to make it possible for a passenger to use different modes of transport in a combined and seamless trip chain (Riley et al. 2011)

urban areas. Hence, the achievement of climate and energy policy goals represents a key driver for its expansion (Peters et al. 2012). As a result, several polices for clean and energy-efficient road transport have been introduced in the EU in recent years that promote BEVs either directly or indirectly (Nanaki and Koroneos 2016). Generally though, it is argued that the promotion of BEVs should not lead to conflicts with other environmentally-friendly transport options, particularly not with the public transport (Peters et al. 2012). As electro mobility represents a radical innovation, it entails major changes in industry structures, market patterns, technological measures, policy making as well as user behavior (Langer 2014; Augenstein 2015). Due to these necessary, but difficult changes, BEVs have not yet achieved greater market penetration in Germany. Morever, currently many people perceive the driving distances permitted by BEVs, in comparison to ICEs, as inadequate. This results in skepticism and range fears (Beyer et al. 2013; Boesche et al. 2013). Based on this fact, the existence of public charging infrastructure is important (Schatzinger and Rose 2013). However, this kind of infrastructure is currently insufficiently developed in Western countries such as Germany (Schott 2015; Augenstein 2015. In addition, the high purchasing costs of BEVs represent another obstacle (Schmidt 2016).

Based on the emergence of post-materialistic values in the lifestyles of the urban population, the principle “use rather than own” is gaining more ground (Loose 2014). The so called “sharing economy” is an economic model wherein people borrow or rent assets owned by someone else to optimize the usage phases of a product (Boyko et al. 2017; Witzke 2016). Particularly CS is emerging as an alternative sharing transportation mode, as compared to individual vehicles (Chen et al. 2016). It was established in the 1980s in Switzerland and is defined as the "organized and collective use of motor vehicles" (Loose 2016, p. 1). Whereas the possession of the vehicles is collective, individuals use them (Shaheen and Cohen 2013). It seems to fit a slow trend towards sustainability and environmental awareness among the urban population (Frenken 2013). Its deployment allows to reduce the dependence on private car ownership, lowers energy consumption and vehicle emissions, and supports active lifestyles (Shaheen and Cohen 2013). It is particularly effective if the combination with a high-quality public transport, and the walking and cycling infrastructure represents a fully-fledged alternative to individual car ownership. This is because users are encouraged to reflect on their individual choices (Schwer and Timpf 2016; Glotz-Richter 2013b). CS is recognized as an environmentally-friendly option in the transport policy of most European countries (Loose 2014). Despite this and the fact that it is being tipped to play a significant role in transport in the next few years (Luca and Di Pace 2015), it is still of relatively low importance concerning the general mobility behavior (Witzke 2016). Moreover, an increased political support and its usage is not yet given to a degree, which could challenge the existing transport paradigm of the private car (Frenken 2013; Geels 2012).

Based on a perceived interrelatedness, often several innovations are combined to facilitate their diffusion. Combining CS and BEVs – in form of electric CS (e-CS) – can encourage both concepts, as they are said to be mutually beneficial (Seign and Bogenberger 2012). This would particular reduce the given disadvantages of BEVs (bcs 2012; Fraunhofer ISI 2011). Generally, the use of BEVs in sharing concepts is for many users clearly more imaginable than their purchase (Peters et al. 2012). This is because the fear of an insufficient range can be solved, as relatively small travel distances are carried out in urban areas, when CS is applied (Schott 2015; Peters et al. 2012). This would also reduce the problem of the low charging infrastructure coverage (Augenstein 2015; Chen et al. 2016). In addition, it would

significantly reduce the costs of BEVs (Leurent and Windisch 2011), as a high utilization would compensate the current high investment costs (Hoffmann et al. 2012). Despite these positive effects, support for such a combination is often not provided by the political stakeholders, even it seems necessary (Seign and Bogenberger 2012).

Cities play a special role in relation to sustainable mobility concepts (such as e-CS), as space and land use represent key factors for their implementation (Rothfuss et al. 2012). Moreover, cities possess favorable conditions for testing, implementing and making new sustainable mobility concepts visible (Wilhelm et al. 2011). They provide a framework within which sustainable mobility concepts can unfold (Grausam et al. 2014; Aichinger et al. 2014). It is generally demanded that sustainable mobility concepts in urban areas take more account of the peculiarities of the urban built environment and urban neighborhood characteristics, based on a systematic and holistic view (Proff et al. 2016; Rothfuss et al. 2012). Hereby, particularly the target groups (mobility concept affinity, socioeconomic status, etc.) (Bozem et al. 2013), the urban structure and the urban density should be dealt with (Dentel-Post 2012). Despite the importance of linking sustainable mobility concepts – particularly BEVs – with urban development and planning, such a link has not yet been taken into account sufficiently. This is particularly true for the structural aspects of battery charging and the parking of BEVs in residential neighborhoods. It is said that it needs partnerships between various actors, in particular public-private ones, to advance BEVs and CS in urban areas (Terrien et al. 2016; Lutsey et al. 2016). However, up until now, the cooperation between the housing industry and mobility providers is still seen as insufficient (Clausnitzer et al. 2012). Generally, the necessary collaborations are new and unfamiliar, between actors that have traditionally not worked together (Grausam et al. 2014).

To date, transportation studies have primarily focused on improving service operations and quantifying environmental impacts (Shaheen et al. 2015b). Generally though, to advance e-CS concepts in cities, institutional and organizational fields of action should be taken into account. Based on this fact, the following practical issues and gaps in scientific knowledge exist, which should be addressed:

- An often-missing political support for e-CS, particularly visible in form of an insufficient infrastructure, policies and regulations. Hence, a need exists for a higher prioritization of sustainable mobility concepts and e-CS, visible through an increase in policy, regulatory and financial efforts (Landeshauptstadt München 2015);
- An often-missing consideration of the urban structure in mobility concepts, particularly visible in form of uniform approaches, which are not adapted to the specific infrastructural circumstances of the urban districts/neighborhoods. A need exists to more explicitly take into account the urban built environment (Proff et al. 2016);
- An often-missing link between e-CS and housing developments in urban residential neighborhoods, particularly visible in form of few existing e-CS offers and a limited involvement of the housing industry. Generally, an understanding of overall mobility is missing, because mobility is usually understood as individual “automobility” (Hachleitner n.d.; Kemmerzehl 2016). As a result, further developments of business models and an increased involvement of the housing industry are welcome (Clausnitzer et al. 2012);

- The still often inadequate cooperation of different actors in a public-private setting to create sustainable mobility concepts, such as e-CS (Terrien et al. 2016; Lutsey et al. 2016). For a successful integration of e-CS in urban neighborhoods, cooperations between CSOs and the housing industry are said to be necessary (Rau 2015). A need exists for experience exchanges between actors (possibly in pilot projects/experiments) (Landeshauptstadt München 2015).

With a focus on the societal relevance, this thesis acknowledges the importance and growth of urban areas, the existing deep-rooted and unsustainable transportation system in these and the need for a new and improved transportation system, which provides various mobility options for different mobility needs. This thesis seeks to contribute to a decrease in the dependence of individual cars and to developments that allow for an increase in sustainable shared mobility approaches in urban areas. Moreover, as the concepts of CS and BEVs represent new approaches, which could possibly become mainstream, but still represent niches, further academic research is important in order to evaluate the constraining and enabling factors concerning their adoption. In carrying out such research, the intention of this thesis is to contribute a better assessment of how shared sustainable mobility approaches that are based on electro mobility could become established. This would add to academic studies that have focused on analyzing the weaknesses and strengths of sustainable mobility concepts, such as quantifying their environmental potentials etc. As a result, the research in this thesis allows one to see if the diffusion of e-CS as such a new and innovative mobility concept is feasible, and shows on which aspects to focus in order to strengthen e-CS, so that it could possibly become mainstream.

1.2 Case selection

This thesis deals with the development of e-CS in urban residential neighborhoods in the City of Hamburg. Besides the previously mentioned knowledge gaps, there are specific local circumstances, which make Hamburg a very interesting case to study. To analyze the developments in Hamburg, the recent advances of electro mobility in Germany – particularly in form of an ambitious national initiative for fostering electro mobility – are discussed at first, as these influence the City of Hamburg strongly.

1.2.1 German electro mobility developments

The German government's goal is to reduce CO2 emissions by 40% by 2020, compared to 1990. To reach this target, the transport sector is seen as an important field of action (Grausam et al. 2014), as it is responsible for 19% of CO2 emissions in Germany (UBA 2014). Due to the fact that legislators primarily emphasize an increase in energy efficiency in the passenger car sector, electro mobility is seen as a suitable option (Lambrecht et al. 2013). As early as 2007, the government declared the promotion of electro mobility in the 'Integrated Energy and Climate Program' as an essential element for climate protection. Further political efforts were articulated in the 'National Development Plan for Electro mobility' (NEPE) in 2009. The latter spells out the objective for Germany to become a "leading market for electro mobility by 2020" and to have "one million electric cars on Germany's roads by 2020" (Die Bundesregierung 2009, p. 46). Germany's main stated objectives can be summarized as meeting energy and climate policy targets, fostering new mobility practices and developing international competitiveness (Leurent and Windisch 2011). The 'Electro mobility government program 2011' specifies the measures to support the introduction of BEVs. Emphases are put, among

others, on research and development support, market incentives, the development of infrastructure and demonstration projects. These are accompanied by usage privileges, e.g. in the context of the 'Act on Priority Use of Electronic Vehicles' (EmoG) of 2015 (Lutsey et al. 2016).

It is argued that to successfully deploy shared electric vehicle services, pilot projects play an important role to overcome existing entrance barriers (Leurent and Windisch 2011). On the basis of this, and the assumption that electro mobility is developing from within regional clusters (Kasperk and Drauz 2013), the German government initiated eight model regions (four 'Electro mobility model regions' and four 'Showcases electro mobility'). The former four regions will receive 260 million euro from the 'Electro mobility model regions' program between 2009 and 2017 (Knahl 2013). Here, electro mobility is to be tackled holistically (Rothfuss et al. 2011) and an application-oriented research is to be conducted. This should allow one to integrate electro mobility into mobility, spatial and urban developments (Tenkhoff et al. 2011). In addition, vehicles and infrastructure should be developed, and test fleets employed (Leurent and Windisch 2011). The collaboration includes car manufacturer, mobility services provider, energy supply actors (Langer 2014), public and scientific institutions, the housing industry, and users, among others (Rothfuss et al. 2011). Research is conducted on topics such as fleet management, charging infrastructure, energy storage, user perspectives, and business models (Lutsey et al. 2016).

1.2.2 Hamburg case study

In recent decades, there has been an increase in economic value creation and a growing population in Hamburg. Related to this are the growing demands on mobility and on transport infrastructure. However, since 1990 only a little expansion of the transport infrastructure has taken place (Färber et al. 2014). As a result, mobility in Hamburg is facing major challenges (Senat der FHH 2016). Generally, about 25% of Hamburg's CO2 emissions are generated by the transport sector (Shell Deutschland Oil GmbH 2009). Besides climate protection goals, air and noise pollution as well as crowded thoroughfares and parking pressure are seen as significant issues that need to be dealt with (Färber et al. 2014). These issues are largely related to the fact that the mobility behavior in Hamburg is strongly influenced by ICE vehicles (Rah 2017), as 99% of all existing vehicles are ICEs (Färber et al. 2014). In 2008, individually-used vehicles represented 42% of the total modal split[2], as visible in Figure 1.

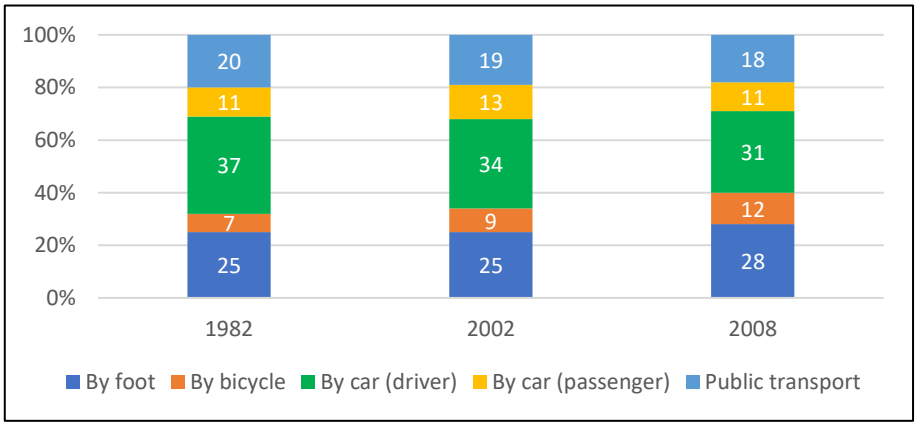


Figure 1: Modal split in the City of Hamburg
Source: Own representation based on DLR 2010; KIT 2015

[2] A modal split is defined as "the percentage share of different transport modes in total inland passenger transport" (EEA 2015)

In total, 68% of the households in Hamburg own a car (Follmer 2011). By 2025, the demand for ICEs is expected to have increased by 19%, compared to 2004 (ITP & BVU 2007); and by 2030 they are assumed to account for still more than 90% of all passenger cars (Exxon Mobil 2011). Besides that, the city's forecasted growth indicates that the transport infrastructure will be even more heavily used in the future (Holtermann et al. 2015).

A significant element in the German 'Electro mobility model regions' represents the integration of BEVs in sharing fleets (Dütschke et al. 2016; Augenstein 2015) and into urban development planning (Aichinger et al. 2014). Based on this, the project 'e-Quartier Hamburg' ran from 2012 until 2017 and was funded by the *BMVI* as a model project of the 'Electro mobility model regions' in Hamburg (Lindlahr 2017). Grounded on a holistic approach, the systematic integration and practical application of innovative mobility services – in particular station-based e-CS – and their linkage with traffic and urban planning goals have been tested in residential neighborhoods (Knie 2014). As part of this, a model cooperation of the housing sector, CS organizations (CSOs), city and traffic planning offices, scientific institutions and energy suppliers took place (Lindlahr 2017). Despite the fact that the project was acknowledged for its innovative character and can be considered as a "good practice" example, some of its results were not as sufficient as was expected in the beginning. In addition, the overall aim to create a network of around 150 vehicles with a total of around 2,000 users was not achieved, as only 20 vehicles were ultimately used by ca. 800 users (Lindlahr. Interview 24.04.2017). As the project ended in autumn 2017, it is currently a good time to evaluate, which issues within the project and generally on a city-wide scale impact the development of e-CS in urban neighborhoods.

1.3 Research objectives and questions

Through a sociological and political lens, this thesis aims to explain, identify and clarify which factors enable or constrain the development towards a successful diffusion of e-CS as a mobility option in urban neighborhoods. The main research question is the following:

> *"Which combination of relevant institutional, bounded rationality and niche management factors influence the development towards a diffusion of station-based electric carsharing in urban residential neighborhoods in the City of Hamburg?"*

A neighborhood in this regard is to be understood as a place of residence and a living space for people. It serves as a place of living, supply and a space of local mobility and social contacts (Willen 2005). In such neighborhoods, it is the objective for the niche innovation of station-based e-CS to become diffused. A niche innovation represents a novelty, which deviates on one or several dimensions from existing systems. It can be a new behavioral practice (e.g. CS), a new technology (e.g. electro mobility), a new business model, or a combination of these (Geels et al. 2015). A diffusion is required for any new innovation (Augenstein 2015). It is related to the embedding of an innovation in the wider contexts of policy, social, business and user environments of an existing system (Geels et al. 2015). Moreover, it implies a degree of marketability and maturity of the innovation (Lindloff et al. 2014). Niches are equated with the emergence of innovations and technologies and are developed by networks of actors who are interested in the innovation's development. Niches can be managed by means of several factors (Geels 2004) as will be explained in the second chapter.

The following sub-questions are theory-inspired, depending on the theories made use of in the conceptual framework:

1. *"Which cognitive and normative institutions of the housing sector and carsharing organizations can be perceived as most enabling or constraining with regard to a further diffusion of the innovation?"*

   "Normative institutions" represent belief systems, values, societal norms and role responsibilities. "Cognitive institutions" represent cognitive routines, tacit knowledge, perceptions of user preferences (Geels 2004), and perceptions of existing developments.

2. *"To what extent are changes necessary in the institutional regulatory and policy frameworks due to constraining factors that influence the further diffusion of the innovation?"*

   "Regulative institutions" consist of highly regulated rules, such as laws, as well as rather vague forms of governing, such as policies or financial incentives (Geels 2004). On the basis of this, a "policy and regulatory framework" represents the infrastructure which supports the control, direction or implementation of a proposed or adopted course of action, rule, or law (CARICOM 2011).

3. *"On the basis of bounded rationality, to what extent are the actors from the housing industry, the local government and carsharing organizations willing to provide resources and cooperate concerning the topic of electric carsharing in urban residential neighborhoods, and what are their boundedly rational interests for doing so?"*

   "Boundedly rational interests" are the stakes in an undertaking that are based mostly on egoistic motives. However, they can also take into account ideas, experiences, intrinsic motivations or tradition. All this has to be seen in light of the fact that actors are not able to choose an ideal option due to uncertainty and a limited knowledge base ('bounded rationality') (Simon 2000).

4. *"Which niche management aspects that are seen as relevant in the scientific literature are existent, hence enabling, and which ones non-existent, hence constraining, in the project 'e-Quartier Hamburg'?"*

   "Niche management aspects" are interrelated and mutually reinforcing processes that are vital for the development of a niche. They represent a "social actor network", "co-evolutionary learning", the "articulation of expectations" and "protective measures" (Schot and Geels 2008).

The research and sub-questions will be examined by using a socio-technical (Geels 2004; Smith et al. 2005) and an institutional approach (Scott 1995). By offering a conceptual framework on basis of this and applying it to the case of Hamburg, the aim is to analyze the different kinds of factors that support the development towards a diffusion of e-CS in urban neighborhoods as well as critical barriers that may hinder it. Moreover, insights shall be provided, which could prove helpful for the formulation and implementation of sustainable mobility strategies and policies. The scientific relevance can be derived from the fact that two different theories are combined in a theoretical framework. This allows for the emergence of new insights on how to combine institutional and socio-technical theories and, as a

result of their possible interplay, on how these could conceivably be enhanced with regard to their weaknesses (if they are applied on their own and/or in combination with each other). This is supposed to result in new possibilities in academic research concerning the analysis of socio-technical innovations, such as e-CS, as well as the influences of institutional factors on these. Generally, applying institutional theory allows for a more thorough approach to investigate a multi-dimensional environment (Glover et al. 2014), such as the transport system. This is because various institutional aspects have imperative influences on stability or changes in the system. As a result, institutional theory offers a promising contribution to the understanding of socio-technical transitions and to transition studies (Fünfschilling 2014). Besides these aspects, the scientific relevance can also be derived from the fact that this thesis deals with a new case study in a specific geographical location, focusing on not only on the overall city (City of Hamburg), but also on a project level ('e-Quartier Hamburg'). This is done in order to better take into account the circumstances on a micro project and a meso city-level. On the one hand, due to such an interlinkage of different levels, the scientific relevance can possibly be enhanced. On the other hand, this interlinkage proves difficult, since both levels offer different points of reference for research, which need to be dealt with.

1.4 Scope and outline of the thesis

The thesis is divided into seven chapters. The chapter following this introduction introduces a theoretical framework that allows the reader to understand the different applied theories and their interplay. Chapter 3 deals with the research methodology, allowing one to understand the research strategy and framework, the associated research methods and the carried out data analysis. Subsequently, chapter 4 describes the regulative institutions that are focused on CS and BEVs, and the associated public infrastructural provision for both innovations in Hamburg. Chapter 5 addresses the cognitive and normative institutions, bounded rationality and the willingness of resource provision of the housing sector and CSOs in Hamburg. Chapter 6 discussses the project 'e-Quartier Hamburg' and the attributable niche management aspects that are influencing the developments concerning e-CS in Hamburg. Ultimately, chapter 7 provides a discussion of the results, gives suggestions for e-CS policy development, and states possible improvements of the applied theories. Moreover, a critical reflection of the research results is also provided in this chapter.

In general, electro mobility is said to include all electrically driven individual traffic carriers, and does not differentiate between them (Fraunhofer ISI 2011). However, the scope of definition that is applied in this thesis is limited purely to BEVs in urban land transport.

2. Theoretical foundations and conceptual framework

The following chapter outlines the conceptual framework (see Figure 2) made use of in this thesis. It draws on the concepts of neo-institutional theory and Strategic Niche Management (SNM). Within these, one can understand the development towards the diffusion of an innovation in socio-technical systems and interpret research findings. This allows one to gain in-depth insights into the constraining and enabling formal and informal institutional factors, bounded rationality and niche management aspects. These are of a greater significance when combined than on their own. This is since as all of these offer interesting insights for possibilities of change and stability in socio-technical systems. Whereas SNM focuses on niches and how change can be achieved (rather enabling focus), neo-institutional theory deals with rather stabilizing factors (rather constraining focus, but not solely). Ultimately, a deeper understanding of transition processes, in light of institutional influences, can be developed. March and Olsen (2009) state that the identification of the enabling versus the constraining factors seems to be key in order to understand the conditions for changing mobility.

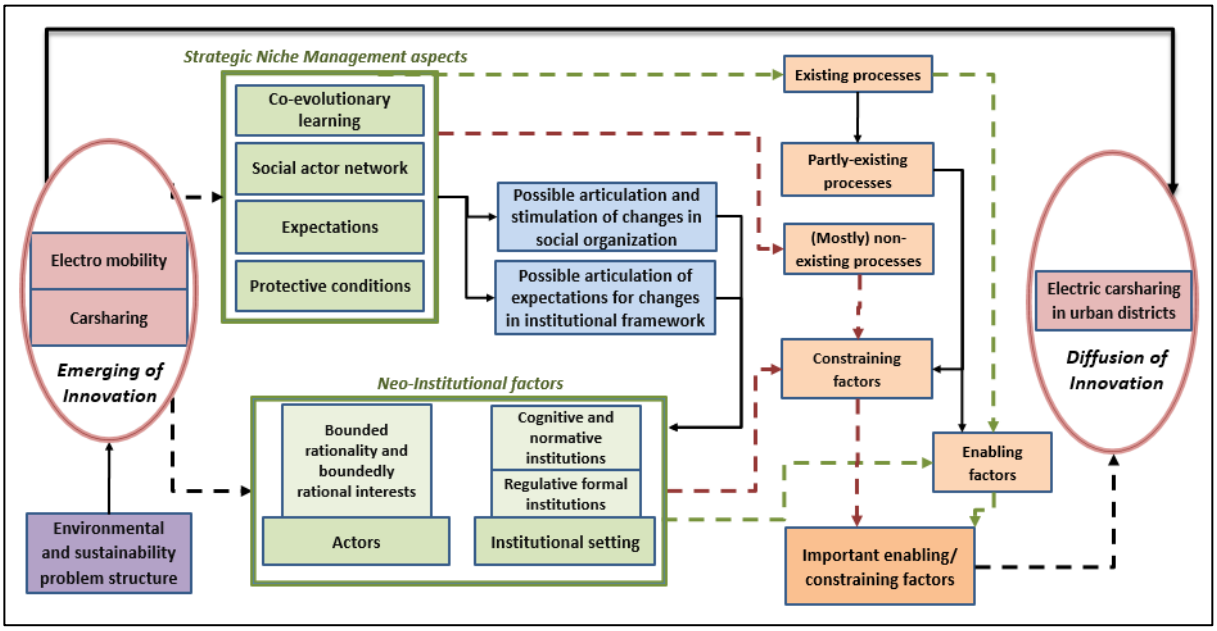


Figure 2: Representation of the conceptual framework
Source: Own representation

The framework provides an approach for the analysis of socio-technical change with a particular emphasis on institutions. It bridges the gap between primarily actor-oriented and structure-oriented perspectives, allowing one to neither overestimate nor underestimate institutional factors, actor's boundedly rational interests, nor niche management aspects. The approach is to systematically synthesize theories and explore the interactions at different but interrelated levels – while still analytically separating these levels – in order to reach a deeper understanding of the critical aspects and processes at hand. This may cast new light on the roles of actors, strategies, policies and an understanding of transition processes in general (Foxon 2011). This is important as various structural institutional dimensions and actors' practices and interests are highly relevant for a better understanding of transition processes (Fünfschilling 2014). Hence, there is not one single, but rather a multitude of variables to look at. An analytical distinction is made between:

a. Prevailing formal and informal institutions which guide actors' perceptions and activities
b. Actors' bounded rationality, boundedly rational interests and willingness to provide resources
c. Niche management aspects (which are based on actors' collaborations in a niche)

As transitions, such as the introduction of e-CS, affect many domains, socio-technical transition theory is used in the conceptual framework due to its ability to capture key dimensions of a transition process (Mazur et al. 2015). Socio-technical transition studies (Rip and Kemp 1998; Hoogma et al. 2002) have received increasing attention over the past two decades. They draw on several disciplines (particularly evolutionary economics, science and technology studies, innovation studies), and offer an integrated and system-wide view to address complex problems (Whitmarsh 2012). They include multiple, interlinked social and technical elements such as technologies, markets, industries, policies, infrastructures and user practices (Geels 2005; Geels 2004). All of these aspects co-evolve with each other to create 'socio-technical systems' (Hughes 1983). Socio-technical transitions are long-term and represent various co-evolutionary processes that allow for fundamental shifts in socio-technical systems to take place (Markard et al. 2012). As a new product or practice has to become embedded in different environments, including business, policy and user environments (Geels et al. 2015), resource mobilization, the creation of social networks and the construction of markets are important (Geels and Schot 2011). Since the 1990s, different analytical frameworks have gained attention, out of which the following four are considered the most important (Markard et al. 2012): Technological innovation systems (Hekkert et al. 2007), SNM (Kemp et al. 1998; Weber 1999), Transition Management (Rotmans et al. 2001) and the Multi-Level-Perspective (MLP) (Geels 2005; Smith et al. 2005).

The MLP describes the structure and dynamics of socio-technical systems. This theory is of importance in order to understand SNM, which is applied in this thesis. MLP is based upon three 'levels of structuration' of societal systems: 1. Socio-technical regime: It constitutes dominant technologies, institutions and actors; 2. Niches: They are equated with the emergence of innovations; 3. Landscape: It accounts for a variety of exogenous environmental, socio-economic and cultural influences (Whitmarsh 2012; Geels 2012). The MLP argues that transitions are explained by alignments between niche, regime and landscape (Fischer and Newig 2016): (a) niche-innovations build up internal momentum, driven by various reinforcing mechanisms such as the expansion of social networks, increased learning, growing support from policy-makers, etc.; (b) changes at landscape level put pressure on the regime; (c) Resulting from niche and landscape influences, windows of opportunity for niche-innovations emerge due to the destabilization of the regime (Geels 2012; Geels et al. 2015).

It is argued that the MLP often tends to overlook activities and behavioral changes that take place on a micro-level (Shove and Walker 2010; Cairns et al. 2014). Thus, it would benefit from more in-depth studies on the strategic interplay of different actors on the niche level (Musiolik and Markard 2011). Based on this recommendation, SNM is made use of in this thesis, which gives insights into niche management aspects that are based on actors' collaboration and their purposive actions in a niche on a micro level. They are interrelated and mutually reinforcing (Schot and Geels 2008). Through SNM one can systematically document processes that possibly lead to an adoption of new technologies, and analyze enabling and constraining factors (Hoogma et al. 2002; Kemp et al. 1998).

Generally though, institutional interactions and dynamics are not often considered explicitly enough in transition theory (Truffer et al. 2017; Geels 2004). Applying institutional theory offers a promising contribution to the understanding of socio-technical transitions (Fünfschilling 2014). This allows one to conceptualize a dynamic interplay between actors and structures (Geels 2004). By introducing insights from institutional theory, it becomes possible to understand the "rules of the game" of a system, such as the transport system. In addition, it enables one to see to what extent different degrees of institutionalization, i.e. the process of embedding some conception within an organization or a societal system, influence the perception and behavior of actors (Geels and Schot 2011). Based on institutional theory, the framework in this thesis encompasses informal (i.e. normative and cognitive) and formal institutions (i.e. regulative) (Truffer et al. 2017) as well as actors' bounded rationality.

2.1 Institutional theory

Institutional theory has become one of the most influential approaches in organization science today (Greenwood et al. 2008). It has been made use of largely in the fields of economics (e.g. North (1990)), political science (e.g. Ostrom (2005)), organizational studies (e.g. Powell and DiMaggio (1991)) and sociology (e.g. Giddens 1984)). Taking into account higher order principles like rules, norms or cultural belief systems, the application of institutional theory makes it possible to explain why certain characteristics and behaviors of actors exist, or practices emerge and diffuse (DiMaggio and Powell 1983; Scott 1995). This allows one to gain specific insights into how actors and their environment relate to each other (Fünfschilling 2014), and understand not only organizational but also individual actions (Mukhtar-Landgren et al. 2016). An institution is said to be a highly institutionalized structure which reaches a high age, scale and degree of acceptance (Barley and Tolbert 1997; Tolbert and Zucker 1999). To achieve this, institutionalization has to take place. It involves developments by which processes and obligations in the social realm take on a rule-like status in belief and action (Meyer and Rowan 1977). Scott (1995, p. 33) conceptualizes institutions as "multifaceted systems incorporating symbolic systems – cognitive constructions and normative rules – and regulative processes carried out through and shaping social behavior". They might include formal or informal rules (Bell 2002). Beckert (2016) assumes that it is only possible for actors to act strategically if the uncertainty is low. Stable institutions reduce the uncertainty of actors' behavior and practices, but also provide limitations as of what actors are permitted to do (North 1990; Ostrom 2005). A change in institutions is possible when facing new demands and trends, but the possibilities to do so vary (North 1990; Olsson 2008). This is since a transformation of institutions requires changes of formal and informal rules. Hereby, changes in the latter are said to take longer and are more difficult to achieve (Olsson 2008).

Literature on institutional analysis in social science is based on two different traditions. The first strand is known as 'old institutionalism' with a primary focus on how formal regulative institutions influence actors' behavior and their practices, without taking into account of informal institutions (Powell and DiMaggio 1991; Peters 1999). In the early 1980s, a counter-movement emerged that was led by the works of March and Olsen (1984) who argued that an analysis of institutions should include both formal and informal dimensions and be accompanied by individuals' behavior. This so called 'new institutionalism' emphasizes the mutual interaction and symbiotic relationship between actors' cognition and behavior as well as institutions, giving each of them different explanatory weight

(Giddens 1984; North 1990). The existence of several variants of 'new institutionalism' is agreed upon in the literature (Hall and Taylor 1996; Peters 1999). They differ in their understanding of the nature of institutions, the degree of human behavior to be able to alter them, as well as how formal and informal rules and behavior might translate into change (March and Olsen 2009). Political science created historical institutionalism (HI) which perceives institutions mostly as formal rules (Steinmo et al. 1992). It focuses on the analysis of historical processes, which lead to specific policy choices and outcomes. Path dependence can be considered the key concept for this approach. Rational choice institutionalism (RCI) was developed in the economics realm (Maggi 2016). It considers actors and their self-interest as well as individual utility maximization, based on the assumption that individuals react rationally, central to the explanations for behavior (Peters 1999). Sociology developed sociological institutionalism (SI) (Hall and Taylor 1996). It focuses on the importance of collective processes of legitimacy for the creation and development of institutions. Norms and values are seen as central in explaining behavior (Peters 1999).

2.2 Neo-institutionalism

More of an analytical framework than its own institutional theory, neo-institutionalism combines insights from the three main 'new institutionalism' schools (HI, RCI, SI) (Maggi 2016). The first neo-institutional arguments were formulated by Meyer and Rowan (1977), and were further developed by DiMaggio and Powell (1983), by linking it to organizational and sociological theory. In neo-institutionalism, the explanatory power of institutions and actors are combined (Maggi 2016). It allows one to analyze core institutional structures of the organizational level, such as routines and strategies, as well as of the institutional level, including formal and informal rules (Augenstein 2015). The concept of "duality of structure" (Giddens 1984) is present in neo-institutionalism. It has been used to characterize the relationship between structures – the "rules and resources" – and agency by showing that structures are powerful in a structural sense, but also socially constructed. This means that actors are embedded in structures, but also able to reproduce them (Powell and DiMaggio 1991; Scott 1995).

It assumes knowledgeable actors who are able to deviate from structure through strategic actions, but also emphasizes institutional structures in local practices, upon which actors draw (Geels and Schot 2011; Geels 2004). Their behavior is rather complex, strongly depending on their values, given resources and the strategies they intend to follow (Foxon et al. 2010); all of which can change over time as a result of social action (Geels 2004). Furthermore, actors form part of social groups, which share particular belief systems and cultural values that provide meaning and guide their actions (Geels 2010). From HI, the possible constraining power of institutions is inherited, whereby the role of actors is adopted from RCI and SI (Maggi 2016). Based on not being fully informed ("bounded rationality"), actors act upon self-interested motivation, with the aim usually to improve the given situation and control resources ("boundedly rational interests") (Geels 2004). However, utility maximization is not deemed the primary motivation, as they are also influenced by certain social norms and values (Maggi 2016).

Generally, neo-institutionalism encourages us to consider three kinds of institutions (Bastedo 2007). They are based on a conceptual framework by Scott (1995) (see Table 1) and comprise of cognitive, normative and regulative institutions. These are interrelated rather than mutually exclusive and are

included in this thesis. Moreover, on basis of RCI, this thesis includes the aspect of "bounded rationality" and the given "boundedly rational interests".

Table 1: Cognitive, normative and regulative institutions
Source: Own representation based on North 1990; Geels 2004; Scott 1995

Categories	Sub-categories
Regulative institutions	Laws, regulations, policies
Cognitive institutions	Cognitive routines, tacit knowledge, perceptions of user preferences, perceptions of existing developments
Normative institutions	Belief systems, values, societal norms, role responsibilities

2.2.1 Formal regulative institutions

In light of a formal "capacity to establish and determine rules and inspect others' conformity to them" (Scott 2014, p. 59), regulative institutions form a central part in all types of governing. They consist of highly regulated rules, such as laws, and rather vague forms of governing, such as policies or financial incentives (e.g. subsidies) (Geels 2004). Actors' cognition and habits can be shaped in the long-term through formal institutions (Scott 1995). An institutionalization of regulative changes, i.e. an achieved stability, is achieved through policy plans and laws (Geels and Schot 2011). It is argued that governments generally should find a good combination of regulatory measures and funding options to make innovations attractive (Porter and van der Linde 1995).

2.2.2 Informal cognitive and normative institutions

Informal institutions influence actors' behavior and choices by means of deeply embedded rules, such as attitudes, preferences, understanding, knowledge and experience (North 1990; Powell and DiMaggio 1991). In addition, they influence actors' perceptions and preferences by defining what is desirable, acceptable and legitimate (Geels 2010). A hurdle in analyzing informal institutions is that these rules tend to be rather complex, unspoken and only acknowledgeable with difficulty (Ostrom 2005).

Cognitive institutions constitute the nature of reality through which meaning and sense are continually interpreted (Scott 2014). These rules influence social behavior in that it is more based on orthodoxy ("way we do things") than normative appropriateness or regulative conformity (Bührman 2011). They represent cognitive routines, guiding principles (Geels and Schot 2011), problem agendas, tacit knowledge or perceptions of user preferences. In addition, they guide perceptions, orient these to the future and influence actions in the present (Geels 2004). Based on cognitive institutions, actors may look in particular directions, and are blind to developments outside their focus (Nelson and Winter 1982). Despite cognitive rules, there is room for interpretation and variety. Changes in cognitive rules may be achieved through experiences in local practices or socio-cognitive activities by dedicated macro actors (Geels and Schot 2011).

Normative institutions introduce an obligatory and evaluative dimension into social life, whereby the behavior is guided by a logic of appropriateness. Actors adhere to norms and follow rules (Scott 1995). This is a result of actors' perceptions that these are rightful and legitimate. Other actions are rendered unacceptable due to social obligations (Powell and DiMaggio 1991). Social groups are normatively stabilized by belief systems, values, codes of conduct, societal norms and role responsibilities (Geels 2004). Norms become internalized through experience, normalization, and endorsement from authoritative actors. However, there exists space for variety, as actors can deviate from normative obligations (Geels and Schot 2011).

2.2.3 Bounded rationality and boundedly rational interests

RCI includes to a large degree actors' bounded rationality and boundedly rational interests (Böcher 2012). This is since it is based on a "wide" version of modern rational-choice theory (Opp 1999). In RCI, actors act upon self-interested motivation, with the aim usually to improve the given situation (Geels 2004). Whereas their interest is mostly egoistic, their behavior can also be influenced by ideas, intrinsic motivations or experiences. In addition, their decisions are based on bounded rationality, as their rational choices are constrained insofar that their decisions are affected by conditions of a limited cognitive knowledge base and a context of structural uncertainty in their environment (Simon 2000). This thesis includes actors' bounded rationality and boundedly rational interests which are based on rather self-interested and utility maximizing motivations. This is seen as useful, since the (market) actors share the intention to deal with e-CS as a new innovation in order to gain a first mover advantage and maximize their financial resources.

2.3 Strategic Niche Management

SNM (Kemp et al. 1998; Weber 1999) was invented as a research model and policy tool at the end of the 1990's (Loorbach and Raak 2006). It is based on insights from sociology of technology studies and is rooted in an analytical core that allows to conceptualize the emergence of new technologies (Geels and Raven 2006). Niche innovations can represent a new behavioral practice, technology, business model, or a combination of these (Geels et al. 2015). The real-world introduction of innovations is said to be difficult because the necessary supportive socio-technical contexts, i.e. networks, knowledge, design standards, norms, financial resources, etc., do no yet exist (Geels et al. 2015). Niches are developed by networks of actors which make a supportive context for the innovation possible. These actors are interested in the development of a specific technology and support it, based on the hope that it may be used in the regime, or even possibly able to replace the mainstreamed technologies in it (Geels 2004). However, niches are characterized by uncertainty, unstable social networks with no clear role relationships, imprecise rules and disagreements etc. (Geels and Schot 2011). SNM is criticized by some researchers for its strong market approach (Loorbach and Raak 2006) as well as for its principal focus on technology, hereby neglecting the social dimension of transitions (Hielscher et al. 2013; Hegger et al. 2007).

A need is emphasized in transition literature to deliberately manage niche formation through protected societal experiments (Caniëls and Romijn 2008). Such experiments allow one to learn about the new technology, demonstrate its viability, and protect it against regime forces (Schot et al. 1999). Through experimentation it is possible for elements of market, social, cultural and political dimensions

to develop in a process of co-evolution (Mourik and Raven 2006; Geels and Schot 2011). Nonetheless, the diffusion of novelties is dependent on alignments with regime and landscape levels (Geels and Schot 2011), as mentioned before. In general, the possibilities of experiments to contribute to possible transitions are small if they are not linked to long-term strategies for structural change (Loorbach and Raak 2006). Hence, it is necessary for the innovation to become connected to its wider social, political and economic context (Weber 1999). This includes institutional embedding, an embedding into the existing socio-technical infrastructure, and the creation of appropriate networks between actors (Schot et al. 1999). Moreover, to create more widespread support, it may be necessary for government institutions to become involved (Weber 1999). Whereas local governments might improve local affairs, regional and national governments could provide financial incentives or establish macro-policies. Furthermore, by supporting various niche projects, they could strengthen learning (Kemp et al. 1998).

Niche management aspects consist of four interrelated and mutually reinforcing sub-processes which are important for the wider diffusion of the innovation: a “social actor network”, “co-evolutionary learning”, the “articulation of expectations” and “protective measures” (Schot and Geels 2008). All these aspects are described below.

2.3.1 Social actor network

A niche may require the development of a new actor network (Kemp et al. 1998), which could facilitate the development of the innovation (Mourik and Raven 2006). Actors involved in such a network might better understand how to develop the innovation and are willing to invest resources. Their strengths, such as knowledge, skills, network relations, etc. are supposed to be harnessed appropriately (Weber 1999). Networks should be broad, i.e. include multiple important actors (Schot and Geels 2008; Weber 1999). In addition, networks should be deep, i.e. an ability of actors should exist to mobilize resources as well as commitment (Schot and Geels 2008). This is supposed to be accompanied by inputs from outsiders, such as potential users. Generally, actors with vested interests in existing technologies may not be interested to provide support for the new innovation and may only participate for defensive reasons (Weber 1999). They could even hamper its market introduction (Mourik and Raven 2006). Despite this, these actors are often needed due to their possibility to provide resources (Geels et al. 2015). Moreover, a network manager is seen as advantageous with regard to the guidance of the network, an active actor involvement and goal setting activities (Caniëls and Romijn 2008). Generally, new responsibilities and tasks might emerge in the course of the actor network (Weber 1999). These give rise to the necessity for actors to adjust their involvement accordingly (Kemp et al. 1998). Besides that, an attitude of openness towards investigating the technology should exist, and a willingness to change course, if necessary (Caniëls and Romijn 2008). Furthermore, it is important that the involved actors are responsible for the tasks and committed to the approach (Roep et al. 2003). Generally though, the participating actors have different interests, belief systems and power (Schot et al. 1999). This might cause rather low commitments and low levels of risk taking (Caniëls and Romijn 2008).

2.3.2 Co-evolutionary learning

Experimental projects allow one to learn more about the barriers of the development of a new technology and how these may be overcome. In an ideal context, learning comprises of various aspects, such as technology, infrastructure, user context, societal and environmental impact,

production network as well as policy and regulatory frameworks. Learning processes are generally considered to be adequate when they entail single-loop and double-loop learning. However, experiments generally cover only part of such learning (Weber 1999). Single-loop learning processes involve the accumulation of facts, data and experiences on a cognitive basis (Argyris 1976). In addition, they include learning about the effectiveness of a technology to achieve specific pre-defined goals (Mourik and Raven 2006). Double-loop learning involves changes in or the questioning of cognitive frames, beliefs, values and norms (Geels 2010). In addition, double-loop learning allows one to analyze the role of the innovation in a wider system change towards sustainability (Mourik and Raven 2006). Generally, it is important to store the gained knowledge, and establish follow-up activities (Weber 1999). In such projects, specific issues can come up, which could pose problems for learning processes. Whereas role-constrained learning makes actors become stuck in role expectations or standard procedures, situational learning denies a transfer to other projects. Strategic learning is influenced by powerful actors who take advantage of the project's processes (Mourik and Raven 2006).

2.3.3 Articulation of expectations

The articulation of expectations of the potential of new innovations (Weber 1999) allows one to steer learning processes, legitimize protection and gain attention (Schot and Geels 2008). Moreover, such articulation permits one to possibly receive funding from external actors (Geels 2012) and it reduces uncertainty (Mourik and Raven 2006). Expectations can be related to the following aspects: Technical specifications, public opinion, government policy, production network, market, infrastructure network, as well as environmental and societal effects (Kemp et al. 1998). Partners have often different expectations that differ in content and aspiration. The expectations are often rather broad, but important for motivation and for making commitments (Weber 1999). Furthermore, they can be described as "powerful" if they are shared by more actors, supported by facts and tests, and are specific about their technological, economic and social aspects (Kemp et al. 1998). In combination with shared cognitive rules, they can provide direction to projects (Geels and Raven 2006). Expectations should continuously be articulated by all parties. Moreover, they can change as a result of learning processes (Weber 1999) and because of voicing them (Mourik and Raven 2006). If the expectations are confirmed, further refinement within shared rules is given. However, if the outcomes fall below the expectations, faith in the innovation and its further development might decrease (Geels and Raven 2006).

2.3.4 Protective measures

It is important that a project is carried out under protected conditions, as projects usually face many uncertainties and disadvantages, mostly of an economic nature. Implementing specific actions on various dimensions to overcome uncertainties and barriers is necessary for the widespread development of a technology (Mourik and Raven 2006). Whereas new innovations are protected in experimental projects and are not directly put in competition with incumbent technologies, they nonetheless interact with "the real world" (Loorbach and Raak 2006; Weber 1999). Protection measures represent particular applications, geographical areas (Kemp et al. 1998), financial incentives, infrastructure, technical standards, laws (Smith and Raven 2012) or the setting of specific and clear policy goals (Kemp et al. 1998). All these different measures have the intention that the innovation's advantages outweigh its disadvantages (Mourik and Raven 2006).

3. Research methodology

This chapter presents the methodology of this thesis. It describes the research strategy and the conceptual framework and outlines the methods of data collection and analysis. The research framework is attached as Appendix 1.

3.1 Research design and strategy

A research design "provides a framework for the collection and analysis of data" and entails choices about the priority that is given in the research process (Bryman 2012, p. 46). It represents the plan of how the research question will be answered (Lamnek 2010) and specifies the objectives and data sources. In addition, it gives information on possible constraints of the research (Saunders et al. 2009).

3.1.1 Qualitative research strategy

The research strategy represents the general way social research is conducted (Bryman 2012). The approach of this thesis follows an inductive approach, which was chosen due to the stronger spatial orientation and the associated variety of methods. It allows one to explore a social phenomenon in light of theories with the aim to find empirical patterns and reveal key elements about it. These can be used to generate a theory (Mills et al. 2010). To answer the research question and also for the formation of findings, the data can be derived from quantitative and qualitative methods (Flick 2007). Whereas qualitative methods allow one to gain a qualitative picture of a given phenomenon based on qualitative statements, quantitative methods allow one to gain various numerical data. Depending on the type of research question and sub-questions at hand, both methods on their own, or in combination, represent important means to properly address the given (sub-)research question(s). In this thesis, a qualitative research approach was seen as appropriate and adopted. Such an approach is usual for transition research (Markard et al. 2012). The given research questions were answered through evidence collection and the assessment of the evidence. The purpose was to identify qualitative responses of the stakeholders, which are based on their specific personal attitudes, and interpretations from their perspectives, in order to reveal barriers to or enablers of the diffusion of e-CS in urban neighborhoods. In general, qualitative methods can give insights into institutional and social aspects and can "expose the range of beliefs and their construction in a social setting" (Whitmarsh et al. 2009, p. 237). This allows one to "describe and understand social phenomena […] [and] to produce rich, descriptive data [...] [and] findings that can contribute to theoretical knowledge and practical use" (Boije 2010, p. 11). With the intention of methodological triangulation, this qualitative approach is supplemented by quantitative data gained through two surveys, in order to reinforce the validity of the qualitative results. Generally though, quantitative research methods and data sources were seen as unsuitable as the main research method. This is because this thesis deals with a geographical case study, concerning which qualitative data from various actors in the city and in the project 'e-Quartier Hamburg' was existent to a sufficient degree and focused upon.

3.1.2 Explanatory case study approach

In this thesis, an explanatory single case study with a retrospective design is employed, which focuses on the recent historical development of e-CS in Hamburg. Such a methodological approach allows one to purposefully address the given research questions. This is because one deals with a specific urban

area, its concrete context and characteristics, the roles and strategies of specific actors and institutional circumstances; all of which can be taken into account to answer the research question appropriately. These aspects in combination and within specific geographical boundaries prove very feasible to address the given research questions. The empirical case focuses purely on Hamburg, but when the national context matters, Germany is discussed as a whole.

Yin (1994) argues that case studies can be seen as the best-suited approach when it comes to conducting research on a phenomenon in relation to its complex real-life context. This approach enables one to understand the phenomenon's causal links in an environment, where many variables interact, rather than focusing on a particular variable. In addition, specific contexts and complexity can be incorporated in in-depth case studies (Flyvbjerg 2006). This makes it possible to explore social processes and understand the real barriers of a specific phenomena (Nykvist and Nilsson 2015). In addition, empirical case studies represent a fruitful method to develop new concepts and theories (Ragin 1987) and enable an "analytical generalization" of conceptual theories (Yin 1994). In this thesis, the conclusions about the development towards the diffusion of e-CS hold mainly for this case in Hamburg, as the qualitative data is purely collected in Hamburg. Yet, the results are meant to provide a basic overview of the enabling and constraining factors faced in the introduction of e-CS in urban areas in general. This is because other urban areas also deal with the topic/innovation of e-CS and find themselves in a rather similar position when it comes to specific issues, such as infrastructural issues, public opinion etc. Hence, the findings of this thesis might prove relevant for further research or policy applications in the field of e-CS in urban areas in Germany. Moreover, the results could possibly be compared with other studies that focus on e-CS in urban areas in Germany.

Furthermore, as mentioned in chapter 2, the two different theories made use of in this thesis (SNM and neo-institutionalism) were applied on different geographical scales. SNM theory is applied to the 'e-Quartier Hamburg' project, whereas neo-institutional theory is applied to the City of Hamburg as a whole. This application was carried out with intention, since SNM theory has the intention to capture and analyze niches and niche projects on a micro scale. As the 'e-Quartier Hamburg' project is a niche project located on a micro scale, the practices and developments in this project could be analyzed particularly well with SNM theory. However, as these developments are influenced by the meso scale of the City of Hamburg, it was useful to apply neo-institutionalism with a focus on the whole city. Doing so enabled one to see to some degree the interrelation of both scales (micro and meso) and of both theories (SNM and neo-institutionalism). This is particularly important, as institutions (regulative, normative, cognitive) on the meso city-wide scale influence the micro scale to a rather large degree (vice versa not as much).

3.2 Data collection and analysis

This thesis comprises of various empirical research methods, including primary as well as secondary sources. Hence, a mixed method research design is applied (Teddlie and Tashakkori 2008). Analyzing an emerging social phenomenon by using intertwined methods that mutually reinforce the validity of each approach allows one to increase the quality of a study (Yin 1993). This can mitigate an incomplete explanation of a phenomenon, which is possibly caused by only applying one method (Dijk and Yarime 2010). In this thesis, the research questions were driving the data collection.

3.2.1 Secondary data

The secondary data sources are based on a thorough literature review of the local context literature. For this thesis, various secondary sources, such as current works and internet contributions, project reports, policy documents, research reports and scientific journals were used (Ogborn 2010). By using the literature analysis, a basic understanding of the topic was created, as well as the basis for its further research set.

3.2.2 Primary data: Qualitative expert interviews

As the case is local in character and only some documentation is available, this thesis relies heavily on in-depth semi-structured interviews as a primary data source. Such interviews are particularly useful in cases where processes have to be reconstructed that are complex and may be subject of different opinions (Creswell and Zhang 2009). Such an approach makes it possible for the researcher to ask specific questions and compare the responses from various actors with different backgrounds (Whitmarsh et al. 2009). In addition, it enables an approximation of the aspects that are seen as relevant by most of the interviewees and might be of broader significance (Creswell and Zhang 2009). In total, 17 semi-structured stakeholder interviews were conducted face-to-face between April and May 2017. The candidates were chosen according to their involvement in the project 'e-Quartier Hamburg' or according to their position in relation to the investigated phenomenon (Creswell and Zhang 2009). The latter means that the topics CS, electro mobility, sustainable mobility concepts in urban neighborhoods were taken as important subjects and people that were closely related to and dealt with those in the City of Hamburg were contacted and asked for an interview. In general, the intention was to elicit specific information from nine stakeholders that were related to the project 'e-Quartier Hamburg' and eight others that were not directly associated with it.

The project stakeholders were approached concerning their attitudes towards the project based on the four aspects of SNM theory (social actor network, co-evolutionary learning, protective measures, articulation of expectations) as well as on neo-institutional aspects. The involved stakeholders in the project represented actors pertaining to three CSOs *(cambio Hamburg CarSharing GmbH, Mindways Hamburg GmbH, STARCAR GmbH Kraftfahrzeugvermietung)*, two housing cooperatives (*HANSA Baugenossenschaft eG, Gemeinnützige Bau-genossenschaft Bergedorf-Bille eG*), one research university (*HafenCity University)*, one project management consultancy (*D&K drost consult GmbH),* and the electro mobility head office in Hamburg (*hySolutions GmbH)*. The stakeholders that were not associated with the project were asked questions purely based on neo-institutional theory. Depending on their postion and organization, specific topics (and sub-research questions) were covered more in-depth in order to gain a comprehensive picture of the topic of e-CS in Hamburg from various perspectives. These actors belonged to three private companies (*steg GmbH, Stromnetz Hamburg GmbH, HFK Rechtsanwälte LLP*), four public sector institutions (*BSW, BWVI, District Hamburg-Mitte, Landesbetrieb Verkehr*), as well as one housing sector association *(VNW e.V.)*. A detailed listing of each contact is given in Table 2 of Appendix 2.

Concerning the housing sector, a sole focus was put in the interviews on housing cooperatives and not on housing companies. This is due to the fact that housing cooperatives seem to be predestined actors who, based on their social integration, economic culture and identification with neighborhoods, can

positively promote e-CS at a local scale (Akelbein 2015). The interviews lasted between 20 to 90 minutes, were recorded and transcribed. All interviewees were asked to review the citations that were stated by them and used in this thesis. 1 out of the 17 respondents did not want to be quoted directly. A semi-structured interview guide was used for the interviews and is included in Appendix 4. Such a guide was helpful in order to structure the interviews according to thematic blocks (particularly the topics of CS and electro mobility, as well as the perceived barriers and enabling factors in Hamburg) and ask open questions, related to these thematic blocks. This ensured that all topics relevant to answering the research questions were addressed. The interview guide was handled flexibly so that new and relevant aspects could be discussed as needed. The topics and thematic blocks that were included in the guide were selected by means of a literature research (Peters and Dütschke 2010).

3.2.3 Primary data: Quantitative online surveys

Quantiative research methods were applied in this thesis with the intention to triangulate the results of the qualitative case study and ascertain the confidence in the qualitative results. In this thesis, two online surveys were used as quantitative research methods, and were distributed via the online survey tool 'SoSciSurvey' during April and May 2017. The first one was distributed to approx. 1,050 housing cooperatives (see Appendix 5 for the questionnaire) and the second one to 63 station-based CSOs (see Appendix 6 for the questionnaire) in Germany. The housing cooperatives were found in the directories of federal state associations of housing cooperatives. The CSOs were found through internet search on Google. Those two actor groups were chosen, as both represent the most significant actors concerning the possibility to integrate e-CS in urban neighborhoods. Even though the case study in this thesis deals with an urban area (City of Hamburg), Germany as a whole was seen as a suitable scale to carry out the quantitative surveys and chosen as a result. This was done, because it allowed one to gain a larger amount of data (focusing only on urban areas could have resulted in too few quantitative datasets) and proved to be a rather low effort in collection the data in comparison to e.g. choosing specific cities. This means that the data was collected not solely in large urban areas (similar to Hamburg), but conducted on a Germany-wide scale, including smaller cities and even rural areas. This can be seen as difficult when it comes to comparability, since large urban areas, such as Hamburg, possess somewhat different circumstances, particularly concerning infrastructure, financial aspects and policies. However, despite this fact, all areas in Germany where CS and/or electro mobility concepts are applied, have at least in part similar prerequisites, because they are all located in the same country with culturally, economically and politically rather similar circumstances. This means that on a very basic level they are comparable. A focus on (the cities of) other countries was not seen as a meaningful option because of possibly very different circumstances, language barriers, and a too high effort in collecting the data.

The survey for the housing cooperatives included nine questions, whereas the survey for the CSOs included twelve questions. Both surveys involved a combination of dichotomous type (yes/no), demographic survey type (10-20 / 21-40), likert-type (strongly agree, agree, etc) and multiple-choice type questions. Both surveys were completed within 5-10 minutes. In response to the housing cooperatives' survey solicitation, 60 respondents (out of 1,050) completed the survey, representing a rather low response rate of approximately 6%. The CSO survey was completed by 27 respondents (out of 63), representing a rather high response rate of approximately 43%. In both cases, respondents

were assured in advance that their responses would remain strictly confidential. The quantitative data was applied in the thesis, when a comparison of the qualitative and quantitative data seemed reasonable and meaningful. The data was then included in chapters 4 and 5.

The quantitative data is meant to triangulate the qualitative data for the sub-questions 1,2 and 3, but not sub-question 4. Hence, in carrying out the surveys, a focus was solely put on neo-institutional theory. This means that SNM was not covered at all. This is because it would not make much sense to quantitatively analyze the project 'e-Quartier Hamburg' nor to quantitatively compare it to other projects in Germany that are focused on e-CS. Besides that, the online surveys did not address all relevant aspects of neo-institutionalism, i.e. all the indicators of the analytical operationalization of Appendix 3, but only the majority of them. Moreover, whereas the CSO survey focused on the aspects of CS, electro mobility, and e-CS, the housing cooperative survey focused almost exclusively on CS. As a result, the topics of electro mobility and e-CS were not covered in depth in this survey. The reason for leaving out these aspects is that only few housing cooperatives offer CS, as became apparent in the research that was carried out before running the surveys. Dervived from this, the offer of e-CS is smaller than CS, possibly to a very large degree. Overall, as a result of these aspects and the before mentioned problems as well as further data analysis issues (see next sub-chapter), the overall quality of the quantitative data is not high.

3.2.4 Data analysis and analytical operationalization

The qualitative data gained in the expert interviews was interpreted through the identification of categories and the association of these with indicators via a content analysis (Boije 2010). Hereby, in a systematic and replicable manner the phenomenon was broken down into various parts, and the relationship between these determined. The aim was to quantify the findings in terms of specific categories (Bryman 2012). To achieve this, the notes were transcribed after each interview, resulting in a fully transcribed dataset. The transcripts were then analyzed based on an analytical framework (included as Appendix 3), which was informed by the theoretical assumptions of the thesis, based on different indicators. The list of indicators was constantly refined as a result from emerging themes of the interviewees' statements (Patton 2002; Coffey et al. 1999). This resulted in the following final categories: 1.) Regulative institutions; 2.) Actors' boundedly rational interests; 3.) Cognitive and normative institutions; 4.) Niche management aspects. The results in the thesis consist of the descriptions that are based on these categories. The analytical framework allows to operationalize these four categories. The indicators mark the presence or absence of each category.

The quantitative data was analyzed by means of an analysis in MS Excel concerning interesting variables and their components. A focus was hereby put on specific values, highest and lowest values, as well as proportions. Trends over time and distributions were not included (Saunders et al. 2009). As the focus of the thesis is qualitative in nature, a context-dependency on the City of Hamburg is given. As a result, the quantiative data was not analyzed in-depth from a professional statistical analysis' point of view. This means that neither was a statistical software like SPSS applied, nor correlations found and described to a sufficient degree. As a result, the quantiative data is supposed to represent a rather basic tool, which allows a comparison with the qualitative results on a very elementary basis.

3.3 Research philosophy

The underlying research philosophy is defined as the term, which relates to what constitutes acceptable knowledge. It influences the research, as it "contains important assumptions about the way in which the world is viewed" (Saunders et al. 2009, p. 108). This thesis is based on an interpretive epistemological style, which allows the study of uncertain processes, such as socio-technical transitions (Geels 2012). This requires interpretive creativity of the researcher in order to notice mechanisms and patterns of interest. The position of this thesis assumes that empirical observations and the analytical framework are relative to the specific frame of reference adopted by an observer.

The ontology refers to foundational assumptions about the nature of the (social) world and its causal relationships (Ritzer 1980). As socio-technical transitions are multi-dimensional phenomena, they can be studied from various angles by different disciplines (Geels 2010). It is argued in transition studies that it is helpful to learn from established frameworks of other fields, which can complement explanations (Markard et al. 2012). Concerning this, crossover approaches (Gioia and Pitre 1990) recognize the different ontologies (in this thesis the ontologies of SNM and neo-institutionalism), but aim for a fruitful interplay of these. This makes them particularly applicable in socio-technical transitions (Geels 2010). Based on Giddens's (1984) structuration theory – which combines an interpretive approach with structural ontologies –, the application of neo-institutionalism in this thesis postulates an embeddedness of heterogeneous actors within an institutional environment (Geels 2010). SNM, which is based on an interpretive/constructivist ontology, takes a more agency-oriented approach (Geels 2010). It focuses on the aspect of symbolic and intersubjective constructions of reality through which actors create interpretations (Berger and Luckman 1967). Actors are creative and knowledgeable agents who draw upon rules as well as interpret and tailor them to their necessities. Actors' interpretations create meaning and precede their decisions and strategies. The crossover of structural ontologies and the interpretive stance allows to combine the importance of a structural environment with an interest in social enactment and sense-making (Geels 2010).

4. Policy, regulatory and infrastructural conditions in Hamburg

This chapter addresses the regulative institutions of neo-institutional theory, including highly regulated and rather soft forms, for CS and electro mobility as well as for their specific integration into urban developments in Hamburg. In addition, the city's boundedly rational interest and willingness to provide infrastructure is discussed. Further insight is provided in form of the results of the online survey of the CSOs, when these are seen as specifically meaningful. This chapter includes answers for the research questions 2 and 3.

Hamburg (see Figure 3) is situated in the north of Germany and is the second largest city in Germany with approximately 1.8 million residents (and 5 million people living in the metropolitan region). A further growth of the city's population of 5.9% to 1.91 million is expected by 2030 (BBSR 2012). The traffic volume in Hamburg has increased significantly in the last couple of decades, parallel to the population and employment growth. Moreover, Hamburg has had the role of a transport hub for Northern Europe since 1990. Since then, hinterland and commercial traffic have risen sharply. Generally, the share of economic value added by the transport industry is in Hamburg about twice as high as the national average. Traffic is seen as the root of the quality of life (Färber et al. 2014).

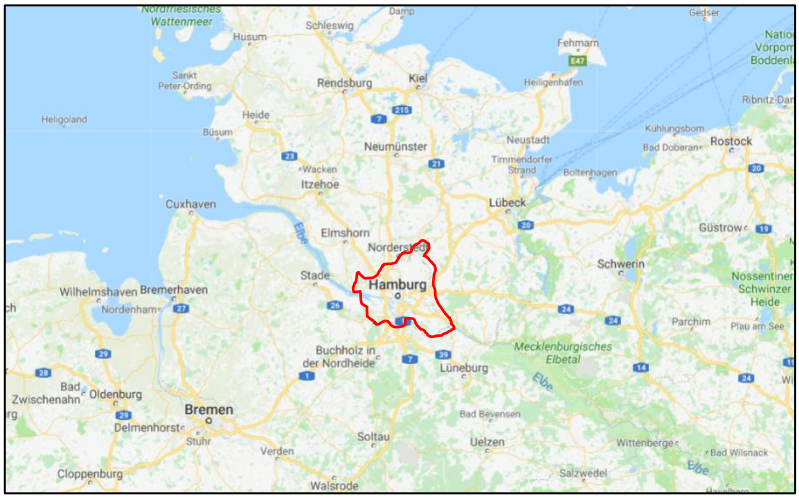


Figure 3: Map of the City of Hamburg
Source: Google Maps n.d.

As a former 'European Green Capital', Hamburg is particularly committed to the principle of sustainability and is working to improve social, economic and environmental conditions for its citizens. Influenced by normative principles, the city perceives it as an important task to reduce the negative effects of transport on health, climate and the environment. In addition, it associates economic growth and prosperity with transport. In general, the promotion of sustainable urban mobility should contribute to the improvement of the quality of life and to a livable and environmentally-friendly city (Senat der FHH 2016). Furthermore, in accordance with federal policy goals, energy-related CO2 emissions are to be reduced by 40% by 2020, compared to 1990 levels, and by 2050 by at least 80% (Bürgerschaft der FHH 2015a). Nitrogen emissions are also to be further reduced (Färber et al. 2014).

As extensions of the road network can hardly be realized (Färber et al. 2014) and the city acknowledges increased demands on mobility, it sees the most intensive possible utilization of the existing traffic network and public traffic space as pivotal (Bürgerschaft der FHH 2017). Besides that, a primary

objective of the city is a more sustainable and reduced use of the motorized individual transport. Other objectives include an increased usage of public transport, bicycles and walking (Bürgerschaft der FHH 2013). The remaining individual traffic is to receive a new sustainability quality through the implementation of innovative and intermodal mobility behaviors, such as CS, and new technologies, such as electro mobility (Bürgerschaft der FHH 2013). The 'Mobility program 2013' forms the basis for tackling the given challenges in the transport sector. It outlines the framework conditions that affect traffic developments and describes guidelines and measures in various fields of action. Hereby, all means, mediums and purposes of transport are considered in an integrated manner, based on a holistic approach. With regard to electro mobility and CS, the following two guidelines are particularly of importance:

1. "Efficient management and integration of mobility": The combination of transport modes and mobility services, particularly at metro stations, is important. In new residential constructions, complementary mobility offers are to be sensibly integrated from the start;
2. "Developing electro mobility, designing transport and living spaces": The usage of BEVs and the necessary infrastructure should be expanded and accompanied by other environmentally-friendly modes of transport (Bürgerschaft der FHH 2013).

4.1 Carsharing

Carsharing (Figure 4) has been undergoing dynamic developments in Germany for several years (Truffer et al. 2017). This is the result of a commercialization at the end of the 1990s, when bigger CS enterprises were established. In particular since 2012, the growth rates for free-floating CS increased in Germany (Lindloff et al. 2014). Free-floating is one of two types of CS. In such CS systems, the vehicles are distributed over a corresponding business area on the public parking space. Members can use an unoccupied car without reservation and park it elsewhere (Witzke 2016). Station-based CS allows members to pick up the car at a designated location after its reservation and return it (Shaheen and Cohen 2013). It is convenient for users who need a vehicle for only one trip (BUE Hamburg 2017).

In Hamburg, CS has become an integral part of the mobility offer (Henrichs 2016), as both variants have become established in recent years (Bürgerschaft der FHH 2015b). Hamburg sees CS as a trendsetting form of mobility and wants to create the necessary conditions for its further

Figure 4: A free-floating CS vehicle in Hamburg
Source: hamburg.de GmbH & Co. KG n.d.

establishment by actively supporting its expansion (BUE Hamburg 2017). It is hoped that CS will change the modal split in favor of environmentally-friendly means of transport, reduce pollutant and noise emissions as well as the number of private cars (Bürgerschaft der FHH 2013). From a city and traffic planning point of view, CS represents a significant potential to reduce car ownership (Luca and Di Pace 2015). Current assumptions assume that a station-based CS vehicle can replace around 15 (Loose 2016), or conservatively at least 5 to 10 private vehicles (Lienkamp 2012). The contribution of free-floating CS to reduce the overall number of vehicles is perceived to be much lower (Glotz-Richter 2013b; Haller et al. 2013), amounting to between 3 cars or no reduction at all (bcs 2016). Generally, with the implementation of CS there is a decrease in the demand for parking space (Grischkat et al. 2014). Moreover, a reduction in noise and pollutant emissions is achieved, as less powerful engines in CS vehicles are employed (Glotz-Richter 2013a). This entails also a reduction in CO2 emissions (Baptista et al. 2014). According to Ryden and Morin (2005), such a reduction can amount to as much as 39-45%.

Offering CS in Hamburg is seen as a means to meet the growing willingness among the population to refrain from using their own car if alternative mobility services are provided comprehensively and cheaply (Bürgerschaft der FHH 2013). However, based on normative principles, the city does not want to cause inequalities by actively intervening in the CS market and subsidize land to specific CSOs (Lancken 2014; Fischer and Newig 2016). Adding to this, only a limited technical and professional cohesion is evident from public documents, mentioning CS very briefly and with rather vague implications. Also, there is an absence of any specific CS expert.

The city focuses on the expansion of CS close to connection points, such as metro stations (Bürgerschaft der FHH 2017). Here, the initiative 'switchh' offers attractive offers based on agreements between the *Hamburger Hochbahn AG*[3] and CSOs (Haller et al. 2013). In the expert interviews (Kulus and Domaschke (both 2017)), it was mentioned that 'switchh' is seen as a useful supplement to public transport in public areas, as it enables one to park CS vehicles easily and without barriers.

4.1.1 Number of vehicles and types of carsharing

In Germany, 1.26 million CS users made use of 16,100 vehicles in 2016; of which 9,100 were station-based (bcs 2017a). In 2015, the number of existing CS vehicles in Hamburg amounted to a total of 1,468 (1,014 vehicles in 2013); out of which station-based CSOs offered 318 vehicles. In recent years, more free-floating offers were established in the market; *car2go*[4] launched its offer in 2011 and *DriveNow*[5] in 2013. In 2015, both offered a combined total of 1,150 vehicles (Bürgerschaft der FHH 2017). The 'CS Barometer Index' ranks the amount of CS vehicles per 1,000 inhabitants in 135 major cities in Germany. Concerning station-based CS, Hamburg achieved only 43rd place with 0.10 vehicles per 1,000 inhabitants (Karlsruhe 1st place with 2.15 vehicles). With regard to free-floating CS, Hamburg offers 0.66 vehicles per 1,000 inhabitants, rising to 5th place (Düsseldorf 1st place with 0.90 vehicles) (bcs 2015). Combining both free-floating and station-based CS puts Hamburg overall in 12th place, as visible in Figure 5.

[3] The *Hamburger Hochbahn AG* operates the metro system and large parts of the bus system in Hamburg
[4] *car2go* is a German car rental company and subsidiary of *Daimler AG* which provides CS services in Europe and North America
[5] *DriveNow* is a German CS service of the automotive manufacturer *BMW* and the car rental company *Sixt*.

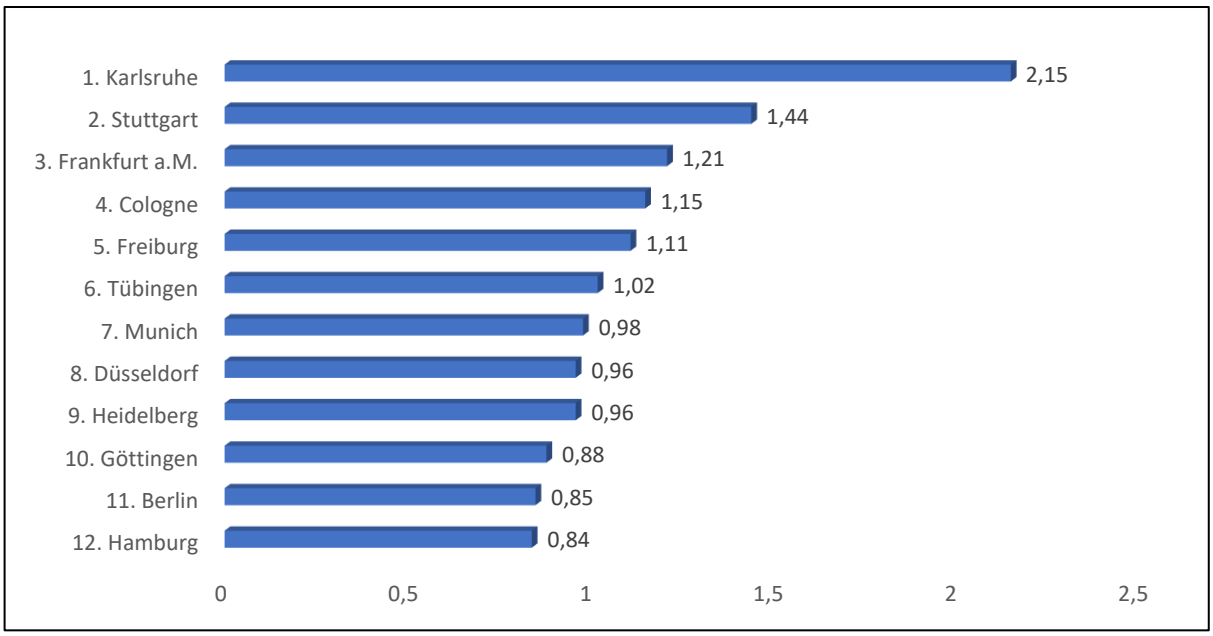


Figure 5: CS vehicles per 1,000 inhabitants in German cities with more than 50,000 inhabitants
Source: bcs 2015

It became apparent during one expert interview (no quote permission obtained) that it is not the case that the City of Hamburg particularly focuses on free-floating CS. Generally though, more incentives are provided for this form of CS. For instance, from autumn 2017 onwards, as part of the densification of the electro mobility charging infrastructure with a focus on CS areas, specific support in form of public parking spaces will be given for free-floating CS. In addition, the city offers free-floating CSOs the opportunity to automatically pay parking fees (Bürgerschaft der FHH 2013). Thus, it seems that an increased support is given to free floating CS, although its positive effects are not yet proven, as compared to station-based CS (Bürgerschaft der FHH 2013). Station-based CS, in comparison, generally plays only a minor role with fewer users and is in need of public support in form of parking spaces (Henrichs 2016).

4.1.2 Electro mobility in carsharing

In Hamburg, CS is perceived as an important building block to promote electro mobility. The city is therefore aiming for a substantial conversion of CS fleets to become electric (BUE Hamburg 2017). However, as of yet, in station-based CS only a very small number of cars are BEVs (Landeshauptstadt München 2015). In free-floating CS, *car2go* does not offer a single BEV, while *DriveNow* employs a fleet that consists of only 15% of BEVs (Osterhage 2017). As a result, only around 3% of the total number of CS vehicles in Hamburg are BEVs. In other cities, significantly more vehicles are electric, such as Stuttgart with 100% BEVs in CS (Landeshauptstadt München 2015). Here, *car2go* has been offering purely electric cars (500 BEVs) since 2013. Besides that, it offers a total of 350 BEVs in Amsterdam and *DriveNow* offers 400 BEVs in Copenhagen (Nahverkehr Hamburg 2017). To change the given situation in Hamburg, bilateral agreements between the city and industry providers, such as *Volkswagen*, *BMW* and *Mercedes* were initiated in 2017. These focus on testing new and innovative business models or mobility solutions with the objective to expand electro mobility, particularly in the area of CS (BUE Hamburg 2017). Yet, in comparison to other cities, the city is setting these agreements up only with a focus on free-floating CS (and not station-based CS) and rather late (Nahverkehr Hamburg 2017).

4.1.3 Parking space issues

The acquisition of suitable parking space in urban areas represents the biggest challenge for CS in Germany (Lindloff et al. 2014; Loose 2014). Also in Hamburg, the capacity limits of parking spaces for CS are reached in certain neighborhoods (Spörrle 2017). This is means that the densification of the inner-city areas makes it increasingly difficult to rent private parking spaces for the CSOs (Bürgerschaft der FHH 2013). This leads them to demand more parking spaces in public areas (Spörrle 2017). The need for an optimization of parking spaces for CS is also mentioned as an important aspect in the city's climate plan (Bürgerschaft der FHH 2015a) and became strongly apparent in the expert interviews (Redlich, Prill, Dierks (all 2017), among others). It was argued that allocating space for CS would increase the reliability of the CS system and further open it up to the general public. This is confirmed by the CSO online survey, in which infrastructural support is considered important for 67% of the respondents. However, national regulations have not yet been passed for CS promotion, and a strategy to support CS hardly exists in Germany (Lindloff et al. 2014). The current legislation does not allow to privilege specific purposes, such as parking spaces for CS, in public space (Parzinger et al. 2016; BBSR 2014). According to some expert interviews (no quote permission obtained), the local authorities are responsible to increase the infrastructural support, indicate how much space is provided for CS, and provide clearer rules and criteria for parking spaces in general. Political actors could through specific policies make CS a more established mode of transportation (Dentel-Post 2012; Lindloff et al. 2014). Doing so would entail the need to articulate the expected public benefits for providing public street space for CS and to determine the allocation of specific parking spaces (Dentel-Post 2012).

As of yet, there exists almost exclusively the possibility that local authorities grant parking rights in form of “special uses” in particular cases (Lindloff et al. 2014). Generally though, one has to go through specific administrative processes in order to identify parking spaces for CS. Furthermore, these parking spaces are said to be not truly legally secure, as legal statuses have to be interpreted creatively (Landeshauptstadt München 2015). For many authorities this is not secure enough and they act reserved. The districts in Hamburg are very cautious and oftentimes decide against this measure (Spörrle 2017). This might also be related to the fact that approval procedures for “special uses” are cumbersome:

> *“As soon as you go into public space, it often becomes difficult, as approval procedures regularly take several months. This is since decisions can only be made by weighing up the interests of many different actors” (Baum. Interview 02.05.2017).*

The soon to be given adoption of the ‘Carsharing Act’ (bcs 2017b) will improve the situation, as it will enable the implementation of measures to increase the use of CS (Loose 2016). Hereby, on the basis of a competitive selection process, parking privileges will be granted to CSOs, such as reserved parking spaces and the exemption of parking fees. In this process, aspects such as the integration with public transport and climate protection are taken into account before issuing permits (Die Bundesregierung n.d.). Moreover, despite the fact that no CS legislation as of yet exists, the City of Hamburg follows the intention to make parking spaces for CS available to a notable extent as the first German city by 2019 (Osterhage 2017). In addition, it was mentioned in the expert interviews (Engstfeld, Redlich, Dierks (all 2017), among others) that it is necessary to create visibility for CS. Nowadays, most vehicles – even in

new housing districts such as the 'HafenCity' in Hamburg – are parked in underground garages. It was argued that the city should help to improve the given situation in form of specific signs for underground parking (or parking spaces above ground, as mentioned before).

4.2 Electro mobility

The City of Hamburg wants to make good use of the potentials of more efficient and innovative propulsion technologies in all areas of transport. In that regard, electro mobility is seen as an opportunity to make the traffic more environmentally- and climate-friendly. Its environmental and climate benefits come mostly in the form of a reduction of CO2 emissions. For Hamburg, the reduction of CO2 is the most important reason for its promotion, with traffic noise and air pollution playing other major factors (Bürgerschaft der FHH 2017). To deal with the latter is even required, owing to legal necessities in the form of EU guidelines on air pollution and noise, and the fact that air pollution norms have over the last couple of years been exceeded (Färber et al. 2014). A decrease in traffic noise possibly results in positive effects for the residential quality (NPE 2014; Hüttl 2010). Moreover, electro mobility can contribute to an independence from fossil fuels (Rothfuss et al. 2012; Beyer et al. 2013) and is seen as an essential part of the expansion of the energy transition in Germany. By integrating BEVs into the grid, smart energy concepts can be developed to counteract and compensate for fluctuation effects of energy resources (as the energy can be stored in the vehicles' batteries, if needed) (NPE 2014). Hamburg has generally made a political commitment to support electro mobility:

> *"There exists a strong political backing. A stringent way with a long-term strategy has been followed, although electro mobility does not represent a sovereign task, and other strategic approaches to sustainability issues could have been taken" (Paulsen. Interview 04.05.2017).*

The city has made various efforts for many years to help electro mobility achieve a breakthrough. In general, electro mobility is increasingly playing a key role not only in traffic, but also in urban development and the reorganization of the energy infrastructure (BUE Hamburg 2017). Generally, the city relies on a "three-pillar strategy" which follows the intention to integrate BEVs into:

- Commercial transport (as commercial vehicles have a high demand potential and mileage);
- Urban development and housing construction, and the setting up of charging infrastructure;
- CS and intermodal concepts (Bürgerschaft der FHH 2013).

4.2.1 Tools for electro mobility promotion

In 2009, Hamburg was selected as one of the four 'electro mobility model regions' and received funding from the *BMVBS* and *BMUB*. This was coupled with the objective to practically test BEVs, as well as set up the necessary charging infrastructure (Bürgerschaft der FHH 2013). As a result, various projects were implemented and the topic studied comprehensively by many actors (BSU Hamburg 2013). The activities in the first phase (2009 until 2011) focused on the identification of target groups for the use of BEVs and the development of charging infrastructure. In addition, agreements of cooperation with OEMs were initiated. All this was done by setting up a comprehensive program. In the second phase (from 2012 until 2017) the focus was put on different key areas of action, including on the development

and implementation of concepts for the systematic integration of electro mobility in residential neighborhoods (Bürgerschaft der FHH 2013).

The city's employed tools for promoting electro mobility include establishing publicly accessible charging infrastructure, the cooperation with OEMs and financial support for electro mobility projects. Furthermore, the city invests as a role model in its own fleets (Rah 2017). Electro mobility plays a prominent role, among others, in the 'Environmental program 2012-2015', the 'Clean air plan 2017', the 'Noise action plan 2013' and the 'Hamburg climate plan 2015' (BUE Hamburg 2017). In order to further promote the topic, the 'Master plan charging infrastructure' was published in 2014 (Ajanovic and Haas 2016). It acts as a central planning and implementation instrument for the needs-based expansion of electro mobility and in particular its infrastructure (see Figure 6) (Bürgerschaft der FHH 2014). For a further development of electro mobility, the *hySolutions GmbH* was established as a project and competence head office (Rothfuss et al. 2012), and a responsible person employed at the *BWVI*. Moreover, the city changed the regulation of parking fees in 2015 and became the first German city to adopt the 'EmoG' (Bürgerschaft der FHH 2015a). The latter privileges BEVs to be parked free of charge within the maximum parking time at charging stations (BUE Hamburg 2017).

Figure 6: Electro mobility charging station in Hamburg
Source: hamburg.de GmbH & Co. KG n.d.

4.2.2 Number of electric vehicles

In 2013, the city announced the target to have 5,000 BEVs in the city by 2016 (Bürgerschaft der FHH 2013). However, as this target would not be achieved, it was already lowered in 2015 to 3,000 BEVs by 2017 (Bürgerschaft der FHH 2015a). But even this goal was not achieved, since the numbers amounted to a total of only 2,500 BEVs at the beginning of 2017. 1,250 of these belonged to corporate fleets, 550 were employed by the city itself, 100 were used in electric CS or the taxi sector, and 600 were privately used (Rah 2017). The city acknowledges that the total number is rather low, and represents only 0.4% of the whole car fleet in the city (Bürgerschaft der FHH 2017). This is comparable to German developments on a national scale. When compared to the total car stock, the number of BEVs in Germany is very low. In 2016 the number of BEVs amounted to a total of 30,000 (in 2012 ca. 4,500); which represent a market share of only 0.04% (BMVI 2017). It is argued that current developments of market penetration do not yet live up to the expectations (Truffer et al. 2017). Also, it is assumed that

a rapid market development will not happen until 2020 in Germany (Clausnitzer 2015). Thereafter, BEVs are expected to become an important component in the transport system (Peters et al. 2012).

4.2.3 Charging infrastructure issues

For Hamburg, as an 'electro mobility model region', it is important to gradually set up the charging infrastructure (BUE Hamburg 2017). It became apparent in one expert interview (no quote permission obtained) that it was, in comparison to other cities, the exception to start building infrastructure early on. Doing so was a result of the fact that it was argued that BEVs would not be driven in the city without the necessary accompanying charging infrastructure. The construction should send out important signals to both supply-side actors, such as CSOs, and the demand-side of potential users (BUE Hamburg 2017). Currently, only the city (and no market actors) is developing the charging infrastructure. This should be seen critically:

> *"It is necessary to critically highlight that the public sector is driving the expansion of electro mobility infrastructure at the expense of the taxpayers" (Redlich. Interview 20.04.2017).*

In the expert interviews, it was mentioned that the implementation of the charging infrastructure by the city is necessary, as the market actors are not willing to engage themselves. This is because it is not yet economically viable to set up the charging infrastructure due to the low amount of BEVs and the low infrastructure utilization. However, it is said that the market actors – particularly OEMs or energy supply actors – should become involved as well. It is generally expected that these will in the near future probably become engaged to a higher degree:

> *"It is to be expected that the city will eventually withdraw from the active expansion of charging infrastructure and the further run-up will be designed by private market participants. Hence, the current situation represents a transitional situation" (Paulsen. Interview 04.05.2017).*

In 2016, around 6,500 charging points existed in Germany (BMVI 2017). Yet, further expansion has slowed down since 2012 due to low utilization (NPE 2015). This is since the latter makes an expansion of the charging infrastructure not yet economically viable (Bozem et al. 2013); a fact that is similar in Hamburg, as mentioned before. In 2017, 350 charging points were deployed in the city (Rah 2017). These offer electricity from 100% renewable sources, a non-discriminatory access and an easy-to-use access model which is exemplary in Germany (BUE Hamburg 2017). For the fall of 2017 there is a target of 600 publicly accessible charging points in the city. From then onwards, a densification of a further 400 charging points in CS areas is to be achieved (Rah 2017). In the expert interviews it was mentioned that the city is on the right path concerning the charging station implementation, but should officially be further ahead (no quote permission obtained). Moreover, despite all efforts, there are not yet enough exisiting charging stations. The latter is also criticized in the online survey of the CSOs. For 78% of the respondents, too little charging infrastructure is provided. In 2017, other German cities, such as Berlin and Stuttgart were further ahead than Hamburg (536 and 375 charging points, respectively). When these absolute numbers are broken down to the electric charging points every 10 km², Stuttgart offers 18 and Copenhagen 70. In Hamburg there are only 4, as visible in Figure 7 (Nahverkehr Hamburg 2017).

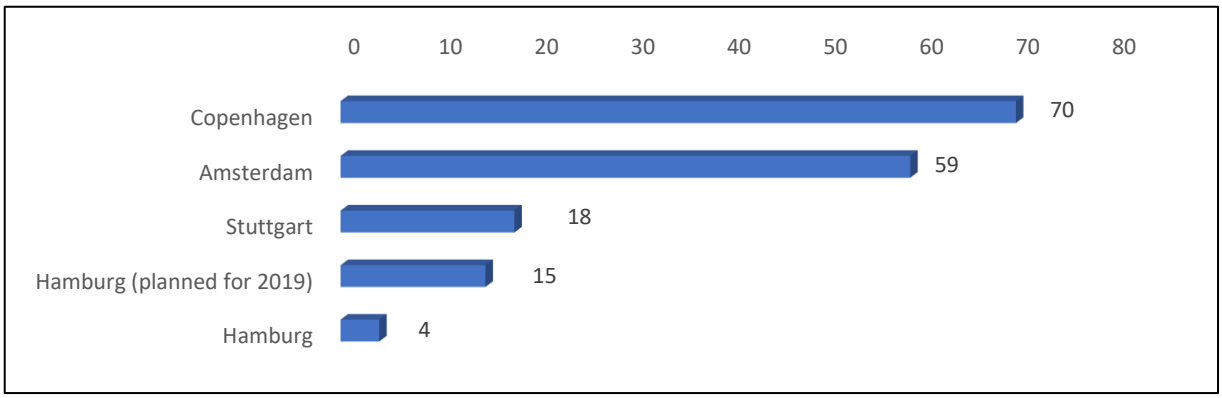


Figure 7: Public charging infrastructure for BEVs per 10km² urban area in European cities
Source: Nahverkehr Hamburg 2017

To develop the charging infrastructure in Hamburg, a criteria-based matrix is used, which enables the evaluation of locations according to various factors. They particularly represent the proximity to public transport, intermodality, the existence of businesses, the local supply infrastructure, and costs. After the locations are evaluated, the city's districts are subsequently contacted, as they have to agree with these locations. Due to to approval procedures for "special uses", this oftentimes proved to be difficult in the past – similar to CS. The majority of the districts did not approve the locations as a result of local space issues. This resulted, according to one expert interview (no quote permission obtained), in 2016 in only a 30% approval rate of the location proposals, even though infrastructure would have made sense. However, this has in 2017 improved to a large degree, as more districts increasingly see it as an important task. As a result, the processes of location approvals are oftentimes successful and rather fast. Nevertheless, the city is generally limited by the criteria of the evaluation for potential locations, costs and the decisions of the districts. Due to this fact, in addition to public spaces, private areas such as petrol stations are increasingly being targeted. Generally though, it appears that the development of the private charging infrastructure is way more important than the public one, since most BEVs are charged over night in private parking places or at the workplace (Nykvist and Nilsson 2015).

4.2.4 National level influencing factors

On a national level, several challenges are associated with the introduction of electro mobility, which hinder its development and influence its successful application (Langer 2014). These are not only of a technical but to large degree of political and organizational nature (Hüttl 2010; Steinhilber et al. 2013). These political framework conditions have an influence on the city. In the expert interviews, it was criticized that rather unclear and insufficient signals in political support for electro mobility are provided. In particular, a perceived lack of policy strategies, instruments and clear guidelines, e. g. for OEMs, are said to result in a weak signal and uncertainty for industry and consumers. In addition, it is argued that it will not suffice to only set goals:

> *"We talk about 1 million cars; the question is whether the conditions are also created for it to work. The main initiator must be the state" (Brandt and Menzel. Interview 03.05.2017).*

> *"Electro mobility needs a further impetus in Germany, which goes beyond CS, in order to be accepted" (Memmler. Interview 21.04.2017).*

Besides, a rather low commitment and ambivalent signals of the federal government, further currently perceived barriers represent OEMs' commitments to the ICE technology – which makes them not focus on BEVs – and the lack of proactive energy supply companies to implement charging infrastructure (Peters and Dütschke 2010; Aichinger et al. 2014).

4.3 New mobility forms in urban neighborhoods

The population growth of recent years and a further expected growth lead to a high demand for new housing in Hamburg. Resulting from this, developments in the last couple of years have largely been steered by a local urban development agenda to create 6,000 new apartments each year over the next couple of years. This on-going development is putting further pressure on urban resources, as the city grows through densification. As a result, the city wants to manage the urban spatial development through more efficient land use. This should increase the qualities of public spaces (Bürgerschaft der FHH 2013) and provides the city with good conditions to implement sustainable and innovative mobility concepts in urban neighborhoods (see Figure 8) (Bürgerschaft der FHH 2015a). In relation to this, the focus of policy considerations in Hamburg in recent years has shifted away from individual buildings to the "system neighborhood" and to a more holistic perspective. Here, an intelligent and sustainable combination of housing and mobility is to be achieved:

> *"It is imperative that urban and transport development are not perceived separately. Nowadays, an integrated planning is pivotal that allows for affordable housing, livable neighborhoods and environmentally-friendly mobility services" (Ferber. Interview 28.04.2017)*

Figure 8: e-CS employed in an urban residential neighborhood in Hamburg
Source: ecomento UG

In general, the residential location plays a key role in terms of everyday mobility, as more than 80% of all routes in Germany start and end here (VCD e.V. 2017). Hence, what kind of mobility offers are available here has a significant impact on citizens' mobility behavior (Parzinger et al. 2016). Particularly, access to environmentally-friendly means of transport promotes more automobile independent mobility (VCD e.V. 2017). However, the use of such modes of transport is only possible if they are easily accessible and without barriers (hySOLUTIONS GmbH 2012). CS is increasingly becoming an important aspect in the context of integrated urban planning (Hildermeier and Villareal 2014). Offering CS in urban neighborhoods generally leads to "win-win"- situations for several actors (Stiewe and Bäumer 2013). For the local authorities it is possible to achieve environmental goals, residents experience less

car traffic, CSOs can gain new customers and the housing industry can save costs due to fewer built parking spaces (Autobild 2012). In addition, the existing residential areas or new urban developments can be made more attractive by offering CS (Stiewe and Bäumer 2013; Aichinger et al. 2014). Housing companies are important, as they can provide parking spaces and make marketing (Loose 2014).

The participation of the housing industry can also support the development of electro mobility. In total, ten million parking spaces in Germany belong to housing companies and cooperatives (Clausnitzer et al. 2012). These could function as electro mobility pounds, equipped with charging infrastructure (Aichinger et al. 2014). Moreover, the housing industry is soon to be legally required to think about electro mobility concepts (Augenstein 2015). This is because of the 'Energy Efficiency Guideline' of the EU, which makes charging stations for at least 1 out of 10 parking spaces for single and multi-family houses mandatory from 2023 onwards (Claussen 2017). The integration of charging infrastructure and the interface between vehicles and buildings leads to spatial, technical, energetic, economical and organizational issues (Schatzinger and Rose 2013; Clausnitzer et al. 2012). Besides that, numerous fields of law, such as tax, construction, energy and data protection laws are affected. These fields of law are not yet fully attuned to electro mobility (Söchtig 2017). Ongoing legislative initiatives with the aim to improve the given legal conditions are currently stuck (Harendt and Mayer 2015). As the topic of electro mobility is new for the housing sector and regulatory necessities do not yet exist, companies and cooperatives can await developments or participate in pilot projects (Clausnitzer et al. 2012).

It is said that local authorities should exert a formative influence on the general conditions of local mobility services in urban neighborhoods (Knie 2016). To achieve this, a comprehensive overall concept is deemed advantageous that allows to interlink various sustainable mobility options (Kurth 2015). Based on this, it is envisaged by the City of HAmburg that supplementary mobility offers from private third parties, like CS from CSOs, should be implemented in neighborhood development in cooperation with the housing industry to a larger degree (Bürgerschaft der FHH 2013). However, in the expert interviews it was viewed in a critical light that two economic sectors – the housing and mobility sector – that should actually work together on a cooperative basis, are not doing so. As a result, they are on an orderly basis imposed to work together and carry out specific measures:

> *"The fact that the mobility and housing sectors – as two potential business partners – are not cooperationg to a sufficient degree is one of the reasons that the government is intervening in this area through regulatory measures" (Paulsen. Interview 04.05.2017).*

4.3.1 Existing measures to promote sustainable mobility concepts

One policy measure is a reduction in parking requirements, which currently encourage greater car ownership. The interlinkage of lower parking requirements with policies to encourage sustainable ownership alternatives is particularly useful (Dentel-Post 2012). With regard to this, the adaptation of the parking policy in Hamburg became more flexible, which lead to the abolition of the previously applicable parking space requirement of 0.6 places per residential unit (InnoZ GmbH n.d.). This measure is currently not used by many other German authorities (bcs n.d.). Besides that, the establishment of building and land use plans is a municipal obligatory task, in which the interests of climate protection are to be taken into account. This instrument allows to establish sustainable

mobility concepts in urban planning processes on a legal basis (Aichinger et al. 2014). Concerning this, the city sees it as a pivotal task of integrated urban and transport planning to create mobility services at an early stage in the planning phases of the developments of neighborhoods (Bürgerschaft der FHH 2013). This is also considered as essential by the experts (Kulus, Lindlahr, Ferber (all 2017)). To achieve this, the city stipulates regulations for planning and approval processes and sets specific framework conditions for the development of neighborhoods (Bürgerschaft der FHH 2017). This is done by means of regulatory-planning instruments, such as land-use planning, the urban development contract, or concept tendering. In this regard, it is possible to specify certain requirements in advance, upon which the allocation of land depends. This makes it obligatory for project developers to deal with new and sustainable mobility concepts in urban developments (Knie 2016; Grausam et al. 2014). In that way, to win a tender, real estate developers have to submit meaningful and sustainable mobility concepts (Müller 2017). However, the usage of such regulative instruments is seen in an ambivalent light. The question arises as to whether a rethinking can actually be enforced on such a legal basis:

> *"If regulatory benchmarks are set by law to an overly large extent, it could create a lot of resistance. Regulatory stimulus should be the last resort" (Memmler. Interview 21.04.2017).*

Moreover, regarding the implementation of e-CS in urban neighborhoods, legal issues are still partly unsolved, including e.g. the accessibility of underground garages. In the interviews it was stated that many housing companies rely on legal conditions (Memmler, Prill (both 2017)). This means that as long as particular issues are not regulated by law, there are no or rather few investments and a low interest.

4.3.2 Examples of the application of sustainable mobility concepts

Examples of integrating sustainable mobility concepts into urban developments in Hamburg are the 'Mitte-Altona' and the 'HafenCity' districts. In 'Mitte-Altona', the objective was to develop a future- and needs-oriented neighborhood and contribute to the avoidance of vehicle use by strengthening the environmentally-friendly modes of transport. In total, only 0.4 parking spaces per apartment exist. Out of these, 1/3 have to be used for CS (Bürgerschaft der FHH 2013). In the 'HafenCity', a neighborhood-based e-CS concept is to be developed. In addition, conditions are set in the tendering process for the equipment of buildings for electro mobility at the beginning of the planning phase (Schatzinger and Rose 2013). In total, 1/3 of the parking spaces must be equipped with charging infrastructures in all underground garages. Besides that, the developers have to become involved in setting up a concept for e-CS (InnoZ GmbH n.d.). In the expert interviews, these two urban districts, among others, are praised for contributing to an increase in sustainable mobility concepts. Yet, it is pointed out that the procedures in the districts are oftentimes not uniform, which is particularly problematic for the CSOs:

> *"It is necessary to harmonize the different concepts for neighborhood development. If it is dissimilar in the neighborhoods, there are no comparable circumstances for the CSOs. A uniform definition is important" (Lohmann. Interview 25.04.2017).*

Furthermore, it is criticized that the implementation of sustainable mobility concepts is, despite these legal stipulations, currently still difficult, as a clear commitment to sustainable mobility concepts, is missing by the city.

5. Cognitive-normative institutions and bounded rationality in Hamburg

This chapter discusses the cognitive and normative institutions of neo-institutional theory, which influence the attitudes and behavior of the housing sector and the CSOs about e-CS in urban neighborhoods in Hamburg. In addition, thi chapter addresses the boundedly rational interests of their involvement in e-CS and their willingness to provide resources for its advancement. Further insight is supplemented by the results of the two online surveys when these are seen as specifically meaningful. This chapter includes answers for research questions 1 and 3.

5.1 Boundedly rational interests, cognitive routines and normative aspects

In the following two sub-chapters, the boundedly rational (mostly financial) interest of CSOs and housing industry in becoming involved in the topic of e-CS in urban neighborhoods are combined with cognitive routines and normative role responsibility aspects. This is done because the combination of these three aspects is more meaningful (in comparison to a sole focus) and allows one to see if and to what degree both groups become involved in the topic of e-CS. In order to better distinguish CSOs and the housing industry, both are separated into two sub-chapters.

In general, every neighborhood development involves different circumstances and requirements that have to be taken into account. This entails a high level of coordination and detailed planning, predominantly when electro mobility is involved. To achieve that, it needs specific motivated actors at the local level. Concerning this, in particular the commitment and collaborations of the supply-side stakeholders, i.e. the housing industry and CSOs, represent essential prerequisites for implementing e-CS:

> *"It is essential that CSOs and the housing industry work together and learn to understand each others needs" (Prill. Interview 03.05.2017).*

5.1.1 Carsharing organizations (CSOs)

CSOs are the main drivers of CS. It is essential for them to find attractive niches in the competitive market that is the City of Hamburg (Henrichs 2016). The combination of the urban living environment and CS represents such a niche. Here, different CSOs are trying to settle, even though it does not necessarily represent their core business area:

> *"For CSOs, e-CS in urban neghborhoods represents a new business field, in which they would like to engage. Yet, one needs to take into consideration that housing is not their core business" (Prill. Interview 03.05.2017).*

Generally though, their business model and cognitive routine of offering CS is not yet tailored specifically to urban neighborhoods. However, they become open to electro mobility, as they perceive this mobility form to be of economical importance in the future:

> *"The earlier we deal with electro mobility in CS, the more [economic] advantages we will have long-term. Due to this fact, we extend our fleet step by step to electro mobility" (Töllner. Interview 18.04.2017).*

As of yet, the CSOs in Hamburg offer still mainly ICE vehicles. The online survey of the CSOs provides similar results. Whereas only 12% of the respondents stated that more than 20% of their fleet consists of BEVs, 44% stated that they offer very few (1-19%) and 44% stated that they do not offer BEVs at all. However, as visible in Figure 9, 67% of the respondents that do not offer BEVs mentioned they have a "very high" or "high" interest to increase the share of BEVs. For those already offering BEVs, the share amounts to 50%. This shows that BEVs will in the future possibly be used to a larger degree.

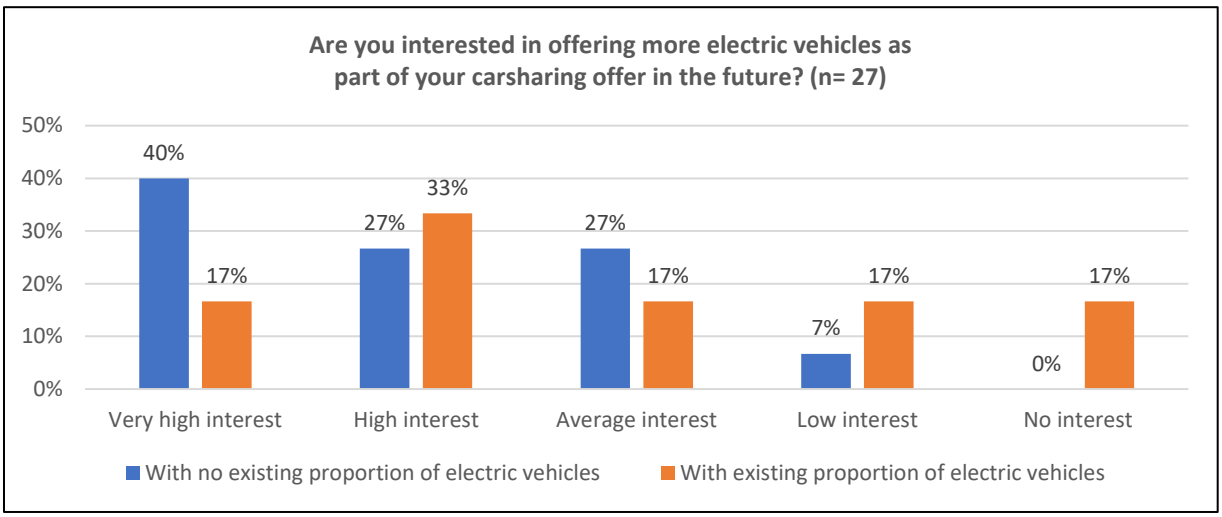


Figure 9: Interest of CSOs in offering BEVs
Source: Own representation

Since the costs of BEVs form a hurdle, CSOs stated there should be more financial incentives to increase the adoption of BEVs in their fleets. The online survey also supports this to some degree, as 63% of the respondents indicated that financial barriers for BEVs are too high. In addition, the CSOs stated in the expert interviews (Redlich, Töllner, Dierks (all 2017)) that the user characteristics, neighborhood structures and the existence of public transport are essential in determining the utilization of CS. The most important user characteristics are a high population density and target groups with CS affinity, including commercial customers. The noteworthy neighborhood structures are the proximity to the city center, good local supply structures, and sufficient public transport services. Moreover, CSOs in Hamburg want the housing industry to engage more, at least in the initial stage of the CS development, particularly when it comes to their financial involvement. For the CSOs, the consideration of all of these factors is important in order to achieve a – based on their cognitive routines – long-term CS offer:

> *"It is our objective to offer mobility in the long term, which means that the offer should exist possibly for a couple of years. That is an important concern for us" (Töllner. Interview 18.04.2017).*

In addition to these prerequisites, the experts oftentimes mentioned that the visibility of the CS offer is an essential boundedly rational factor for their involvement. They particularly pointed out that above-ground pitches have a higher occupancy than underground garages:

> *"Visibility is central for an innovation in the pioneering phase, for which acceptance needs to be created. This is only possible in the visible public space and not in underground garages" (Engstfeld. Interview 20.04.2017).*

5.1.2 Housing companies and cooperatives

It is generally necessary to separate housing companies and housing cooperatives, as both possess different attitudes towards mobility concepts. Generally though, the housing sector in Hamburg is showing a very small but somewhat increasing interest in implementing sustainable mobility concepts because they expect these to become of significance in urban neighborhoods in the near future:

> *"Sustainable mobility concepts will become very important assets of a modern residential neighborhood. It can be assumed that it will be more difficult to lease out apartments without such a mobility concept in the near future" (Söchtig. Interview 09.05.2017).*

However, as sustainable mobility concepts represent a new topic for the housing sector, developments are slow and at a trial stage. Generally, many housing companies do not yet understand the importance of implementing sustainable mobility concepts. Hence, only a few housing companies are actively engaged, particularly in offering BEVs or charging infrastructure. Moreover, other issues are generally of greater importance for them, as compared to the provision of mobility:

> *"They have completely different issues. Mobility and particularly electro mobility represent only minor issues" (Redlich. Interview 20.04.2017).*

> *"The business model of the housing industry is concerned with apartment rental services and not so much with providing mobility options for their customers" (Prill. Interview 03.05.2017).*

The online survey of the housing cooperatives confirms this. In response to the question of why housing cooperatives do not (yet) offer CS, 72% of the respondents mentioned that mobility does not represent a core area of their business model. As a result, housing companies generally do not yet see the provision of mobility as an issue they need to advance. This results in a lack of motivation and requires certain circumstances to change:

> *"The market-driven housing companies know exactly what the criteria are for selling or renting" (Redlich. Interview 20.04.2017).*

> *"Mobility concepts are more of a sales and an image factor than an emotionalized story. As the topic is currently mostly not on their agenda, it is necessary to improve either their emotional acceptance or the financial situation" (Engstfeld. Interview 20.04.2017).*

Moreover, time-varying differences in innovation cycles exist between vehicles and buildings which amount to several years for vehicles (and the accompanying charging infrastructure) and many decades for buildings. These time-varying differences influence the cognitive perceptions and routines of the actors in each sector:

> *"Real estate can only be developed slowly, usually only in decades, since investments in building fabric only amortize in such time units" (Söchtig. Interview 09.05.2017).*

> *"Real estate developers in general have a long-term mindset. They do not (usually) have to implement new trends every few months. For us as mobility providers, services represent our*

> *core business. As service companies of smaller size, we have a different mentality and can and must act faster when new trends and innovations arise" (Dierks. Interview 25.04.2017).*

Generally, the existing working habits could prevent actors from recognizing new opportunities (Mukhtar-Landgren et al. 2016). In addition, it was apparent in the interviews that the housing industry can generally not afford to deliver many other services besides its core business (e.g. Memmler (2017)).

Due to a more sustainable attitude, housing cooperatives (in comparison to housing companies) are rather open towards sustainable mobility concepts, such as e-CS:

> *"Because of housing cooperatives' common good orientation, they are generally more willing to deal with issues of sustainability and environmental protection – including e-CS – than other actors in the housing industry" (Kulus. Interview 10.05.2017).*

Moreover, they possess a large circle of members and can reach a broad mass of people. In Hamburg, they are mostly organized in the *VNW e.V.* It is said that the cooperatives in this association become involved in the lives of their members in different ways:

> *"Our housing companies [of the VNW e.V.] are major players in the neighborhoods. On the basis of social responsibility they deal with all areas of life" (Memmler. Interview 21.04.2017).*

Generally, in the last few years the topics of mobility and CS have to some degree moved into the focus of housing cooperatives. As a result, some cooperatives of the *VNW e.V.* are willing to move forward with pilot projects and test mobility concepts:

> *"Housing cooperatives are willing to carry out pilot projects and test new concepts that sometimes push them to the limits of economic efficiency" (Memmler. Interview 21.04.2017).*

The interviewed housing cooperatives are also willing to actively promote electro mobility and/or CS, and internally use BEVs for their own employees or the Board of Directors. However, in comparison, only 17% of the respondents in the online survey indicated that they currently offer CS. This share is increased to 32% if more than 200,000 inhabitants are living in the city, and to 25% if their members' attitude towards CS is perceived to be "rather open" or "very open", as visible in Figure 10:

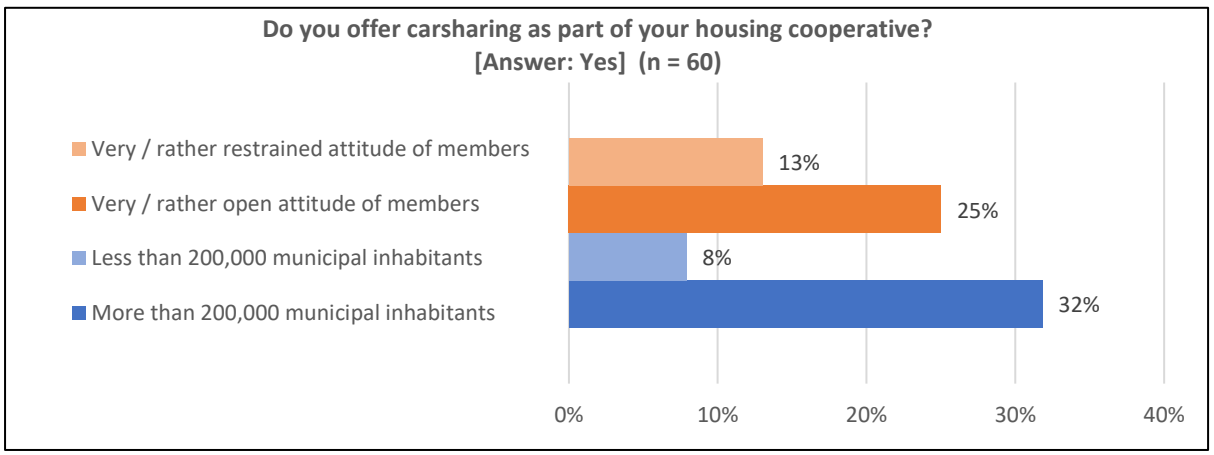


Figure 10: Existing CS offer in housing cooperatives
Source: Own representation

The *VNW e.V.* (2017) mentions that CS and electro mobility should particularly be promoted to protect the environment and improve the residential quality of the neighborhoods. In the online survey of the housing cooperatives, the respondents indicated that the reasons to offer CS are indeed the support of CS due to environmental reasons, such as less vehicle emissions (for 53% of the respondents), and the reduction of traffic and space issues (i.e. improvements of residential quality) (73%). These are perceived as more important, when compared to the relevance of an improved marketing of the buildings (29%) and the testing of new business models (31%).

It became apparent in the interviews that it is important for the housing cooperatives to develop a strategy focused both on the existing building stock and new buildings in order to be able to successfully offer (e-)CS. However, they do not want to be seen as the responsible actor to advance e-CS. The burden to be the "engine" for the development of electro mobility should be put on the national government and for the development of CS on the CSOs:

> *"The state must not make us responsible for the switch to electro mobility; we can go along, but the main initiator must be the state" (Brandt and Menzel. Interview 03.05.2017).*

> *"Our housing cooperative is not the one that pushes on a permanent basis. It has to be the CSOs. As long as they are not the engine and do not want to be, it will not work" (Lohmann. Interview 25.04.2017).*

5.2 Cognitive perceptions of users' preferences and behavior

In this sub-chapter, the cognitive perceptions of the users' preferences and behavior is addressed, as it has been a key issue in light of the expert interviews. Users are seen as a an important aspect for the successful implementation and expanding of CS and electro mobility. Hence, CSOs focus on targeting these appropriately:

> *"When it comes to electro mobility, you have to look at the customers. They will decide if it becomes successful. Also, one has to be aware of the circumstances under which CS works; these are people with specific mobility needs and how to satisfy them. Everything else represents marginal topics" (Redlich. Interview 20.04.2017).*

In the expert interviews, the CSOs stated that societal attitudes and values of the population are changing due to an increasing concern for the environment and sustainability. These changes might give rise to a growing need for environmentaly-friendly mobility concepts:

> *"As a CSO, we notice that the mobility behavior is changing and mobility is perceived differently by people, as compared to earlier times" (Töllner. Interview 18.04.2017).*

> *"Environmental awareness contributes to the fact that new mobility concepts are accepted to a greater extent than has been the case in the past" (Appeldorn. Interview 09.05.2017).*

Related to this, it was argued that a growing number of people show a more pragmatic attitude towards car ownership. This leads to a decrease in the importance of the car as a status symbol and to a more intermodal mobility behavior.

The public opinion of CS has improved in recent years and it is nowadays perceived as an alternative mobility option. The *Institute for Applied Social Sciences* (infas 2012) has calculated that one out of four Hamburg citizens is potentially open to make use of CS. However, CS is overall regularly used by only 3% of the citizens (Färber et al. 2014). A significant difference exists between the two types of CS. Free-floating CS is of an expectionally high significance in terms of usage and is expected to grow strongly in the near future (Bürgerschaft der FHH 2013):

> *"Free-floating CS works particularly well in Hamburg. The popularity is higher than at any other location in Germany" (Lindlahr. Interview 24.04.2017).*

Whereas people state they could imagine making use of station-based CS, the actual usage is low. As most housing companies and cooperatives know about free-floating CS, this leads to the question of why station-based CS should be offered at all:

> *"If free-floating is already sufficient and station-based CS represents only a niche for a rather small kind of mobility behavior, then why offer it at all?" (Lohmann. Interview 25.04.2017).*

The results of the online survey of the housing cooperatives also indicate that the acceptance for station-based CS is rather low. 73% of the respondents indicated that their members have a rather restrained attitude concerning station-based CS. This attitude has consequences for the provision of CS by the housing cooperatives, as visible in Figure 11. Whereas 67% of the respondents said they could imagine offering CS if the attitude of the members was perceived to be "very open" or "rather open", only 48% indicated they could imagine this if the attitude was perceived to be "very restrained" or "rather restrained". In addition, 94% of the respondents perceive the future implementation of e-CS in housing cooperatives as "very interesting" or "interesting" if the attitude of the members is "very open" or "rather open". If the attitude of members is "very restrained" or "rather restrained", this number is reduced to 61%.

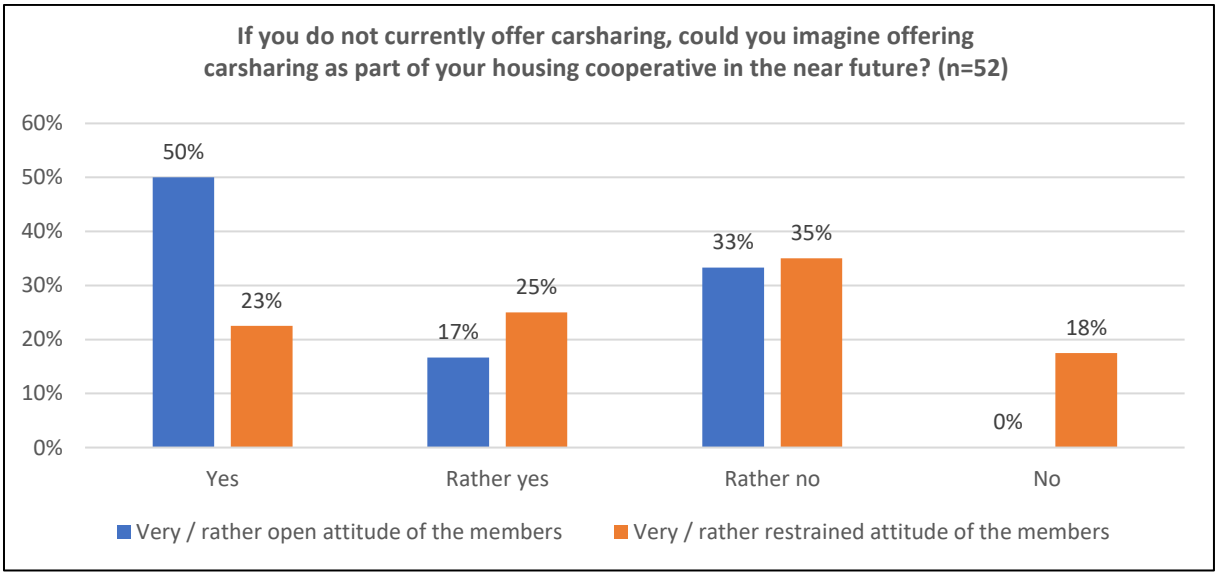


Figure 11: Perception about the possiblity to offer CS in the future in housing cooperatives
Source: Own representation

The rather restrained attitude of the copperatives' members towards CS might also be related to the fact that mobility represents only one of several important topics for them:

> *"For tenants, mobility represents only one issue out of several, which are of importance. In comparison to others, such as the price or the location, mobility can be perceived as only of minor importance" (Redlich. Interview 20.04.2017).*

In the expert interviews, it was obvious that reservations and fears exist in the public concerning electro mobility. This leads to reluctances to deal with the topic and a low actual usage of BEVs and charging stations. Generally, electro mobility is perceived by the public as immature regarding technological and economical aspects:

> *"Currently, people are associating various unsolved issues with electro mobility that do not (yet) outweigh its potential benefits" (Memmler. Interview 21.04.2017).*

> *"People relate electro mobility to higher costs, less flexibility in comparison to the conventional car and they give specifically rise to the fear of range, resulting from an insufficient expansion of charging stations" (Brandt and Menzel. Interview 03.05.2017).*

> *"People perceive of electro mobility as a political playfield and not necessarily as an environmental-friendly alternative for oil" (Redlich. Interview 20.04.2017).*

Furthermore, it was criticized in the expert interviews that still a high number of ICEs exist in Hamburg and that these could not be replaced within a short period of time:

> *"It represents a big issue that today people in Hamburg drive cars to a greater extent than has been in the past" (Ferber. Interview 28.04.2017).*

> *"From one day to the other you cannot make people abandon the car" (Kulus. Interview 10.05.2017).*

The fact that the number of cars is perceived to be very high in specific neighborhoods in the city might lead housing cooperatives to consider an involvement in (e-)CS as not being worthwhile:

> *"In the neighborhoods where many people drive their own car, there is no great affinity to use CS; in such cases it is for the housing cooperative not worthwhile to become – at least not extensively – involved in the topic" (Memmler. Interview 21.04.2017).*

5.3 Cognitive tacit knowledge and perception of the need for collaboration and advice

In this sub-chapter, cognitive tacit knowledge aspects are combined with the perception of a need for collaboration and advice. This combination was carried out explicitly because both are strongly related to each other; if the knowledge regarding the topic of e-CS in urban neighborhoods is perceived as low, a need for collaboration and advice (on a cognitive basis) is with a high probability perceived as high; and vice versa.

It became apparent in the expert interviews that currently no "successful" concept of e-CS exists that one can understand and apply; hence, no solutions are given by default. In addition, no actor possesses long-term experience with sustainable mobility concepts in urban neighborhoods. Particularly housing companies and cooperatives possess large information deficits and have to gain knowledge. This is accompanied by economic uncertainties, and uncertain legal and technical circumstances. For instance, the electrical wiring systems in underground garages are undersized and often do not provide the necessary electric capacity. Moreover, the charging stations lack standardization. For housing companies and cooperatives, it is diffuclt to deal with these kind of technical barriers on their own. However, housing cooperatives feel that the necessary support is lacking:

> *"I have the feeling that the support concerning electro mobility is only reflected on the private sector; housing cooperatives as such are not taken along when it comes to electro mobility" (Brandt and Menzel. Interview 03.05.2017).*

The results of the online survey of the housing cooperatives also show that an increased support is welcomed, as visible in Figure 12. Here, 55% of the respondents perceive a "very high need" or "high need" for support with regard to CS (for cooperatives with less than 500 apartments more than 71% perceive such a need). Out of the cooperatives that perceive a need for support, for 65% perceive a support in guidance and formation, and for 59% a cooperative support from other actors is important.

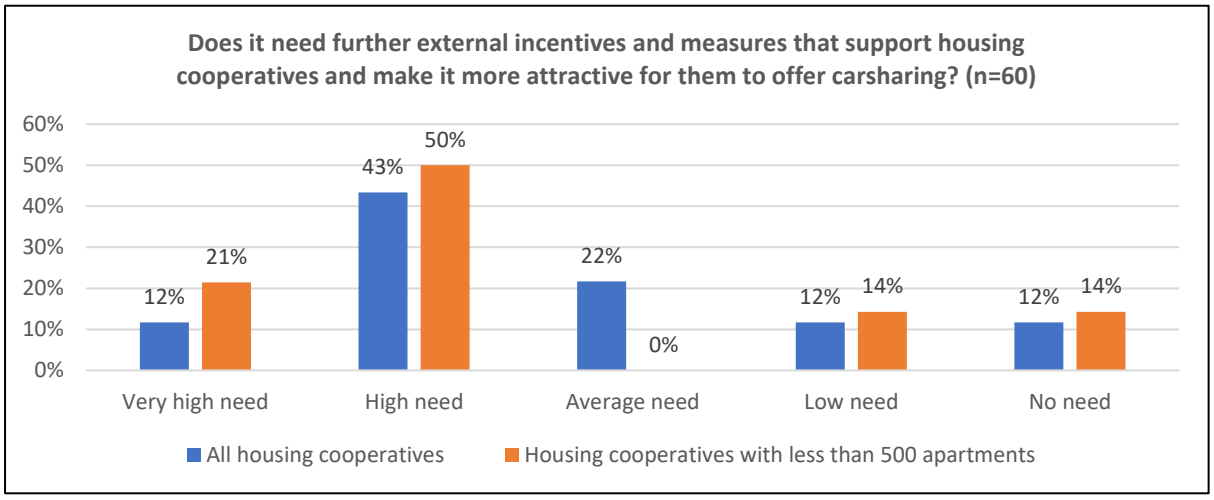


Figure 12: Perception about necessary support for housing cooperatives to offer CS
Source: Own representation

The housing cooperatives in Hamburg are in contact with other cooperatives of the *VNW e.V.* and various actors, such as CSOs or energy companies, to receive advice and exchange knowledge. Also, best practice examples, guidelines or specific events have been mentioned as means of information provision. In addition, it is argued that the advice of service providers should accompany the above-mentioned types of information. Such actors could act as "interface actors" by connecting various actors, demonstrating how a mobility concept could be implemented, and solving certain obstacles:

> *"A service provider would be of advantage who could function as an interface actor and connect the different parties, raise awareness as well as provide advice through informal tools for interested housing cooperatives and companies" (Kulus. Interview 10.05.2017)*

It is said that a large service sector of such “interface actors” exists. However, as a result of a lack of a common service structure, housing cooperatives perceive it as rather difficult to find and compare the different service providers.

Another pivotal method to decrease the given uncertainties with regard to e-CS (e.g. concerning technology, finances, etc) for housing companies and cooperatives is mobility management. It involves long-term oriented strategies as well as practical and short-term oriented measures to stimulate the demand of the potential users and share the responsibilities of the supply-side stakeholders:

> *“Mobility management, at least in the initial phase, is of high importance. It enables local stakeholders to deal with uncertainties in a better way because it allows them to compensate risks and share responsibilities” (Prill. Interview 03.05.2017).*

In addition to the housing industry, the CSOs consider it to be important to cooperate with other actors, specifically the housing sector. This allows them to see which necessary measures have to be implemented in order to be able to succesfully offer e-CS in urban neighborhoods. The online survey of the CSOs shows similar results. 52% of the respondents indicate that a need for cooperation with other sectors is perceived as “very high” or “high”. Moreover, of the respondents that indicated a “very high”, a “high” or an “average” need for cooperation, 70% state that more cooperation with the housing industry is needed. Cooperations with energy suppliers (56%) or car makers (30%) are perceived as less important.

5.4 Boundedly rational interest in resources provision

In this sub-chapter, the boundedly rational interest to provide resources for e-CS is addressed.

It is argued that implementing e-CS requires a certain amount of financial investments and a willingness to take risks, as a lot of technical equipment has to be financed. However, this is perceived as difficult due to the boundedly rational interests of the housing and mobility sectors:

> *"Implementation is difficult as you deal with two sectors of the economy that are highly cost-oriented and the interest is repeatedly reduced to numbers” (Paulsen. Interview 04.05.2017).*

CSOs argue that companies and cooperatives of the housing sector should become more financially involved if they see e-CS as an important topic. However, in the case of housing cooperatives, financial resources are not substantive, and the consent from their members is necessary before spending financial resources. The consent to make investments (for topics such as mobility concepts) is usually only given until the members perceive of a topic as sufficiently meaningful for them. As it is oftentimes rather difficult to achieve such a consensus, cooperatives look for ways to shift the costs. Generally, it is recommended for the housing companies and cooperatives to develop long-term economical concepts for e-CS that make it possible to recover the added value of e-CS as a sales price:

> *“Housing companies have in principle to set up a marketable concept; it has to be economical, otherwise it will not work in the long term” (Memmler. Interview 21.04.2017).*

> *"Particularly in a competitive environment it is important to create an added value for real estate buyers. This value could be created in the mobility field. In such a case, customers may*

> *be willing to pay more for property if it incorporates an additional value for them (like the possibility to abandon an own car). This way, also the real estate developer may earn a higher sales price for his property." (Dierks. Interview 25.04.2017).*

Because CSOs are also financially limited, their mobility concepts must be self-sustaining after a start-up phase of several months. In this light, BEVs could pose difficulties, as they require substantially higher investments than ICEs and achieve a lower usage:

> *"CSOs undertake with the implementation of CS offers a financial risk. They have a small margin and have to calculate each location properly" (Appeldorn. Interview 09.05.2017).*

> *"Concerning electro mobility in CS you have in the beginning lower sales, but at the same time double the amount of effort as well as higher investments that are necessary" (Söchtig. Interview 09.05.2017).*

In neighborhoods, where it is not economically possible to cover the costs (e.g. too few customers are generated), CSOs need support in form of sales guarantees. Here, housing companies and cooperatives often have to subsidize CS through grants. This poses no problem for the interviewed housing cooperatives for the start-up period – as they are interested in trying out new mobility concepts and willing to fund these – but must not become a permanent funding:

> *"If you support CS for half a year, that does not represent a problem, but it must not become a long-term financial investment for us" (Lohmann. Interview 25.04.2017).*

When it comes to technological investments, the interviewed housing cooperatives are sometimes inclined to open a charging station for testing purposes. However, both the CSOs and the housing sector have the intention to neither deal with the construction of the charging stations nor with their operation, including service and payment modalities:

> *"CSOs and the housing industry generally have no interest in investing in technology if they do not know how long it will actually be up to date" (Prill. Interview 03.05.2017).*

Due to these financial barriers, it is on the one hand argued that a cost distribution plan is needed so that the costs and risks can be shared among the actors. On the other hand, it is said that this is insufficient and that mobility concepts, as of yet, only work through cost savings elsewhere. Particularly the possibility to build less parking garages for new buildings could lead to a reduction of the construction price. Moreover, it is seen as advantageous to pre-equip new buildings, e.g. designing the house cable connections larger, so that one can incorporate electro mobility rather comfortably. Oftentimes though, housing companies and cooperatives do not pre-equip at all or to an insufficient degree in new urban developments. An implementation in already existing neighborhoods is due to insufficient surfaces rather difficult to achieve.

5.5 Cognitive perceptions about the current development phase

In this sub-chapter, the cognitive perceptions about the current developments of e-CS are addressed. This is important since the actors' perceptions about these developments have an influence on their behavior concerning and involvement in the topic.

Generally, a stagnation of CS concepts in combination with electro mobility is currently perceived (possibly due to the mentioned cognitive, normative and boundedly rational difficulties of chapter 5 and the stated infrastructural issues in chapter 4):

> *"It seems to stagnate a bit at the moment. There are many questions and no answers yet. Many actors have made initial attempts of e-CS and generally do not have an unfavorable attitude concerning electro mobility. However, there is an initial negative image slowly emerging" (Lohmann. Interview 25.04.2017).*

It is argued that the development of e-CS at a local neighborhood level requires patience, as its positive growth can only be expected within the next 5-10 years. To achieve success, it may be necessary to improve the existing concepts until they become accepted by more actors. In addition, one would have to design these systematically so that these do not have to be constantly redeveloped. Concerning this, it is indicated that a lot of room for change of sustainable mobility concepts exists. This should be made use of appropriately:

> *"It can be seen as positive that the integration of sustainable mobility concepts in urban neighborhoods represents a new area with a wide scope. It seems rather easy to make changes in this field, since new approaches and concepts can be tried out in a relatively easily. However, it is a process that needs a direction and it is necessary to get the different target groups and stakeholders involved" (Prill. Interview 03.05.2017).*

It was even argued that besides the above-mentioned aspects, a kind of pioneer is necessary who not only provides a direction, but is also willing to make an extra effort to develop e-CS:

> *"A pioneer is necessary in such a pioneering phase, so that you can implement [e-CS concepts and stations] until the state is reached when it becomes reasonably marketable" (Engstfeld. Interview 20.04.2017)*

.

6. The niche project ‘e-Quartier Hamburg’

In this chapter, an analysis of the project ’e-Quartier Hamburg’ is provided. Based on SNM theory, a division is made into the niche management aspects of the “social actor network”, “co-evolutionary learning”, the “articulation of expectations” and “protective measures”. The project is analyzed on the basis of these. This chapter gives specific answers for research question 4.

Various pilot projects are carried out within the ‘electro mobility model regions’ in Germany. These are seen as a significant means to overcome existing entrance barriers concerning electro mobility (Leurent and Windisch 2011). This is particularly important, as some questions can only be answered empirically (Canzler et al. 2011). Moreover, as stated in the previous chapter, there exists a need for efforts to collaborate and gain knowledge. This can be achieved by exposing different actors to demonstration, testing and piloting (Nykvist and Nilsson 2015). The project ‘e-Quartier Hamburg’ forms part of a new generation of governance approaches that aim at achieving socio-technical change by means of experimentation and learning (Nykvist and Whitmarsh 2008). Besides the importance of integrating BEVs into CS fleets (Dütschke et al. 2016; Augenstein 2015), their integration into urban development planning has been focused upon in the ‘electro mobility model regions’ since 2013 (Aichinger et al. 2014). In this thesis, it is argued that the project ‘e-Quartier Hamburg’, in combination with all other projects at the interface of CS, electro mobility and housing in Germany can in their entirety be understood as a sub-form of a niche and could evolve into a full niche. This might be possible, as they as a whole want to succeed in promoting the concept of e-CS in urban development.

The project ‘e-Quartier Hamburg’ was carried out on a neighborhood-scale from 2012 to 2017. It was based on the hypothesis that a susceptibility to new forms of inner-city mobility exists, which is grounded on a new understanding of the use of different modes of transport. Based on a strategic and holistic approach, the systematic integration of e-CS in various residential areas (see Figure 13) and its link with traffic and urban planning objectives was tested (Knie 2014). The intention was to identify the synergies between the housing and mobility sectors, and to establish a network structure. Further objectives were the following: Development of target-group-specific concepts, knowledge gains about possible business models, and derivations for urban and traffic planning (hySOLUTIONS GmbH 2012).

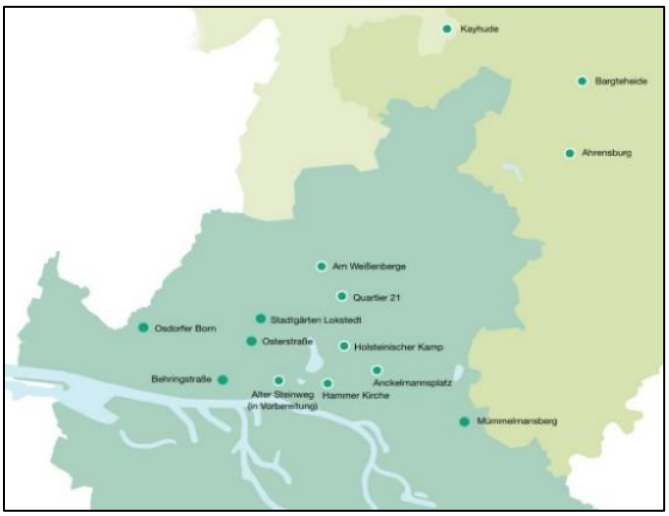


Figure 13: CS stations of the project ‘e-Quartier Hamburg‘
Source: hySOLUTIONS GmbH 2015

6.1 Social actor network

Within the project, novel cooperations between the housing sector, CSOs, urban planning offices, energy suppliers, and scientific institutions took place. Initially, the project comprised of 11 partners (at the end 6) and 20 associate partners. All partners signed a cooperation agreement, which regulated the working structure, finances etc. (Knie 2016). In the expert interviews (Töllner, Engstfeld (both 2017), among others), it became apparent that such a project is the first one of its kind for many of the involved actors. On the one hand, the cooperation between the diverse actors is considered a strong added value in the project. On the other hand, the interfaces between the actors are new and still immature. As a result, it seemed relatively difficult to collaborate:

> *“Actors from very different disciplines come together who previously did not work with each other, and do not have an understanding of where to find the interfaces for cooperation” (Paulsen. Interview 04.05.2017).*

> *“The actors possess diverse working cultures, based on different perspectives and interests. You do not know the interfaces of the other actors” (Engstfeld. Interview 20.04.2017).*

6.1.1 Quality of and possibilities for collaboration

The collaboration within the project is described as good – because the involved actors were able to purposefully collaborate and voice their needs – and has intensified over the course of the project. Generally though, the context in which the collaboration was carried out determined its success. The smaller the scale was, the more successful were the outcomes:

> *“Selection and implementation of the CS stations took place when CSOs and the housing industry worked together on a ‘down-to-earth’ bilateral level. The collaboration has become more intensive, the fewer partners were involved” (Redlich. Interview 20.04.2017).*

This may have been because an exchange of knowledge among the actors in the working groups was by some actors perceived as not being strong enough. As a result, a certain depth did not occur. Generally, the size of the project was regarded as an issue. While the project’s policy was to involve as many actors as possible, it was said that a large consortium may sound theoretically good but represents an obstacle for learning and the practical implementation:

> *“A steering committee, consisting of 40 people – partners and associated partners – does not have the function of dialogue, exchange and learning” (Redlich. Interview 20.04.2017).*

On the contrary, it was argued that e-CS in urban neighborhoods affects a large number of stakeholders and it would have been important to include all relevant ones that possibly have to deal with the topic in the near future. However, not enough resources and funding were available to include such a large number of actors. Hence, the project was stuck in between theoretically involving as many important stakeholders as possible, and keeping the exchange between only a few actors, where an improved cooperation capacity is given.

6.1.2 Types and power of stakeholders

Besides the number of actors, the different types of actors and their dissimilar power were perceived as an issue. The involved companies, which are considered as “big players”, represented at the beginning of the project the *DB (Deutsche Bahn) Rent GmbH,* the *Europcar Car Rental GmbH Germany, and* the *Vattenfall Innovation GmbH*. Whereas *Europcar* barely participated, *Vattenfall* provided some charging infrastructure and the *Deutsche Bahn* a few CS vehicles. Nevertheless, they were rather half-heartedly committed and, based on the companies’ decisions, stopped their involvement early on. It was stated that a possibility for their rather low engagement was that these “big players” are not as adaptable because of their fixed structures. In addition, they might not care much about such a project, as it only represents a minor field of involvement for them. It was on the one hand mentioned that it would have been an advantage if such actors had been involved to a larger degree due to their possible resource contributions etc. On the other hand, it was questioned why such actors become involved in projects that are based on a neighborhood-scale at all; do they want to contribute to a sustainable urban development and future mobility, or only steer developments into paths that are advantageous for them and keep the status quo? On the contrary, smaller companies are more flexible and possess less firm structures. They can change their approach rather easily as they have less employees, less internal stable structures and, as a result, can take advantage of new innovations with less effort. Moreover, for other stakeholders, it is possible to have an intensive exchange with such smaller companies on a crucial level. However, smaller companies must be liable with their full finances and their position strongly depends on risk calculation. This might cause them to become less involved and take less risks. The latter one was the case concerning the involved actor *Mindways Hamburg GmbH*. Generally, the differences between smaller and bigger companies was perceived as an issue in the project:

> *“It represents another world for SMEs when they meet corporate companies; the latter ones are far away from everyday life. This just does not fit together” (Redlich. Interview 20.04.2017)*

6.1.3 Willingness of resource provision

Each participant had a specific defined responsibility in the project. However, even though an appropriate risk sharing of responsibilities was given, all the involved actors had little room to maneuver. This was possibly the case because they all had to deal with their own core businesses, finances, and corresponding human and temporal constraints in addition to the project. Furthermore, it was argued that e-CS is not yet of high importance for the involved actors:

> *“In the currently booming real estate market, an add-on topic such as electric carsharing in urban residential neighborhoods is not really business-critical for the involved project stakeholders” (Dierks. Interview 25.04.2017).*

The interest was continually broken down to numbers and, as a result, particularly the infrastructure provision was not completely resolved. Many meetings were generally needed until funds were invested and infrastructure provided. When the housing industry was willing to invest, the projects oftentimes worked out, though:

> *“When the actors in the housing industry have said ‘Yes, we want to go a different way and try something new because it is not just all about our profit interest – we are willing to spend an extra time, money and energy for this topic’, the projects have usually worked” (Dierks. Interview 25.04.2017).*

6.1.4 Existence of leadership

The overall coordination of the project was carried out by the *hySolutions GmbH* as the regional project and competence head office of the ‘electro mobility model region Hamburg’. This company was not perceived as the project leader, though; possibly because it was also involved in many other projects in Hamburg. However, no other actor in the project was willing to be the leader:

> *“Within the project nobody has said ‘That is my topic, that is what I care about’. Thus, the engine of the project is lacking” (Lohmann. Interview 25.04.2017).*

Due to this fact, the actors postponed decisions in some situations and had to find alternative solutions. It was said that it would have been advantageous if an institution had existed that could have made the stakeholders become involved to a greater extent:

> *“It needs someone to ‘hold the strings together’; a kind of institution that provides information to those actors interested, and brings the actors together” (Kulus. Interview 10.05.2017).*

6.1.5 Involvement of relative outsiders

The involved users in the project represented defined target groups belonging to various neighborhoods. They were involved via surveys, workshops, recorded driving data and “mobility diaries”; all of which was important to collect information on their mobility behavior as well as their needs and experiences from the usage of e-CS. They were also advised as part of the mobility management of the project. However, they were not involved in specific project committees. Moreover, the communication between users and suppliers could have been more in-depth:

> *“To involve the local population is what you have to theoretically do in such a project. This is often underestimated, as usually only a specialist group, consisting of planners, works in a kind of ‘superstructure’ and is involved with the issue at hand“ (Engstfeld. Interview 20.04.2017)*.

Besides private users, it was an objective to involve business customers in the neighborhoods. This was perceived as difficult, as there was no specific business model existent to target these. This meant that overall few business customers participated in the project.

Furthermore, the project description of the project indicates that an intention existed to plan and implement the project in “close cooperation with similarly designed projects [...] of other model regions in order to organize exchange of experience and know-how and [...] make synergies possible" (hySOLUTIONS GmbH 2014, p. 5). At the beginning of the project, an intensive exchange of information with partners from other cities such as Bremen and Stuttgart took place. Such exchanges became less frequent at the end of the project.

6.2 Co-evolutionary learning

All stakeholders view the exchange of knowledge, the given joint learning, and the development of ideas and concepts as a greatly added value of the project.

6.2.1 Development of theoretical foundations

Before the stations could be implemented, it was said to be necessary to develop methodological and theoretical competencies, particularly concerning the necessity to take into account the urban structures. This was seen as important in order to develop a prequalification tool (to assess the suitability of urban structures for CS) and make the approach replicable. Based on socio-demographic, urban planning and traffic indicators, this tool – as a rating methodology – allowed one to decide the 14 neighborhood locations where e-CS was ultimately implemented (HafenCity Universität Hamburg 2013). This methodology was positively appreciated in the context of the accompanying research at federal level and represented a unique product:

> *“More or less pioneering work has been achieved, creating something model-like that had not been established on the market before” (Lindlahr. Interview 24.04.2017).*

It is argued that it took a long time until these important theoretical foundations were built. This is related to the fact that new topics and insights continuously emerged through discussions and needed to be dealt with. However, the long-lasting theoretical and methodological part came at the expense of the actual implementation of the stations and the usage of the vehicles. Both were perceived as rather short, even though some actors saw them as the most relevant aspects to gain knowledge from:

> *“From the practical implementation – the learning-by-doing – one has learned the most” (Lohmann. Interview 25.04.2017).*

6.2.2 Single-loop learning

Generally, learning was possible in the project with regard to various topics and multi-level problems. Such learning represented an important aim of the project and allowed the involved actors to gain knowledge about the strengths and weaknesses of the topic of e-CS, in particular at the interface with housing:

> *“The aim of the project was to gain knowledge about how mobility needs manifest themselves, how mobility works and what kind of approaches can be developed for environmentally-friendly neighborhood mobility“ (Töllner. Interview 18.04.2017).*

Single-loop learning took place to a large degree in the project. Such learning concerning “technical” aspects resulted in the knowing that a lack of a certain standardization of charging infrastructure concepts still represents a major hurdle. In addition, new insights into BEVs and their technical conditions were accumulated. Concerning the “market” aspects, an understanding of different business models was given. This resulted in the knowing that flatrate offers (charging a monthly fee) do not work well for station-based CS. Furthermore, it became obvious that a successful implementation of e-CS in urban neighborhoods depends on an engaged project developer of the

housing industry. Concerning the “users” aspect, it became apparent that it is of high importance to reach out to people and offer them sustainable mobility concepts when these find themselves in relocation situations, as they are more willing to change their mobility behavior in such situations.

6.2.3 Double-loop learning

Learning also took place with regard to the project itself as well as concerning the actors within the project. It became particularly evident, how complex a project under such dimensions is and which problems could arise; a fact that was not really clear at the beginning of the project. Moreover, some kind of double-loop learning took place concerning interpersonal circumstances of the actors:

> *“Learning took place at interhuman levels about the thought structures of the other actors, so that one could develop a greater understanding of the others’ issues“ (Engstfeld. Interview 20.04.2017).*

Generally though, double-loop learning, which resulted in changes of normative and cognitive perceptions, was achieved only to a small degree. While an understanding in the housing industry grew to some extent with regard to the importance of mobility concepts in urban developments (they e.g. started thinking about corresponding drillings, empty pipes, etc. for the charging infrastructure), a change of their perceptions was not achieved intensively enough. This is because too many questions remained unanswered, such as the perceived added value for the housing sector to work together with CSOs. Moreover, instead of changes in their perceptions, rather an uncertainty emerged:

> *“It has not yet come to prominence to highlight the marketing advantages, i.e ‘How can I make the vehicle a systematic benefit for the housing industry?’ (Paulsen. Interview 04.05.2017).*

> *“It was difficult with regard to the housing industry because they could not be emotionalized; it was rather a kind of uncertainty that emerged” (Engstfeld. Interview 20.04.2017).*

In addition to the housing cooperatives, CSOs also made a few changes in their operations, such as an improved concept for parking spaces, and have generally become more open towards the topic of electro mobility. Despite this, they were reluctant to change their business model of CS and tailor it specifically to urban neighborhoods.

In total, despite the fact that extensive single-loop learning concerning various topics took place, an insufficient amount of double loop-learning was achieved, i.e. no overcoming of normative and cognitive barriers, and no influencing of boundedly rational interests took place sufficiently.

6.3 Articulation of expectations

Due to different backgrounds, attitues, specific core businesses and generally a local assessment of e-CS, the involved project actors have often unlike expectations about the potentialities of e-CS and about expections that are related to the project ‘e-Quartier Hamburg’. It is argued that actors strategically use German electro mobility projects to follow their specific agendas based on their interests and expectations (Augenstein 2015).

6.3.1 Expectations about the project

With regard to the project as a whole, the topic of connecting urban development and mobility as well as creating interfaces between the housing sector and CSOs is seen as a requirement and an expectation of the project by all the involved stakeholders:

> *"Linking the topics of urban development and transport and including e-CS in planning processes as early as possible is very important from a planning and user perspective" (Lindlahr. Interview 24.04.2017).*

Furthermore, the *HafenCity University* and the *hySolutions GmbH* shared the expectation to simplify the integration of e-CS concepts in urban neighborhoods through the development of methods, their transferability to and reproducibility in other locations:

> *"A criteria-based approach was of great importance, in order to be able to distinguish neighborhoods and decide why one project is implemented in a neighborhood and not in another" (Lindlahr. Interview 24.04.2017).*

As this expectation is of a rather methodological nature, it was not very relevant for the involved market actors. The expectation for them to participate in the project – and become involved in the topic of e-CS at neighborhood-level – is to receive a good return on investment in the longer term through new business opportunities (Foxon et al. 2010; Terrien et al. 2016).

Focusing rather on the operational level, there is a shared expectation of the market actors that potential users will make good use of e-CS. Thus, they are seen as the ones that need to be targeted and put one's focus on. CSOs see the opportunity to expand their offer and accomplish customer loyalty. To achieve this, their expectation is to collect long-term insights and see what their role is in relation to a changing mobility behavior:

> *"What motivates us to participate is the fact that we notice that mobility behaviors are changing, mobility is being perceived differently. We need to develop an understanding and adapt our concepts to be attractive in the long term" (Töllner. Interview 18.04.2017).*

The expectation for the housing cooperatives is that their (new) tenants become more interested in sustainable mobility concepts in the near future:

> *"We have the strategic expectation that mobility concepts for the housing industry will become more and more important with regard to marketing perspectives, especially in inner-city locations" (Lohmann. Interview 25.04.2017).*

Concerning the overall result of the project, an expectation/goal was articulated at the start in 2012 to offer 100 station-based e-CS vehicles that are used by 2,500 individuals. This expectation was not met as only 20 vehicles were offered and used by approx. 800 users. In total, whereas it was possible to achieve good results on a methodological basis in the project, the operational basis provided a different picture. This lead to a relatively large discrepancy between political demands and the

practical implementation on the ground. It is argued that the expectations of all project partners were at the beginning of the project much higher than what was ultimately implemented.

6.3.2 Expectations about the potentialities of electric carsharing

In addition to the expectations concerning project, various expectations with regard to the potentialties of e-CS were voiced. Concerning the “environmental and societal effects” aspect, the actors in the project consider e-CS an innovation that contributes to solving environmental issues. In that regard, they share the expectations for e-CS to help decrease CO2 emissions. Mostly though, their expectations are local in nature and focus on the potential reductions of noise, parking space and air pollution issues. Related to this, there is from a societal point of view a shared hope for an increase of the quality of urban neighborhoods.

With regard to the “public opinion” aspect, it was stated by the housing sector that the general attitude of the public concerning station-based CS is still rather restrained. As a result, an expectation was stated that free-floating CS may already be sufficient. This is because the “public opinion” for this form of CS is perceived as positive, and it possibly serves the mobility needs of the users the best. Moreover, two other expectations were voiced, if one nonetheless wanted to focus on station-based instead of free-floating CS. These were that either the users would have to be pushed more by the supply-side and/or political actors, or that the users – as they are not yet sufficiently ready – would in the near future themselves have to become more interested in station-based e-CS. However, no details were mentioned how these expectations could possibly be achieved.

Concerning the “market” aspect, it was stated that e-CS requires financial support as a new innovation in urban neighborhoods. However, whereas CSOs have the expectation for the housing industry to become more financially involved in the topic, the same can be said of the housing industry about the CSOs’ involvement. Both also see the public actors in the need to provide more funding for measures in the field of e-CS in urban neighborhoods.

With regard to the “production network” and “technical specifications” aspects, a high expectation is voiced for improvements of the electro mobility technology. This is mostly related to the existing range issues of BEVs, which are still perceived as insufficient and result in fears and negative opinions in the population. Moreover, the price of BEVs are stll seen as too high. Hence, an expectation is voiced for OEMs to improve and commit to the technology of electro mobility.

Concerning the ”government policy” and the associated “infrastructure network” aspects, the low commitment and ambivalent signals of the federal government are criticized when it comes to offering parking space in public areas and a supporting legal framework for CS, as well as charging infrastructure for electro mobility. Some actors go further than that and mention that they expect the city to come up with a whole new willingness to support sustainable mobility concepts. A further expectation is related to the necessity of energy supply companies to be more proactive when it comes to the implementation of charging infrastructure.

In general, the expectations concerning the potentialties of e-CS did not result in a clearer picture of the potential of e-CS, in addition to its environmental solutions potenials. Furthermore, the failure to

meet project expectations and the current difficult phase of e-CS (see chapter 5.5) led to the expectation that the given e-CS concepts might need to be improved and the implementation process needs to be steered further. However, none of the actors were sure from whom an increased willingness could or should emerge:

> *“The question is who ultimately defines the direction of the development: Is it the national government, the city with specific requirements or rather the local actors in the urban neighborhoods?” (Prill. Interview 03.05.2017).*

6.4 Protective measures

As e-CS represents a novel innovation, it needs different kinds of protective measures that protect it against mainstream technologies.

6.4.1 Geographical spaces

14 locations represented "geographical spaces" within the project where stations were built and within which the innovation of e-CS could possibly develop. However, developing the stations was not always perceived as easy when the locations were generally seen as suitable to implement e-CS in these. This is because it was argued that it was oftentimes difficult to implement e-CS concepts in certain locations, as no access was gained; this resulted in the fact that these locations could not be perceived as “protective spaces”:

> *“If you cannot develop stations in the neighborhoods as planned because you do not get access to the sites you prefere due to specific regulations, then it is usually not possible to implement e-CS in these neighborhoods. In turn, if the stations are not existent, it is difficult to advertise e-CS” (Prill. Interview 03.05.2017).*

Moreover, specific innovation criteria should be met in the context of setting up the e-CS stations, such as the combination of e-bike sharing and e-CS, or the integration of e-CS into a low-energy house. While these made the e-CS concepts theoretically more innovative, it made the implementation more difficult.

6.4.2 Public relation measures

Public relations can also be seen as a way of promoting and at the same time protecting the project, as it allows to increase the attention and interest of external stakeholders (possibility to receive financial funding or other resources from these) and of the general public (possibility to attract more potential users, which participate in the project). Public relations were made use of in form of measures such as a website, posters, information materials, etc. (hySOLUTIONS GmbH 2014). However, this was not considered as sufficiently adequate. Particularly the "communication with the outside" – i.e. campaigns, media presence or events – was perceived as insufficient. As a result, the project was not as much known in the city as would have been necessary to make an increased impact. In relation to this, it was argued that services such as e-CS generally require increased promotional activities to be more widely known:

"It involves an extremely high amount of promotional activity with specific marketing and promotional actions to introduce a new service such as electric carsharing” (Dierks. Interview 25.04.2017).

6.4.3 Financial incentives

Due to the particularly high economic risks of electro mobility, financial contributions were provided to reduce these risks for the involved project actors (hySOLUTIONS GmbH 2012). In total, the German government provided federal funding of approximately € 4.7 million (NOW GmbH n.d.). The City of Hamburg made funds as high as € 460,000 available (Knahl 2013). It is said that these financial risk reductions in electro mobility projects like the ‘e-Quartier Hamburg’ create windows of opportunity for the (market) actors to receive financial support. This represents an essential reason for the commitment of the project actors (Augenstein 2015):

“The project partners have as an essential point the funding in mind. Without funding, the actors would not engage in the way they do now” (Lindlahr. Interview 24.04.2017).

Concerning the form of the funding, it was the case that no subsidy was given, but only half a "loss cover" provided. This meant that only half of the investment was compensated, and participants were obliged to pay the other half of the costs. This support is viewed as sufficient by some actors. For others, this did not seem to be an adequate method of financial contribution, particularly not for the CSOs. The fact that the participants had to spend rather large amounts of money in the project even resulted in the feeling of “bought” knowledge:

“The knowledge generated in the project is to some extent "bought” as we spend quite extensive amounts of financial resources in the project” (Töllner. Interview 18.04.2017).

7. Conclusion and recommendations

In this conclusion, the main findings from the case study on the developments of e-CS in urban residential neighborhoods in the City of Hamburg are discussed. Furthermore, theoretical and research recommendations are provided, which is complemented by practical recommendations. This chapter ends with a critical reflection on the limits of the research results.

As became apparent in this thesis, urban areas face major environmental and societal challenges due to the existing transport system. In the future, transport and urban developments have to provide fundamental answers as to how to make transport more sustainable, how to more effectively use urban spaces, and how to enhance the quality of life. To achieve this, the dominance of the private car in mobility behavior has to be addressed and broken. CS and electro mobility are perceived as new innovations that offer manifold potentials for a paradigm shift to a more sustainable mobility behavior. Both in combination – in form of e-CS – and integrated in urban neighborhoods could contribute to solving the given challenges in urban areas. However, e-CS is still a niche product and is not yet mainstream.

By incorporating a conceptual framework in the context of neo-institutionalism and SNM, a fruitful combination of both structural influences and those related to actors (and niche developments) is given. This allows one to analyze the interactions of institutional factors, actors' practices, and niche developments at the local level. The socio-cognitive- and actor-related theory of SNM – applied to a local niche project – makes it possible to operationalize agency. This theory allowed to analyze the project 'e-Quartier Hamburg' on basis of the existence of a protected social actor network, in which co-evolutionary learning takes place and expectations are articulated. Neo-institutionalism allowed to operationalize structural institutional influences (in form of regulative, normative and cognitive institutions). In addition, the more actor-related bounded rationality of neo-institutionalism was included as well.

7.1 Research contributions based on neo-institutionalism

The most important results based on neo-institutionalism are discussed below.

7.1.1 Cognitive and normative institutions

For the actors of the housing sector, the topic of mobility, and particularly e-CS, represents a new business area, which is not their core business. On a cognitive level, they possess little knowledge (technical, organizational, etc.) and are uncertain about their involvement in e-CS, which is in some part related to the fact that they have as of yet no or very few experience with sustainable mobility concepts. Moreover, they share specific ways of working that do not (yet) fit well with the innovation of e-CS. This is because differences between mobility as a fast-changing topic and the rather slow developments of houses exist. The latter influences the cognitive perceptions and routines of the housing sector. In that regard, housing companies and cooperatives are said to have a different mentality than service providers, such as CSOs. Generally, housing companies and cooperatives perceive a high need for cooperation, advice, and information. Particularly the cooperation with CSOs is perceived as a good option to increase their cognitive tacit knowledge. For CSOs, the inclusion of BEVs in their fleets and the collaboration with the housing sector also represent new business areas,

to which they have to adapt and concerning which they have to learn. The collaboration with the housing sector is perceived as somewhat important by them. Generally though, both CSOs and the housing sector do not yet know each others' interfaces. Moreover, difficulties are increased as currently no "successful" concept of e-CS exists that one can understand and apply; this is also related to the fact that every case of e-CS development is still to a large degree context-dependent. Concerning this, it might be necessary to improve the existing concepts and/or systematically implement new ones, until they become accepted by more actors.

CSOs and the housing sector are consumer-oriented because they cognitively perceive that consumers will decide the success of e-CS. Consumers are said to become more inclined to share products and services (such as station-based CS vehicles) and possess an increasing environmental consciousness (important for the success of BEVs). However, on a practical level a usage of BEVs and station-based CS is low. This leads the housing sector to question the need for station-based CS and assume that free-floating CS is possibly already sufficient for the consumers. For electro mobility, the low demand strongly correlates with the users' limited awareness of BEVs and constraints in form of range fears because of the low coverage of the charging infrastructure. Furthermore, CSOs and housing companies themselves have made mixed experiences with BEVs. They perceive them as interesting, but at the same time associate them with various unsolved issues such as a low charging infrastructure coverage or price and range issues. This is related to a perceived lack of political signals and insufficient support for BEVs. Furthermore, only few spaces exist in Hamburg for actors and users to gain knowledge of BEVs. Hence, their cognitive change in perception of BEVs is possibly too slow. Moreover, a beginning negative image towards e-CS is growing. It is said that a great scope for the development of e-CS exists in that no approaches exist by default. As a result, new ones can be tried out (e.g. in projects). This process has to be explicitly designed and steered by actors (possibly a pioneer) which are willing to make an extra effort to develop e-CS. Generally, the development of e-CS at a local neighborhood level requires patience, as growth can possibly be expected not before the next 5-10 years.

7.1.2 Bounded rationality and willingness of resource provision

Actors of the housing sector generally deal with issues that are more important for them than mobility. The online survey also supports this, as only 6% of the contacted housing cooperatives participated, in comparison to 43% of the CSOs. CS is currently not offered by the housing sector to a large degree (only 17%, as mentioned in chapter 5.1). However, an overall positive attitude of housing cooperatives (up to 94%) towards e-CS makes one perceive CS and electro mobility as future mobility options that need time to become mainstream. For housing cooperatives, offering CS is a way to protect the environment and improve the residential quality of neighborhoods. While they are willing to engage in cooperation, they see financial support and an overall strategy as important to become further involved in the topic. Moreover, they demand an increased engagement from the national government to steer electro mobility developments and from CSOs to steer CS. CSOs want to cooperate with the housing sector, as they follow the agenda to exploit opportunities and seek niches. Generally though, to offer CS, CSOs require the availability of various existing socio-infrastructural aspects in the neighborhoods (e.g. population with CS affinity), as well as the vehicle's visibility. They also demand an increased involvement of housing companies in e-CS and financial incentives for the acquisition of BEVs from the national government. As the latter is not yet sufficiently provided, CSOs offer few BEVs.

While risk-taking and financial involvement are perceived as necessary conditions for the advancement of e-CS, there is a low willingness by the housing sector and CSOs to provide resources, particularly in form of private charging infrastructure for electro mobility. This is because one deals with two cost-sensitive sectors that are focused on making profitable investments, but are not naturally inclined to spend resources on risky endeavors. In the public space, even with the city's large degree of involvement in its expansion, the charging infrastructure coverage for BEVs is seen as too low. It is said that private actors – particularly the energy suppliers – should become involved as well. In addition, only few public parking spaces are provided by the city for CS.

7.1.3 Regulative institutions

The principle of sustainability is beginning to receive attention by policy-makers in the city. This in turn influences the implementation of sustainable mobility concepts positively. Nonetheless, CS is still perceived as an innovation with rather difficult circumstances, as few supportive policy measures are put in place when it comes to space and visibility for CS. As a result, CSOs often have difficulties in finding parking spaces for their vehicles. This is also due to the fact that no CS legislation is existent as of yet. Moreover, this thesis argues that with regard to policy prioritization, the city focuses on free-floating CS, instead of station-based CS. This is visible in form of more policy and regulatory measures tailored to it (e.g. less parking fees for this form) as well as in form of more collaborations of the city with free-floating providers. In addition, a focus is rather put on the integration of CS in public transport hubs instead of urban residential neighborhoods, as the city perceives that in those locations more people can be specifically targeted with sustainable mobility concepts. In total, it appears that more regulative and policy measures have to be put in place for station-based CS. On a regulatory level, as mentioned above, the CS legislation is needed, and on a policy level, more collaborations with station-based CSOs should be facilitated, as well as more visibility of the vehicles and generally increased financial incentives provided.

The topic of electro mobility is not sufficiently supported at the national level. This in turn negatively influences the circumstances on the local level. Even though a law exists, uncertainty and a lack of policy directions on the national scale is perceived. As a result, the rather advantageous circumstances in the City of Hamburg, where various informal policies are tailored to the support of electro mobility, cannot be implemented to their full potential.

Concerning the integration of e-CS in residential neighborhoods, a focus is put in the city on its inclusion in urban planning processes. Unfortunately, non-uniform approaches in various neighborhoods make this challenging. Concerning this, various new urban developments that currently take place in the city include sustainable mobility concepts into their approaches. These are not coherent, though, as no uniform approach of sustainable mobility concepts is applied (because it does not yet exist and because every development is at least in part context-dependent). Moreover, as of yet, various unregulated legal issues have to be addressed in order to be able to appropriately include CS and electro mobility in urban development and planning approaches

7.2 Research contributions based on Strategic Niche Management theory

The most important results based on SNM theory are discussed below.

7.2.1 Social actor network

The project 'e-Quartier Hamburg" was the first project of such kind for many of the involved actors. Generally, the cooperation between the diverse actors was considered a strong added value. However, not all the actors related to e-CS development in urban neighborhoods were involved in the project and it was said that it would have been important to include all relevant ones. This might have proven very difificult, though, as there even existed a difficulty for the involved actors in that these had not previously worked together and did not know each others' interfaces or how they related to each other. Moreover, the size of the project was regarded as an issue, even without all relevant actors. This resulted in the perception of some actors that an exchange of knowledge among the actors in the working groups was perceived as not being strong enough.

Moreover, the different types of actors were perceived as an issue. While on the one hand the "big players" that engaged in the project provided some important resources, they were not very engaged and left the project early on. Smaller companies on the other hand were very engaged, but could often not act and engage appropriately, resulting from the fact that they were liable with their full finances. In relation to this, a significant issue that was perceived was that e-CS in urban neighborhoods is seen as an "add-on" topic by the involved market actors. As a result, no actor steered the project as a leader, the interest was continually broken down to numbers and the involved stakeholders were rather unwilling to provide infrastructural resources. Generally though, when the housing industry was willing to invest, the projects oftentimes worked out. Users were involved via surveys, workshops, recorded driving data and "mobility diaries". Nonetheless, the communication between users and suppliers could have been more in-depth. In addition, possible business customers in the neighborhoods were not involved to a sufficient degree, as no specific business model existed to target these. Exchanges with other projects existed, but became less frequent at the end of the project. It can generally be argued that the major achievement of the project was that more information about these interfaces was collected, as the actors worked with each other and exchanged their views.

7.2.2 Co-evolutionary learning

The project has contributed to a large degree towards single-loop learning about e-CS in various areas, in order to gain knowledge about the strengths and weaknesses of the topic of e-CS. Concerning technical aspects, it became apparent that a certain standardization of charging infrastructure is missing. With regard to market aspects, it was evident that flatrate offers do not seem to work well for stationed-based CS and that it depends on an engaged project developer to make the implementation feasible. Concerning the users, it was noticed that it is of high importance to reach out to people and offer them sustainable mobility concepts when these find themselves in relocation situations. In the project, it was necessary to develop theoretical competencies before the stations could be implemented. These resulted in the development of a prequalification tool. However, due to a long period of creating a theoretical knowledge base, only a short period of practical "learning-by-doing" took place. An increase in the latter could have possibly led to amplified learning results.

Moreover, besides single-loop learning, some kind of double-loop learning took place, mostly concerning the interpersonal circumstances of the involved actors in the project. In addition, while an understanding in the housing industry grew as to why integrate e-CS in the building and why to pre-equip the buildings for electro mobility, generally a change of their perceptions was not achieved intensively enough. Many questions remained unanswered, such as the perceived added value for the housing sector to work together with CSOs. While the CSOs became more open to electro mobility and made minor changes in their operations, such as an improved concept for parking spaces, they were in general reluctant to change their business model of CS and tailor it specifically to urban neighborhoods. Hence, only few double-loop learning took place that could have stimulated the actors to change their cognitive attitudes and practices, as well as their boundedly rational interests.

7.2.3 Articulation of expectations

With regard to the project, specific expectations were voiced. All actors shared the expectation to create interfaces between housing and mobility. Moreover, the non-market actors shared the expectation to create methodological competencies, which should result in a prequalification tool to assess the suitability of urban structures to implement e-CS. As this expectation was of a rather methodological nature, it was not very relevant for the involved market actors. Their expectation was to receive a good return on investment through new business opportunities. In that regard, a focus was put on the potential users, who it was hoped would make good use of e-CS. Concerning the result of the project, an expectation/goal was articulated to offer 100 station-based e-CS vehicles that are used by 2,500 individuals. This expectation was by far not met. Overall, a large discrepancy between successful methodological knowledge gains on the one hand and the insufficient practical implementation on the other hand was perceived. It is said that the expectations of all project partners were at the beginning of the project much higher than what was ultimately implemented.

Concerning environmental and societal effects, the project participants share the expectation of e-CS to contribute to a reduction of CO2 emissions, noise, parking space and air pollution as well as to an increase in the quality of urban neighborhoods. With regard to the public opinion, as the general attitude of the public concening station-based CS is perceived as still rather low, an expectation of the housing cooperatives was voiced that free-floating CS should possibly be seen as already sufficient. Concerning the market, an expectation was voiced that more financial support is required. Whereas CSOs have the expectation for the housing industry to become more financially involved, the same can be said of the housing industry about the CSOs' involvement. With regard to the production network and technical specifications, a high expectation was voiced calling for improvements of electro mobiliy technology. This is mostly related to range issues of BEVs, which are still perceived as insufficient. Hence, an expectation was articulate for OEMs to improve and commit to the technology of electro mobility. Concerning the government policy and the associated infrastructure network, the low commitment and ambivalent signals of the federal government are criticized when it comes to offering parking space in public areas and a supporting legal framework for CS, as well as a more sufficient charging infrastructure coverage for electro mobility. In general, an expectation is voiced that the existing e-CS concepts might need to be improved and that the implementation process needs to be steered further. However, none of the actors were sure from whom an increased willingness to steer e-CS developments could emerge.

7.2.4 Protective measures

14 locations represented "geographical spaces" where the e-CS stations were implemented and e-C could possibly be developed further. However, an access to specific locations, which were seen as suitable, was oftentimes not given, as in some cases (due to various context-dependent issues), no access was provided to the preferred sites. Public relations were used as a way of promoting and at the same time protecting the project, as it was perceived as a way to increase the attention of external stakeholders and receive resources or financial incentives from these. However, particularly the "communication with the outside" through campaigns, media presence or events, was perceived as insufficient. As a result, the project was not as much known in the city as would have been necessary to make an increased impact. Protective measures in the project were also given in form of financial support because high economic risks of electro mobility still exist, which need to be reduced appropriately. Generally, it seemed that the project partners had as an essential point the funding in mind. The amount of such support was perceived differently, though, with some actors stating it was sufficient, others claiming it was not enough. This is because only half of the investments was compensated, and participants were obliged to pay the other half of the costs.

7.3 The interrelation of structure and agency in the conceptual framework

The interrelation of structure and agency is discussed here. Regulative institutions – as a structural influence in form of policies, legislation and finances –, if applied to a sufficient degree, provide protective conditions for e-CS on a local (agency) level. Such forms of protection – mostly in form of financial incentives – possibly satisfy the boundedly rational interests of the local actors (that are focused on utility maximization). In addition, the actors' willingness to provide resources can be positively influenced by specific regulative and protective measures. This means that if they are assured economic/financial protection, they might be more willing to provide specific types of resources (e.g. infrastructure or knowledge).

Moreover, regulative and protective measures also make it possible for social actor networks to be set up. This is because such protection allows to increase the advantages of the innovation, while at the same time lowering its uncertainties and disadvantages. As result, actors might want to participate in these networks. Social actor networks are also influenced by a normative appropriateness and cognitive institutions (i.e. "way we do things", knowledge, etc.). These could influence such networks either negatively or positively, depending on how much the actors' cognitive and normative attitudes are already attuned to deal with the innovation and become involved in such projects. While cognitive and normative institutions influence social actor networks, such networks also theoretically provide a ground to influence and alter both institutions – particularly the cognitive ones. This means that it is possible to gain the necessary knowledge in these networks, build new cooperations, and realize interfaces between the actors, etc. If the collaborations and the knowledge are sufficiently developed, it could possibly lead to a change in or questioning of cognitive frames, beliefs, values, and norms.

Normative and cognitive institutions as well as boundedly rational interests (in form of specific, mostly egoistic reasons to deal with a new innovation) influence the articulations of expectations of actors in social actor networks. If these expectations are confirmed, further refinement of these within shared

cognitive institutions is possible. Moreover, such articulations could in the long-term also lead to an alteration of cognitive institutions and boundedly rational interests. If this is achieved, it could lead to an increased interest in the innovation and greater collaboration with other actors, such as in social actor networks. This could, as a result, lead to an amplified co-evolutionary learning in these networks, as more actors become involved. In addition, the boundedly rational interests of the actors can also be influenced through the articulation of expectations. This is because articulating expectations might make actors less take into account the boundedly rational (mostly financial) interests when they voice expectations that they perceive as very meaningful and which they would very much like to see achieved. If the boundedly rational interests and cognitive institutions are changed and/or influenced, it could mean that less (financial) protective and regulative measures have to be put into place. This is because the actors themselves possibly have more positive attitudes towards e-CS and do not require extensive protective measures in form of financial incentives and/or legislation in order to be willing to deal with the innovation and engage themselves.

7.4 Scientific recommendations and avenues for research

Specific scientific recommendations are given in this chapter for the theories made use of in this thesis.

7.4.1 Neo-institutionalism

The focus on both institutional factors and the more actor-related bounded rationality in neo-institutionalism can on its own be seen as positive for an integrated analysis. The combination with SNM, which focuses on socio-cognitive aspects, provides an even more coherent picture when dealing with new innovations, such as e-CS. However, it would be helpful to combine neo-institutional theory in the realm of transition studies not only with SNM, but also with other theories, such as the MLP. As mentioned in chapter 2, SNM is based on the aspect of niches of the MLP. An analysis of the other MLP factors (regime and landscape) that influence the development of e-CS, in combination with neo-institutional factors, would prove to be very fruitful. This would give a more holistic picture of processes that are relevant for the diffusion of innovations. In addition to MLP, other theories in the realm of transition studies could also be applied.

Furthermore, focused on the topic of e-CS, it would be recommended to analyze how normative, regulative, and cognitive institutions of the housing sector and/or CSOs influence and how they specifically relate to each other. This would give even more insight into the importance of institutional factors, their interrelations, and specifically where to put one's focus on. In relation to this, it would prove practical to investigate how one might overcome cognitive and regulative institutional constraints. In addition, with regard to the bounded rationality, it would be wise to investigate which specific supportive measures are necessary to lower the existing constraints on e-CS.

7.4.2 Strategic Niche Management

Generally, this thesis perceives of transition concepts, such as niches, as beneficial for the discussions on pathways towards a more sustainable mobility. This is particularly true for their ability to highlight the relations between actors, learning, protection and technology. These aspects are put in context to each other in SNM theory in order to see how an innovation might in the long-term become established

in a system. Despite this, it is difficult to see how projects that are either set up based on SNM, or projects that are analyzed with SNM, can contribute to the establishing of trajectories that allow for an adoption of a new innovation in the system. With regard to this, the role of interactions between niche projects are relevant. Concerning this, the socio-technical transitions literature introduces many aspects that are relevant to the emergence of innovations and prove interesting to expand and/or improve SNM.

Role of interactions between niche projects

It is of high relevance to discuss the role of interactions between various niche projects, as knowledge gains concerning new innovations need to be spread and exchanged. This topic was addressed, among others, by Geels and Raven (2006) who focused on how niche development trajectories (in the agricultural sector), which have their origin in local projects, could become established. However, this topic is not yet sufficiently covered in the transitions literature. As is apperant in this thesis, a connection between the project 'e-Quartier Hamburg' and other projects that deal with CS, electro mobility, and housing was not existent to a sufficient degree in order to exchange knowledge on a meaningful basis. It would be fruitful if research was carried out on how to interlink and connect such projects in Germany in order to facilitate learning, knowledge exchange, and capacity development.

Role of actors, leadership and power issues in niche projects

It would prove useful to analyze the structure of social networks, including the role of niche actors and incumbent regime actors, due to the differences among both groups in their approach to innovations (Holtz et al. 2008). The collaboration of both groups holds the promise to combine each one's strengths, but invariably entails some "mainstreaming" (Smith 2007). Concerning e-CS, it would particularly be interesting to analyze the role of car manufacturers and energy suppliers as regime actors. Moreover, an investigation of in-depth cooperation possibilities between the housing sector and CSOs is welcomed. Another point of interest relates to the question of which actors drive the innovation of e-CS. As has become apparent in this thesis, the issue of leadership played an important role in the project 'e-Quartier Hamburg'. The fact that no leader steered the project proved to be a barrier. Generally it is said that the role of leadership should be discussed to a greater extent in transitions literature (Lawhon and Murphy 2011).

Role of policy in shaping diffusion

There is a need to further articulate the instruments (e.g. collaborative, regulative, market-driven) that are made use of in support of e-CS. Even though no single instrument can be considered as superior along all dimensions (Goulder and Parry 2008), the policy literature still deals with individual policy instruments (Geels et al. 2015). When applied individually, though, these usually have a limited impact, and could in combination mutually reinforce each other (van der Heijden 2014). It would be necessary to identify the interactions of the existing instruments, and investigate how these hinder or stimulate the diffusion of e-CS. Resulting from this, it should be analyzed which combination of instruments proves to be the most advantageous for the support of the development of e-CS.

Role of economic factors

A need exists to further articulate the economic dimensions of innovations on a niche level. Only a few business model perspectives in combination with core concepts from transition theory are applied. As a result, the role of business models is rather unclear (Sarasini and Linder 2017). Hence, SNM's socio-cognitive dimensions could be complemented with research on business models and the role of private and public funding mechanisms (Geels et al. 2015). For e-CS, an analysis of the various kinds of of business models on a local level for the different kinds of customer groups might prove to be advantageous for an increased market streaming of e-CS. This should include a focus on the differences between business models that deal with regular CS and the ones focused on CS in urban residential neighborhoods, the latter including the cooperation with the housing sector (and local businesses).

7.5 Policy implications and practical recommendations

As this thesis provides new understandings of the developments towards the diffusion of e-CS in urban areas (and particularly its issues and challenges), new insights for policy-making can be obtained. Besides the City of Hamburg, this might also prove to be of significance for other urban areas that intend to establish e-CS. Generally, the conclusions drawn from this thesis do not allow to go into detail on advice for policy-making, but only make general observations about policy and governance measures that could be applied to address the existing issues.

As was visible in this thesis, the potential benefits of e-CS should not be taken for granted. In addition, the described challenges should be addressed so that its potentials can fully develop. This requires a holistic and integrative approach. As the debates about supporting policies for e-CS tend to revolve around economic incentives, charging infrastructure, and parking space, this thesis suggests that this focus must be complemented with other measures. Neighborhood-based mobility and e-CS concepts represent cross-sectional activities that require interactions between different actors. Besides policy actors, potential users and supply-side actors should become involved to a larger degree as well. If these are not sufficiently engaged, a backlash is risked. Moreover, if a focus is put on short sighted technological fixes, this might solve only some issues (Nykvist and Whitmarsh 2008). As e-CS has to be transformed from a rather unknown innovation to a familiar artefact that is embedded in users' daily routines, specific policy measures have to be put in place.

The following types of "work" from Lie and Sørensen (1996) are implicitly discussed in the following sub-chapters, as these could provide some solutions for the introduction of new innovations: cognitive work (learning about the innovation and developing associated competencies); symbolic work (articulation of new interpretations and beliefs that guide 'sense-making' towards the innovation); and practical work (adjustment of user routines to match the new innovation) (Geels et al. 2015). As these are not discussed in-depth, subsequent research could possibly focus on these.

7.5.1 Regulative institutions

For an increased adoption of innovations, specific and comprehensive policy and legal measures should be put in place that support the innovation, based on a holistic assessment of its environmental, economic, and social effects (Peters et al. 2012). It remains to be seen when the planned CS legislation

will be passed, as this would give CS vehicles more space and visibility. Until then, the city is advised to apply other policy measures. Generally, a stronger policy signal is needed in the city, including an increase in the importance of CS in various sectoral policies and guidelines that relate to and focus on transport and mobility planning. If this was to be achieved, it could make a support for station-based CS more likely than for free-floating CS. This could be simplified if there was a person responsible for CS in the local government. Moreover, it is argued that an increased integration of CS into urban development planning is significant for its further development (Glotz-Richter 2013b). In general, the policy solutions should not only be focused on e-CS as a new technology, but on the accompanying services and institutions as well (Nykvist and Whitmarsh 2008). Based on the fact that radical innovations involve cultural change and on the above-mentioned "symbolic work", it would be welcomed if policy makers would establish dedicated campaigns or projects beyond information provision. They could create a sense of enthusiasm, foster positive discourses about e-CS and would give assistance in changing cultural preferences (Geels et al. 2015). However, new and comprehensive measures might prove to be difficult. This is because governments are likely to select a specific policy based on the existing policy and regulatory frameworks, their knowledge capabilities, given financial capacities (Leurent and Windisch 2011), and political will (Geels et al. 2015).

The topic of electro mobility is, in comparison to CS, supposed to be dealt on a national rather than local level. Whereas a national legislation already exists and gives BEVs, in comparison to ICEs, specific advantages, current economic incentives are not adequately put in place to support the introduction of BEVs. If improved financial incentives for BEVs and the accompanying charging infrastructure are not (yet) possible to a large degree, they should at least be provided for the CS sector. Furthermore, it would be advantageous if more specific regulations and specifications for OEMs were put in place, so that these would be forced to invest more resources in the development of BEVs.

On a city-wide scale, the current state of e-CS in urban developments could be positively influenced if the integration of sustainable mobility concepts in urban development areas were carried out more coherent. Some kind of policy or regulatory measures should exist, which make it possible that mobility conecpts do not differ to a large degree when being integrated into the urban development. A possibility in that regard represents the adaptation of the Federal State Building Code to more easily integrate electro mobility, in combination with CS, into spatial planning concepts (NPE 2014).

7.5.2 Cognitive and normative institutions

In addressing cognitive uncertainties, "cognitive work" and "practical work" would prove helpful. Here, the city should provide more possibilities for potential users of e-CS and the housing sector to develop new competencies and adjust their routines to match e-CS. This could possibly be achieved by means of exposing these actors and customers to demonstration and testing, such as local niche projects.

Besides the city, the housing sector should acknowledge that they might have to adjust their routines and norms, as the formation of sustainable mobility concepts is likely to warrant a renegotiation of deep-rooted roles (Mukhtar-Landgren et al. 2016). However, to achieve this normative change, first a cognitive change, or at least an increased cognitive knowledge base, has to be established. This could partially be achieved through an interface actor who would provide the necessary informational

support. Regarding this, it may be necessary to make the existing service structure of service providers more coherent. In addition, associations such as the *VNW e.V*. could function as interface actors. Generally though, such cognitive-informational work might not prove to be sufficient. Measures most probably have to be applied, which either normatively emotionalize the actors of the housing sector, or make them perceive that e-CS is economically worthwhile (see chapter 7.5.3 below). These aspects are also related to their customers (and their routines and practices). However, as a use of e-CS is not yet sufficient, increased policy measures are necessary, which target possible users. This might prove helpful, as various signs indicate that an increased usage of e-CS is in the near future rather given. For CSOs, a change in normative and cognitive rules might prove to be necessary as well. They particularly have to gain cognitive knowledge about business models in urban neighborhoods and adapt these more to the housing sector. This entails a closer cooperation with the housing sector.

7.5.3 Bounded rationality and boundedly rational interests

The city's intention to provide parking spaces for CS to a greater extant from 2019 onwards should be seen as positive. Yet, in case of a real want of station-based CS, these could be established earlier. As regards the charging infrastructure in the public space, the national government should make its construction more financially attractive for market actors, so that the city is not solely responsible for its provision. In relation to this, the city should work on business models which enable various actors to become involved in the provision of the charging infrastructure, including energy supply companies. Such business models could be tested in local niche projects. Economic funding for these projects provides a large opportunity for improved developments of electro mobility at a local scale (Nykvist and Whitmarsh 2008). For both housing and CS actors, an option to decrease financial risks would be to draw up a cost and distribution plan, which specifically states which actor is responsible for which specific measure(s). There may be difficulty in evaluating investment rationality, though, as subjective assumptions, e.g. of learning curves and market demand, generally influence CBAs (Gross et al. 2013).

7.5.4 Niche developments

As was visible in this thesis, niche projects prove to be an important source for collaboration and learning. Based on the results of the project 'e-Quartier Hamburg', it is recommended to set up more local niche projects that deal with e-CS. This would allow to assess the state and potentials of e-CS further. Generally, a connection of the various local niche projects (or at least some) would be fruitful, so that knowledge exchange as well as a replicability and scalability of the obtained results is possible. As of yet, no specific network exists. The City of Hamburg also sees development of platforms to exchange policy approaches as imperative. At the same time, it acknowledges that support is needed to set these up (Rah 2017). One difficulty in the replicability of the results represents the fact that neighborhood-specific circumstances and needs always have to be taken into account.

Since the networks of actors who are developing innovations are often unstable, it would be advantageous to improve incentives and protection measures. These should focus on the boundedly rational interests of the involved actors. Concerning the institutional factors, (economic) protection measures only prove partly helpful. Based on the aspect of "symbolic work"', the coherence and influence of niche developments could be strengthened by developing and articulating some kind of future "visions" (e.g. graphics or documents defining stakeholders' views, perceptions, and key aspects

for them) for sustainable mobility together with various important stakeholders. These could at first be implemented on a local scale, e.g. in niche projects, and then gradually be scaled up (Nykvist and Whitmarsh 2008). By developing these "visions" – which guide sense-making – niche developments can be further stimulated on a local level, e.g. regarding learning, knowledge exchange, and to attract new investments from regime actors at the macro level.

7.6 Critical reflection on the limits of the research results

The thesis is built upon two theories that are combined in a conceptual framework. The process of choosing these theories was difficult insofar that the transition and institutional studies offer various theories that could be applicable. Hence, it took a long time to find suitable and appropriate theories that allow one to combine both structure and agency, and build a conceptual framework out of these. This was complicated by the fact that at the beginning of the thesis three, instead of two theories were initially to be used. The intention was that the combination of three categories would allow one to assess the topic more in-depth. In that regard, as well as generally, the contact with my supervisor, Dr. Sietske Veenman, was really helpful. She steered me into the right direction and made me see that I needed to be efficient and effective, not too extensive concerning my chosen theories and methods, as well as straightforward and concise with regard to my writing. Due to this fact, in the end only two theories were applied.

The process of figuring out the important actors in the City of Hamburg that deal with the topic of e-CS, as well as coming in contact with them was rather easy. This is also because a "snowball principle" was used. Concerning this, previously interviewed actors were asked if they knew of other actors that deal with or are involved in the topic of e-CS. Moreover, the actors in the project 'e-Quartier Hamburg' were already known either way. In general, given time and resource constraints, it was not viable to interview more than the interviewed actors. Yet, a greater number of actors would have added to the qualitative basis of the thesis by possibly reinforcing the most important factors that were emerging in the analysis. This includes particularly actors of energy supply companies who are perceived to be important to the topic of e-CS. However, contacting some actors, for instance "big players" that were involved in the project, such as *Vattenfall* or the *Deutsche Bahn,* did not lead to any responses. As a result, it was not possible to interview these.

In total, this thesis deals with only one empirical case of a local niche project, hence does not focus on a higher level of niche management, including several projects that are dealing with e-CS in urban neighborhoods. As a result, a rich empirical picture, where the interactions between local niche developments are analyzed, is not provided. This would have made the analysis appear stronger on an empirical foundation, but was not possible due to time, resource and spatial constraints.

As this thesis deals with an urban area, it makes the analysis challenging. Urban built environments can be described as complex due to their scale and context-dependency. This includes the permanence of the built environment, specific norms, different interests, and various lifestyles that are associated with the way urban areas are built (Hodson and Marvin 2010). This results in an extraneous number of variables that could be looked at; all of which could not have been taken into account in this thesis. Besides, as urban areas differ to a large extent from other areas, it makes comparisons rather difficult.

Bibliography

Aichinger, W.; Gies, J.; Klein-Hitpaß, A.; Zwicker-Schwarm, D. (eds.) (2014): Elektromobilität in der Stadt- und Verkehrsplanung. Praxiserfahrungen aus den Modellregionen und weitere Wissensbedarfe. Deutsches Institut für Urbanistik; NOW GmbH. Berlin: Deutsches Institut für Urbanistik difu (Modellregionen Elektromobilität).

Ajanovic, A.; Haas, R. (2016): Dissemination of electric vehicles in urban areas. Major factors for success. In: *Energy* 115, pp. 1451–1458. DOI: 10.1016/j.energy.2016.05.040.

Akelbein, B. (2015): Genossenschaften als Impulsgeber für quartierbezogenes E-Carsharing? Eine Analyse von Hamburger Genossenschaftsquartieren. Hamburg. Online available at http://edoc.sub.uni-hamburg.de/hcu/volltexte/campus/2016/266/. Accessed on 30.09.2017.

Altenburg, T.; Schamp, E. W.; Chaudhary, A. (2016): The emergence of electromobility. Comparing technological pathways in France, Germany, China and India. In: *Science and Public Policy* 43 (4), pp. 464–475. DOI: 10.1093/scipol/scv054.

Appeldorn, E. (09.05.2017): Personal Interview. Hamburg. Recorded audiofile.

Argyris, C. (1976): Singe-loop and double loop models in research on decision-making. In: *Administrative Science Quarterly 21* (3), pp. 363–375.

Augenstein, K. (2015): Analysing the potential for sustainable e-mobility – The case of Germany. In: *Environmental Innovation and Societal Transitions* 14, pp. 101–115. DOI: 10.1016/j.eist.2014.05.002.

Autobild (2012): Wohnen ohne eigenes Auto. Autobild.de. Online available at http://www.autobild.de/artikel/wohnung-mit-auto-zu-vermieten-3677554.html. Updated on 18.10.2012. Accessed on 21.08.2017.

Banister, D. (2008): The sustainable mobility paradigm. In: *Transport Policy* 15 (2), pp. 73–80. DOI: 10.1016/j.tranpol.2007.10.005.

Baptista, P.; Melo, S.; Rolim, C. (2014): Energy, environmental and mobility impacts of car-sharing systems. Empirical results from Lisbon, Portugal. In: *Procedia – Social and Behavioral Science* (111), pp. 28–37.

Barley, S. R.; Tolbert, P. S. (1997): Institutionalization and Structuration: Studying the Link between Action and Institution. In: *Organization Studies* 18 (1), pp. 93-117.

Barter, P. (2013): Cars are parked 95% of the time. Online available at http://www.reinventingparking.org/2013/02/cars-are-parked-95-of-time-lets-check.html. Updated on 22.02.2013. Accessed on 05.09.2017.

Bastedo, M. N. (2007): Sociological Frameworks for Higher Education Policy Research. In: P. J. Gumport (ed.): Sociology of higher education. Contributions and their contexts. Baltimore: Johns Hopkins University Press.

Baum, H.; Heinicke, B.; Mennecke, C. (2012): Carsharing als alternative Nutzungsform für Elektromobilität. In: *Zeitschrift für Verkehrwesen* 02, pp. 63–109.

Baum, G. (02.05.2017): Personal Interview. Hamburg. Recorded audiofile.

BBSR (2012): Die Attraktivität großer Städte: ökonomisch, demografisch, kulturell. Ergebnisse eines Ressortforschungsprojekts des Bundes. Bonn.

BBSR (2014): Neue Mobilitätsformen, Mobilitätsstationen und Stadtgestalt. Eine ExWoSt-Studie. Bonn.

bcs (n.d.): CarSharing und Wohnen - eine echte Win-win-Situation. Bundesverband CarSharing. Online available at https://carsharing.de/themen/carsharing-wohnen/carsharing-wohnen-echte-win-win-situation. Accessed on 05.06.2017.

bcs (2012): Positionspapier Elektromobilität im Carsharing. Bundesverband CarSharing. Online available at www.carsharing.de/images/stories/pdf_dateien/bcs_positionspapier_elektromobilitaet_und_carsharing_final.pdf. Accessed on 21.06.2017.

bcs (2015): bcs-Städtevergleich 2015: CarSharing-Angebote in deutschen Städten über 50.000 Einwohner. Bundesverband CarSharing e. V. Online available at https://carsharing.de/sites/default/files/uploads/uebersichtstabelle_staedteranking_2015.pdf. Accessed on 22.06.2017.

bcs (2016): CarSharing fact sheet Nr. 3. Bundesverband CarSharing. Online available at https://carsharing.de/sites/default/files/uploads/bcs_factsheet_3.pdf, Accessed on 17.07.2017.

bcs (2017a): Aktuelle Zahlen und Daten zum CarSharing in Deutschland. Bundesverband CarSharing e. V. Online available at http://www.carsharing.de/alles-ueber-carsharing/carsharing-zahlen. Accessed on 30.08.2017.

bcs (2017b): Bundestag verabschiedet CarSharing-Gesetz. Bundesverband CarSharing. Online available at https://carsharing.de/bundestag-verabschiedet-carsharing-gesetz. Accessed on 05.09.2017.

Beckert, J. (2016): Agency, Entrepreneurs, and Institutional Change. The Role of Strategic Choice and Institutionalized Practices in Organizations. In: *Organization Studies* 20 (5), pp. 777–799. DOI: 10.1177/0170840699205004.

Beckmann, K. J. (2013): Veränderte Rahmenbedingungen für Mobilität und Logistik. Zeitfenster für Technik-, Verhaltens- und Systeminnovationen. In: K. J. Beckmann und A. Klein-Hitpaß (eds.): Nicht weniger unterwegs, sondern intelligenter? Neue Mobilitätskonzepte. Berlin: Edition Difu, pp. 31–58.

Bell, S. (2002): Institutionalism: Old and New.

Berger, P. L.; Luckman, T. (1967): The Social Construction of Reality: A Treatise in the Sociology of Knowledge. New York: Doubleday Anchor.

Beyer, J.; Waßmuth, V.; Plank-Wiedenbeck, U. (2013): Welche Rolle soll Elektromobilität insgesamt spielen? In: V. Boesche, O. Franz, C. Fest und J. Gaul (eds.): Berliner Handbuch der Elektromobilität. München: C.H. Beck, p. 29–56.

Bibri, S. E.; Krogstie, J. (2017): Smart sustainable cities of the future. An extensive interdisciplinary literature review. In: *Sustainable Cities and Society* 31, pp. 183–212. DOI: 10.1016/j.scs.2017.02.016.

BMVI (2017): kompakt² Elektromobilität. Berlin.

Böcher, M. (2012): A theoretical framework for explaining the choice of instruments in environmental policy. In: *Forest Policy and Economics* 16, pp. 14–22. DOI: 10.1016/j.forpol.2011.03.012.

Boesche, V.; Franz, O.; Fest, C.; Gaul, J. (eds.) (2013): Berliner Handbuch der Elektromobilität. München: C. H. Beck.

Boije, H. (2010): Analysis in Qualitative Research: SAGE Publications Ltd.

Boyko, C.; Clune, S.; Cooper, R.; Coulton, C.; Dunn, N.; Pollastri, S. et al. (2017): How Sharing Can Contribute to More Sustainable Cities. In: *Sustainability* 9 (5), pp. 701. DOI: 10.3390/su9050701.

Bozem, K.; Nagl, A.; Rath, V.; Haubrock, A. (2013): Elektromobilität. Kundensicht, Strategien, Geschäftsmodelle. Wiesbaden: Springer Fachmedien Wiesbaden.

Brandt, N.; Menzel, G. (03.05.2017): Personal Interview. Hamburg. Recorded audiofile.

Bryman, A. (2012): Social research methods. 4. ed. Oxford u.a: Oxford Univ. Press.

BSU Hamburg (2013): Ein Mobilitätskonzept für die Zukunft. Behörde für Stadtentwicklung und Umwelt Hamburg. Online available at http://www.hamburg.de/mobilitaetskonzept/. Accessed on 30.06.2017.

BUE Hamburg (2017): 2. Fortschreibung des Luftreinhalteplans für Hamburg. Behörde für Umwelt und Energie Hamburg. Online available at http://www.hamburg.de/contentblob/8693060/2388789a9f4f1278d96e367c50f7e1bb/data/d-entwurf-lrp-2017.pdf. Accessed on 20.05.2017.

Bührman, G. (2011): Institutional Pressures and Strategic Responses: The Case of the BP Oil Spill. Amsterdam.

Bürgerschaft der FHH (2013): Mobilitätsprogramm 2013. Grundlage für eine kontinuierliche Verkehrsentwicklungsplanung in Hamburg. Bürgerschaft der Freien und Hansestadt Hamburg. Online available at http://www.hamburg.de/contentblob/4119700/50fd34e0e06432b8ea113bf40cfc6ca7/data/mobilitaetsprogramm-2013.pdf. Accessed on 21.08.2017.

Bürgerschaft der FHH (2014): Masterplan Ladeinfrastruktur. Bürgerschaft der Freien und Hansestadt Hamburg. Online available at http://www.hamburg.de/contentblob/4479262/dcabd1a0157d6ac7c2ab1bfb06b22dc7/data/masterplan-ladeinfrastruktur.pdf. Accessed on 05.06.2017.

Bürgerschaft der FHH (2015a): Hamburger Klimaplan. Bürgerschaft der Freien und Hansestadt Hamburg. Online available at http://www.hamburg.de/contentblob/4658414/370c9407227173a4c9a27a4b4619f598/data/d-21-2521-hamburger-klimaplan.pdf. Accessed on 10.05.2017.

Bürgerschaft der FHH (2015b): Zusammen schaffen wir das moderne Hamburg. Koalitionsvertrag über die Zusammenarbeit in der 21. Legislaturperiode der Hamburgischen Bürgerschaft zwischen der SPD, Landesorganisation Hamburg und Bündnis 90/Die Grünen, Landesverband Hamburg. Bürgerschaft der Freien und Hansestadt Hamburg. Online available at http://www.hamburg.de/contentblob/4479010/0e0dc965584486bf76aa1a974471f843/data/download-koalitionsvertrag-2015.pdf. Accessed on 30.04.2017.

Bürgerschaft der FHH (2017): Mobilität in Hamburg - Ziele. Bürgerschaft der Freien und Hansestadt Hamburg. Online available at http://www.buergerschaft-hh.de/ParlDok/dokument/56376/mobilit%c3%a4t-in-hamburg-%e2%80%93-ziele.pdf. Accessed on 23.03.2017.

Burns, T. R.; Flam, H. (1987): The shaping of social organization. Social rule system theory with applications. Beverly Hills/Calif.: Sage Publ.

Cairns, S.; Harmer, C.; Hopkin, J.; Skippon, S. (2014): Sociological perspectives on travel and mobilities. A review. In: *Transportation Research Part A: Policy and Practice* 63, pp. 107–117. DOI: 10.1016/j.tra.2014.01.010.

Caniëls, M. C. J.; Romijn, H. A. (2008): Strategic niche management. Towards a policy tool for sustainable development. In: *Technology Analysis & Strategic Management* 20 (2), pp. 245–266. DOI: 10.1080/09537320701711264.

Canzler, W.; Knie, A. (1994): Das Ende des Automobils. Fakten und Trends zum Umbau der Autogesellschaft. 1. ed. Heidelberg: C.F. Müller.

Canzler, W.; Schmidt, G. (eds.) (2003): Das zweite Jahrhundert des Automobils. Technische Innovationen, ökonomische Dynamik und kulturelle Aspekte. Berlin: Edition Sigma.

Canzler, W.; Wentland, A.; Simon, D. (2011): Wie entstehen neue Innovationsfelder? Vergleich der Formierungs- und Formungsprozesse in der Biotechnologie und Elektromobilität. Berlin: WZB (Discussion paper / Wissenschaftszentrum Berlin für Sozialforschung, Forschungsschwerpunkt Gesellschaft und wirtschaftliche Dynamik, Forschungsgruppe Wissenschaftspolitik, SP III 2011-601).

CARICOM (2011): CARICOM Workshop on the Development of Caribbean Specific Information and Communication Technologies (CSICT) Statistics and Indicators. AREA: Policy and Regulatory Framework. Antigua and Barbados, 06.12.2011. Online available at www.caricomstats.org/Files/ICT/ICT%2520Workshop%2520-%2520Policy%2520and%2520Regulatory%2520Framework%2520Presentation.ppt. Accessed on 15.03.2017.

Chen, T. Donna; Kockelman, Kara M.; Hanna, Josiah P. (2016): Operations of a shared, autonomous, electric vehicle fleet. Implications of vehicle & charging infrastructure decisions. In: *Transportation Research Part A: Policy and Practice* 94, pp. 243–254. DOI: 10.1016/j.tra.2016.08.020.

Clausnitzer, K.-D. (2015): Elektromobilität und Wohngebäude. Was kommt auf die Immobilienbranche zu? 23. Deutscher Verwaltertag. Berlin, 2015.

Clausnitzer, K.-D.; Gabriel, J.; Buchmann, M. (2012): Elektromobilität und Wohnungswirtschaft. [Abschlussbericht]. Stuttgart: Fraunhofer IRB. (Reihe Wissenschaft, 33).

Claussen, V. (2017): Elektromobilität und Immobilien. Es gibt schon Lösungen - Praxisbeispiel Heidrehmen: Kopplung von Energieerzeugung, Wohnen und E-Mobilität. Immobilienpartner im Gespräch. Hamburg, 03.04.2017. Online available at https://www.vnw.de/fileadmin/redakteur/Veranstaltungen/Immobilienpartner_im_Gespraech_-_Elektromobilitaet_und_Immobilie/Beitraege/170403_Volker_Claussen_BVE_Praesentation.pdf. Accessed on 22.04.2017.

Coffey, A.; Holbrook, B.; Atkinson, P. (1999): Qualitative data analysis. Technologies and representations. [S.l.]: [s.n.].

Creswell, J. W.; Zhang, W. (2009): The application of mixed methods designs to trauma research. In: *Journal of traumatic stress* 22 (6), pp. 612–621. DOI: 10.1002/jts.20479.

Dentel-Post, C. (2012): Less parking, more carsharing. Supporting small-scale transit-oriented development. Berkeley, Calif (Working paper / Institute of Urban and Regional Development). Online available at http://www.iurd.berkeley.edu/publications/wp/2012-04.pdf. Accessed on 20.07.2017.

Die Bundesregierung (n.d.): Nachhaltige Mobilität. Das Auto teilen statt besitzen. Presse- und Informationsamt der Bundesregierung. Online available at https://www.bundesregierung.de/Content/DE/Artikel/2016/12/2016-12-21-carsharing-gesetz.html. Updated on 12.05.2017. Accessed on 14.06.2017.

Die Bundesregierung (2009): Nationaler Entwicklungsplan Elektromobilität der Bundesregierung. Online available at http://www.bmbf.de/pubRD/ nationaler entwicklungsplan elektromobilitaet.pdf. Accessed on 14.04.2017.

Dierks, C. (25.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Dijk, M.; Orsato, R. J.; Kemp, R. (2013): The emergence of an electric mobility trajectory. In: *Energy Policy* 52, pp. 135–145. DOI: 10.1016/j.enpol.2012.04.024.

Dijk, M.; Yarime, M. (2010): The emergence of hybrid-electric cars. Innovation path creation through co-evolution of supply and demand. In: *Technological Forecasting and Social Change* 77 (8), pp. 1371–1390. DOI: 10.1016/j.techfore.2010.05.001.

DiMaggio, P. J.; Powell, W. W. (1983): The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields". In: *American Sociological Review* 48 (2), pp. 147–160.

Dudenhöffer, K. (2015): Akzeptanz von Elektroautos in Deutschland und China. Wiesbaden: Springer Fachmedien Wiesbaden.

Dütschke, E.; Schneider, U.; Sauer, A.; Wietschel, M.; Hoffmann, J. (2012): Roadmap zur Kundenakzeptanz Elektromobilität. Karlsruhe (Technologie-Roadmapping am Fraunhofer ISI). Online available at http://nbn-resolving.de/urn:nbn:de:0011-n-1929158. Accessed on 05.05.2017.

Dütschke, E.; Schneider, U.; Schlosser, C.; Sevin, D.; Wilhelm, T. (2016): Elektromobile Sharing-Angebote: Wer nutzt sie und wie werden sie bewertet? Begleitforschung zu den Modellregionen Elektromobilität des BMVI - Ergebnisse des Themenfeldes Nutzerperspektive. NOW GmbH; Fraunhofer-Institut für System- und Innovationsforschung; Deutschland. Berlin. Online available at http://edok01.tib.uni-hannover.de/edoks/e01fn16/872840522.pdf. Accessed on 30.03.2017.

EEA (2015): Transport — passenger transport demand and modal split. European Environment Agency. Online available at https://www.eea.europa.eu/soer-2015/countries-comparison/transport. Updated on 15.11.2016. Accessed on 14.08.2017.

EEA (2017): Greenhouse gas emissions from transport. European Environment Agency. Online available at https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-10. Updated on 23.10.2017. Accessed on 14.11.2017.

Elgström, L.; Erman, M.; Klindworth, K.; Koenig, C. (2014): European Cities Moving Towards Climate Neutrality. Practices, Tools and Policies. CLUE – Climate Neutral Urban Districts in Europe. Online available at http://www.hamburg.de/contentblob/4433362/5cdc2899d6d449e436be461d45dd2dd1/data/d-clue.pdf. Accessed on 23.02.2017.

Engstfeld, J. (20.04.2017): Personal Interview. Hamburg. Recorded audiofile.

European Commission (2001.): A sustainable Europe for a better world: a European Union strategy for sustainable development. Brussels. Online available at http://ec.europa.eu/regional_policy/archive/innovation/pdf/library/strategy_sustdev_en.pdf. Updated on 25.09.2017. Accessed on 11.10.2017

European Commission (2011): Roadmap to a Single European Transport Area: Towards a competitive and resource efficient transport system. White Paper. Brussels.

European Commission (2014): The 2020 climate and energy package. Online available at https://ec.europa.eu/clima/policies/strategies/2020_en. Accessed on 30.06.2017.

European Union (2012): EU Transport in Figures. Statistical Pocketbook.

Exxon Mobil (2011): Energieprognose 2011 bis 2030 Deutschland. Schwerpunkt: Wie viel Zukunft steckt im Auto von heute? Exxon Mobil Central Europe Holding GmbH. Hamburg. Online available at http://www.forschungsnetzwerk.at/downloadpub/Energieprognose_2011.pdf. Accessed on 11.10.2017.

Färber, C.; Ölschläger, M.; Schleinitz, J.; Siebrand, J.-O.; Wolf, R. (2014): Stadtmobilität in Hamburg 2030. Eine lebenswerte Stadt in Bewegung. Handelskammer Hamburg. Online available at https://www.hk24.de/blob/hhihk24/produktmarken/interessenvertretung/wirtschaft-politik/wirtschaftspolitik/downloads/1153060/150421f8a1dc1bb8bfc368d3197cc2e1/Standpunkt_Stadtmobilitaet_in_Hamburg_2030-data.pdf. Accessed on 09.11.2017.

Ferber, B. (28.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Fischer, L.-B.; Newig, J. (2016): Importance of Actors and Agency in Sustainability Transitions. A Systematic Exploration of the Literature. In: *Sustainability* 8 (5), pp. 476. DOI: 10.3390/su8050476.

Flick, U. (2007): Qualitative Sozialforschung. Eine Einführung. Reinbek bei Hamburg: Rowohlt-Taschenbuch-Verlag.

Flyvbjerg, B. (2006): Five Misunderstandings About Case-Study Research. In: *Qualitative Inquiry* 12 (2), pp. 219–245. DOI: 10.1177/1077800405284363.

Follmer, R. (2011): Mobilität im Großraum Hamburg. Vorstellung der regionalen Ergebnisse „Mobilität in Deutschland“. Regionalkonferenz Verkehr & Mobilität. infas Institut für angewandte Sozialwissenschaft GmbH. Hamburg, 04.11.2011. Online available at http://www.mobilitaet-in-deutschland.de/pdf/Praesentation_MiD_Bericht_Region_HH_Regionalkonferenz_VerkehrMobilitaet.pdf. Accessed on 15.10.2017.

Foxon, T. J. (2011): A coevolutionary framework for analysing a transition to a sustainable low carbon economy. In: *Ecological Economics* 70 (12), pp. 2258–2267. DOI: 10.1016/j.ecolecon.2011.07.014.

Foxon, T. J.; Hammond, G. P.; Pearson, P. J.G. (2010): Developing transition pathways for a low carbon electricity system in the UK. In: *Technological Forecasting and Social Change* 77 (8), pp. 1203–1213. DOI: 10.1016/j.techfore.2010.04.002.

Fraunhofer ISI (2011): Gesellschaftspolitische Fragestellungen der Elektromobilität. Online available at http://www.isi.fraunhofer.de/isi-wAssets/docs/x/de/publikationen/elektromobilitaet_broschuere.pdf. Accessed on 20.06.2017.

Frenken, K. (2013): Towards a prospective transition framework. A co-evolutionary model of socio-technical transitions and an application to car sharing in The Netherlands.

Fünfschilling, L. (2014): A dynamic model of socio-technical change. Institutions, actors and technologies in interaction. [s.n.]: Basel.

Geels, F. W. (2002): Technological transitions as evolutionary reconfiguration processes. A multi-level perspective and a case-study. In: *Research Policy* 31 (8-9), pp. 1257–1274. DOI: 10.1016/S0048-7333(02)00062-8.

Geels, F. W. (2004): From sectoral systems of innovation to socio-technical systems. In: *Research Policy* 33 (6-7), pp. 897–920. DOI: 10.1016/j.respol.2004.01.015.

Geels, F. W. (2005): Technological Transitions and System Innovations: Edward Elgar Publishing.

Geels, F. W. (2010): Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. In: *Research Policy* 39 (4), pp. 495–510. DOI: 10.1016/j.respol.2010.01.022.

Geels, F. W. (2012): A socio-technical analysis of low-carbon transitions. Introducing the multi-level perspective into transport studies. In: *Journal of Transport Geography* 24, pp. 471–482. DOI: 10.1016/j.jtrangeo.2012.01.021.

Geels, F. W.; Raven, R. (2006): Non-linearity and Expectations in Niche-Development Trajectories. Ups and Downs in Dutch Biogas Development (1973–2003). In: *Technology Analysis & Strategic Management* 18 (3-4), pp. 375–392. DOI: 10.1080/09537320600777143.

Geels, F. W.; Schot, J. (2011): PART I: The Dynamics of Transitions: A Socio-Technical Perspective. In: J. Grin, J. Rotmans und J. Schot (eds.): Transitions to sustainable development. New directions in the study of long term transformative change. First issued in paperback. New York, London: Routledge.

Geels, F. W.; Schwanen, T.; Sorrel, S. (2015): The socio-technical approachto low-energy innovation. Research Strategy of the Centre on Innovation and Energy Demand (CIED).

Giddens, A. (1984): The constitution of society. Outline of the theory of structuration. 1. publ. Berkeley: Univ. of California Press.

Gioia, D. A.; Pitre, E. (1990): Multiparadigm Perspectives on Theory Building. In: *The Academy of Management Review* 15 (4), pp. 584–602. DOI: 10.5465/AMR.1990.4310758.

Glotz-Richter, M. (2013a): Carsharing in kommunalen Mobilitätsstrategien. In: K. J. Beckmann und A. Klein-Hitpaß (eds.): Nicht weniger unterwegs, sondern intelligenter? Neue Mobilitätskonzepte. Berlin: Edition Difu, pp. 209–224.

Glotz-Richter, M. (2013b): Der Verkehr, die Stadt und die „mobil.punkte“ – wie Carsharing das Klima schützt. In: Jan Walter und Patrick Diekelmann (eds.): Klimaschutz & Mobilität. Beispiele aus der kommunalen Praxis und Forschung - so lässt sich was bewegen. Köln: Service- und Kompetenzzentrum Kommunaler Klimaschutz.

Glotz-Richter, M. (2016): Reclaim Street Space! – Exploit the European Potential of Car Sharing. In: *Transportation Research Procedia* 14, pp. 1296–1304. DOI: 10.1016/j.trpro.2016.05.202.

Glover, J. L.; Champion, D.; Daniels, K. J.; Dainty, A.J.D. (2014): An Institutional Theory perspective on sustainable practices across the dairy supply chain. In: *International Journal of Production Economics* 152, pp. 102–111. DOI: 10.1016/j.ijpe.2013.12.027.

Goulder, L. H.; Parry, I. W. H. (2008): Instrument Choice in Environmental Policy. In: *Review of Environmental Economics and Policy* 2 (2), pp. 152–174. DOI: 10.1093/reep/ren005.

Grausam, M.; Müller, U.; Rid, W.; Sperling, C.; Wolpensinger, H. (eds.) (2014): Elektromobilität in Kommunen. Handlungsleitfaden: Bausteine zur Entwicklung kommunaler Strategien für Planer und Entscheidungsträger. NOW GmbH (Modellregionen Elektromobilität). Online available at http://edok01.tib.uni-hannover.de/edoks/e01fn16/87166965X.pdf. Accessed on 14.06.2017.

Greenwood, R.; Oliver, C.; Suddaby, R.; Sahlin-Andersson, K. (eds.). (2008): The Sage handbook of organizational institutionalism. Thousand Oaks: Sage.

Grischkat, S.; Hunecke, M.; Böhler, S. (2014): Potential for the reduction of greenhouse gas emissions through the use of mobility services. In: *Transport Policy* 35, pp. 295–303.

Gross, R.; Heptonstall, P.; Greenacre, P.; Candelise, C.; Jones, F.; Castillo, A. C. (2013): Presenting the Future: An assessment of future costs estimation methodologies in the electricity generation sector. UKERC report. UK Energy Research Centre.

Hachleitner, B. (n.d.): Mobilitätskonzepte statt bloßem Zählen der Stellplätze. VCÖ - Mobilität mit Zukunft. Online available at https://www.vcoe.at/news/details/mobilitaetskonzepte-statt-blossem-zaehlen-der-stellplaetze. Accessed on 29.04.2017.

HafenCity Universität Hamburg (2013): WORKSHOP. e-Quartier Hamburg - Welche Kriterien sind relevant für die Auswahl und Bewertung von Quartieren? Hamburg, 02.12.2013.

Hall, P. A.; Taylor, R.C.R (1996): Political Science and the Three New Institutionalisms. In: *Political Studies* (XLIV), pp. 936–957.

Haller, W.; Gerstenberger, T.; Bytzek, C. (2013): Freie und Hansestadt Hamburg: Mobilitätskonzept Mitte Altona. Online available at http://www.hamburg.de/contentblob/4111664/2809d680baf01c026ab2f8583eb46d3c/data/mobilitaetskonzept-mitte-altona.pdf. Accessed on 15.05.2017.

Harendt, B.; Mayer, C. (eds.) (2015): Rechtliche Rahmenbedingungen für Ladeinfrastruktur im Neubau und Bestand. Schaufenster Elektromobilität - eine Initiative der Bundesregierung. Deutsches Dialog Institut (Ergebnispapier der Begleit- und Wirkungsforschung). Online available at http://edok01.tib.uni-hannover.de/edoks/e01fn16/869398482.pdf. Accessed on 23.06.2017.

Hegger, Dries. L. T.; van Vliet, Jenneke; van Vliet, Bas J. M. (2007): Niche Management and its Contribution to Regime Change. The Case of Innovation in Sanitation. In: *Technology Analysis & Strategic Management* 19 (6), pp. 729–746. DOI: 10.1080/09537320701711215.

Hekkert, M. P.; Suurs, R.A.A.; Negro, S. O.; Kuhlmann, S.; Smits, R.E.H.M. (2007): Functions of innovation systems. A new approach for analysing technological change. In: *Technological Forecasting and Social Change* 74 (4), pp. 413–432. DOI: 10.1016/j.techfore.2006.03.002.

Henrichs, B. (2016): Warum-Carsharing-noch-Potenzial-hat.html. Die Welt. Online available at https://www.welt.de/regionales/hamburg/article154576137/Warum-Carsharing-noch-Potenzial-hat.html. Updated on 21.04.2016. Accessed on 16.08.2017.

Hielscher, S.; Seyfang, G.; Smith, A. (2013): Grassroots innovations for sustainable energy. Exploring niche-development processes among community- energy initiatives. In: M. Cohen, H. Brown und P. Vergragt (eds.): Innovations in Sustainable Consumption: Edward Elgar Publishing, pp. 133–158.

Hildermeier, J.; Villareal, A. (2014): Two ways of defining sustainable mobility. Autolib' and BeMobility. In: *Journal of Environmental Policy & Planning* 16 (3), pp. 321–336. DOI: 10.1080/1523908X.2014.880336.

Hodson, M.; Marvin, S. (2010): Can cities shape socio-technical transitions and how would we know if they were? In: *Research Policy* 39 (4), pp. 477–485.

Hoffmann, C.; Graff, A.; Kramer, S.; Kuttler, T.; Hendzlik, M.; Scherf, C.; Wolter, F. (2012): Bewertung integrierte Mobilitätsdienste mit Elektrofahrzeugen aus Nutzerperspektive. Ergebnisse der Begleitforschung im Projekt BeMobility. Berlin elektroMobil. designhaus berlin. Berlin. Online available at https://www.bemobility.de/file/bemobility-de/2449072/2QL4WWAnVZvm2JXz7F0NNnKSKw8/2556486/data/innoz-baustein_11.pdf. Accessed on 14.04.2017.

Holtermann, L.; Jahn, M.; Otto, A. H.; Wedemeier, J. (2015): Metropolregion Hamburg 2020: Verkehrsinfrastruktur und ihre Auslastung. UNTERNEHMER POSITIONEN NORD Eine Initiative der HSH Nordbank. Hamburg. Online available at http://www.hwwi.org/fileadmin/hwwi/Publikationen/Partnerpublikationen/HSH/150415_Verkehr_Studie_web.pdf. Accessed on 20.09.2017.

Holtz, G.; Brugnach, M.; Pahl-Wostl, C. (2008): Specifying “regime” - A framework for defining and describing regimes in transition research. In: *Technological Forecasting and Social Change* 75 (5), pp. 623–643. DOI: 10.1016/j.techfore.2007.02.010.

Hoogma, R.; Kemp, R.; Truffer, B.; Schot, J. (2002): Experimenting for sustainable transport. The approach of strategic niche management. London: Spon Press.

Høyer, K. G. (2008): The history of alternative fuels in transportation. The case of electric and hybrid cars. In: *Utilities Policy* 16 (2), pp. 63–71. DOI: 10.1016/j.jup.2007.11.001.

Huber, J. (2004): New Technologies and Environmental Innovation. Cheltenham: Edward Elgar.

Hughes, T. P. (1983): Networks of Power. Baltimore: Johns Hopkins University Press.

Hüttl, R. (ed.) (2010): Elektromobilität. Potenziale und wissenschaftlich-technische Herausforderungen. Berlin: Springer.

hySOLUTIONS GmbH (2012): Vorhabensbeschreibung. Entwicklung und Umsetzung modellhafter Konzepte zur systematischen Integration von Elektromobilität in Wohnquartiere („e-Quartier Hamburg“).

hySOLUTIONS GmbH (2014): Abstimmungsgespräch Projektkonsortium und assoziierte Partner. hySOLUTIONS GmbH - Projektleitstelle Elektromobilität Hamburg. Hamburg, 13.11.2014.

hySOLUTIONS GmbH (2015): e-Quartier Hamburg. Quartiere im Aufbruch - Mobilität neu erfahren. Online available at http://elektromobilitaethamburg.de/wp-content/uploads/2016/10/E-Quartier-digital.pdf. Accessed on 15.01.2017.

IEA (2010): Energy Technology Perspectives 2010: Scenarios & Strategies to 2050. International Energy Agency. Online available at https://www.iea.org/publications/freepublications/publication/etp2010.pdf. Accessed on 17.09.2017.

infas (2012): Mobilität im Wandel. Potenziale des Carsharing. Institut für angewandte Sozialwissenschaft GmbH. Online available at https://www.yumpu.com/de/document/view/4187716/mobilitat-im-wandel-potenziale-des-car-sharing-infas. Accessed on 20.08.2017.

InnoZ GmbH (n.d.): Smart HafenCity Mobilität. Innovationszentrum für Mobilität und gesellschaftlichen Wandel (InnoZ) GmbH. Online available at https://www.innoz.de/de/smart-hafencity-mobilitaet. Accessed on 09.04.2017.

IPCC (2007): IPCC Fourth Assessment Report: Climate Change 2007.

ITP & BVU (2007): Prognose der deutschlandweiten Verkehrsverflechtungen 2025. ITP Intraplan Consult GmbH und BVU Beratergruppe Verkehr + Umwelt. München / Freiburg. Online available at http://daten.clearingstelle-verkehr.de/220/3/FE_96_857_2005_Verflechtungsprognose_2025_Gesamtbericht_20071114.pdf. Accessed on 13.11.2017.

Kairies, B. (2014): Marketing für Elektroautos. Akzeptanz als notwendige Bedingung für die Marktdurchdringung. 1. ed. Hamburg: Diplomica Verlag.

Kallinich, D.; Feesche, H.; Geiges, L.; Sosada, J.; Heinevetter, M.; Tiemann, J. (2016): E-Mobilität im kommunalen Alltag. Verstehen, vermitteln, verankern: Abschlussbericht: Schaufenster Elektromobilität - eine Inititiative der Bundesregierung: eMobilität in Niedersachsen. Göttinger Institut für Demokratieforschung. Göttingen. Online available at http://edok01.tib.uni-hannover.de/edoks/e01fb16/872705900.pdf. Accessed on 27.05.2017.

Kasperk, G.; Drauz, R. (2013): Geschäftsmodelle entlang der elektromobilen Wertschöpfungskette. In: A. Kampker, D. Vallée und A. Schnettler (eds.): Elektromobilität. Berlin, Heidelberg: Springer Berlin Heidelberg.

Keichel, M.; Schwedes, O. (2013): 1 Einleitung: Plädoyer für eine neue Mobilitätskultur. In: M. Keichel und O. Schwedes (eds.): Das Elektroauto. Wiesbaden: Springer Fachmedien Wiesbaden.

Kemmerzehl, R. (2016): Das Stellplatzäquivalent. Wie Quartiersentwicklung mit zukunftsfähigen Mobilitätskonzepten verknüpft werden kann. In: *Die Wohnungswirtschaft* (5), pp. 10–12.

Kemp, R.; Schot, J.; Hoogma, R. (1998): Regime shifts to sustainability through processes of niche formation. The approach of strategic niche management. In: *Technology Analysis & Strategic Management* 10 (2), pp. 175–198. DOI: 10.1080/09537329808524310.

Kent, J. L.; Dowling, R. (2013): Puncturing automobility? Carsharing practices. In: *Journal of Transport Geography* 32, pp. 86–92. DOI: 10.1016/j.jtrangeo.2013.08.014.

Klinger, T. (2017): Moving from monomodality to multimodality? Changes in mode choice of new residents. In: *Transportation Research Part A: Policy and Practice. DOI:* 10.1016/j.tra.2017.01.008.

Knahl, T. (2013): Einsatzpotenziale für Elektrofahrzeuge in der Hamburger Wirtschaft. Ergebnisse einer Unternehmensbefragung und Handlungsempfehlungen. Handelskammer. Hamburg (Analysen / Handelskammer Hamburg). Online available at https://www.hk24.de/blob/hhihk24/produktmarken/beratung-service/innovation/downloads/1153066/1658cad5a4497e33c507a2665b3e1dab/Analyse_Einsatzpotenziale_von_Elektrofahrzeugen_in_Hamburger_Un-data.pdf. Accessed on 14.04.2017.

Knie, A. (2013): Was bewegt uns? Veränderte Nutzerpräferenzen und Angebotsformen im Verkehr: Chancen und Risiken für die Energie- und Verkehrswende. In: K. J. Beckmann und A. Klein-Hitpaß (eds.): Nicht weniger unterwegs, sondern intelligenter? Neue Mobilitätskonzepte. Berlin: Edition Difu, pp. 256–270.

Knie, A. (2014): Innovationen für eine nachhaltige Mobilität, Elektromobilität: e-Quartier Hamburg. In: Dirk Groh und Larissa Pipke (eds.): Stadtentwicklung in der Umweltforschung. Forschungsprojekte von 2009 bis 2014, pp. 115–116.

Knie, A. (2016): Schlussbericht der DB Rent GmbH zum 31.07.2016. DB Rent GmbH.

Kulus, D. (10.05.2017): Personal Interview. Hamburg. Recorded audiofile.

Kurth, D. (2015): Gemeinsam zum Erfolg Vernetzen von Wohnungsbaugesellschaft, Kommune, ÖV und Carsharing. Kassel, 21.01.2015. Online available at https://carsharing.de/sites/default/files/uploads/arbeitsschwerpunkte/pdf/praesentation_kurth_sharegroup_wuerzburg_.pdf. Accessed on 14.03.2017.

Lambrecht, U.; Helms, H.; Dünnebeil, F. (2013): Steigende Umweltanforderungen - Was bedeutet dies für den Verkehr? In: K. J. Beckmann und A. Klein-Hitpaß (eds.): Nicht weniger unterwegs, sondern intelligenter? Neue Mobilitätskonzepte. Berlin: Edition Difu, pp. 59–77.

Lamnek, S. (2010): Qualitative Sozialforschung. Lehrbuch. 5. ed. Basel: Beltz Verlag.

Lancken, L. von der (2014): Carsharing. Eine Analyse zur Ausweisung von Parkplätzen für Carsharing-Fahrzeuge im öffentlichen Raum. Hamburg, HafenCity Univ., Bachelor Thesis, 2014. Hamburg.

Landeshauptstadt München (2015): Carsharing und Elektromobilität. Ein Praxisleitfaden für Kommunen. München.

Langer, R. (2014): Innovationslobbying. Wiesbaden: Springer Fachmedien Wiesbaden.

Lawhon, M.; Murphy, J. T. (2011): Socio-technical regimes and sustainability transitions. In: *Progress in Human Geography* 36 (3), pp. 354–378. DOI: 10.1177/0309132511427960.

Leurent, F.; Windisch, E. (2011): Triggering the development of electric mobility. A review of public policies. In: *Eur. Transp. Res. Rev.* 3 (4), pp. 221–235. DOI: 10.1007/s12544-011-0064-3.

Lie, M.; Sørensen, K. H. (eds.) (1996): Making Technology Our Own. Domesticating Technology into Everyday Life. Oslo: Scandinavian University Press.

Lienkamp, M. (2012): Elektromobilität. Berlin, Heidelberg: Springer Berlin Heidelberg.

Lindlahr, P. (2017): Wenn alles denn so einfach wäre… Anforderungen an e-mobile Konzepte in der Wohnungswirtschaft. Immobilienpartner im Gespräch. Hamburg, 03.04.2017. Online available at https://www.vnw.de/fileadmin/redakteur/Veranstaltungen/Immobilienpartner_im_Gespraech_-_Elektromobilitaet_und_Immobilie/Beitraege/170403_Peter_Lindlahr_HySolutions_Praesentation.pdf. Accessed on 05.04.2017.

Lindlahr, P. (24.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Lindloff, K.; Pieper, N.; Bandelow, N. C.; Woisetschläger, D. M. (2014): Drivers of carsharing diffusion in Germany. An actor-centred approach. In: *IJATM* 14 (3/4), pp. 217. DOI: 10.1504/IJATM.2014.065291.

Lohmann, M. (25.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Loorbach, D. A.; Raak, R. (2006): Strategic Niche Management and Transition Management. Different but complementary approaches. Rotterdam, Rotterdam. Online available at https://www.researchgate.net/profile/Derk_Loorbach/publication/241885490_Strategic_Niche_Management_and_Transition_Management_different_but_complementary_approaches/links/54047020

0cf2c48563b09069/Strategic-Niche-Management-and-Transition-Management-different-but-complementary-approaches.pdf. Accessed on 11.03.2017.

Loose, W. (2014): The State of European Car-Sharing. Bundesverband CarSharing e. V. Online available at http://www.eltis.org/sites/eltis/files/tool/the_state_of_carsharing_europe.pdf. Accessed on 17.06.2017.

Loose, W. (2016): Platz für Menschen – wie CarSharing Städte entlastet. Jahresbericht 2015/2016. Bundesverband CarSharing e.V. Berlin. Online available at https://carsharing.de/sites/default/files/uploads/alles_ueber_carsharing/pdf/endbericht_bcs-eigenprojekt_final.pdf. Accessed on 15.06.2017.

Lorimier, A. de; El-Geneidy, A. M. (2012): Understanding the Factors Affecting Vehicle Usage and Availability in Carsharing Networks. A Case Study of Communauto Carsharing System from Montréal, Canada. In: *International Journal of Sustainable Transportation* 7 (1), pp. 35–51. DOI: 10.1080/15568318.2012.660104.

Luca, S. de; Di Pace, R. (2015): Modelling users' behaviour in inter-urban carsharing program. A stated preference approach. In: *Transportation Research Part A: Policy and Practice* 71, pp. 59–76. DOI: 10.1016/j.tra.2014.11.001.

Lutsey, N.; Chambliss, S.; Tietge, U.; Mock, P. (2016): A comparative analysis of electric-drive policy in Germany and California. Zero emission. Berlin: National Organisation for Hydrogen and Fuel Cell Technology GmbH (NOW). Online available at http://edok01.tib.uni-hannover.de/edoks/e01fn16/871677164.pdf. Accessed on 14.05.2017.

Maggi, E.-M. (2016): Actor-centered Europeanization. In: E.-M. Maggi (ed.): The Will of Change. Wiesbaden: Springer Fachmedien Wiesbaden, pp. 13–42.

March, J. G.; Olsen, J. P. (1984): The New Institutionalism: Organizational Factors in Political Life. In: *The American Political Science Review* 78 (3), pp. 734–749.

March, J. G.; Olsen, J. P. (2009): The Logic of Appropriateness: Oxford University Press.

Markard, J.; Raven, R.; Truffer, B. (2012): Sustainability transitions. An emerging field of research and its prospects. In: *Research Policy* 41 (6), pp. 955–967. DOI: 10.1016/j.respol.2012.02.013.

Mazur, C.; Contestabile, M.; Offer, G. J.; Brandon, N. P. (2015): Assessing and comparing German and UK transition policies for electric mobility. In: *Environmental Innovation and Societal Transitions* 14, pp. 84–100. DOI: 10.1016/j.eist.2014.04.005.

Memmler, P. (21.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Meyer, J. W.; Rowan, B. (1977): Institutionalized organizations: Formal structure as myth and ceremony. In: *American Journal of Sociology* (83), pp. 340–363.

Mills, Albert; Durepos, Gabrielle; Wiebe, Elden (2010): Encyclopedia of Case Study Research. Thousand Oaks California 91320 United States: SAGE Publications, Inc.

Mol, A. P. J. (ed.) (2009): The ecological modernisation reader. Environmental reform in theory and practice. 1. publ. London: Routledge.

Mourik, R.; Raven, R. (2006): A practioner's view on strategic niche management. Towards a future research outline. [Petten] (ECN-E--06-039). Online available at http://www.ecn.nl/docs/library/report/2006/e06039.pdf. Accessed on 20.02.2017.

Mukhtar-Landgren, D.; Karlsson, M.; Koglin, T.; Kronsell, A.; Lund, E.; Sarasini, S. et al. (2016): Institutional conditions for integrated mobility services (IMS). Towards a framework for analysis. Online available at http://portal.research.lu.se/portal/files/16645053/K2_Working_Papers_2016_16.pdf. Accessed on 23.04.2017.

Müller, R. (2017): Stadt in Bewegung. Süddeutsche Zeitung. Online available at http://www.sueddeutsche.de/geld/mobilitaet-stadt-in-bewegung-1.3329892. Updated on 12.01.2017. Accessed on 04.02.2017.

Musiolik, J.; Markard, J. (2011): Creating and shaping innovation systems. Formal networks in the innovation system for stationary fuel cells in Germany. In: *Energy Policy* 39 (4), pp. 1909–1922. DOI: 10.1016/j.enpol.2010.12.052.

Nahverkehr Hamburg (2017): Deswegen gibt es bis jetzt kaum Elektro-Carsharing in Hamburg. Online available at http://www.nahverkehrhamburg.de/deswegen-gibt-es-bis-jetzt-kaum-elektro-carsharing-in-hamburg-8224/. Updated on 16.05.2017. Accessed on 23.11.2017.

Nanaki, E. A.; Koroneos, C. J. (2016): Climate change mitigation and deployment of electric vehicles in urban areas. In: *Renewable Energy* 99, pp. 1153–1160. DOI: 10.1016/j.renene.2016.08.006.

Nelson, R. R.; Winter, S. G. (1982): An Evolutionary Theory of Economic Change. Cambridge (Mass.): Belknap Press.

North, D. C. (1990): Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press.

NOW GmbH (n.d.): eQuartier Hamburg - Definition und Umsetzung eines kombinierten Mobilitätsangebotes für Bewohner einer Wohnsiedlung in Hamburg unter Einbezug von Elektrofahrzeugen. Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie. Online available at https://www.now-gmbh.de/de/modellregionen-elektromobilitaet/projektfinder/modellregionen/hamburg/equartier-hamburg. Accessed on 15.04.2017.

NPE (2014): Fortschrittsbericht 2014 – Bilanz der Marktvorbereitung. Nationale Plattform Elektromobilität (NPE). Berlin. Online available at https://www.bmbf.de/files/NPE_Fortschrittsbericht_2014_barrierefrei.pdf. Accessed on 24.03.2017.

NPE (2015): Ladeinfrastruktur für Elektrofahrzeuge in Deutschland. Statusbericht und Handlungsempfehlungen. Nationale Plattform Elektromobilität (NPE). Online available at https://www.bdew.de/internet.nsf/id/738755292F651650C1257F0A0038C66D/$file/AG%203_Statusbericht_LIS%202015_final.pdf. Accessed on 02.05.2017.

Nykvist, B.; Nilsson, M. (2015): The EV paradox – A multilevel study of why Stockholm is not a leader in electric vehicles. In: *Environmental Innovation and Societal Transitions* 14, pp. 26–44. DOI: 10.1016/j.eist.2014.06.003.

Nykvist, B.; Whitmarsh, L. (2008): A multi-level analysis of sustainable mobility transitions. Niche development in the UK and Sweden. In: *Technological Forecasting and Social Change* 75 (9), pp. 1373–1387. DOI: 10.1016/j.techfore.2008.05.006.

OECD/ITF (2017): ITF Transport Outlook 2017: OECD Publishing.

Ogborn, M. (2010): Chapter 7: Finding historical Sources. In: N. Clifford, S. French und G. Valentine (eds.): Key Methods in Geography. 2nd Edition.: Sage Publications Ltd. London, pp. 89–102.

Olsson, R. A. (2008): Planning metropolitan regions - Institutional perspectives and the case of spare. Doctoral Thesis. Stockholm.

Opp, K.-D. (1999): Contending conceptions of the theory of rational action. In: *Journal of theoretical politics* 11 (2), pp. 171–202.

Osterhage, S. (2017): Hamburg möchte grüner fahren. Großstadtpapier. Online available at http://www.grossstadtpapier.de/innovation/news/hamburg-moechte-gruener-fahren/?tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Baction%5D=detail&cHash=2b3c4c6bb25c70b739953dfd2abb52bd. Updated on 28.05.2017. Accessed on 06.06.2017.

Ostrom, E. (2005): Understanding institutional diversity. Princeton, N.J., Oxford: Princeton University Press.

Parzinger, G.; Rid, W.; Müller, U.; Grausam, M. (eds.) (2016): Elektromobilität im Carsharing. Status Quo, Potenziale und Erfolgsfaktoren. NOW GmbH (Begleitforschung zu den Modellregionen Elektromobilität des BMVI - Ergebnisse des Themenfeldes Flottenmanagement). Online available at http://www.starterset-elektromobilität.de/content/3-Infothek/3-Publikationen/4-elektromobilitaet-im-carsharing-staus-quo-potenziale-und-erfolgsfaktoren/now_handbuch_e-carsharing_web_2.ueberarb.aufl.pdf. Accessed on 17.06.2017.

Patton, M. Q. (2002): Qualitative research & evaluation methods. 3. ed. Thousand Oaks, Calif.: SAGE.

Paulsen, T. (04.05.2017): Personal Interview. Hamburg. Recorded audiofile.

Peters, A.; Doll, C.; Kley, F.; Möckel, M.; Plötz, P.; Sauer, A. et al. (2012): Konzepte der Elektromobilität und deren Bedeutung für Wirtschaft, Gesellschaft und Umwelt. Innovationsreport. Berlin: Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag (TAB) (Arbeitsbericht TAB, Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag). Online available at http://www.isi.fraunhofer.de/isi-wAssets/docs/n/de/publikationen/TAB-Elektromobilitaet-Konzepte/TAB-Arbeitsbericht-Elektromobilitaet-ab153.pdf. Accessed on 10.04.2017.

Peters, A.; Dütschke, E. (2010): Zur Nutzerakzeptanz von Elektromobilität. Analyse aus Expertensicht. Karlsruhe, Hannover: Fraunhofer ISI; Technische Informationsbibliothek u. Universitätsbibliothek. Online available at http://edok01.tib.uni-hannover.de/edoks/e01fb11/672256282.pdf. Accessed on 17.07.2017.

Peters, B. G. (1999): Institutional theory in political science. The "new institutionalism". London: Pinter.

Porter, M. E.; van der Linde, C. M. (1995): Toward a new conception of the environment-competitiveness relationship. In: *The journal of economic perspectives: A journal of the American Economic Association*. 9 (4), pp. 97-118.

Powell, W.; DiMaggio, P. (eds.) (1991): The New Institutionalism in Organizational Analysis. Chicago: The University of Chicago Press.

Prill, T. (03.05.2017): Personal Interview. Hamburg. Recorded audiofile.

Proff, H.; Brand, M.; Mehnert, K.; Schmidt, A. J.; Schramm, D. (eds.) (2016): Elektrofahrzeuge für die Städte von morgen. Wiesbaden: Springer Fachmedien Wiesbaden.

Ragin, C. C. (1987): The Comparative Method. Moving Beyond Qualitative and Quantitative Strategies. Berkeley, Los Angeles, and London: University of California Press.

Rah, S. (2017): Hamburg – moving towards Electromobility. Hanse-Office, Joint Representation of Hamburg and Schleswig-Holstein to the EU, 08.06.2017. Online available at https://great-region.org/wp-content/uploads/2017/06/Sicco-Rah.pdf. Accessed on 21.06.2017.

Rau, O. (2015): Mehrwert schaffen durch nachhaltige Kooperationen. Wohnungswirtschaft und Carsharing- eine gelungene Kombination in München, 21.01.2015. Online available at https://carsharing.de/sites/default/files/uploads/arbeitsschwerpunkte/pdf/praesentation_olaf_rau_stattautomuenchen.pdf. Accessed on 02.05.2017.

Redlich, C. (20.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Riley, P.; Bührmann, S.; Hoenninger, P.; Christiaens, J. (2011): Intermodal Passenger Transport in Europe. Passenger Intermodality from A to Z. LINK-consortium. The european forum on intermodal passenger travel. Online available at http://www.rupprecht-consult.eu/uploads/tx_rupprecht/LINK_Guidance_Brochure.pdf. Accessed on 01.12.2017.

Rip, A.; Kemp, R. (1998): Technological change. In: S. Rayner und E. L. Malone (eds.): Human choice and climate change. Vol. II, Resources and Technology. Columbus, pp. 327–399.

Ritzer, G. (1980): Sociology: A Multiple Paradigm Science. Boston: Allyn and Bacon.

Roep, D.; van der Ploeg, J. D.; Wiskerke, J.S.C. (2003): Managing technical-institutional design processes. Some strategic lessons from environmental co-operatives in the Netherlands. In: *NJAS - Wageningen Journal of Life Sciences* 51 (1-2), pp. 195–217. DOI: 10.1016/S1573-5214(03)80033-7.

Rothfuss, F.; Rose, H.; Ernst, T.; Braun, S.; Radecki, A. von (2011): Roadmap - Elektromobile Stadt. Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO). Stuttgart. Online available at https://www.muse.iao.fraunhofer.de/content/dam/iao/muse/de/documents/Aktuelles/Roadmap-Elektromobile-Stadt.pdf. Accessed on 14.06.2017.

Rothfuss, F.; Rose, H.; Ernst, T.; Radecki, A. von (eds.) (2012): Strategien von Städten zur Elektromobilität. Städte als Katalysatoren auf dem Weg zur Mobilität der Zukunft. NOW GmbH; Fraunhofer-Institut für Arbeitswirtschaft und Organisation. Online available at http://wiki.iao.fraunhofer.de/images/studien/strategien-von-staedten-zur-eletromobilitaet.pdf. Accessed on 30.05.2017.

Rotmans, J.; Kemp, R.; van Asselt, M. (2001): More evolution than revolution. Transition management in public policy. In: *Foresight* 3 (1), pp. 15–31. DOI: 10.1108/14636680110803003.

Ryden, C.; Morin, E. (2005): Mobility services for urban sustainability: Environmental assessment. Moses Report WP6, Trivector Traffic AB. Stockholm.

Sarasini, Steven; Linder, Marcus (2017): Integrating a business model perspective into transition theory. The example of new mobility services. In: *Environmental Innovation and Societal Transitions. DOI:* 10.1016/j.eist.2017.09.004.

Saunders, M.; Lewis, P.; Thornhill, A. (2009): Research methods for business students. 5. ed. Harlow: Financial Times Prentice Hall.

Schaefers, T. (2013): Exploring carsharing usage motives. A hierarchical means-end chain analysis. In: *Transportation Research Part A: Policy and Practice* 47, pp. 69–77. DOI: 10.1016/j.tra.2012.10.024.

Schatzinger, S.; Rose, H. (2013): Praxisleitfaden Elektromobilität. Hinweise für Bauherren, Architekten und Ingenieure zum Ausbau elektromobiler Infrastrukturen in der Hafencity. Hamburg. Online available at http://www.hafencity.com/upload/files/files/HafenCity_Praxisleitfaden_Elektromobilitaet.pdf. Accessed on 23.04.2017.

Schmidt, B. (2016): Reichweite, Kosten, Ladeinfrastruktur, Ladezeiten. In: C.n Preiser (ed.): Forum Qualitätsjournalismus FQJ.dossier "Elektromobilität". FQJ.dossier "Elektromobilität". Frankfurt am Main: Forum Qualitätsjournalismus, pp. 26–36.

Schot, J.; Geels, F. W. (2008): Strategic niche management and sustainable innovation journeys. Theory, findings, research agenda, and policy. In: *Technology Analysis & Strategic Management* 20 (5), pp. 537–554. DOI: 10.1080/09537320802292651.

Schot, J.; Kamp, R.; Maruo, K.; Prätorius, G.; Truffer, B.; Potter, S.; Sorup, P. (1999): Strategic Niche Mnagement as a tool for transition to a sustainable transport system.

Schott, B. (2015): Instrumentenmixstrategien für Umweltinnovationen am Fallbeispiel der Elektromobilität. Ulm Univ., Diss., 2015. Ulm.

Schwer, J.; Timpf, S. (2016): Local-Level Site-Selection Model for Integrated Carsharing Services. In: *giforum* 1, pp. 243–249. DOI: 10.1553/giscience2016_01_s243.

Scott, W. R. (1995): Institutions and Organizations. Thousand Oaks, CA: SAGE Publications.

Scott, W. R. (2014): Institutions and Organizations: Ideas, Interests, and Identities. Thousand Oaks, California: SAGE Publications.

Seign, R.; Bogenberger, K. (2012): Prescriptions for the Successful Diffusion of Carsharing with Electric Vehicles. München. Online available at https://mediatum.ub.tum.de/doc/1171405/1171405.pdf. Accessed on 31.01.2017.

Senat der FHH (2016): Memorandum of Understanding zwischen Volkswagen AG, und Freie und Hansestadt Hamburg (FHH). Senat der Freien und Hansestadt Hamburg. Online available at http://www.hamburg.de/contentblob/6770750/79dfb53810fce0a30027b01de5160168/data/2016-08-29-pr-mobilitaetspartnerschaft.pdf. Accessed on 30.07.2017.

Shaheen, S. A.; Chan, N. D.; Bansal, A.; Cohen, A. P. (2015a): Shared mobility. A sustainability & technologies workshop: definitions, industry developments, and early understanding. [Berkeley, Calif.]: Transportation Sustainability Research Center, University of California, Berkeley.

Shaheen, S. A.; Chan, N. D.; Micheaux, H. (2015b): One-way carsharing's evolution and operator perspectives from the Americas. In: *Transportation* 42 (3), pp. 519–536. DOI: 10.1007/s11116-015-9607-0.

Shaheen, S. A.; Cohen, A. P. (2013): Carsharing and Personal Vehicle Services. Worldwide Market Developments and Emerging Trends. In: *International Journal of Sustainable Transportation* 7 (1), pp. 5–34. DOI: 10.1080/15568318.2012.660103.

Shell Deutschland Oil GmbH (2009): Shell Pkw-Szenarien bis 2030. Fakten, Trends und Handlungsoptionen für nachhaltige Auto-Mobilität. Hamburg. Online available at http://www.forum-elektromobilitaet.ch/fileadmin/DATA_Forum/Publikationen/shell_2010-mobility_scenarios-langfassung.pdf. Accessed on 21.10.2017.

Shove, E.; Walker, G. (2010): Governing transitions in the sustainability of everyday life. In: *Research policy: policy, management and economic studies of science, technology and innovation* 39 (4), pp. 471–476.

Simon, H. A. (2000): Bounded rationality in social science: today and tomorrow. In: *Mind & Society* 1 (1), pp. 25–39.

Smith, A. (2007): Translating Sustainabilities between Green Niches and Socio-Technical Regimes. In: *Technology Analysis & Strategic Management* 19 (4), pp. 427–450. DOI: 10.1080/09537320701403334.

Smith, A.; Raven, R. (2012): What is protective space? Reconsidering niches in transitions to sustainability. In: *Research Policy* 41 (6), pp. 1025–1036. DOI: 10.1016/j.respol.2011.12.012.

Smith, A.; Stirling, A.; Berkhout, F. (2005): The governance of sustainable socio-technical transitions. In: *Research policy: policy, management and economic studies of science, technology and innovation* 34 (10), pp. 1491–1510.

Smith, A.; Voß, J.-P.; Grin, J. (2010): Innovation studies and sustainability transitions. The allure of the multi-level perspective and its challenges. In: *Research Policy* 39 (4), pp. 435–448. DOI: 10.1016/j.respol.2010.01.023.

Söchtig, S. (2017): ELEKTROMOBILITÄT UND IMMOBILIE: Mobilität und Energieversorgung im Umbruch. Immobilienpartner im Gespräch. Hamburg, 03.04.2017. Online available at https://www.vnw.de/fileadmin/redakteur/Veranstaltungen/Immobilienpartner_im_Gespraech_-_Elektromobilitaet_und_Immobilie/Beitraege/170403_Stefan_Soechtig_HFK__Praesentation.pdf. Accessed on 20.04.2017.

Söchtig, S. (09.05.2017): Personal Interview. Hamburg. Recorded audiofile.

Sparrow, J. A. (1989): Graphical displays in information systems. Some data properties influencing the effectiveness of alternative forms. In: *Behaviour & Information Technology* 8 (1), pp. 43–56. DOI: 10.1080/01449298908914537.

Späth, P.; Rohracher, H.; Radecki, A. von (2016): Incumbent Actors as Niche Agents. The German Car Industry and the Taming of the “Stuttgart E-Mobility Region”. In: *Sustainability* 8 (3). 252. DOI: 10.3390/su8030252.

Spörrle, M. (2017): Wieso gibt es immer noch keine Parkplätze für Carsharing-Autos?. Zeit Online. Online available at http://www.zeit.de/2016/21/carsharing-parkplaetze-parkplatzsuche-hamburg, updated on 16.06.2016. Accessed on 17.07.2017

Steinhilber, S.; Wells, P.; Thankappan, S. (2013): Socio-technical inertia. Understanding the barriers to electric vehicles. In: *Energy Policy* 60, pp. 531–539. DOI: 10.1016/j.enpol.2013.04.076.

Steinmo, S.; Thelen, K.; Longstreth, F. (1992): Structuring Politics: Historical Institutionalism in Comparative Analysis: Cambridge University Press.

Stiewe, M. (2015): Die Idee des autofreien Wohnens – Was wurde daraus? Welche Potenziale zu einer Renaissance gibt es? Kassel, 21.01.2015. Online available at https://carsharing.de/sites/default/files/uploads/arbeitsschwerpunkte/pdf/praesentation_stiewe_ils_autofreieswohnen.pdf. Accessed on 23.05.2017.

Stiewe, M.; Bäumer, D. (2013): Klimaverträglich mobil in Zeiten des demographischen Wandels – Wie wohnen Mobilität bestimmt. Online available at http://www.corp.at/archive/CORP2013_181.pdf. Accessed on 20.04.2017.

Teddlie, C.; Tashakkori, A. (2008): Foundations of mixed methods research. Integrating quantitative and qualitative approaches in the social and behavioral sciences. Thousand Oaks: SAGE Publications, Inc.

Tenkhoff, C.; Braune, O.; Wilhelm, S. (2011): Ergebnisbericht 2011. Der Modellregionen Elektromobilität. Unter Mitarbeit von. Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie (NOW).

Terrien, C.; Maniak, R.; Chen, B.; Shaheen, S. (2016): Good practices for advancing urban mobility innovation. A case study of one-way carsharing. In: *Research in Transportation Business & Management* 20, pp. 20–32. DOI: 10.1016/j.rtbm.2016.08.001.

Tolbert, P. S.; Zucker, L. G. (1999): The Institutionalization of Institutional Theory. In: S. Clegg und C. Hardy (eds.): Studying Organization. Theory and Method. London: SAGE, pp. 169–184.

Töllner, S. (18.04.2017): Personal Interview. Hamburg. Recorded audiofile.

Truffer, B.; Schippl, J.; Fleischer, T. (2017): Decentering technology in technology assessment. Prospects for socio-technical transitions in electric mobility in Germany. In: *Technological Forecasting and Social Change* 122, pp. 34–48. DOI: 10.1016/j.techfore.2017.04.020.

UBA (2014): Treibhausgasausstoß im Jahr 2013 erneut um 1,2 Prozenz leicht gestiegen. Umweltbundesamt. Online available at http://www.umweltbundesamt.de/presse/presseinformationen/Treibhausgasaustoss-im-jahr-2013-erneut-um-12. Accessed on 24.08.2017.

UN DESA (2013): World Economic and Social Survey. Sustainable Development Challenges. United Nations, Department of Economic and Social Affairs (UN/DESA). United Nations publication. Online available at https://sustainabledevelopment.un.org/content/documents/2843WESS2013.pdf. Accessed on 23.07.2017.

UN DESA (2014): World Urbanization Prospects: The 2014 Revision, Highlights. United Nations, Department of Economic and Social Affairs (UN/DESA), Population Division. United Nations publication. Online available at https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf. Accessd on 23.07.2017.

Vallée, D. (2013): 3.1 Mobilitätskonzepte. In: A. Kampker, D. Vallée und A. Schnettler (eds.): Elektromobilität. Berlin, Heidelberg: Springer Berlin Heidelberg.

Vallée, D.; Schnettler, A. (2013): 2.2 Infrastruktur für die Elektromobilität. In: A. Kampker, D. Vallée und A. Schnettler (eds.): Elektromobilität. Berlin, Heidelberg: Springer Berlin Heidelberg.

van der Heijden, J. (2014): Governance for Urban Sustainability and Resilience: Edward Elgar Publishing.

VCD e.V. (2017): Wohnen leitet Mobilität. Vorhaben zur Förderung klimaverträglicher Mobilität am Wohnstandort Projektförderer. Berlin. Online available at https://www.vcd.org/fileadmin/user_upload/Redaktion/Themen/Wohnen_leitet_Mobilitaet/pdf/Projektvorstellung_WoMo.pdf. Accessed on 14.07.2017.

VNW e.V. (n.d.): Kurzvorstellung. Verband norddeutscher Wohnungsunternehmen e.V. Online available at www.vnw.de/vnw/ueber-uns/kurzvorstellung. Accessed on 22.08.2017.

VNW e.V. (2011): Statistik 2011. Daten der Wohnungswirtschaft in Norddeutschland. Verband norddeutscher Wohnungsunternehmen e.V. Online available at www.vdw-online.de/pdf/presse/statistik/Jahresstatistik-2011.pdf. Accessed on 22.08.2017.

VNW e.V. (2017): Positionspapier 2017 des VNW Landesverbandes Hamburg e.V. Verband norddeutscher Wohnungsunternehmen e.V. Online available at https://www.vnw.de/presse/positionen/positionen-landesverband-hamburg-ev/16-februar-2017-positionspapier-des-landesverbandes-hamburg-ev/. Updated on 16.02.2017. Accessed on 22.08.2017

Weber, M. (1999): Experimenting with sustainable transport innovations. A workbook for strategic niche management. Enschede: Universiteit Twente.

Whitmarsh, L. (2012): How useful is the Multi-Level Perspective for transport and sustainability research? In: *Journal of Transport Geography* 24, pp. 483–487. DOI: 10.1016/j.jtrangeo.2012.01.022.

Whitmarsh, L.; Swartling, Å. G.; Jäger, J. (2009): Participation of experts and non-experts in a sustainability assessment of mobility. In: *Env. Pol. Gov.* 19 (4), pp. 232–250. DOI: 10.1002/eet.513.

Wilhelm, S.; Hollerbach, H.; Mayer, C.; Schulte, U.; Funk, G.-U.; Böhn, F. (2011): Elektromobilität in Deutschland - Praxisleitfaden. Aufbau einer öffentlich zugänglichen Ladeinfrastruktur für Genehmigungsbehörden und Antragsteller. Bundesministerium für Verkehr, Bau und Stadtentwicklung (BMVBS). Online available at https://www.electrive.net/wp-content/uploads/2011/12/Praxisleitfaden-Ladeinfrastruktur.pdf. Accessed on 04.04.2017.

Willen, L. (2005): Annäherung ans Quartier. BBSR. Online available at http://www.bbsr.bund.de/BBSR/DE/Aktuell/Veranstaltungen/Dokumentation/Downloads/ProjektwerkstattHalle_VortragWillen.pdf?__blob=publicationFile&v=2. Accessed on 24.09.2017.

Witkamp, M. J.; Raven, R. P.J.M.; Royakkers, L. M.M. (2011): Strategic niche management of social innovations. The case of social entrepreneurship. In: *Technology Analysis & Strategic Management* 23 (6), pp. 667–681. DOI: 10.1080/09537325.2011.585035.

Witzke, S. (2016): Carsharing und die Gesellschaft von Morgen. Wiesbaden: Springer Fachmedien Wiesbaden.

Xue, Y.; You, J.; Liang, X.; Liu, H.-C. (2016): Adopting Strategic Niche Management to Evaluate EV Demonstration Projects in China. In: *Sustainability* 8 (2). 142. DOI: 10.3390/su8020142.

Yin, R. K. (1993): Applications of case study research. Newbury Park, Calif.: SAGE Publications.

Yin, R. K. (1994): Case study research: design and methods. Thousand Oaks, London, New Delhi: SAGE Publications.

Yin, Y. (2014): Environmental integration in sustainable urban planning from an institutional perspective. A study of Swedish and Chinese eco-city development. Stockholm (TRITA-SOM). Online available at https://www.diva-portal.org/smash/get/diva2:743655/FULLTEXT02.pdf. Accessed on 23.03.2017.

Appendices

Appendix 1: Research framework

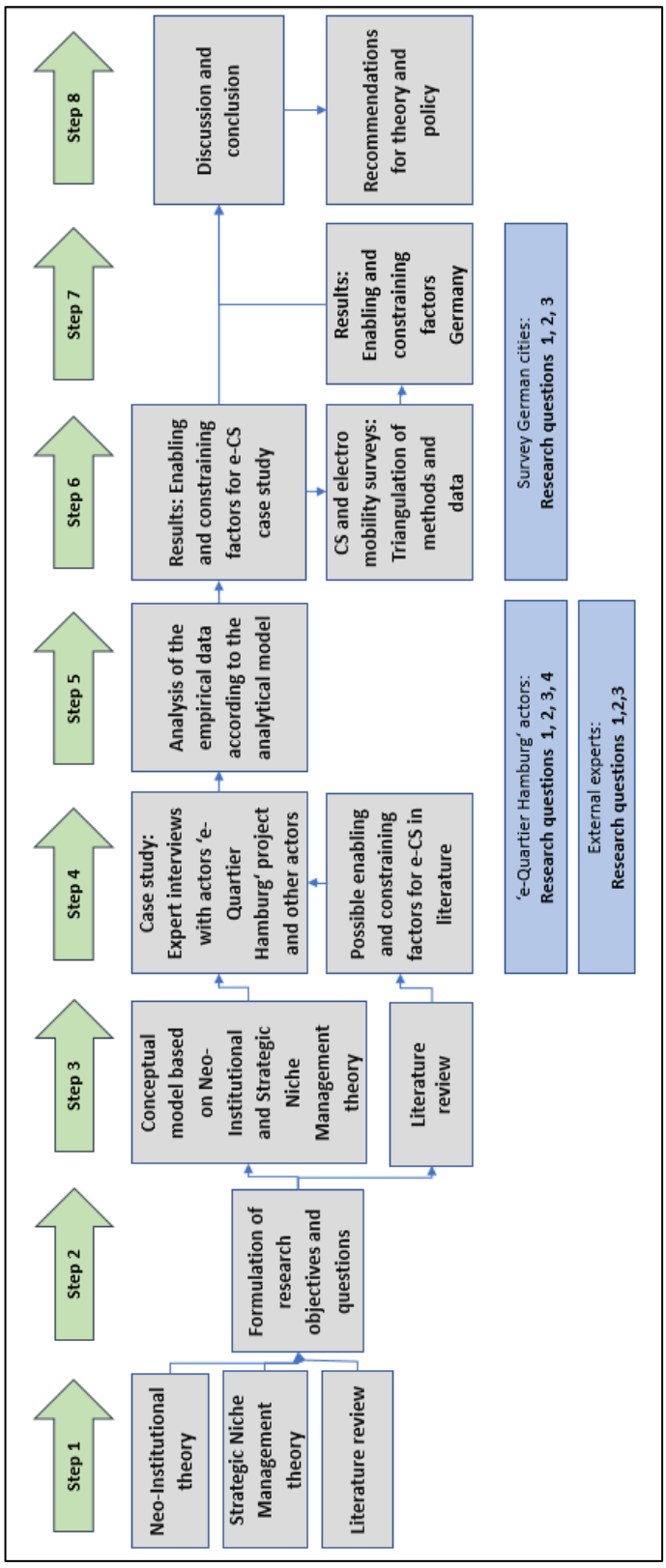


Figure 14: Representation of the employed research framework
Source: Own representation

Appendix 2: List of interviewed experts

Table 2: List of interviewed experts
Source: Own representation

Expert	Role and organization	Type of organization	Project involvement	Date
Eike Appeldorn	Urban planner, *steg Stadterneuerungs- und Stadtentwicklungsgesellschaft Hamburg mbH*	Private company	No	09.05.2017
Gerd Baum	Head, Public Administration Office of the Management of Public Space, *District Hamburg-Mitte*	Public sector	No	02.05.2017
Nina Brandt and Gunar Menzel	Project Leader and Head, Technology and Energy, *HANSA Baugenossenschaft eG*	Housing cooperative	Yes	03.05.2017
Dr. Carsten Dierks	Managing Director, *Mindways Hamburg GmbH*	Private company	Yes	25.04.2017
Lukas Domaschke	Traffic Management, *Landesbetrieb Verkehr*	Public sector	No	18.04.2017
Joachim Engstfeld	Consultant, *D&K drost consult GmbH*	Consultancy	Yes	20.04.2017
Birgit Ferber	Head of Project Group "Planung Mitte Altona", *Ministry of Urban Development and Housing (BSW)*	Public sector	No	28.04.2017
Dr. Nadja Hammami	Cluster policy and promotion, Electro mobility, *Ministry of Economy, Transport and Innovation (BWVI)*	Public sector	No	02.05.2017
Daniel Kulus	Researcher, Resource Efficiency in Architecture and Planning, *HCU*	University	Yes	10.05.2017
Peter Lindlahr	Managing Director, *hySolutions GmbH*	Private company (associated with the FHH)	Yes	28.04.2017
Marko Lohmann	Board, *Gemeinnützige Baugenossenschaft Bergedorf-Bille eG*	Housing cooperative	Yes	25.04.2017
Petra Memmler	Consultant, Technology and Energy, *Association of North German Housing Companies e.V. (VNW e.V.)*	Association of housing companies	No	21.04.2017
Timo Paulsen	Project Manager, *Stromnetz Hamburg GmbH*	Private company (associated with the FHH)	Yes	04.05.2017
Dr. Thomas Prill	Researcher, Resource Efficiency in Architecture and Planning, *HCU*	University	Yes	03.05.2017
Carsten Redlich	Management *cambio Hamburg CarSharing GmbH*	Private company	Yes	20.04.2017
Stefan Söchtig	Lawyer, *HFK Rechtsanwälte LLP*	Private company	No	09.05.2017
Stephan Töllner	Project Manager, *STARCAR GmbH Kraftfahrzeugvermietung*	Private company	Yes	18.04.2017

Appendix 3: Analytical framework

Table 3: Analytical framework in form of a list of indicators
Source: Own representation

Categories	Indicators
Regulative institutions	I. Existence of or changes (closing of legal gaps) in formal sectoral regulation concerning the innovation(Truffer et al. 2017) II. Existence of informal policies focusing on the new innovation (Truffer et al. 2017) III. Complementarities of the new innovation with other policy realms (Truffer et al. 2017) IV. Existence of specific government structures with regard to the new innovation (Truffer et al. 2017)
Boundedly rational interests	I. Willingness of collaboration with other actors (Yin 2014) II. Non-physical and physical resources contribution (Yin 2014) III. Boundedly rational reasons for non-physical and physical resources contribution and collaboration with other actors IV. Necessary financial, infrastructural and organizational conditions for collaboration with other actors and for non-physical and physical resources contribution
Cognitive and normative institutions	I. Match/mismatch of the innovation with normative values and role responsibilities (Geels 2004) II. Match/mismatch of the innovation with cognitive routines (Geels 2004) III. Perception about the importance taking into account user perceptions and behavior (Geels 2004) IV. Perception about overall existing developments concerning the innovation V. Existence of tacit knowledge gaps and/or uncertainty, and necessity of advisory/informational support (Geels 2004) VI. Symbolic associations of the innovation with environmental issues (Truffer et al. 2017)
Niche management aspects	I. Existence of learning and knowledge exchange along multiple areas (Schot and Geels 2008) II. Existence of a social actor network, degree of collaborating and willingness of stakeholders of providing resources (Schot and Geels 2008) III. Existence of protective measures (Schot and Geels 2008) IV. Existence of shared expectations concerning the innovation along multiple areas (Schot and Geels 2008)

Appendix 4: Expert interview guide

1. Beginning and background information expert

- What is your background and role in your organization?

2. Role and importance of topic and frameworks in the city

- What role do carsharing and electro mobility play in traffic and urban development?
- What formal and informal tools do the local and national governments use to support e-CS?
- How do you see the current political and legal framework of CS and electro mobility in Hamburg?

3. Existence and supply of necessary infrastructure

- How is the current charging infrastructure supply for electro mobility and who should be responsible for it?
- What would you say about the current presence of CS parking spaces in the city?
- How are planning and approval procedures related to electro mobility or CS carried out?

4. Beneficial drivers and major barriers

- What are the most beneficial factors that allow for an integration of e-CS into residential neighborhoods?
- What are the biggest barriers concerning an integration of e-CS into residential neighborhoods?

5. Interest and involvement

- Why are you and your organization interested in the topic of e-CS in urban neighborhoods and to what extent are you currently involved in it?
- Do you cooperate with other actors concerning the topic of e-CS in urban neighborhoods?
- How would you describe your knowledge concerning electric carsharing?
- Does the integration of e-CS in urban neighborhoods fit with your current practices?

6. Public opinion

- What is the current public opinion on e-CS and, based on this, what are the implications for your involvement in the topic?

7. Project 'e-Quartier Hamburg' (only for people involved in the project)

- Why were you interested to participate and what did you expect from your participation?
- How can the cooperation between the actors be described?
- How would you describe the existence of knowledge sharing and joint learning?
- What resources and incentives were important to you and how was their provision?
- Were shared expectations concerning the innovation along multiple areas given?
- Which aspects have brought you the greatest added value and where do you see room for improvement due to obstacles?

Appendix 5: Housing cooperatives questionnaire

This questionnaire is focused on housing cooperatives in Germany. It includes nine questions. These are intended to provide new insights about the motivations, attitudes and practices of German housing cooperatives with regard to sustainable mobility concepts and particularly carsharing. This allows one to compare these results with the qualitative results of the expert interviews on a basic level and see where differences or similarities can be found.

1. ***In which state is your housing cooperative located?***
    a. Baden-Wurttemberg
    b. Bavaria
    c. Berlin
    d. Brandenburg
    e. Bremen
    f. Hamburg
    g. Hesse
    h. Lower Saxony
    i. Mecklenburg-Vorpommern
    j. North Rhine-Westphalia
    k. Rhineland-Pfalz
    l. Saarland
    m. Saxony
    n. Saxony-Anhalt
    o. Schleswig-Holstein
    p. Thuringia

2. ***How many inhabitants live in the municipality, in which your housing cooperative is located?***
    a. < 10,000
    b. 10,000 – 50,000
    c. 50,000 – 200,000
    d. 200,000 – 500,000
    e. 500,000 – 1,000,000
    f. > 1,000.000

3. ***How many apartments does your housing cooperative own?***
    a. 1 – 10
    b. 10 – 50
    c. 50 – 200
    d. 200 – 500
    e. 500 – 2,000
    f. > 2,000

4. ***What is the attitude of the members of your housing cooperative towards new mobility concepts such as carsharing?***
    a. Very open
    b. Rather open
    c. Rather restrained
    d. Very restrained

5. ***Do you offer carsharing as part of your housing cooperative?***
    a. Yes
    b. No

5.1. If "no", could you imagine offering carsharing as part of your housing cooperative?

a. Yes
b. Rather yes
c. Rather no
d. No

6. What are possible reasons for housing cooperatives to offer carsharing (multiple choice possible)?

a. Existing or possible future demand of the members
b. Reduction of traffic or counteracting parking space shortage
c. Possibility of an improved marketing of residential buildings
d. Possibility to test new and possibly future relevant business models
e. Increase in mobility-related topics for housing cooperatives
f. Support of a social change towards "sharing instead of owning"
g. Support for a reduced use of private cars based on environmental reasons

7. What are the reasons why carsharing is not (yet) offered by housing cooperatives (multiple choice possible)?

a. Infrastructural barriers, e.g. possible conflicts of land use
b. Carsharing is not a core area of the business model of housing cooperatives
c. Low interest of the members or existing mental barriers
d. Insufficient knowledge to implement carsharing
e. Insufficient resources to implement carsharing
f. Legal barriers/complexities
g. Financial barriers due to new emerging costs or insufficient financial incentives
h. Too little political support in the form of parking space provision
i. Low interest in cooperating with other actors, e.g. CSOs

8. Does it need further external incentives and measures that support housing cooperatives and make it more attractive for them to offer carsharing?

a. Very high need
b. High need
c. Average need
d. Low need
e. No need

8.1. If "very high need", "high need" or "average need", which supporting aspects or incentives would be important for your housing cooperative (multiple choice possible)?

a. Increased cooperation with other actors
b. Increased financial support or incentives
c. Improved information provision and advice
d. Improved legal framework
e. Improved infrastructural conditions

9. What do you think of the concept of implementing electric carsharing in the future within housing cooperatives, including an existing charging infrastructure?

a. Very interesting
b. Interesting
c. Neutral
d. Less interesting
e. Uninteresting

Appendix 6: Carsharing organizations questionnaire

This questionnaire is focused on CSOs in Germany. It includes twelve questions. These are intended to provide new insights about the motivations, attitudes and practices of CSOs with regard to carsharing and electro mobility. This allows one to compare these results with the quantitative results of the expert interviews on a very basic level and see where differences or similarities can be found.

1. ***What type of company or corporation do you represent?***
    a. CSO
    b. Car rental with carsharing offer
    c. Car dealership with carsharing offer
    d. Public utilities / energy service providers with carsharing offer
    e. Private community with carsharing offer
    f. Other

2. ***What kind of carsharing do you offer?***
    a. Station-based
    b. Free-floating
    c. Private-to-Private

3. ***How many carsharing vehicles do you offer?***
    a. 1 – 2
    b. 3 – 10
    c. 10 – 50
    d. 50 – 300
    e. >300

4. ***What percentage of your vehicles are electric vehicles?***
    a. 0%
    b. 1 – 19%
    c. 20 – 49%
    d. 50 – 79%
    e. 80 – 99%
    f. 100%

5. ***Are you interested in offering more vehicles that are electric as part of your carsharing offer in the future?***
    a. Very high interest
    b. High interest
    c. Average interest
    d. Low interest
    e. No interest

6. ***Do you consider the current public opinion on carsharing to be conducive or hindering your carsharing offer?***
    a. Very conducive
    b. Rather conducive
    c. Neutral
    d. Rather restraining
    e. Very restraining
    f. I am not aware of that

7. ***In your opinion, which of the following aspects represent current problem areas related to carsharing (multiple choice possible)?***
    a. Low cooperation of political and economic actors
    b. Low interest or existing mental barriers in the population with regard to carsharing
    c. Too few secure carsharing spaces in public spaces
    d. Difficult or complex legal framework for carsharing pitches in public spaces
    e. Too little connection of carsharing with other sectors, such as the housing industry
    f. Too little integration of carsharing offers with other transport services
    g. Too little political support through financial incentives

8. ***Do you currently see the public opinion on electro mobility as conducive or hindering with regard to the expansion of electric vehicles in Germany?***
    a. Very conducive
    b. Rather conducive
    c. Rather restraining
    d. Very restraining
    e. I am not aware of that

9. ***Which of the following do you consider to be current problem areas related to electro mobility (multiple choice possible)?***
    a. Low cooperation of political and economic actors on the subject of electro mobility
    b. Low interest or existing mental barriers in the population
    c. Too little expansion of publicly accessible charging infrastructure
    d. Too little interest of the energy industry to provide charging infrastructure
    e. Too little use of legal tools to support electro mobility
    f. Insufficient linkage of electro mobility with other sectors, such as the housing or energy sectors
    g. Too little integration of electro mobility with other transport services, such as public transport or carsharing
    h. Existing technological barriers, such as a smaller range of electric vehicles
    i. Existing financial barriers, such as increased costs of electric vehicles

10. ***Does it need further external incentives and measures to support mobility service providers to make it more attractive for them to offer carsharing?***
    a. Very high need
    b. High need
    c. Average need
    d. Low need
    e. No need

10.1. If you see a"very high need", "high need" or "average need", which supporting aspects or incentives would be important to you (multiple choice possible)?
    a. Increased cooperation with other actors
    b. Increased financial support or incentives
    c. Improved information provision and advice
    d. Improved legal framework
    e. Improved infrastructural conditions

11. ***Do you see a need to connect carsharing and/or electric carsharing with other economic sectors, such as the housing or energy industry?***
    a. Very high need
    b. High need
    c. Average need

d. Low need
e. No need

11.1. If you see a "very high", "high" or "average" need, concerning which sectors do you see such a need?

a. Housing industry
b. Energy suppliers
c. Car maker
d. Wholesale and retail
e. Services (excluding wholesale and retail)

12. Would you be interested in offering carsharing or electric carsharing in the future in cooperation with housing companies/cooperatives?

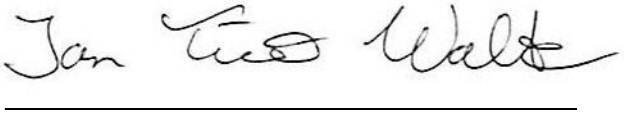
a. Very high interest
b. High interest
c. Average interest
d. Low interest
e. No interest
f. A cooperation with housing companies/cooperatives already exists

Statutory declaration

I hereby certify that I have written the present master's thesis independently and have used no other than the specified sources and resources. All statements that are taken literally or in content from other writings, I have identified as such. Furthermore, I declare that the work has not yet been used in any other course of study or examination as an examination or academic achievement – not even in excerpts.

Jan Timo Walter
Hinterm Teich 28
21217 Seevetal
Germany

Seevetal, 19th February 2018



Jan Timo Walter