

Identifying the barriers for diffusion of stationary car sharing in the Netherlands using an innovation system approach

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Preface

This thesis is submitted in partial fulfilment of the requirements for the degree of Master of Science in Complex Systems Engineering and Management at the Technology, Policy and Management faculty of the Delft University of Technology. This research presents the barriers for diffusion of stationary car sharing in the Netherlands. It is aimed at showing the perspectives of different stakeholders on barriers for diffusion for car sharing.

When looking for a graduation topic I wanted to do research on a sustainability topic within the transport sector. WeGo, a car sharing provider in Amsterdam, gave me the opportunity to do research on this topic while doing my internship for them. I learned a lot about car sharing providers in the Netherlands and the issues they are facing nowadays. I want to thank all my colleagues there who made this thesis possible.

I want to express my gratitude to a number of people. First, I want to thank the eleven interviewees for their cooperation and the interesting insights they provided that formed the basis of this research. I was really impressed to see how they were all making their efforts to make car sharing a success.

Secondly, I want to thank Jan Anne. I really appreciated the feedback he gave during our meetings. I am convinced that the quality of this research increased every time I saw Jan Anne. His enthusiasm helped me to get the confidence and inspiration to finish this thesis. I also want to thank Bert and Mark for their feedback during the kick-off and greenlight meeting. It really helped me to get the right focus and mindset for writing this thesis. I am also grateful for the clear recommendations for improvement I got during these meetings.

Finally, I would like to express my thanks to my family and friends who supported me during writing this thesis. They were always supportive in listening to my stories and they definitely helped me progress during this project.

Enjoy the read!
Jeroen Kloeke

Delft, May 2018

Executive summary

Car sharing is an innovation in the transportation sector which has been defined by Shaheen & Cohen (2007) as: “Car sharing (or short-term auto use) provides a flexible alternative that meets diverse transportation needs across the globe, while reducing the negative impacts of private vehicle ownership”. Car sharing has resulted in individuals gaining benefits of private vehicle use without the costs and responsibilities of ownership. Besides offering a new way of transportation, car sharing also has environmental benefits compared to privately owned cars. Privately owned cars are causing negative externalities like pollution, CO₂ emissions and extensive use of public space. Stationary car sharing can be an opportunity to reduce these negative externalities. Therefore the government set the goal for 100,000 shared cars in 2018. Currently there are around 30,697 shared cars in the Netherlands, compared to 8,222,974 privately owned cars.

A literature review on car sharing showed a lack of knowledge in blocking powers limiting the diffusion of car sharing. This has led to the following research question:

What blocking mechanisms and policy issues can be reduced to boost the diffusion of stationary car sharing taking an innovation system perspective?

Two theoretical frameworks were used to answer this question: innovation system frameworks by Kuhlmann & Arnold (2001) and Hekkert et al. (2007). These frameworks were used to analyse the structural- and functional performance of the innovation system for stationary car sharing. The innovation system consists of national- and local governments, car manufacturers, car sharing providers, users, research organisations and interest groups. Eleven semi-structured interviews were conducted with different stakeholders in the field of car sharing to exploit the barriers in the innovation system. In conclusion there are 68 barriers in the Dutch innovation system for car sharing. There are five barriers unanimously perceived by all the actor groups in the innovation system. Reducing these barriers is beneficial for all involved stakeholders, thus the key for boosting diffusion.

Firstly, there is the difficulty of creating profitable business models. Risk allocation among stakeholders in car sharing projects and time consuming sales processes contribute to this difficulty. Also, a lack of transferability of car sharing projects limits the ability to implement a proven business model in a new situation. Variability in context factors such as user group characteristics and urban density contributes to this lack of transferability. Secondly, lack of scalability of car sharing projects limits the network ability of car sharing services. When shared cars are available at a few locations, users don't experience the opportunity of using car sharing services anywhere they would like. Currently, car sharing is only widespread in highly urbanised regions. Lack of scalability also limits the magnitude and visibility of societal- and environmental effects. Thirdly, the national fiscal policy is seen as barrier albeit different actor groups view this barrier differently. According to the governmental parties fiscal incentives can contribute to the diffusion of car sharing in the Netherlands. However, in their view it is not essential in this stage as the market size is too small for creating fiscal incentives. On the other hand the business parties have emphasized that in the current fiscal system there is no fiscal level playing field. Car sharing as a mobility solution encounters resistance competing with other forms of automobility, because of the fiscal incentives users get in the current system. Fourthly, there is no push for behavioural change in the current market for automobility. Terms of employments are favouring the choice for car ownership/lease. Context factors, e.g. no parking pressure, no paid parking licenses, and the lack of accessibility of other mobility services than a private car limit the transition from private use to shared use of cars. Fifthly, the absence of insurance products is a barrier of minor importance according to the interviewees.

There were also barriers perceived by specific actor groups. Car manufacturers admit that shared mobility is new in their strategies or as a service they want to adopt, but it may not harm sales of

privately owned cars. Furthermore, operating a car sharing service is labour intensive caused by negative reciprocity and unfamiliarity among users. Resulting among others in damage from negligence or improper use of the shared car. Local governments cope with undercapacity for initiating car sharing projects. They are also unfamiliar with the concept of car sharing. Therefore, local governments opt for existing solutions instead of car sharing, to solve public space and parking issues. National- and local government state that there is a lack of integrating shared mobility in spatial development and other mobility services. They state that integration has high potential for actors outside the innovation system as real estate developers and energy companies.

Both solutions mentioned by interviewees and solutions found in academic literature were taken into consideration for suggestions to reduce the barriers for diffusion. This resulted in three promising solution directions. Firstly, increasing accessibility, interoperability and ease of use can be achieved through smart cards and mobility as a service applications (MaaS). However, more research needs to be done on the feasibility of solutions of this kind. Secondly, creating a level playing field on fiscal policies for automobility needs an in-depth analysis. This analysis should exploit the weaknesses and opportunities for opportunistic behaviour of car drivers in the current fiscal policy. Thirdly, integrating shared mobility in spatial development is perceived as promising. Improved knowledge is required to assess how such an integration can be configured to be beneficial for all involved stakeholders.

Semi-structured interviews resulted in a list of barriers, but it is not an exhaustive list. The research remains strongly exploratory in character. Improving this research requires multiple iterations of the structural analysis and subsequently new interview rounds. Iterations can expand the current list of barriers and broaden the stakeholders' perspective on the list of barriers. Additionally, a comparative analysis of the innovation system for car sharing to other innovation systems, such as wind energy in Colombia (Edsand, 2017), is missing in this research. Through a comparative analysis a more reasonable development of the focal innovation system can be given. It could be that some barriers are inherent to the phase of the innovation and will reduce over time without policy interventions.

Summary

Car sharing is an innovation in the transportation sector which has been defined by Shaheen & Cohen (2007) as : “Car sharing (or short-term auto use) provides a flexible alternative that meets diverse transportation needs across the globe, while reducing the negative impacts of private vehicle ownership”. Car sharing has resulted in individuals gaining benefits of private vehicle use without the costs and responsibilities of ownership. Next to the ability of offering a new way of transportation, car sharing also has environmental benefits compared to privately owned cars. Privately owned cars cause negative externalities like pollution, CO₂ emissions and extensive use of public space. Stationary car sharing can be an opportunity to reduce these negative externalities. Therefore the government sets the goal for 100,000 shared cars in 2018. Currently there are around 30,697 shared cars in the Netherlands, compared to 8,222,974 privately owned cars.

A literature review on car sharing showed a lack of knowledge in blocking powers present, limiting the diffusion of car sharing. These blocking powers are hampering the diffusion of car sharing in the Netherlands. Research by Williams (2007) supported these findings and suggested an innovation system perspective to exploit the barriers for car sharing in the Netherlands. The innovation system consists of national- and local governments, car manufacturers, car sharing providers, users, research organisations and interest groups. Using this innovation system perspective is justified by the fact that car sharing does not only require technological changes, but also requires changes in the social environment. Williams (2007) states that changes in automobility and the institutional context of automobility (policies, rules and culture) are needed to diffuse car sharing.

The lack of knowledge in how these socio-technical changes are currently blocked in the innovation system can be filled by answering the following research question:

What blocking mechanisms and policy issues can be reduced to boost the diffusion of stationary car sharing taking an innovation system perspective?

The innovation system methodology by Bergek et al. (2008) has been used to answer this question. The methodology consists of a structural analysis and a functional analysis (Hekkert et al., 2007; Kuhlmann & Arnold, 2001). The structural analysis presents insight in who is active in the system and rules that make up the system. The rules in the innovation system were described by the New Institutional Economics theory (Coase, 1937; Williamson, 1998). The rules identified by this theory shape human interaction between stakeholders in the innovation system. These interactions focus on which knowledge and resources are exchanged to support or hamper diffusion of car sharing. In this context by hampering diffusion is meant e.g. strategically keeping knowledge and resources for own use.

Besides the structural analysis, the functional analysis has been carried out. The innovation system functions present insight in what stakeholders do and whether this is sufficient to successfully diffuse innovations. Compared to the structural analysis, the functional analysis gives insight in the performance of the focal innovation, car sharing. Both structural- and functional analyses are related. Namely, underperformance on a functional indicator can possibly be caused by a weakness in a structural component.

The functional barriers were exploited through eleven semi-structured interviews with stakeholders originating from the structural components of the innovation system. After eleven interviews the data was getting saturated. This is supported by the fact that the number of new findings after each new interview decreased. However, the model of barriers remains exploratory in character and it is not exhaustive.

There turned out to be 68 barriers in the Dutch innovation system for car sharing, based on the interviews with eleven stakeholders. The current performance of the innovation system in the Netherlands has been qualitatively measured based on seven innovation functions. Assessing the performance by the stakeholders showed that car sharing has difficulty in competing with existing mobility solutions, such as the private car or public transport. According to the interviewees the competitive advantages, such as favourable tax regimes or legal exemptions, are underdeveloped to provide a protected space for car sharing. Besides, there are also difficulties in turning knowledge, networks and markets in viable car sharing concepts. Barriers are mainly related to these two factors of underperformance. There are five barriers unanimously perceived by all the actor groups in the innovation system. Reducing these barriers is beneficial for all involved stakeholders, thus the key for boosting diffusion. In the next part these five functional barriers are presented. After each barrier (functional analysis) the possible structural causes (structural analysis) for these barriers are discussed.

Firstly, there is a difficulty in creating profitable business models. Risk allocation among stakeholders in car sharing projects and time-consuming sales processes contribute to the difficulty of creating profitable business models. A lack of transferability of car sharing projects also limits the ability to implement a proven business model in a new situation. Variability in context factors such as user group characteristics and urban density are contributing to this lack of transferability.

The structural analysis showed that integrating all the subsystems, e.g. reservation system, billing system, fleet management, into one platform owned by the car sharing providers offers advantages. Although, it is easier to comply to legal and liability requirements when you have only one access channel to the platform, it decreases the opportunity of compatibility with other mobility services. It also decreases the opportunity of covering large geographical areas, supported by the fact that car sharing is currently only widespread in strong urbanised areas. The structural analysis also showed a lack of harmonisation of public policies for car sharing which is limiting the transferability of car sharing projects. Car sharing providers need to adjust business models to these local policies.

Secondly, lack of scalability of car sharing projects is limiting the network ability of car sharing services. When shared cars are available at a few locations, users don't experience the opportunity of using car sharing services anywhere they would like it. Currently, car sharing is only widespread in highly urbanised regions. Lack of scalability also limits the magnitude and visibility of societal- and environmental effects. According to the car sharing provider in the sample there is dependence on the car industry to scale-up your services.

This dependence can be supported by a structural barrier. Research shows that if the car industry allocates more resources, e.g. funding, cars, technology, it will have positive impacts for car sharing providers (Le Vine et al., 2014; Loose, 2010). However, according to Spulber & Dennis (2016) the car industry currently sees car sharing not as a mobility solution they need to fully commit on, but as a mobility development they need to hedge for. Increasing this commitment can reduce this barrier and possibly improve scalability.

Thirdly, the national fiscal policy is seen as barrier albeit different actor groups view this barrier differently. According to the governmental parties fiscal incentives can contribute to the diffusion of car sharing in the Netherlands. However, in their view it is not essential in this stage as the market size is too small for creating fiscal incentives. On the other hand, business parties have emphasized that in the current fiscal system there is no fiscal level playing field. Car sharing as mobility solution encounters resistance competing with other forms of automobility, because of the fiscal incentives users get in the current system.

Structural barriers related to this function barriers are shown by Geels (2012). Geels (2012) stated that there is reticence about creating fiscal advantages for alternatives to private car mobility, because of

the danger of political defeat. Besides a political defeat, a possible structural barrier is the dependence on the car industry for economic welfare (Cosentino, 2009). Making private car mobility less attractive could result in a loss of economic welfare.

Fourthly, there is no push for behavioural change in the current market for automobility. Terms of employments are favouring the choice for car ownership/lease. Context factors, e.g. no parking pressure, no paid parking licenses, and the lack of accessibility of other mobility services than a private car limit the transition from private use to shared use of cars.

In the structural analysis the research of Dias et al. (2017) and Efthymiou et al. (2013) showed characteristics which also limit this push for behavioural change. They showed that people with mid incomes who are more environmentally consciousness have a higher probability of joining car sharing schemes. Also people who now travel by public transport are more likely to switch to a shared car than people using other modes of transport. If these characteristics are not present among a potential user group a behavioural change is less likely to happen.

Fifthly, the absence of insurance products is a barrier of minor importance according to the interviewees. The interviewees assumed this barrier will reduce over time when insurance companies see the importance of developing an insurance product for car sharing. In the structural analysis Baggio (2015) emphasized data gathering by car sharing providers is important for compiling risk profiles of their users. When car sharing providers can discuss these profiles with insurers the lack of insurance products can possibly be reduced.

There were also barriers perceived by specific actor groups. Car manufacturers admit that shared mobility is new in their strategies or only seen as revenues next to car sales and may not harm those sales. Furthermore, operating a car sharing service is labour intensive caused by negative reciprocity and unfamiliarity among users.

In the structural analysis it was emphasized that car sharing systems always have to comply to legislation for, e.g. data privacy (The European Parliament and The Council of the European Union, 2016) and liability issues in case of damages. According to the car manufacturers in the sample these are important structural causes for high operational costs and difficulty of creating business models.

Local governments cope with undercapacity for initiating car sharing projects. They are also unfamiliar with the concept of car sharing. Therefore, local governments opt for existing solutions instead of car sharing, to solve public space and parking issues. National- and local government state that there is a lack of integrating shared mobility in spatial development and other mobility services. They state that integration has high potential for actors outside the innovation system as real estate developers and energy companies.

In order to reduce the barriers some solutions were suggested. These were solutions mentioned by interviewees and solutions found in academic literature. With respect to academic literature the criterion was that case studies showed reducing barriers similar to the ones found for car sharing. This resulted in three promising solution directions.

Firstly, increasing accessibility, interoperability and ease of use can be achieved through smart cards and mobility as a service applications (MaaS). Using smart cards gives users more opportunities driving a shared car. The smart card can make it possible to use cars of different car sharing providers, while currently you have to be member of a specific provider and can only use their cars. MaaS case studies show an increased use of car sharing when it is for example connected to public transport services. However, more research needs to be done on the feasibility of solutions of this kind.

Secondly, creating a level playing field on fiscal policies for automobility needs an in-depth analysis. Current policies mainly focus on making purchased cars more sustainable, but usage of cars is not discouraged enough to make car sharing a competitive alternative. Besides the level playing field, internalisation of negative externalities is something which lacks in the current situation. It is debateable to which extent the polluter-pays principle, based on the European directive (2004/35/EC) set in 2004, is adequately preserved. Therefore, an analysis should exploit the weaknesses and opportunities for opportunistic behaviour of car drivers in the current fiscal policy. Hereby, the fiscal policy can be adjusted to create a level playing field between privately owned- and shared cars.

Thirdly, integrating shared mobility in spatial development is perceived as promising. For car manufacturers these are projects which are interesting since it gives them the opportunity to sell automobility to people who are not likely to buy a car. These people can make use of a shared car if it is offered at their apartment complex. It does not harm car manufacturer's car sales. However, in these kind of projects the car manufacturers still address the difficulty of creating a profitable business model. It seems important that governmental parties participate in such projects as they have the opportunity to mitigate the risks. Primarily reducing the risk that in the short run such a project is not profitable for car sharing providers can be done via, e.g. subsidies or other financial support (Bressers & O'Toole, 1998; Docherty, Marsden, & Anable, 2017). Improved knowledge is required to assess how such an integration can be configured to be beneficial for all involved stakeholders.

Summarising all these analyses led to a graphical overview. An overview of the structural barriers related to the functional barriers and the suggested solutions to reduce these barriers is depicted in Figure 1. This is the key deliverable of this research and an answer to the main question of this research.

Nevertheless, there are some limitations in this research for which some recommendation for future research can be done. Firstly, the semi-structured interviews resulted in a list of barriers, but it is not an exhaustive list. The research remains strongly exploratory in character. Improving this research requires multiple iterations of the structural analysis and subsequently new interview rounds. Iterations can expand the current list of barriers and broaden the stakeholder perspective on the list of barriers.

Secondly, a comparative analysis of the innovation system for car sharing to other innovation systems, such as the innovation system for wind energy in Colombia (Edsand, 2017), is missing in this research. Through a comparative analysis a more reasonable development of the focal innovation system can be given. It could be that some barriers are inherent to the phase of the innovation and will reduce over time without policy interventions. However, the severity of the found barriers cannot be demonstrated without this comparative analysis.

Thirdly, after exploiting the functional barriers the structural weaknesses were related to functional barriers. However, this linking is not embedded in a structured scientific process. Bergek et al. (2008) remain superficial in describing this relation between structural- and functional barriers. In fact, the relations are based on information in the interviews and reasoning by the researcher. This weakness undermines the strength of the conclusions that can be drawn about the relations between the structural- and functional barriers. Therefore, an improvement could be to prescribe procedures in the scheme of analysis by Bergek et al. (2008) how the structural- and functional analysis must be related and how these relations can be validated.

At last a point of reflection. I question the relevance of the structural analysis. The guidelines for defining the structure of the innovation remain superficial. It should contain the following components: technical factors, actors, networks and institutions. In this research specific choices were made to define the structural components, e.g. the choice for New Institutional Economics. This theory

seemed appropriate for defining the institutions in the innovation system. However, there were also other institutional frameworks available to perform the same analysis which might have resulted in different outcomes of the structural analysis and subsequent analyses (Ostrom, 2010). It is unclear how these choices influenced the outcomes of this research. Therefore, from a researcher perspective I suggested to reduce this freedom of choice during the structural analysis. Reducing this freedom of choice might increase the replicability of the research. I also believe reducing freedom of choice can help improving the relevance of the structural analysis to the functional analysis.

Structural barriers (Chapter 4)

- Technical system**
 - Interdependence subsystems
 - Lack of compatibility with other systems
- Actors & Network**
 - Dependence on car industry
 - Car sharing used for hed
- Institutions**
 - Negative reciprocity among users
 - Lack of harmonisation long- and short term incentives

- Actors**
 - Quality of data is lacking
 - Lack of harmonisation local policies
- Institutions**
 - Lack of externalising neg. externalities

- Actors**
 - Dependence on car industry for economic welfare
 - Reticence for creating fiscal advantages
 - Focus on congestion reduction
- Institutions**
 - Lack of externalising neg. externalities
 - Blurred ownership structures

- Contextual barriers**

- Institutions**
 - Uncertainty about future trends in automobility

Blocking mechanisms (Chapter 5)

- Creation of business models
- Ops. car sharing time consuming
- Lack of scalability
- Lack of interoperability
- Lack of transferability
- Lack of integration in spatial development

- Under capacity at local governments
- Lock-in mobility solutions
- Unfamiliarity among local governments

- National fiscal policy
- No critical mass
- Private use unattractive
- Absence of insurance products

- Parking pressure
- Political orientation

- Ridesharing
- Autonomous driving
- Electric driving

Innovation Functions

Entrepreneurial activities

Market formation

Guidance of the search

Knowledge development

Knowledge diffusion

Mobilisation of resources

Legitimise

Inducement mechanisms (Chapter 6)

- Mobility as a Service (MaaS) applications**
 - Increase interoperability
 - Increase awareness/decrease unfamiliarity
 - Increases possibilities to scale up
 - Increases use of car sharing services

- Incentivising through gamification**
 - Increases awareness around sustainable mobility
 - Decrease unfamiliarity among users
 - Increase use of car sharing services

- Create a fiscal level playing field**
 - Increases behavioural push
 - Decreases attractiveness of private car ownership

- Increased internalisation of negative externalities in car usage**
 - Increases behavioural push
 - Decreases attractiveness of car usage

- Cooperation for integration spatial development and shared mobility**
 - Increase knowledge on this topic
 - Provides assistance in development of business models

- Develop Proof of Concept/action framework for local governments**
 - Increases familiarity
 - Decreases lock-in effect for mobility solutions
 - Increase transferability
 - Decreases complexity and possibly less capacity needed at local government to set-up a project

Figure 1 Key result after executing all the research steps

1 Introduction

For the last decades demand for transportation has risen and now resources for satisfying this demand are under pressure. Especially in city centres where resources for car transport are scarce the increasing demand forms a problem (Melia et al., 2012). Car sharing is an innovation in the transportation sector responding to these issues.

Car sharing is defined by Shaheen & Cohen (2007, p. 1) as : “Car sharing (or short-term auto use) provides a flexible alternative that meets diverse transportation needs across the globe, while reducing the negative impacts of private vehicle ownership”. Car sharing has resulted in individuals gaining benefits of private vehicle use without the costs and responsibilities of ownership.

Private transport by car causes extensive user of public space in these city centres. Additionally, air pollution and CO₂ emissions are harming the environment. Car sharing can be a possible solution for reducing these problems as a case study in Ireland by Rabbitt & Ghosh (2013) showed. Based on projected behavioural changes in this case study calculations were made to estimate the benefits of car sharing. Results showed car owners could make significant travel cost and CO₂ emission savings through using a car sharing service. The limitation sketched in this case study was the viability to offer a car sharing service by a provider. It was suggested that only in dense areas car sharing services are economically viable (Rabbitt & Ghosh, 2013).

In the transportation sector, which is highly relying on fossil energy resources, it is important to make a transition to more sustainable forms of transportation. The Social Economic Counsel of the Netherlands (SER) therefore established an Agreement for Energy for Sustainable Growth in which 47 Dutch organisations are involved. In this agreement clear goals of reducing pollution and CO₂ emissions are communicated (Sociaal-Economische Raad, 2013).

The goal for car sharing is to have 100,000 shared cars in 2018 in the Netherlands. To empower this goal a Green Deal was set up by 7 local governments and 33 private companies. The goal of the companies and governments in the Green Deal is to accelerate the growth of shared cars by collaborating within this Green Deal (Rijksoverheid et al., 2015). In September 2016 the number of shared cars was 25,216. To reach the goal in 2018 there is still a gap which must be closed (Natuur en Milieu, 2016).

1.1 Problem introduction

First the general challenges for car sharing in the near future are discussed. Then the scientific knowledge gaps relevant for the research are introduced. Lastly, the scientific and social relevance will conclude this paragraph.

1.1.1 Problem exploration

Although big steps have been taken since the implementation of the Green Deal for shared cars, there is a gap between the objective of 100,000 shared cars in 2018 and the given 25,216 cars in September 2016 (Natuur en Milieu, 2016).

There is still a great desire among traditional car drivers to own a car instead of sharing a car. Behavioural changes need to be triggered to increase the number of people willing to drive a shared car (Bert et al., 2016). Additionally, familiarity among car drivers needs to be created. Insight in the benefits of car sharing compared to privately owned cars needs to be clearly communicated to potential customers (Lane et al., 2015).

Car sharing combines two concepts which are relatively new compared to the traditional concept of private cars. Instead of owning a car after buying it, with shared cars users pay for access based consumption. Car sharing is based on the concept of collaborative consumption (shared consumption) defined by Belk (2007, p. 126) “the act and process of distributing what is ours to others for their use and/or the act and process of receiving or taking something from others for our use”. Within collaborative consumption there are multiple models for collaborative consumption practices. In Figure 2 the different models are summarized by Frenken & Schor (2017). The system in which shared cars are used can be best described as Product Service System defined by Tukker & Tischner (2006) as ‘consists of a mix of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling final customer needs’. Car sharing combines access and goods. Those two concepts change the traditional relationships between car users, manufacturers, service providers and insurance companies (Williams, 2007). Therefore, in the next paragraph the most important knowledge gaps in the field of car sharing as a product service system will be presented.

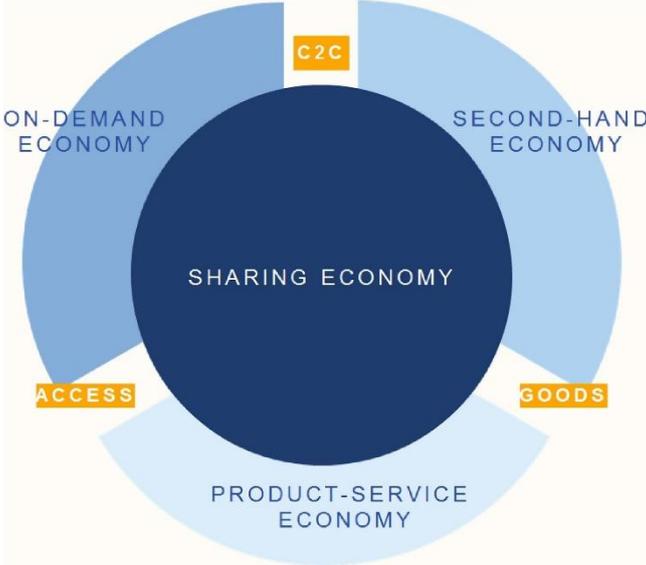


Figure 2 Sharing economy and related forms of platform economy (Frenken & Schor, 2017)

1.1.2 Knowledge gaps

Although research is done on the barriers of car sharing in general, there is no specific research done for car sharing systems which can be described as stationary car sharing systems. Therefore, in this research such a model will be the starting point for researching the barriers for expansion. The searches are performed in the Scopus, Science Direct and Google Scholar database with the following key words: “product service system”, “shared consumption”, “car sharing”, “sustainability”, “barrier”.

Stationary car sharing programs focus on the link between the home and/or the workplace location. It is providing a round trip from the home location to any desired location of the user. The car cannot be used until the car is brought back to the home location (National Academies of Sciences Engineering and Medicine, 2005). The car can be reserved in advance in which the user has to estimate the time needed (Barth & Shaheen, 2002).

The interfaces within the product and service are causing uncertainties, which cause problems when offering a product service system like car sharing. An important barrier within the car sharing industry is the increased risk for car manufacturers. As stated by Williams (2007) the traditional supply chain for manufacturers expands. Firstly, the number of stakeholders they need to take into consideration

increases (Firnkorner & Müller, 2012). Secondly, they have to stay in closer contact with their consumers to fulfil the needs of consumers.

Change in the device concept will occur when product service systems become a success. Nowadays traditional car manufacturers remain owner of the car till the moment the car is sold. In the future different constructions may be possible regarding ownership and this will influence the revenue streams and risk allocation among stakeholders (Baldwin & Clark, 2003).

In the research by Cohen & Kietzmann (2014) the importance of stakeholder management in a car sharing business model is addressed. Car sharing operations touch multiple stakeholders: manufacturers, dealers, users and governmental organizations. The fact that these stakeholders are related to car sharing activities mean that they can possibly block processes for further expansion. Vezzoli et al. (2015) address that it is important to gain knowledge about what part one plays in expansion of car sharing by examining stakeholders' resources, knowledge and motivations.

One of the implications of product service systems are that selling a product and providing a service are combined. In the past companies were mainly focusing on one aspect, either on selling or on providing the service. Being able to combine both aspects requires new competences, skills and experiences. The fact that new parties are active in the automobility market in which new technologies are used, leads to new relationships between manufacturers, providers and customers. Currently the dynamics of these relationships and how these can be effectively managed is unknown (Bardhi & Eckhardt, 2012; Vezzoli et al., 2015). The research should lead in explaining the most important barriers related to the risks and uncertainties in the relationships between those new entrants and incumbents in the automobility market.

As a result of the uncertainty in the interfaces between stakeholders Bartolomeo et al. (2003) stated that the vision of organisations should be aligned. If organisations are facing different incentives, this will lead to an organisation favouring short term rewards instead of long term rewards. Collaboration facing this misalignment will not take the best advantage of the potential of a product service system. Resulting in customers confronted with a solution inferior to their needs. The research should result in exploiting knowledge about actors' incentives to make car sharing a success.

- Unknown where the important blocking powers in the system are active?
- Unknown how new relationships between incumbents and new entrants in the automobility market can be effectively managed?
- Unknown incentives of stakeholders to support car sharing and make it a success?

Tukker & Tischner (2006) support this vision mentioning that barriers in the field of the social technical regime form the barrier for a product service to make the transition from a niche innovation to a mainstream used product service. Car sharing as a system innovation can be analysed as a system innovation to find the barriers for diffusion. The methodology for analysing by Bergek et al. (2008) is used to analyse car sharing in the Netherlands as a 'system innovation' and define the blocking mechanisms for diffusion. The methodology is explained in Chapter 3.

1.2 Research proposal

First the research question will be presented. Secondly the method to provide an answer to these questions will be discussed. Lastly, elaboration on the data and tools needed for this analysis is provided.

1.2.1 Research questions

The main research question in this research is:

What are the blocking mechanisms and policy issues that can be reduced to boost the diffusion of stationary car sharing taking an innovation system perspective?

1. What are the current structural components of a stationary car sharing innovation system in the Netherlands?
2. What are the underdeveloped functions of the innovation system?
3. In which phase is the current innovation system?
4. What are blocking mechanisms for stationary car sharing in the Netherlands?
5. What kinds of interventions can be suggested to reduce the barriers of diffusion?
6. What are the implications for the innovation systems frameworks for applying it to a PSS like car sharing?

To answer the main research question and guide the research innovation system frameworks are used. These frameworks are explained in chapter 2. In chapter 3 the methodology to answer these research questions is discussed.

1.2.2 Research approach

Williams (2007) states that to make collaboration a success not only stakeholders within the sphere of influence of a product service provider must be taken into account. Car sharing requires change at both the technical and the socio-cultural level. Therefore, Williams (2007) states that making a 'system innovation', as he describes car sharing, a success all the stakeholders falling within the scope of the system have to be taken into account. The concept of the innovation system stresses that the flow of technology and information among people, enterprises and institutions is key to an innovative process (Hekkert et al., 2007). In this research these structural (people, enterprises and institutions) and functional (innovative process) components of the innovation system will be analysed. Hekkert et al. (2007) state that through analysing these components the barriers for diffusion of an innovation can be identified. The frameworks needed for this analyses are provided by Kuhlmann & Arnold (2001) and Hekkert et al. (2007). These frameworks are discussed in Chapter 2.

1.2.3 Scope of the research

The innovation system of interest in this research is the Dutch innovation system for car sharing. This implies that only relevant grey literature for the Dutch case is taken into account. Findings in academic papers abroad are not neglected, even if they are not based on the Dutch case. In the first place this is done, because these findings are generalised for the topic 'car sharing' and not for the specific innovation system of the country used in that academic research. Secondly, this research starts broad and should converge to barriers for the car sharing in the Netherlands. Therefore, the most important academic papers about shared consumption and car sharing must be taken into account in order to reduce the chance of not identifying barriers in the current system.

The research focuses on stationary car sharing systems instead of free-floating systems. For the free floating car sharing systems there are more internal operations needed to run such a system compared to stationary car sharing (Cohen & Kietzmann, 2014). A free floating car sharing system is therefore more interesting for an internal business innovation approach. Innovations for free floating can be brought to market in more isolation. These are innovations such as improving relocation algorithms and improving knowledge about travel patterns (Kek et al., 2009; Rickenberg et al., 2013).

1.2.4 Thesis structure

In the next chapter the theoretical frameworks and theories will be first presented. Based on these frameworks a methodology for conducting this research is presented in Chapter 3. This methodology consists of a structural analysis. The structural analysis of the innovation system for car sharing in the Netherlands is presented in Chapter 4. Subsequently in Chapter 5 the functional analysis of the innovation system is presented. In Chapter 6 the synthesis of the structural- and functional analysis, linking structural barriers to functional barriers, is conducted. Chapter 7 suggests some inducement mechanisms to reduce found barriers in the innovation system. Chapter 8 contains the conclusion of the research. It will consist of recommendations for future research, limitations- and implications of this research.

2 Theoretical landscape

In this chapter the theoretical landscape of this research is presented. This will consist of the theoretical frameworks and theories used in this research. An explanation about these frameworks and reasons for using these frameworks is given.

2.1 Innovation system framework for structural components

As already mentioned in the research approach in section 1.2.2 the innovation system framework presented by Kuhlmann & Arnold (2001) is applied to guide this research. Williams (2007) supports the view that an innovation system approach can lead to identification of barriers for diffusion of car sharing. In this framework essential system components for an innovation system are drawn. In Figure 3 these system components are depicted. The development of the system innovation depends on the interrelation of the actors within this framework. It is assumed that these blocks interact with each other and through choices, and actions by stakeholders in this framework the innovation is utilized and diffused (Kuhlmann & Arnold, 2001).

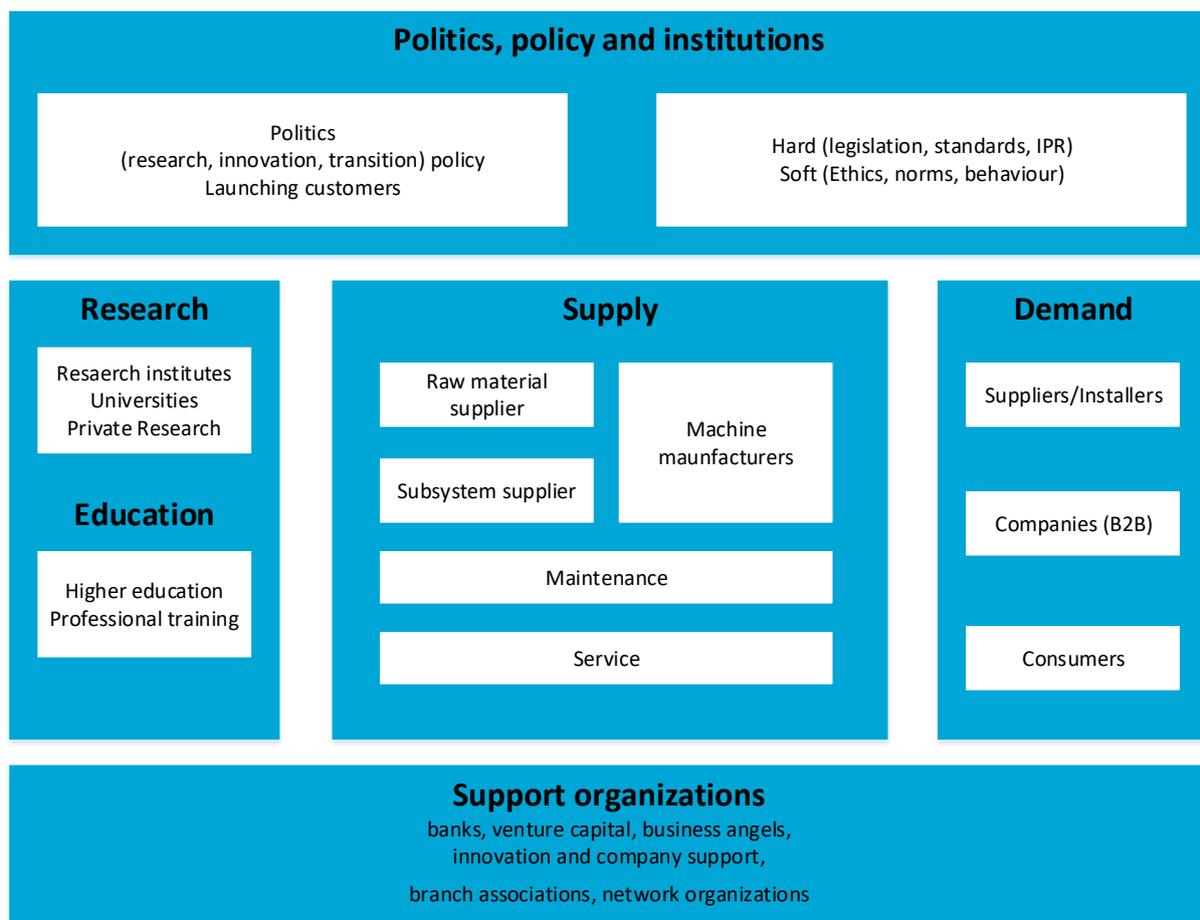


Figure 3 Innovation System Framework (Kuhlmann & Arnold, 2001)

The basis for this framework is that the actors presented in the framework interact with each other to develop and diffuse an innovation. Interaction through exchanging knowledge and resources will according to the framework of Kuhlmann & Arnold (2001) result in diffusion. First, this framework stresses the idea that actors act according to the concept of **bounded rationality** (Kuhlmann & Arnold, 2001, p. 14). Bounded rationality suggests that actors take decisions under time pressure (Simon, 1957). Their rationality is limited by the fact that they are acting in a complex environment. Gathering information about all the possible decision options is an impossibility. Therefore actors tend to focus on sub goals lying within the specific actor's responsibility and losing the vision the overall goal of the

multi actor playing field. Based on bounded rationality the key for economic performance is knowledge, learning and institutions (Kuhlmann & Arnold, 2001, p. 14). Secondly, it is assumed that there is historical **path dependence** in an innovation system. What actors in this system can do depends on previous efforts of themselves or other actors in the system. The structural analysis is important to analyse these previous efforts and apply theories related to institutions shaping the system (Dixit, 1996). Given the bounded rationality and path dependence characteristics of the innovation system framework, the theories of New Institutional Economics (NIE) are used to explain the relations between the stakeholders. NIE consist of three theories which are shortly discussed in the next paragraph.

2.2 New institutional economics

In the innovation system framework by Kuhlmann & Arnold (2001) the relationships between actors are shaped through institutions. The fact that bounded rationality and path dependence are concepts forming part of this innovation system framework supports the idea of making use of NIE. Therefore the innovation system for car sharing in the Netherlands is analysed based on the three most important theories of New Institutional Economics: property rights, transaction costs and principal-agent theory (Coase, 1937; Williamson, 1975).

Within property right theory four economic property rights are defined. Those are the attributes defined by Furubotn & Pejovich (1974) as economic property rights:

1. the right to use the good
2. the right to earn income from the good
3. the right to transfer the good to others
4. the right to enforce property rights

These components can be used to define the relationships between the actors. The allocation of property rights in a shared car setting are different to the allocation of property rights in a private owned car setting (Bardhi & Eckhardt, 2012). This difference might result in changing behaviour and attitudes among stakeholders. The weaknesses caused by this difference are analysed through property rights theory.

The costs for monitoring and enforcing these economic property rights result in transaction costs. Transaction costs are the second component of NIE. The origin and forms of transaction costs are specified by Williamson (1975, 1998). Opportunistic behaviour, bounded rationality and uncertainty are results of the changing behaviour and attitudes of stakeholders. Opportunistic behaviour and bounded rationality are factors leading to transaction costs in stakeholder relationships according to Williamson (1998).

The last building block of the new institutional economics is agency theory. Agency theory can be defined by Eisenhardt (1989, p. 59) as “relationships that mirror the basic agency structure of a principal and an agent who are engaged in cooperative behaviour, but have differing goals and differing attitudes toward risk”. Problem Relationships in which the principal and agent have partly differing goals and risk preference can possibly hamper the diffusion for car sharing in the Netherlands. In the innovation system framework by Kuhlmann & Arnold (2001) these differing goals and differing attitudes toward risk have to be identified to define structural weaknesses in the innovation system.

2.3 Functions of innovation systems framework

As the innovation framework is more of static nature the functions of innovation systems framework by Hekkert et al. (2007) is used to map the processes in the innovation system which are underdeveloped or underperforming. These innovation functions are a response to approaches which

focus only on the structural components of innovation systems. Through the use of the framework of Kuhlmann & Arnold (2001) and Hekkert et al. (2007) both a structural and functional barriers are exploited in the innovation system for car sharing in the Netherlands. These seven innovation functions by Hekkert et al. (2007) are embedded in existing literature on innovation systems.

In Figure 4 the motors of change are depicted. There are multiple interactions possible with seven innovation function. However, through empirical work three initial patterns (A, B and C) for innovation systems were found by Hekkert et al. (2007). These patterns are called the motors of change. The barriers found through the analyses can be related to these innovation functions. In conclusion, use of this framework should lead to identification of the motors of change limiting the diffusion of car sharing in the Netherlands. The seven functions of innovation systems defined by Hekkert et al. (2007) are shortly explained of what they entail and how they are interrelated in section 2.3.1 – 2.3.7.

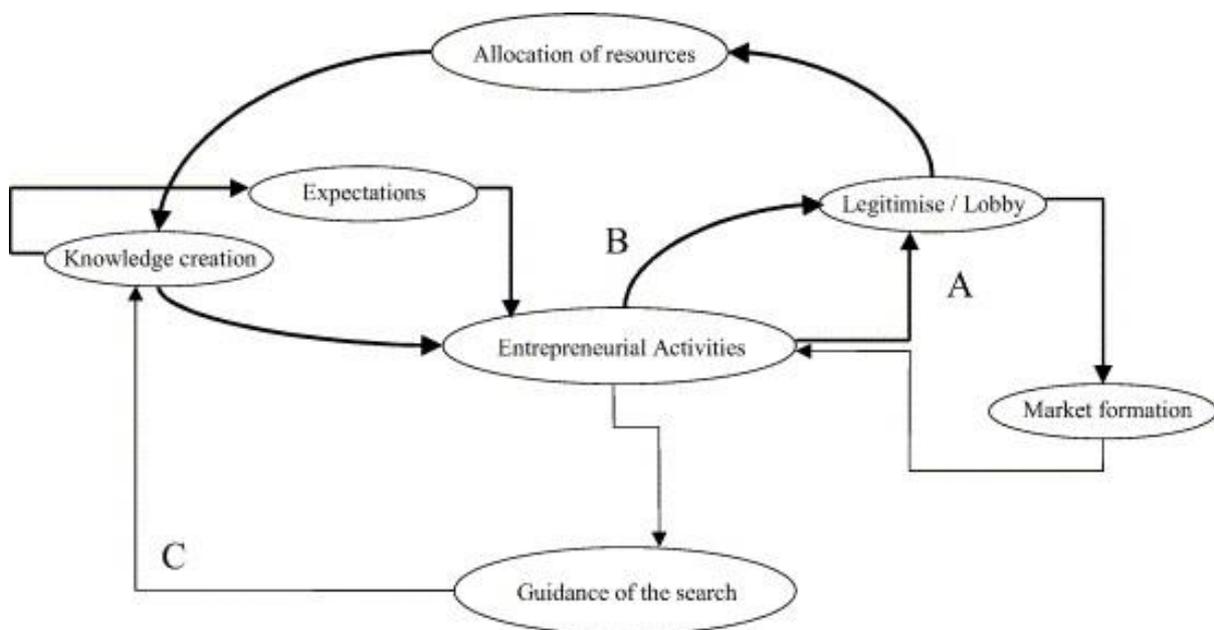


Figure 4 Three typical motors of change (Hekkert et al., 2007)

2.3.1 Entrepreneurial activities

This function captures the ability of entrepreneurs to turn the potential of new knowledge, networks, and markets into concrete actions to generate and take advantage of new business opportunities. Entrepreneurs can be either new entrants that have the vision of business opportunities in new markets, or incumbent companies who diversify their business strategy to take advantage of new developments. The theory assumes that ‘entrepreneurial activities’ lead to input for the ‘guidance of the search’ as the entrepreneur has a vision on how the innovation should develop in the future based on the new business opportunities.

2.3.2 Knowledge development

This function encompasses ‘learning by searching’ and ‘learning by doing’. Learning by searching is guided by the input coming from ‘guidance of the search’ in which clear goals and needs for the future are described. Uncertainty in the future can be reduced by doing research on these future developments. The knowledge developed by research organisations can assist ‘entrepreneurial activities’ to adjust in this case car sharing services to future developments.

Learning by doing is influenced by ‘resources mobilization’. Resources are needed to test e.g., concepts and of car sharing. Being able to learn about successfulness of different car sharing concepts when

running a car sharing services will lead to improved 'entrepreneurial activities' as entrepreneurs are better able to adjust products to the needs of users.

2.3.3 Knowledge diffusion through networks

This function entails the exchange of information between stakeholders. Exchanging information through interaction is important in a heterogeneous context where car sharing providers meet government, competitors, and incumbent parties (car manufacturers, car dealers). Here policy decisions (standards, long term targets) should be consistent with the latest technological insights.

2.3.4 Guidance of the search

Since resources are almost always limited, it is important that, when various development directions are possible, specific directions are chosen. As a function, 'guidance of the search' refers to those activities within the innovation system that can positively affect the visibility and clarity of specific wants among innovation users. If future development demands are clear it will according to the theory by Hekkert et al. (2007) result in clear input for the innovation function 'knowledge development'. This knowledge development then leads to improved 'F1 entrepreneurial activities' and drives cycle C in Figure 4.

2.3.5 Market formation

New technology often has difficulty to compete with embedded technologies. They are, of necessity, badly adapted to many of the ultimate uses to which they will eventually be put; therefore, they may offer only very small advantages, or perhaps none at all, over previously existing techniques. Because of this, it is important to create protected space for new technologies. Another possibility is to create a (temporary) competitive advantage by favourable tax regimes or legal exemptions.

2.3.6 Resources mobilization

Resources, both financial and human capital, are necessary as a basic input to all activities within the innovation system. For a specific technology, the allocation of sufficient resources is necessary to make knowledge production possible. In this sense, this function can be regarded as an important input to 'knowledge development'. Examples of this activity are funds made available for long term pilot programs set up by industry (car sharing providers, car industry) or government to develop specific knowledge, and funds made available to allow testing for new car sharing concepts.

2.3.7 Creation of legitimacy/counteract resistance to change

In order to develop well, a new technology has to become part of an incumbent regime, or it even has to overthrow it. Parties with vested interests will often oppose to this development. In that case, advocacy coalitions can function as a catalyst; they put a new innovation on the agenda (function 4), lobby for 'resources mobilization' and favourable tax regimes and improve 'market formation'. Lobbying will according to Hekkert et al. (2007) result in effects on these related innovation functions and by doing so create legitimacy for the innovation.

2.4 Limitations and knowledge gaps for the innovation system framework

There is theoretical support for applying an innovation system perspective to the Dutch car sharing case, as Williams (2007) confirms in his research. Nevertheless, Warnke et al. (2015) addresses several issues for using the innovation system framework presented by Kuhlmann & Arnold (2001) to a product service system like car sharing. They present three domains which the innovation system framework does not tackle completely, but which are relevant for product service systems like car sharing.

Next to closing the knowledge gaps in a stationary car sharing system a recommendation can be done for improving the innovation system framework for systems with product service system characteristics. In addition, the applicability of the two frameworks can be answered through this research. The three domains addressed by Warnke et al. (2015) which can be improved for a PSS applying an innovation system approach are the following:

- **Broaden the notion of key actors**

In project where a lot of people need to innovate together the question is raised if all the people/actors need to be recognized as system innovation actors. If that's the case how can you add this kind of networks to the innovation system actors.

- **Recognize diverse innovation motivations**

The traditional innovation system theory by Freeman (1995) was built on market based innovation where innovators are driven by monetary incentives. It is suggested that a broader range of motivations should be taken into account. Barriers resulting from motivation don't need to be necessarily reduced by restoring the market failures by financial incentives according to Warnke et al. (2015). Identifying non-monetary motivations is part of this research.

- **Consider new enabling infrastructures and institutions**

In the model by Kuhlmann & Arnold (2001) are already a lot of infrastructures mentioned in the bottom layer. But the suggestion by Warnke et al. (2015) is that there might be infrastructures which are supportive to systems with shared consumption, but not mentioned in the model. This could range from new mediators, sharing platforms, creative consumers and co-creation platforms.

In the conclusion these three domains serve as body for reflection. After performing the research an answer can be given to which extent the critics by Warnke et al. (2015) can be rejected or accepted.

3 Methodology

Working within the boundaries of the frameworks presented by Kuhlmann & Arnold (2001) and Hekkert et al. (2007), Bergek et al. (2008) proposes a method to analyse the innovation system. This methodology consists of six steps which are depicted in Figure 5. In the following sections the content of every step in this scheme of analysis is explained.

3.1 Unit of analysis

To answer the main research question in this research the Dutch innovation system for stationary car sharing has been applied to the scheme of analysis by (Bergek et al., 2008). In Figure 5 the methodology to analyse this innovation system is depicted. The second step in this scheme of analysis covers the innovation system framework of Kuhlmann & Arnold (2001). The third step is covered through the innovation function framework by Hekkert et al. (2007).

The unit of analysis is the Dutch innovation system for stationary car sharing. Through transparent choices in literature and methods replication of the research for stationary car sharing is made possible (Darke et al., 1998). Added value of performing this research for stationary car sharing systems, next to reducing the knowledge gaps, also lies in increasing the empirical knowledge for different innovation systems and their dynamics. Increasing empirical knowledge about innovation systems is also one of the goals for Bergek et al. (2008) for providing their scheme of analysis. Lastly, the scheme of analysis by Bergek et al. (2008) provides visibility of all the steps taken to answer the main research question. This visibility creates comparability between outcomes of these steps to other research using the same scheme of analysis. All the steps taken in this research are explained in the next paragraphs.

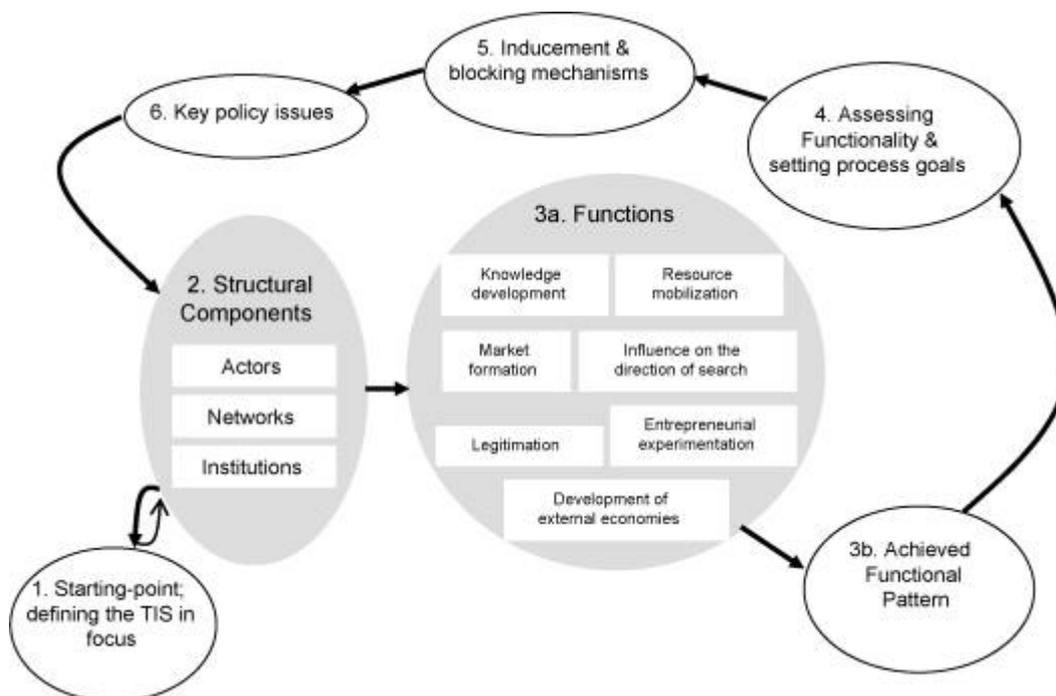


Figure 5 The scheme of analysis (Bergek et al., 2008)

3.1.1 Step 1: Starting-point: defining the TIS in focus

The first step was defining the focus for the structural analysis. The demarcated system is based on the innovation system framework of Kuhlmann & Arnold (2001) and the scope set in Chapter 0. The focus will be on current stationary car sharing systems in the Netherlands. Stationary car sharing systems are not seen as a replacement for only private transport, but as a solution which can add value to

mobility in general in combination with other forms of transport (Loose, 2010). This implicated that not only actors related to car transportation are relevant in this research. Secondly, only for-profit services were taken into account. Non-profit car sharing organisations have a limited size, i.e. 1,354 cars non-profit vs. 29,343 for-profit cars, and this research is about identifying barriers which prohibit growth to 100,000 shared cars (CROW, 2017a).

3.1.2 Step 2: Structural components

The second step was an analysis of the structural components of the innovation system based on what was delineated in step 1. The structural analysis was guided by the innovation system framework by Kuhlmann & Arnold (2001). In this structural analysis academic- and grey literature was gathered to define the structural components potentially causing structural weaknesses in the innovation system of car sharing in the Netherlands. New institutional economics articles about shared consumption were used to sketch the possible weak or uncertain relationships in the innovation system. Ultimately, this led to a list of weak relationships, dependencies between actors and motivations of actors which might block diffusion of car sharing. Results of this structural analysis were ultimately linked to functional barriers found in Step 3. It also helped to modify the diagnostic questions in Table 2 to guarantee relevance of functional barriers to structural barriers.

3.1.3 Step 3: Functional pattern explored by semi structured interviews

Based on the conclusion of the structural analysis weaknesses were identified in the current system. To verify the results found in literature and take into account the beliefs and opinions of stakeholders the semi structured interviews were held. The results of this step led to input for step 4 till 6 and finally helped to answer the main research question. The following people were interviewed to cover all the blocks in the innovation system framework of (Kuhlmann & Arnold, 2001). The interviewees were selected based on convenience sampling. A sampling technique in which a sample is taken from a group of people easy to contact or to reach (Tong et al., 2007).

Starting point for the sample was the GreenDeal established in 2015 (Rijksoverheid et al., 2015). 36 public- and private parties signed this GreenDeal. All the interviewees were part of an organisation signing this GreenDeal, except the car manufacturers/dealers BMW and Louwman. These interviewees were invited based on the availability of e-mail addresses on the contact page of the GreenDeal website (ShareNL, n.d.). The interviewees were also selected on how they fitted into the framework of Kuhlmann & Arnold (2001) and it was made sure that every block in this framework was represented by at least one interviewee.

The car manufacturers/dealers interviewees were selected based on the partnerships with WeGo. WeGo was the company where the interviewer did his internship and through this partnership easy to reach for an interview. The whole sample is purely based on convenience sample. It is not a random sample of a group of potential interviewees. The selected interviewees are presented in Table 1.

Table 1 Selected interviewees

Name	Role	Organisation	Block in innovation system framework of Kuhlmann & Arnold (2001)
Toy Hertogh	Director	WeGo	Supply
Martien Das	Senior Advisor local climate policy and sustainable mobility	Rijkswaterstaat	Politics (national government)
Arjen Kapteijns	Policy officer of sustainable mobility	Ministry of Infrastructure and Environment	Politics (national government)
Edwin Brugts	Partnership Manager BMWi	BMW Nederland	Supply
Erik Lukkassen	Manager Sales Toyota	Louwman Dealer Groep	Supply
Sophie Gunnink	Project Manager	Gemeente Utrecht	Politics (Local government)
Quirijn Oudshoorn	Advisor Sustainable Mobility	Gemeente Rotterdam	Politics (Local government)
Diede Labots	Policy officer	Gemeente Den Haag	Politics (Local government)
Marco van Burgsteden	Project Manager	CROW	Research
Ida Sanders	Project Manager	Natuur & Milieu	Support Organisation
Kees Eriks & Ilse Hoogvliet	Facility Managers	Ernst & Young	Demand

The interviews were all written out and put in text documents and analysed in R, software for statistical programming. The interviewees got a summary of their interview and revised them in cooperation with the researcher. The interviewees did not see the full transcription of the interview. The package ‘RQDA’ by Huang (2017) was used to code parts of the transcription. These codes were then put into categories. Coding the transcriptions was a manual process.

Coding tried to avoid the bias of a researcher, because there is no selective extraction by the researcher. It also ensured that all data remains available for future research, although the researcher selected only the most promising findings (Huang, 2017). Therefore Saldana (2016) suggested to brainstorm with a small team to discuss the barriers which were not mentioned frequently but maybe very relevant for policy issues. The findings were therefore discussed with Jan Anne Annema. This should have reduced the chance of “burying a treasure” as was mentioned by Saldana (2016) as an issue for qualitative research.

3.1.3.1 Content of the interview

The scheme of analysis by Bergek et al. (2008) prescribed that the seven innovation systems functions needed to be analysed during this stage. These function categories were found by Hekkert et al. (2007) via literature research on previous innovation system functions and this resulted in a framework. Analysing the functions was a heuristic method in this research to expose the weaknesses and blocking mechanisms in the system. Diagnostic questions were posed to the interviewees to explore the performance of the seven innovation functions (Hekkert et al., 2007). These diagnostic questions were

used in a semi-structured interview setting. An appropriate method to analyse these innovation functions as these functions are qualitative in nature according to Hekkert et al. (2011).

Compared to internal innovation performance of a company, the innovation system approach is more qualitative than quantitative. There are no quantitative indicators for measuring these innovation functions specified by Hekkert et al. (2007). Capturing the performance of the innovation system in solely quantitative criteria is not possible according to Hekkert et al. (2011). For innovations where no big changes are needed in the socio technical regime, quantitative criteria can be used to measure innovation performance. Frameworks made for analysis in quantitative measures of internal business innovations decrease the uncertainty of future potential of these innovations. Research capturing internal business innovation functions is presented by for instance Carbonell-Foulquié et al. (2004) and Martinsuo & Poskela (2011).

The goal of these interviews was to find a complete list of functional barriers. Ultimately, linking these functional barriers to structural barriers and weaknesses. However, it was impossible due to the time constraints to create a complete list of barriers. This would require multiple interviews of each part of the innovation system framework. For this research at least one interview has been done for each block of the innovation system framework. The interviewees are selected through 'convenience sampling (Tong et al., 2007). As some people were difficult to reach this was the easiest way to cover all the blocks of Figure 3 with at least 1 interviewee. The downside of 'convenience sampling' was that it might fail to capture perspectives of difficult to-reach people. In Table 2 the interview questions used for the semi structured interviews are displayed. These are modifications of interview questions found in the research by Hekkert et al. (2011). These modifications were based on the findings in the structural analysis.

Table 2 Interview questions related to the innovation functions framework (Hekkert et al., 2011; Hekkert et al., 2007)

Innovation function	Interview questions
Entrepreneurial activities	<ul style="list-style-type: none"> • <i>What are the most relevant actors for making car sharing a success, according to the interviewee?</i> • <i>Are there sufficient actors in the innovation system?</i> • <i>Is there sufficient innovations on the ITS side?</i> • <i>Do the industrial actors focus sufficiently on large scale production?</i> • <i>Where is the biggest dependence for developing entrepreneurial activities?</i> • <i>Does the experimentation and the different configurations of these experiments form a barrier to go the next phase of large scale production?</i>
Knowledge development	<ul style="list-style-type: none"> • <i>Is the amount of knowledge development sufficient for the development of the innovation system?</i> • <i>Is the quality of knowledge development sufficient for the development of the innovation system?</i> • <i>Does the type of knowledge developed fit with the knowledge needs within the innovation system?</i> <ul style="list-style-type: none"> ○ <i>What are the most important knowledge needs of the actor?</i> ○ <i>What type of information cannot be shared and might form a barrier for evolution/cooperation of the system</i> • <i>Does the quality and/or quantity of knowledge development form a barrier for the TIS to move to the next phase?</i>

	<ul style="list-style-type: none"> •
Knowledge diffusion through networks	<ul style="list-style-type: none"> • <i>Is there enough knowledge exchange between science and industry?</i> • <i>Is there enough knowledge exchange between users and industry?</i> • <i>Is there enough knowledge exchange between government and industry?</i> • <i>Are there information asymmetries between actors?</i> • <i>Is there sufficient knowledge exchange across geographical borders?</i> • <i>Are there problematic parts of the innovation system in terms of knowledge exchange?</i> • <i>Is knowledge exchange forming a barrier for the IS to move to the next phase?</i>
Guidance of the search	<ul style="list-style-type: none"> • <i>Is there a clear vision on how the industry and market should develop?</i> <ul style="list-style-type: none"> ○ <i>In terms of growth</i> ○ <i>In terms of technological design</i> • <i>What are the expectations regarding the technological field?</i> • <i>Are there clear policy goals regarding this technological field?</i> • <i>Are these goals regarded as reliable?</i> • <i>Are the visions and expectations of actors involved sufficiently aligned to reduce uncertainties?</i> • <i>Does this (lack of) shared vision block the development of the TIS?</i>
Resources mobilisation	<ul style="list-style-type: none"> • <i>Are there sufficient human resources? If not, does that form a barrier?</i> • <i>Are there sufficient financial resources? If not, does that form a barrier?</i> • <i>Are there expected physical resource constraints that may hamper technology diffusion?</i> • <i>Is the physical infrastructure developed well enough to support the diffusion of technology?</i>
Market formation	<ul style="list-style-type: none"> • <i>Is the current and expected future market size sufficient?</i> <ul style="list-style-type: none"> ○ <i>Are important parties not participating?</i> • <i>What are important issues for selling/diffusing the product?</i> <ul style="list-style-type: none"> ○ <i>Insurance?</i> ○ <i>Acquiring a fleet?</i> ○ <i>Knowing your users?</i> • <i>Does market size form a barrier for the development of the innovation system?</i>
Creation of legitimacy	<ul style="list-style-type: none"> • <i>What is the average length of a project?</i> • <i>Is there a lot resistance towards the new technology, the setup of projects/permit procedure?</i> • <i>Is the legislation facilitating room for change in automobility via car sharing?</i> • <i>Where is the resistance to change coming from, which actors?</i>

3.1.3.2 *Process of the interview*

In the first phase of the interview the seven functions are explored by posing the specified diagnostic open-ended questions of each function. It is important to avoid bias for the interview beforehand. Therefore the conclusions of the structural analysis are not shared with the interviewee. These conclusions can lead to answers which are biased and therefore not lead to new insights in barriers.

The interviews will be held in English or Dutch. It depends on the preferred language of the interviewee. Forcing interviewees to do the interview in a language might result in missing data. It can lead to communication problems and misunderstanding, which might damage the results of the interviews. The interviews and summaries of the interviews were not translated to English. The resulting barriers and codes are in English, as this research is written in English. The translations of Dutch texts into English codes was done by one person to avoid different interpretations of the interviews (Filep, 2009).

In the beginning of the interview the interviewee got an overview of the seven innovation functions. These innovation functions were introduced as the topics to guide the interview. There were seven cards and the interviewee could choose the cards based on his perception of underperforming innovation functions. This procedure was carried out to find the most underperforming functions in the beginning as asking all the interview question would have been too time consuming.

A simplified version of the innovation system framework by Kuhlmann & Arnold (2001) in Figure 3 was also shown to the interviewee. It was used as a kind of conclusive step in the interview. After all the information was gathered the interviewees were asked to pin mentioned barriers to the related actors in this framework. It is not shown in the beginning of the interview to avoid bias of the interviewee who wants to frame answers to this framework.

3.1.3.3 *Coding interviews*

A transcript of the research has been written out in the spoken language of the interviewee. After making the transcript the Dutch text statement were coded into English codes. The coding procedure was based on the procedure presented by Saldana (2016):

1. Preparing the data in transcript
2. Familiarization with data
3. Labelling the data
4. Keep record of emergent codes
5. Grouping codes in categories
6. Generating themes from categories

The method for coding was Provisional Coding. Compared to other exploratory methods provisional coding offers the opportunity to compose a start list of codes based on the previous research. The previous research is in this case the structural analysis in Chapter 4. This ensures that important concepts found in literature are not ignored, during the coding process (Saldana, 2009, pp. 120-121). Although bias was reduced by performing the coding in a structured manner, some bias will always exist. Coding is a heuristic and no fixed formulas or strict rules exist. The transparency and visibility of all the steps should assure the rigor, comprehensiveness and credibility of the research (Tong et al., 2007). Therefore a 32-item checklist for qualitative research by Tong, Sainsbury, & Craig (2007) was filled in for every interview. The checklist can be found in Appendix A and the filled in checklist the interview specific part is included in the summaries of transcriptions of the interviews in Appendix B.

3.1.4 Step 4: Assessing functionality & setting process goals

During the interviews in step 3 the functional barriers in the innovation system were explored. Based on the outcomes in the interviews the phase of development of the innovation was determined. The phase of development consisted of the performance. It resulted in a achieved functional pattern which was used to define the underdeveloped functions in the innovation system for car sharing in the Netherlands. Bergek et al. (2008) prescribed a comparison of the achieved functional pattern found in this research to other innovation systems. Literature has been gathered about the innovation systems for wind energy in Colombia (Edsand, 2017) and renewable energy companies in England (Hannon et al., 2015). This comparison leads according to Bergek et al. (2008) to a more robust answer about which innovation functions are truly underdeveloped. It might have been that some functions were underdeveloped, but will improve over time without policy interventions. Poor performance on these functions are inherent to the phase of development (Hekkert et al., 2007). However, due to time constraints this comparison has not been executed.

3.1.5 Step 5: Blocking mechanisms

The fifth step will first present the blocking mechanisms based on the stakeholder views in step 3 and the process goals in step 4. The blocking mechanisms are identified by analysing the weak functions in the context where the innovation system is taking place. In this case this is the transport sector. The causal relations between the functions and blocking mechanisms are explained.

3.1.6 Step 6: Policy issues

The sixth step will look back at the structural analysis performed in step 2. The goals of the involved stakeholders are compared to how the innovation system should perform according to the stakeholders and relevant literature of other innovation systems. In order to perform this step a ranking of the most important barriers is needed. Based on the frequencies of mentioned barriers during the semi structured interviews with the stakeholders a sorted list can be created. Next to this list a brain storm session will ascertain that some low frequent barriers, which might look unimportant based on the frequency, are taken into account. If there is a large gap between how the system should be performing according to stakeholders and literature a policy issue arises and an intervention might be needed.

The recommendation will therefore be which system interventions are possible to reduce the blocking mechanisms in the innovation system of stationary car sharing systems. Looking back at the innovation system framework a possible recommendation can be a collaborative to create a collaborative platform, which performs under certain rules/ conditions that ascertain collaborators that diffusion of the technology is improved. This possible outcome of the research supports an adaptation of the innovation system framework for product service system with shared consumption which is the case for stationary car sharing systems.

3.2 Overview Methodologies related to theories

In Figure 6 an overview of what has been discussed in Chapter 0 and 3 is depicted. The second- and third step were supported by theoretical frameworks. In the fifth and sixth step the findings were part of a discussion. Inducement based were derived based on barriers found in previous steps. Literature which discuss positive effects on similar barriers found in our case were used. Additionally, suggestions of inducement mechanisms by interviewees were discussed in these steps.

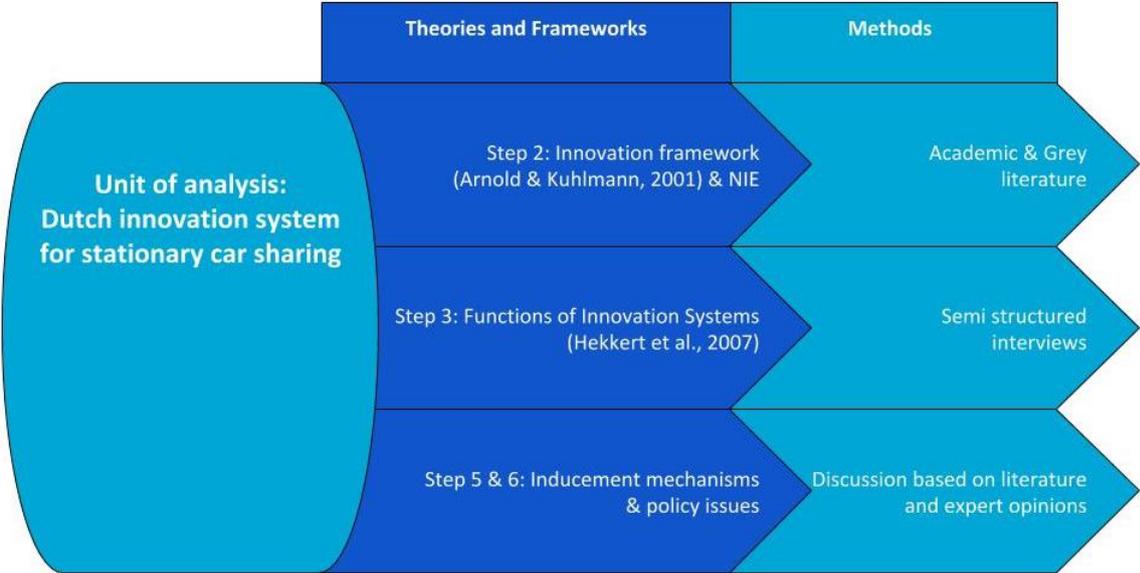


Figure 6 Method related to theories

4 Structural analysis

Based on the scheme of analysis of Bergek et al. (2008) in Figure 5 the structural analysis and second step of this methodology is now presented. The structural analysis follows the sequence that first the technical system of interest is introduced. The technical system entails the 'supply' block in the innovation system of Kuhlmann & Arnold (2001). Secondly, the actors in the innovation system for car sharing in the Netherlands are introduced. Every block in the innovation system framework Kuhlmann & Arnold (2001) represents a group of actors. It will follow the sequence of: Demand, Politics, Support organisations and Research & Education. Subsequently, the networks present in this field are presented. Lastly the institutions shaping the behaviour and relationships of the actors in the innovation system are presented. In each paragraph the last section contains the conclusion and potential structural barriers found in literature. An overview of these barriers can already be found in Table 6 on page 38.

4.1 Technical analysis of the innovation system

Car sharing as product service system should be decomposed in a technical design to visualise the differences to a private car system. This step is the 'supply' block in the innovation system framework of Kuhlmann & Arnold (2001). The other blocks are analysed in the consecutive paragraphs. For the supply the differences leading to new complexities compared to the traditional private car use are analysed. In car sharing systems there are more actor interfaces needed for supplying car mobility than in the traditional manufacturer-consumer relationship for private car mobility (Gaiardelli et al., 2014). The introduction of car sharing changes this relationship. The implications of this change are made clear through the technical analysis.

As already mentioned in the introduction there are multiple variations of a car sharing model. In this research the stationary car sharing system is the focus. The analysis consists of the functions provided by stationary car sharing system. Based on this functional analysis it also becomes clear which actors are related to the supply side of the innovation framework.

A functional analysis is used to study the stationary car sharing system. Where relationships with the actors, networks and institutions can be drawn. The technique used for discovering the technical design on system level is presented by Viola et al. (2012). A structured procedure to conceptualize the functional analysis which will consist of an analysis which will result in a functions-means tree, in which the subsystems are graphically depicted in Figure 7 on page 22.

4.1.1 Vehicle access

The shared car, the product in this case, has some characteristics which are different from conventional cars. First of all, a car is not privately owned anymore, which means that for shared use of the car multiple people need a key to open and start the car. For shared consumption of a car a key management system is needed which allows multiple users to perform the most basic actions for driving a car, namely opening, closing and starting a car. The most common mean to facilitate these functionalities are Intelligent Transportation Systems (ITS). The European Union defined it in their 2010/40/EU directive as "systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport (European Commission, 2010)". The functions related to this subsystem are depicted in the ITS block in Figure 7.

4.1.2 Fleet management

To assure that cars are at certain locations and track where the car is. A GPS-based functionality is needed. When customers want to reserve a car, they need to know where the car is. This depends on on-board vehicle electronics and the developed communication architecture embedding it.

Additionally, for electric vehicles it is relevant to show the battery status. Due to the limited range of electric vehicles it is important to know in advance if the battery status is sufficient for the planned trip (Barth & Shaheen, 2002).

A reservation system is needed to book a car. This system should give insight in the availability and tariffs of the car. For the car user it is important that this system is easy to use. As research shows that convenience is a high priority for users. Car sharing is competing with private mobility and therefore should provide similar convenience van den Berg, 2017).

4.1.3 Billing system

For billing a lot of variations to create a bill are possible. Important for billing is that fleet management and vehicle access are working flawlessly. The input of these systems enables the billing system to create a bill. The GPS coordinates need to be recorded to know the distance travelled by the user or the time travelled needs to be recorded. At the end of the trip the bill has to be created based on the right reservation and travel details (Barth, Todd, & Shaheen, 2003).

4.1.4 Infrastructure

For stationary car sharing systems there are some infrastructure implications. Cars in the fleet need dedicated parking places in order to make sure the car is brought back to the same location. For electric vehicles it is needed as well to ensure charged batteries. Sometimes these dedicated parking spaces are on private property, but in urban areas where you would normally need to pay licence fees or authorisation to park your car it has some implications for your system. Acquiring licences for these parking lots is bound to legal obligations (van den Berg, 2017). Besides parking spaces, road taxes have to be paid for every vehicle. These road taxes depend on vehicle type, fuel type, the weight and in which province the owner of the car is registered. Based on the characteristics a fixed price is paid (Belastingdienst, n.d.).

4.1.5 Potential barriers in technical system

According to Kent & Dowling (2014) the growth for car sharing systems so far is due to the introduction of ITS. Zipcar is the largest car sharing provider in the world. A reason for growing as big as they are now is the use of ITS. The automation of manual tasks which are now carried out by ITS resulted in increased efficiency and profit margins. The function which used to be carried out manually can now be performed by an ITS. These functions are depicted in Figure 7 in the Intelligent Transportation System block.

Within the block of Intelligent Transportation System there are subsystems which constitute the ITS. These systems are depicted as separate blocks, but in fact these systems work closely together and are interdependent on the operations of one another. Therefore it is important to ensure compatibility between those subsystems. If one of the system fails, others will fail too. It is chosen to incorporate all these subsystems in one central car sharing platform (Warnke et al., 2015; Williams, 2007). The fact that the majority of the users is incorporating all the subsystems in one platform means that there is limited modularity. Limited modularity means that multiple reservation systems can't be connected to the platform. In order to make connections with for example public transport applications, the lack of compatibility with other systems offering mobility options might form a barrier for further expansion (Barth et al., 2003; Williams, 2007).

From an innovation system approach the detailed working of these systems is out of scope and will not be further discussed. Nevertheless, it is important to present the technical system to show the links to the institutional and commercial environment. These links show that the ITS and car sharing technology on its own is not a full car sharing service.

The connections to the institutional and legal system are the legal obligations a car sharing service should fulfil. The legal obligations touches broader institutional topics as insuring, transport planning and road building (Kent & Dowling, 2014). In the next paragraphs these topics are covered by the involved actors of these institutional topics. Seeing how these actors shape the institutional environment around car sharing is important to analyse possible incompatibilities of embedding the technical system in the institutional environment.

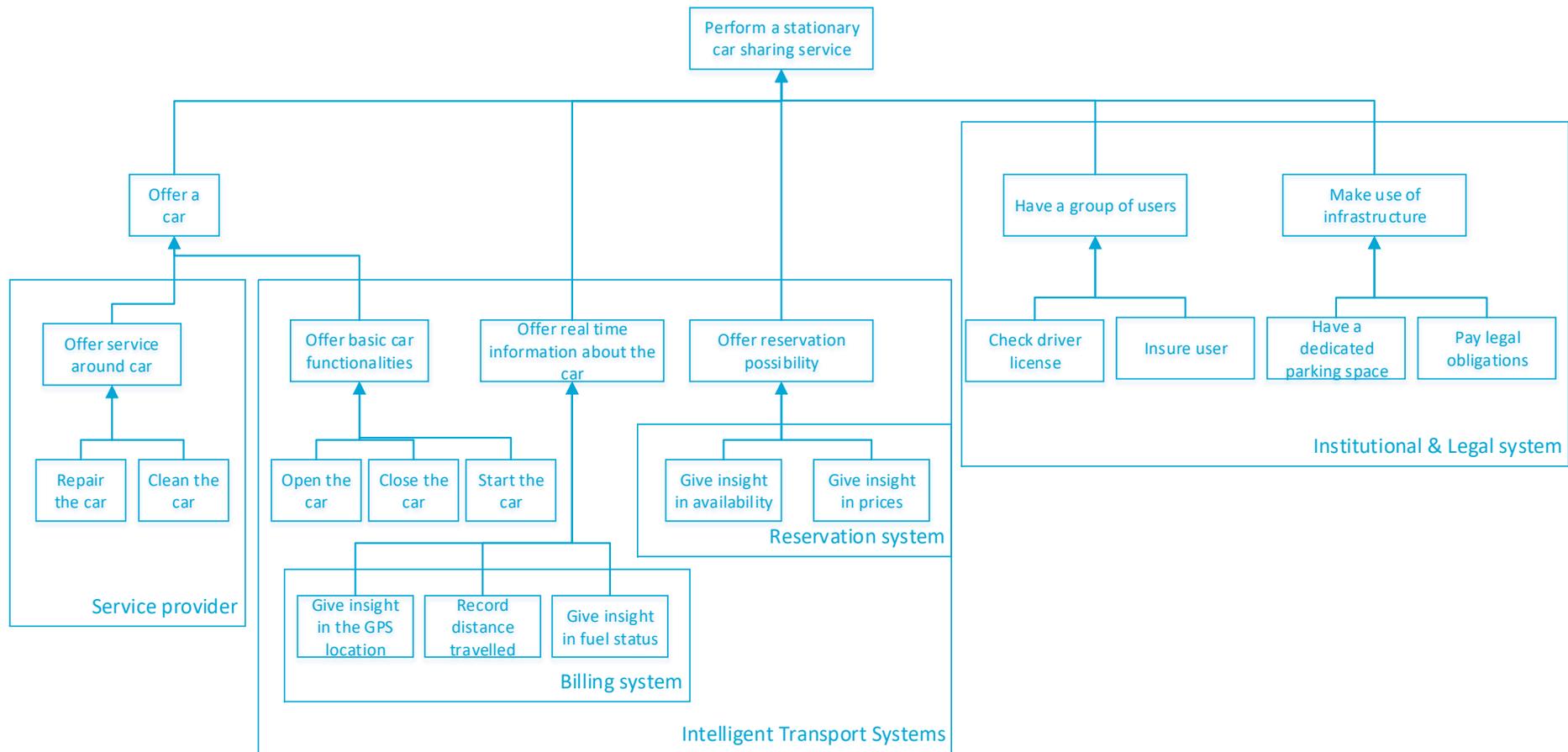


Figure 7 Functional diagram of the technical system of stationary car sharing system

4.2 Actors in the innovation system

Since the supply side has been presented in the previous paragraph the other actors in the innovation system framework of Kuhlmann & Arnold (2001) will now follow.

4.2.1 Demand

Various research has been performed to see which factors are underlying the intentions for using car sharing schemes. The research by Efthymiou, Antoniou, & Waddell (2013) in Greece focused on finding these factors. They showed that people with mid incomes who are more environmentally consciousness have a higher probability of joining car sharing schemes. Secondly, people who travel now by public transport are more likely to switch to a shared car than people using other modes of transport.

Secondly, demand might be limited due to the context factors in their environment. In the research by Dias et al. (2017) a behavioural choice model is presented. The model calculated the probabilities of using a car sharing scheme. The more cars someone owns the lower probability of using a car sharing service. Additionally, the residential density also plays an important role as probability rises when residential density increases.

Lastly, an issue arising for car sharing is that an access based rate is paid by the consumer. Resulting in the fact that car sharing is perceived expensive (Vezzoli et al., 2015). For a private car costs for insurance, license fees and maintenance are not taken into consideration for making a trip. These are not as transparent as the costs for car sharing services. The costs for car sharing services, out of pocket costs and mileage/hourly costs, are visible before using the car. For consumers it is difficult to make a rational choice based on costs between a private car and shared car (National Academies of Sciences Engineering and Medicine, 2005).

In conclusion, car sharing is perceived expensive by users. Moreover, based on empirical research the potential demand is limited due to demographic characteristics, the context where people are living in and their personal preferences.

4.2.2 Politics, policy and institutions

As in the case of car sharing a systemic transition is needed there is an important role for national- and local governments. Geels (2012) states that currently the transport system/sector is facing problems like climate change and rising CO₂ levels. According to Geels (2012) deep structural changes in the socio-technical regime are needed. Geels emphasizes that transitions which are environmentally-relevant do not replace the existing socio-technical regime without input of government agencies. He argues that changes need to be made to economic framework conditions which require changes in policies, such as carbon taxes, emission trading, road pricing (Geels, 2012). If these changes are not made he sees a transition to more a more sustainable transport system as an impossibility.

In his opinion national and local governments should opt for car restraining policies. In the current environment with only incremental change the current transport system in which the car has a dominant position will remain stable. Only public transport will experience some future growth, according to the present developments. Other sustainable forms of transportation can only incrementally replace unsustainable components of the transportation system. It seems likely that the transportation system will gradually become greener instead of a radical change to sustainability (Geels, 2012). Therefore it is important to take a look at the actions governments take to today to make smart mobility solutions with sustainability effects a success.

Although governments try to restrain car use the policies remain isolated, because they only apply to a small area. Governments tend to be reluctant to put drastic car restraining policies in place. They risk electoral defeat if they implement policies which are too tough (Geels, 2012). Therefore they facilitate car mobility, because this mode of transport is widely embedded in people’s lives (Geels, 2012). In addition, the absence of clear normative goals for governing a sustainable transition in a transport system could lead to a market which fails to deliver improvements and innovations (Docherty et al., 2017).

Table 3 Core reasons for state involvement in transport governance (Docherty et al., 2017)

Need for intervention	Key issues today
<i>Public Policy</i>	
1. Setting overall direction of policy	Increasing recognition of the role of transport in supporting economic growth, social progress and health
2. Environmental, economic and social externalities exist	Climate change, air quality, congestion, social exclusion and inequity are not tackled through market
3. Coordination of transport, land-use, and economic goals	Planning to accommodate growth in many cities whilst maintaining or improving requires intervention
4. Setting standards and communicating with public about transport system operation	Defining levels of service and reporting on how these are met, justifying efficient spending of taxation, managing disruptive events
5. Balancing the needs of different transport systems and users	Decisions on infrastructure spend and maintenance, road space allocation and legal frameworks on rights
<i>Market failures</i>	
6. Conditions for a free market do not exist	Managing monopoly infrastructure providers and limited service competition, preventing collusion
7. Acting as a provider or procurer of services which are not profitable	Often to ensure basic levels of service to some communities, evening and weekend services or for bespoke services such as school or hospital transport
8. Problems of co-ordination between modes exist	Competition can exist between public transport operators within and between modes. Limited ticketing integration
9. Basic standards of operation and rules of movement	Interoperability between systems, data, standardization of laws and enforcement
<i>Investment as policy</i>	
10. Funding the provision	Sets general taxes and mobility related taxes and charges at various levels of government to fund the upkeep of infrastructure and subsidy of some services. The state can borrow at lower rates than the private sector
11. Supporting the adoption of transport innovations	Innovations are sometimes expensive in their early stage adoption or require additional infrastructures, supported by state subsidy and investment or new regulation
12. The state is an aggregator of risk and has primary accountability	The state ultimately remains guarantor when private provision of public services fails and retains accountability via the ballot box

In Table 3 the needs for state involvement are given. In the research by Docherty et al. (2017) the issues in the transport governance are presented. These are areas in which governments intervene nowadays. These intervention areas should lead actions by a government. Together with findings of the research by Wockatz & Schartau (2015) the intervention areas can be directly related to actions which governments can possibly take to facilitate intelligent mobility.

Table 4 Role of the state in smart mobility transition (Wockatz & Schartau, 2015)

State level	Action	Table 2
National Government	Fund research and development activities and skills development	11
	Focus on filling the gaps in provision of reliable, fast and ubiquitous connectivity	11
	Establish a data exchange mechanism and mandate open data where appropriate (e.g. in rail franchises)	9
	Create a central ticketing platform and multi-modal marketplace and encourage multi-modal integration to support expected advancements in dynamic pricing and timetabling	8
	Foster cross-industry collaboration to unlock value from Intelligent Mobility	6
Local Government	Encourage and support new business and participate in experimentation with new Intelligent Mobility solutions in private and public transport	11
	Shift focus towards procuring against challenges rather than procuring for solutions	7
	Push for integration and innovation in public transport (e.g. demand responsive services)	8

4.2.2.1 National government

Taking a look at the program ‘Beter Benutten’ the actions taken by the Dutch government to make better use of infrastructure and assets become visible. Within this program Intelligent Mobility played an important role. As car sharing is falling under the scope of intelligent mobility, actions taken in this program are relevant for the car sharing case. Especially, examining if the measures in Table 3 were taken by the Dutch government. This program ‘Beter Benutten’ had been running from 2011-2015 and due to the success has been extended till 2017. Measures within this program had the characteristics of taking the approach of wide problem analyses, in which the main criterion for scoring the alternatives was cost effectiveness. The focus of the government in this program was to set-up collaboration with private parties implement and develop these alternatives. Looking at the results of this program it is clear that the focus was on travel time reduction. Congestion reduction for road transport and stimulation of public transport were the most important underlying objectives to achieve travel time reduction (Ministerie van Infrastructuur en Milieu, 2016). These were measures focused on improving conditions for private car ownership, which also had environmental benefits. However, it was not a focus on a transition, as mentioned by Geels (2012), to replace a socio technical regime (dominance private ownership) with another more sustainable socio technical regime in which more sustainable forms of transportation are favoured.

It can be concluded that even for a long term program like ‘Beter Benutten’ the focus is on short term rewards instead of long term rewards. For car sharing they only report that there were some successful pilots during the program, in which car sharing was used as last mile transport option in a transport chain. Car sharing is not mentioned as a full-grown solution for transport issues mentioned like congestion and pressure on public space (Ministerie van Infrastructuur en Milieu, 2016).

The Ministry of Infrastructure and Environment in the Netherlands supports the fact that only a gradual change is possible for making the transport system in the Netherlands more sustainable. They set the long term goal that in 2050 all the transportation by car should be climate neutral. Within the scope of this long term goal the Ministry sees the sharing economy as one of the possibilities for sustainable mobility. Therefore they organised a research in 2015. In this research the aim was to see whether the

sharing economy can help to attain mobility and sustainability objectives of the Dutch government. (van de Glind, Slijpen, & de Jong, 2015).

In this research some of the challenges described are directly related to actions in Table 4. Van de Glind et al. (2015) state that encouraging and supporting the experimentation of car sharing in the current situation is lacking. Enabling this experimentation should help to gain more interest and familiarity about this topic. Related to the risk of losing your electorate there is reticence about creating fiscal advantages for car sharing or other laws which favours shared cars over private cars. Aside from the majority of the population using traditional cars, which then are affected by these measures. There is also a large dependence of the government on industries (car) for jobs, taxes and economic growth (Cosentino, 2009). This makes the government more receptive to the car industry then to the relatively small sized and nascent car sharing industry. It is clear that the car industry is a key for car sharing providers to change regulations and incentives for car sharing (Geels, 2012).

In conclusion, at national level in the Netherlands there is reticence about creating fiscal advantages favouring alternatives to private car ownership, possibly caused by the risk of electoral defeat for taking unpopular car restraining policies. On the other hand, the dependence on the car industry for economic growth might form reticence for car restraining polices or fiscal advantages. Ultimately, based on previous programs the focus on national level seems on congestion reduction and travel time reduction instead of getting more sustainable in the long term.

4.2.2.2 Local government

Zooming in on local governments the municipalities in dense urban areas are performing best based on the number of shared cars per number of inhabitants. In a research carried out by CROW (2017) results showed that in the four largest municipalities (Amsterdam, Rotterdam, Den Haag, Utrecht) in the Netherlands car sharing is the most popular. The majority of shared cars is located in very highly urbanised areas. This might be purely caused by the fact that it is more attractive to offer a car sharing service in an urbanised area. However, there is a significant differences between Amsterdam (649 shared cars per 100,000 inhabitants) and Rotterdam (270 shared cars per 100,000 inhabitants). Although this difference can't only be explained by the actions taken by these local governments, a comparison is made to map to what extent actions specified in Table 4 are carried out by the municipalities of Amsterdam and Rotterdam.

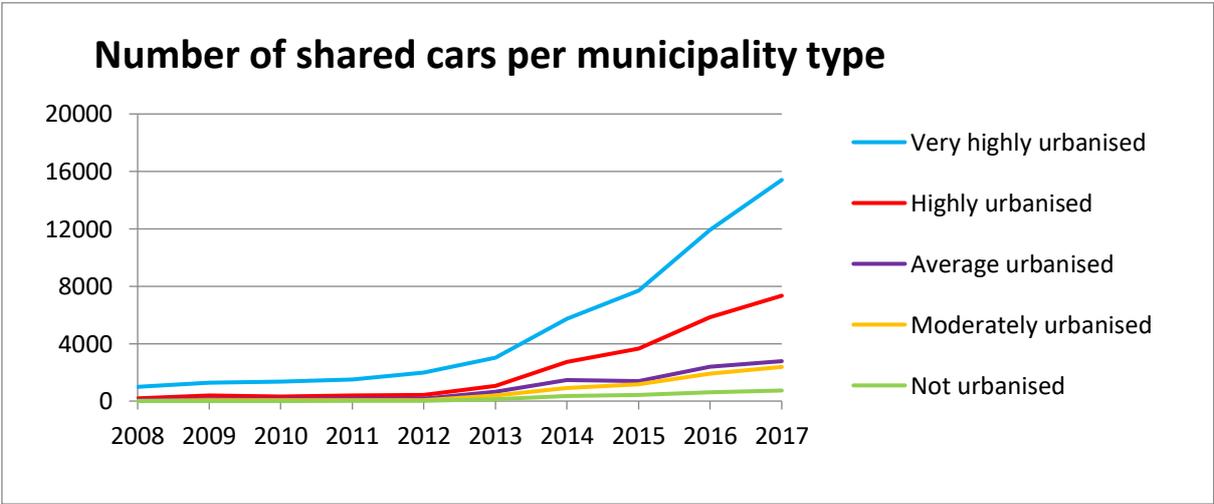


Figure 8 Number of shared car per municipality type (CROW, 2017a)

Amsterdam

The actions of the municipality of Amsterdam and Rotterdam are compared. Amsterdam is offering free parking licenses to car sharing providers, with a maximum of 350 licenses (Koot, 2017). It also offers legislative benefits for housing development projects. It reduces the minimum requirement for creating parking spaces on private property. The role they take is facilitating car sharing instead of introducing it themselves. In addition, they mention that based on the experimentation current policies are evaluated and possibly adapted. The car sharing provider making use of the facilitated legislative advantages has the obligation to deliver data to the municipality of Amsterdam. This offers the municipality the opportunity to map if policy goals are attained or policies have to be changed to increase the use of the potential of car sharing. Only the integration with public transport is something which is missing in the current political agenda. (Gemeente Amsterdam, 2017).

Rotterdam

In Rotterdam there is no separate agenda to encourage car sharing. Compared to Amsterdam there is no plan to facilitate car sharing. However, in their parking policy they mention that investigation is needed to determine how to facilitate car sharing in the future. At this moment there is no clear policy about making parking licenses available for reduced tariffs (Gemeente Rotterdam, 2016). The actions for encouraging smart mobility and procuring against challenges is not happening in Rotterdam. They are investigating the possible actions, but haven't decided how to shape this in new policies for car sharing. The last actions in Table 4 is taken by the municipality of Rotterdam together with the metropolitan area organisation. The intention is to make a platform in which a lot of transportation options are incorporated. Car sharing will be one of these transportation options (MRDH, 2016). Budget for this platform is coming from the 'Progamma Beter Benutten' of the national government. Creating a multi-actor collaboration is believed as the key to develop this multimodal transportation platform (Ministerie van Infrastructuur en Milieu, 2016).

In conclusion, support of integration in public transport systems might be a goal, currently it seems to be lacking. Integration of car sharing services and public transport services would generate higher customer satisfaction and use of the service and it can lead to a greater market penetration according to Barth et al. (2003). Secondly, from the comparison between Amsterdam and Rotterdam it is obvious that there is no harmonisation of local car sharing policies. It offers flexibility in taking specific actions based on the local specificity. However, the lack of harmonisation might limit the attractiveness of offering car sharing services in some municipalities.

4.2.3 Support organisations

The role of the support organisations in the innovation system is to bring the required resources to the innovation system. Distinction is made between financial resources and non-financial resources. The importance of these resources is explained and the issues within the innovation system for car sharing are discussed.

4.2.3.1 Finance

Gathering understanding about the finance structure of the car sharing companies the research by Loose (2010) and Le Vine, Zolfaghari, & Polak (2014) is used. In this research car sharing providers in Europe are analysed. Peer to peer car sharing platforms are excluded as their business models differ too much from commercial car sharing platforms. Peer to peer platforms usually don't have own vehicle fleets and earn money per reservation instead of earning based on the usage (Le Vine et al., 2014). The largest commercial car sharing providers in Europe are DriveNow and Car2Go. In the Netherlands the largest commercial car sharing provider is Greenwheels (see Table 5).

Table 5 Car sharing providers in Europe and the Netherlands

Car sharing provider	Number of cars	Car brand (partial/full owner of the operating company)
DriveNow	6,000 cars (DriveNow, n.d.)	BMW & Mini
car2go	14,000 cars (car2go, 2017)	Smart & Mercedes
Greenwheels	1,700 cars (Greenwheels, n.d.)	Volkswagen (Pon group)

The similarity between these car sharing providers is that a large car manufacturer/importer owns shares of the operating company. For car sharing the support organisation are car manufacturers. This conflicts the innovation system framework of Kuhlmann & Arnold (2001) as car manufacturers are also part of the supply. The model suggests interaction between the blocks, but blocks are not overlapping each other. The reason that car manufacturers are also part of the support organisation lies in the fact that the biggest capital investment for car sharing is to acquire a fleet (Auvinen & Tuominen, 2014). For car manufacturers compared to other parties this is cheaper as they can acquire cars for production costs, while others pay resale prices for vehicles (Le Vine et al., 2014). Therefore, car manufacturers have an advantage over venture capitalists and other investors when purchasing a fleet of shared cars.

The roles of car manufacturers in both support organisation and supply as creates a huge dependence of car sharing providers on the car industry. As they are both the investors and suppliers of private mobility. This causes some blurred boundaries in the innovation system for car sharing compared to the framework by Kuhlmann & Arnold (2001) where clear boundaries between support organisations and supply organisations exist.

In conclusion, car sharing providers are dependent on car manufacturers for increasing capacity of their services. Investment costs in a fleet are lowest for manufacturers. Car manufacturers are often fully/partially owner of the shares of car sharing services, which also creates a dependence on the car industry for future developments.

4.2.3.2 Interest groups

In the research Richardson (2000) the importance of interest groups for policy change is emphasized. In the early political model of 1950s interest group played a minor role in political processes. Interest group have become more active, because of a political environment getting more complex and rapidly changing. Interest groups have created structures of acquiring information and thereby reducing uncertainty of political decision-making processes. In conclusion, the transition of policy making in well-structured political communities to a less predictable collection of stakeholders in 'issue networks'.

Richardson (2000) also references Kingdon (1984) to show the importance. Kingdon (1984, p.21) states that a 'policy soup' exists in which many ideas for future policies float. Decisions are often made in an erratic manner in agreed policy frames, instead of based on clear prescribed rational criteria. Therefore it is important that new ideas like car sharing can be accommodated to existing policy frames by stakeholders close to these frames and with high interest to the topics within this policy frame.

In the GreenDeal there are two clear interest groups: Natuur & Milieu and ShareNL. They participated in the GreenDeal and are a possible key to policy change favouring car sharing (Rijksoverheid et al., 2015). During the interviews it is interesting to map their thoughts about the future of car sharing. They have gained a lot of knowledge about the topic and might have thoughts about policies which need to be changed. Changes which are needed to exploit the full potential of car sharing.

4.2.4 Research & Education

The monitoring of the GreenDeal is carried out by CROW. This is an organisation specialised in gathering and bundling knowledge applicable to public policy issues (CROW, 2018). In this monitor they keep track of the growth of shared cars in the Netherlands. CROW provides insight in geographical data for car sharing and they can make a distinction between the different models of car sharing. In Figure 9 the growth of stationary car sharing models is shown. It can be seen that the biggest growth is seen in the sharing platforms, car shared in a non-commercial setting (CROW, 2017a). The other forms of stationary car sharing are lacking behind since the introduction of the GreenDeal in 2015.

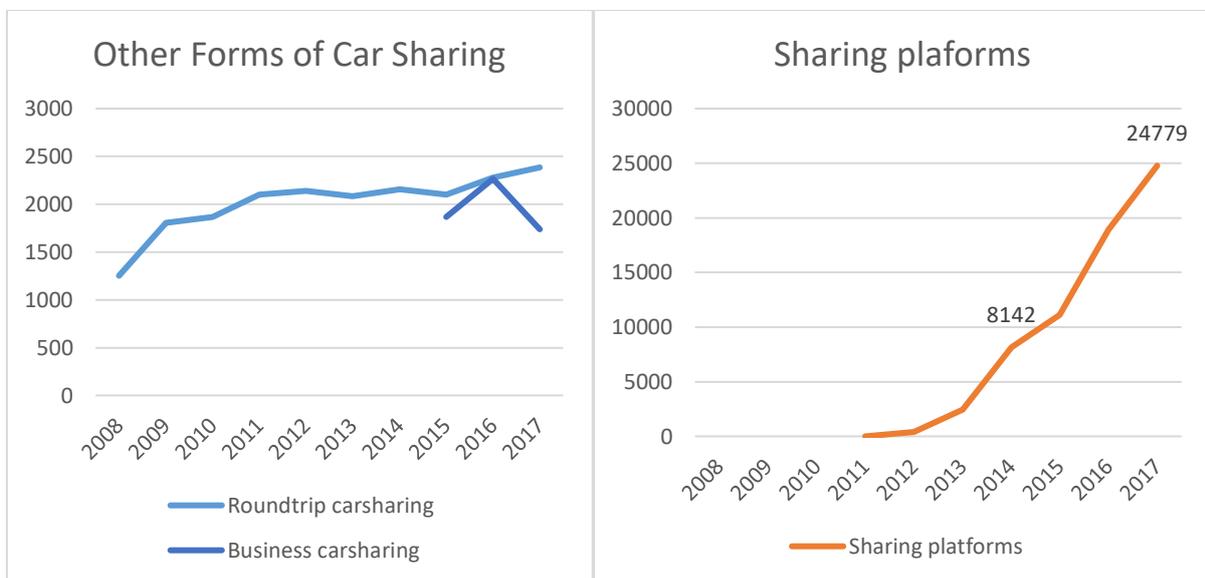


Figure 9 Growth of stationary car sharing cars (CROW, 2017a)

This growth is primarily caused by an increase of shared cars offered at sharing platforms, the other forms of stationary car sharing are lacking behind. Besides, this fact the quality of the information in the dashboard of CROW (2018). There is no information about contribution to environmental goals by shared cars. For governmental organisations this is important information to mobilise resources for car sharing services according to Rabbitt & Ghosh (2013, p. 4). The data needed for estimating the effects is collected otherwise it is impossible to run a car sharing service (Barth et al., 2003).

Next to data for estimating effects there is also knowledge created for defining the future of mobility. It is grey literature playing a role for defining the future of mobility and as a consequence the importance of car sharing in the mobility of the future is emphasized. Consultancy companies like Ernst & Young, Deloitte and McKinsey have all published papers regarding this topic. Problem owner in these papers is mostly the car industry. Most important findings for them are the implications for their businesses and potential of new ways of urban mobility: ridesharing, car sharing, autonomous driving (Deloitte, 2017; McKinsey, 2016). Impact of these developments for car sharing is discussed in more detail in paragraph 4.3.2.

In conclusion, the quality of data is lacking as it is invisible to what extent car sharing is contributing to environmental goals in the Netherlands. There is only geographical data. Moreover, not all the sub models of stationary car sharing have grown since the beginning of the GreenDeal.

4.3 Networks in the innovation system

To draw the network of the innovation system a formal chart is used (Enserink et al., 2010). Central point of focus is the Dutch car sharing market. The informal and formal networks are based on grey literature. For the identified networks their tasks will be made clear. These tasks can range from,

market formation, influencing the institutional set-up, or creating an interest group (Bergek et al., 2008).

4.3.1 Green Deal

The Green Deal set up by the Dutch government can be seen as a covenant between public and private parties. A covenant consists of negotiated, formal understandings between the government and a target entity. In this case are the target entities the actors related to the subject of car sharing. The goal of a covenant is when the negotiations are successfully conducted to create responsibility for policy relevant goal attainment among the target group. Governmental intentions can be adapted to the needs, interest and concerns of the target group. A covenant should result in policy goals being more effectively and efficiently achieved than by authoritative decisions by the government to allocate resources for achieving policy goals (Bressers & O'Toole, 1998).

The aim for covenants is to limit the freedom of choice of the target group during implementation. This means that covenants are suitable in a situation where there is weak cohesion between the actors involved in the topic. On the other hand the interconnectedness between the parties causes the need for interaction and trigger to participate in negotiations (Bressers, 1994).

In the Green Deal the following policy goals were set to achieve the policy goals for the Ministry of Economic Affairs and Ministry of Infrastructure and Environment. These goals entail pollution reduction, improve mobility and efficient use of infrastructure and assets. In the Green Deal the involved parties commit to work on the following goals to achieve 100,000 shared vehicles in 2018 (Rijksoverheid et al., 2015):

- Increase awareness around car sharing
- Create/share knowledge and data
- Set up pilots and projects to scale up car sharing
- Creating a long term collaboration to cooperatively remove barriers and create chances for car sharing

To reach these goals, underlying actions for the involved parties are described in detail in the GreenDeal document. They limit the freedom during implementation of these actions, but ensure visibility of these actions. This should create a natural responsibility to carry out the actions described in the covenant (Bressers & O'Toole, 1998).

In conclusion, it is clear where the collaboration in the GreenDeal is based on. It is questionable if the current configuration of the GreenDeal set up in 2015, will be the best configuration for the future. During the interviews it is important to question the suitability of the Green Deal in the current phase of the innovation system. Evaluating opinions about current- and future collaborations helps to identify the barriers related to this collaboration. It is questionable if cooperation should be intensified.

4.3.2 Car industry

The car industry represents an important power in Western countries. Since the nineteenth century the car industry expanded rapidly to a stage that first private mobility was exclusive to the elite. Nowadays, private mobility is a standard of life for most of the people in first world countries. In addition, the car industry creates a lot of jobs and revenues, which makes the car lobby a powerful influencer of public policy. They offer both mobility and economic welfare, which creates an interdependence between government (Cosentino, 2009, pp. 6-8).

The emergence of car sharing initiatives has some implications for the automotive industry. Research by Spulber & Dennis (2016) states that one of the implications for the car industry of car sharing in the

long term is a net loss of car sales. Given this fact, shared cars compete with private cars on the market for car mobility. Car manufacturers therefore participate in car sharing programs, to hedge the possible private car sale losses. When the trend from car ownership to 'car usership' accelerates, car sales losses can be compensated, because of their partnership with car sharing services. Through participating they can also influence the pace of the transition.

Furthermore, these partnerships in car sharing programs increases visibility to mobility users. The idea is that this increases the probability of a user buying a private car in the future. It also gives the opportunity to gather consumer data, which can be used to prepare their strategies and products for these new mobility services.

In the case of the Netherlands there are also several partnerships. Car2Go is a subsidiary of Daimler, Greenwheels has a partnership with the Pon (importer of Volkswagen/Peugeot). WeGo has partnerships with BMW and Louwman (importer of Toyota). The car sharing provider and manufacturer collaborate closely on developing car sharing. In paragraph 4.4.3.2 this relationship is analysed in more detail and the difficulties for alignment are discussed based on agency theory.

In conclusion, research shows that a transition from private car mobility to shared mobility causes a loss of revenues for car manufacturers. In the research by Spulber & Dennis (2016) it is stated that car manufacturers hedge this loss by participating in car sharing schemes and as a consequence have the opportunity to influence the pace of transition.

4.3.3 ShareNL

ShareNL is a Dutch organisation engaged to the job of gathering knowledge and insights about all online platform, world leading companies, and some of the most advanced city-, state- and intergovernmental organizations. This organisation is connected to sharing providers in more industries than just the car sharing industry. It is an organisation working cross industry on innovations focused on shared consumption (ShareNL, n.d.-b).

It is a leading consulting party for topics related to the sharing economy. ShareNL also gives advice to public and private parties about how they should evolve their businesses (ShareNL, n.d.-b). They are also part of the Green Deal. In this Green Deal focuses on gaining popularity for car sharing as a sustainable way of transportation. Moreover, they try to facilitate collaboration in mobility concepts where car sharing can play a role (Rijksoverheid et al., 2015).

Compared to the covenant, in which there is weak cohesion between the collaborating parties, an intermediary like ShareNL can be a key to intensify collaborations for car mobility according to Bressers & O'Toole (1998). An intermediary can assist in situations when there is strong cohesion and low interconnectedness.

In conclusion, an intermediary can assist in broaden the stakeholder field and create business models cross industry. It is depending on the assessment of the usefulness of the GreenDeal in the current situation if collaboration should be intensified through cross industry collaborations.

4.4 Institutions

This paragraph consists of three parts. In the first part literature on property rights theory applicable to the car sharing case is discussed. In the second part the transaction costs are analysed for the car sharing case. The last part is about complexities in agency relationships in the car sharing case. This results in an overview of missing parts, complexities and weaknesses limiting diffusion of car sharing in the Netherlands.

4.4.1 Property rights theory in the car sharing case

There are some institutions which shape shared cars different than privately owned cars. Taking a look from a property rights theory perspective. For private cars it is clear that from the moment of purchase the full ownership transfers from the seller to the user. The following attributes are obtained when buying a private car. Those are the attributes defined by Furubotn & Pejovich (1974) as economic property rights:

1. the right to use the good
2. the right to earn income from the good
3. the right to transfer the good to others
4. the right to enforce property rights

In the case of a shared cars boundaries between those rights become blurred. Starting with the right to use the good. This right is widespread among the users of the shared car. According to Bardhi & Eckhardt (2012) the fact that users only have the right to use the good leads to negative reciprocity. Negative reciprocity means that users look for their own interest and act opportunistic. Users don't feel responsible for the asset (car) and for the other users using the asset (Bardhi & Eckhardt, 2012). Users act in their own self-interest. In the case of a privately owned car, the user is responsible for its own actions during the lifecycle of the car. Behaviour which lead to negative effects for the assets is directly experienced by the user.

Compared to the situation with a privately owned car all the economic property rights are owned by the car sharing provider. However, the cars are not necessarily owned by the car sharing provider. In the research carried out by Loose (2010) almost half of the large car sharing providers in the survey had collaborations with car rental and car dealership companies. Capacity problems for the car sharing fleets are then easily reduced without large investments for the car sharing provider. In these constructions the property rights boundaries get blurred. Both the car rental/dealer company earn money through the provision of the car sharing service, but the car sharing provider is not the owner of the car. In these situations it is important that motivations and incentives are aligned in order to achieve the same goal and reduce negative reciprocity and opportunistic behaviour among participants (car sharing provider, car manufacturer and end-user).

In conclusion, analysis based on the property rights theory showed in blurred ownership structures. The boundaries are more blurred compared to the traditional manufacturer end-user relationship. In a shared setting revenue streams are shared, responsibility for the vehicle is also shared. Secondly, negative reciprocity among users is directly affecting the profit of a car sharing provider.

4.4.1.1 Internalising negative externalities in car usage

An issue following the property rights theory is that the environmental benefits, which can be monetized in social cost benefit analyses, cannot be redeemed by the owner of this right. Banister (2008) stated it is essential in the transport sector to internalise negative externalities in order to make a transition to sustainable transport sector. Otherwise users won't recognise sustainable mobility options, due to the fact that without internalising benefits the option is irrelevant. Irrelevant means that the costs and time needed for the sustainable option are significantly higher than the conventional option. The co-founder of Zipcar, Robin Chase, stated that "absent taxes on negative externalities... (and) platforms that are financed and controlled by investors will continue the trend to increased income inequality and lack of concern over environmental deterioration (Chase, 2015, p. 201)"

Another cause for the lack of internalising the sustainable benefits might be the deficiency of collaboration. In the research by Niesten et al. (2017) evidence is given that collaboration between firms is needed in your national market to make the transition to a more sustainable society. Stringent

environmental regulation will in most cases result in outsourcing activities to foreign countries, which might lead to detrimental effects for sustainability. Collaboration between firms can lead to sustainable transition if they set-up such a collaboration in a way that contracts and financial mechanism are created which are in favour of a sustainable transition. Niesten et al. (2017) are stating that a collaboration through a joint venture limits opportunistic behaviour among participants, compared to a non-equity alliance. This is because equity in joint ventures can mitigate the hold-up problem created by ex post bargaining through a pre-established division of benefits (Jolink & Niesten, 2016). Finally, this means that environmental benefits are internalised through collaboration and through contracts in which short – and long term incentives are harmonised and a relevant price can be offered on the market.

4.4.1.2 Evolution in the automotive sector

Another possible barrier related to the property rights is the uncertainty of the value of the property rights caused by uncertain evolutions in the automotive sector. In the research of Spulber & Dennis (2016) was stated that car manufacturers are uncertain about the how car mobility will evolve in the future. Participating in car sharing schemes is therefore a way to hedge future reduction in private car sales. On the other hand, the car industry is aware of the fact that a critical population mass is needed in order to offer a profitable car sharing service. Based on the kilometres driven by car users today a maximum market potential of 40% city drivers and 20% compact-car drivers are potential car sharing users according to Bert et al. (2016). Factors which influence the likeliness of a success of car sharing services, are the introduction of autonomous vehicles and ride sharing services. Ride sharing services like Uber will offer more tangible benefits than car sharing services, but both services are competing for the same users. Therefore it is likely that ridesharing will restrain the growth of car sharing (Bert et al., 2016).

Another phenomenon causing uncertainty at the side of car manufacturers is the ‘peak car’ phenomenon. The ‘peak car’ phenomenon can be seen as an analogy to ‘peak oil’. For oil after a certain point the availability or economic feasibility peaks and then turns down (Melia et al., 2012). The concept for oil seems more logic than for cars. Since oil is a finite resource and mobility is a market there is a difference between both concepts. Looking at the figures a decrease of car ownership can be seen from 2001 till 2009. Even with correcting for the effect of the recession this a clear drop can be identified (Melia et al., 2012).

During the rise of car ownership from the second world war till the 2001 various policies were suggested for reducing the pressure on the transport system. Pricing policies to reduce the attractiveness of car use did not result in the desired effects. The rise of car ownership was inelastic to this pricing policies. Steering car ownership by carbon taxes, emission trading, road pricing did not result in reductions according to Melia et al. (2012). In the research by Melia et al. (2012) ‘peak car’ is described as global phenomenon. Based on the figures of CBS (2017) the number of cars is still increasing. However, based on the global phenomenon a ‘natural’ decrease in the future might be possible and resource allocation policies are a waste of time.

4.4.1.3 Taxes

Taxes are an important influencer of developments in mobility. In the research by Docherty et al. (2017) the idea is stressed that the current transport system can’t be replaced without changes in economic frame conditions (e.g., taxes, subsidies, regulatory frameworks). In other words they state that it is impossible that car sharing can exploit its full potential without governmental involvement on national level.

Secondly, Henten & Windekilde (2016) state that variation in local taxes or policies is also impeding activities for shared consumption business models. For car manufacturers the local policies for parking

licenses and costs are irrelevant for offering a car or not. For car sharing providers local policies/taxes determine the feasibility of a certain business model.

4.4.2 Transaction costs in the car sharing case

Transaction costs can explain the growth of car sharing systems since the introduction of ITS coordinating sharing activities can be done more efficiently and effectively as was mentioned by (Kent & Dowling (2014) paragraph 4.1. In the research of Henten & Windekilde (2016) the case of Airbnb and Uber is used for analysing the transaction costs for shared consumption phenomena.

The reason for using a new institutional economics perspective, instead of a neo classical perspective is the fact that shared cars are not fully substitutable. Shared cars can be similar to a privately owned car based type and brand. However, the functionalities and characteristics of using both cars are different. If full substitutability and hyperrationality, which is also an important assumption neo classical economics, are assumed changes in the market can be described by Figure 10. This figure is presented in the research by Bert et al. (2016).

In this figure the break-even costs for distance driven with a certain car are given. The assumption of hyperrationality would explain that the number of users would increase the costs of shared cars would decrease in relation to the costs of traditional cars. Bert et al. (2016) present in their research that the actual users are lower than the potential users based on Figure 10. The reasons presented for not using a shared cars are irrational in neo classical economics, in new institutional economics these reasons can be described as transactional costs. The reasons mentioned are the following (Bert et al., 2016):

- Uncertainty of not having a car
- Users desire a certain car model
- Preference of using a traditional car

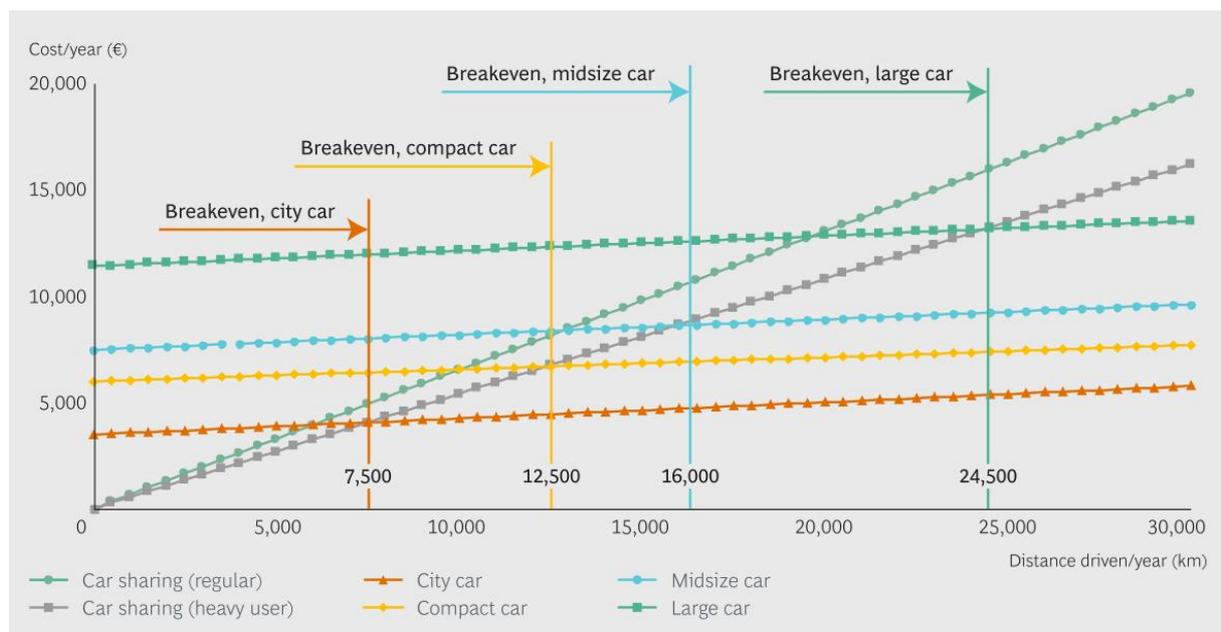


Figure 10 Total yearly costs: owned versus shared cars (Bert et al., 2016)

Taking a value proposition approach in new institutional economics there are more elements which add value or detract value. For a shared car you need to plan your trip in advance, make a reservation, sign a contract, pay directly etc. Some of the transaction costs are reduced by the introduction of ITS, namely the trust and reputational barriers. Still, making a trip requires more effort and time (transaction costs), which reduces the substitutability of a traditional car by a shared car. Improve the

substitutability by reducing, the transaction costs for using a car sharing service is the key for shared consumption solutions. Though, in the current situation the limited substitutability is hindering the diffusion of car sharing services (Henten & Windekilde, 2016).

Being able to reduce the transaction costs of your sharing services will accelerate the growth of your service. The ITS being used for car sharing services should lead to a situation where your marginal- and transaction costs are close to zero. This would imply that when a new user connects to your service, there is only an increase in revenues and not in costs. In theory this would create a high potential for growth, as profits increase. A constraining factor is the capacity of cars in this case. For internet based platforms, where demand and supply are connected via the system by the users, it is theoretically possible to create a “marginal cost society”. Leading to a theoretic situation, in which it is economically feasible to offer the service for free (Rifkin, 2014).

4.4.3 Agency theory in the car sharing case

The last building block of the new institutional economics is agency theory. Agency theory can be defined by Eisenhardt (1989, p. 59) as “relationships that mirror the basic agency structure of a principal and an agent who are engaged in cooperative behaviour, but have differing goals and differing attitudes toward risk”. The research by Cohen & Kietzmann (2014) uses this theoretical lens to define the optimal relationships between car sharing providers and local governments. They define the situations in which agency alignment is possible or impossible between public and private parties. In the research by Baggio (2015) the relationship interfaces between private parties are analysed. The most important findings will be presented in the following paragraphs.

4.4.3.1 Agency alignment public and private parties

In the research by Cohen & Kietzmann (2014) it is stressed that the longevity of shared consumption business models is challenged when there is no active engagement with public parties (national- and local government). They suggest that companies cooperate with local governments to achieve long term viability by turning future policies in their favour and avoid legal actions threatening their activities. Achieving long term viability can be done by aligning incentives. For car sharing this would imply to make evident and visible contributions to the citizen- and environmental goals of the local government.

However, Cohen & Kietzmann (2014) are addressing issues which hinder aligning incentives between public and private parties. They are stating that a pure reliance on the private sector to deliver the desired environmental and mobility impacts will fail. Introducing economic and noneconomic incentives may reduce agency conflicts and improve overall system performance. The improvement makes at least one individual or preference criterion better off without making any other individual or preference criterion worse off. Creating such a situation can be seen as a pre-condition for successful public-private cooperation (Furubotn & Richter, 2010, p. 389).

Secondly, Cohen & Kietzmann (2014) state that there is a dearth of research of how shared mobility business models work and how the outcomes of these models can contribute to align incentives with key stakeholders. The conclusion in their research, to facilitate this alignment, is that the shared mobility business models move towards a model, in which the shared goods can be seen as merit goods. This would not imply that the goods themselves should change. Though, it would imply that public parties should get convinced about the merit good characteristics of shared mobility. Unambiguous knowledge is required to see the impact on environmental and citizen goals. In conclusion, reducing the agency conflicts between public and private parties can be done by reducing the information asymmetry between both parties. This will give better insight in impacts on environmental goals of public parties. On the other this will enable public parties to support car sharing providers and mobilise resources for these providers according to Cohen & Kietzmann (2014).

4.4.3.2 Agency alignment between private parties

As in this research the for profit car sharing providers are considered next to public-private agency relations, also private-private agency relation should be taken into account. In the research of Baggio (2015) the focus is on agency relation between users, car sharing providers and insurance companies. This is a relationship changed compared to the traditional situation. In the traditional situation buy an insurance policy directly from the insurance company. In the car sharing situation users pay an all-in tariff for using the cars. This results in multiple users using one insurance policy. Both settings, traditional- and shared car, are depicted in Figure 11.

The traditional car insurance works in a way that the insurance company let the user pay a fee based on the risk profile of that user. To reduce opportunism of the user a risk profile is established through the information provided by the user. It is assumed that in a principal agent relationship information asymmetries exist. As a result 'complete contracting' is an attempt to mitigate the disparity between the principal and agent. The meaning of a complete contract is foreseeing any future events which potentially affect the transaction (insurance policy).

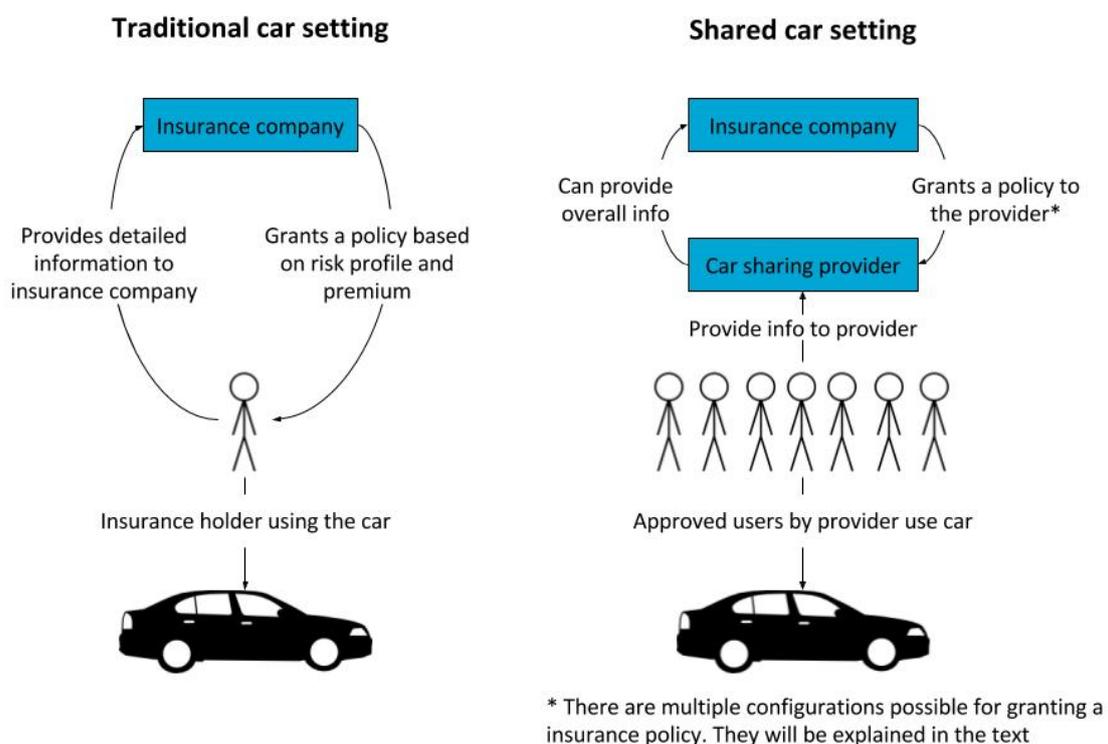


Figure 11 Insurance for a traditional vs. shared car

There are two assumptions according to Baggio (2015) affecting the ability to create complete contracts in the traditional principal agent relationship of insuring a car (Eisenhardt, 1989):

- Human assumptions (Bounded rationality, self-interest, risk aversion)
- Organisational assumptions (Partial goal conflict among participants, information asymmetry between principal and agent)

The objective is to reduce the uncertainty of these assumptions to reduce the gap between the agents action and the expected results. According to Baggio (2015, p. 7) this can be achieved by doing the following: "the principal should design a system of incentives able to align the behaviour of the agent

with the principal's interests and should establish mechanisms of monitoring and control providing valuable information enabling the evaluation of the agent's actions".

In the insurance setting of a shared car there exists no direct link between the insurer and the users responsible for the vehicle claims. In Figure 11 this is clarified as the car sharing provider is placed within this link. The insurer grants a policy to the car sharing provider and is indirectly insuring a group of users, instead of granting a policy directly to a user (Le Vine et al., 2014).

Secondly, a traditional car insurer has the contractual opportunity to gather information in advance and can offer a contract based on the risk profile. A car sharing provider has limited possibilities in doing this and when this procedure gets as time consuming as traditional insuring it will limit the accessibility of car sharing. In general it is hard for a car sharing provider to detect if a user has a high- or low risk profile.

The above mentioned is a clear principal-agent relationship for car sharing. From the semi-structured interviews it is interesting to explore other relationships within the innovation system. Identifying human- and organisation assumptions affecting these relationship is key to amplify this topic.

4.5 Overview of the structural analysis

In the first column of Table 6 the structural weaknesses found in the structural analysis are shown. These are findings found in literature used in this entire chapter and case related materials. The findings of the structural analysis will eventually be linked to the functional barriers found during the semi structured interviews. During the interviews it is tried to verify linkage of these structural weaknesses to functional barriers.

In the second column the related innovation functions, which these structural weaknesses might possible influence, are shown. Putting the different codes in these categories is a subjective task. The allocation of the different innovation functions to the codes are subject to change as understanding might evolve during the interviews.

In the third column the corresponding theory or analysis is shown. As the structural analysis in the methodology of Bergek et al. (2008) consists of the actors, networks and institutions. Within these three components the subcomponents are mentioned. For the actors' subcomponents the blocks in the innovation system framework of Kuhlmann & Arnold (2001) are used. For the institutions the subcomponents are the three theories (property rights, transactions costs, agency theory) forming the foundation for the New Institutional Economics (Coase, 1937; Williamson, 1975).

In the fourth- and fifth column the corresponding page and paragraph of the tag are given. In the sixth and last column the reference for the code of the barrier is shown. These references are also mentioned in the text explaining the possible barrier.

Table 6 List of provisional barriers based on structural analysis

Potential weaknesses based on structural analysis	Innovation Function	Theory / Analysis	Page	Paragraph	Literature
Dependence on car manufacturers for assets	Resources mobilization Market formation	Actor Analysis (Supply)	20	4.1.5	(Loose, 2010)
Interdependence between technical subsystems	Guidance of the search	Actor Analysis (Supply)	20	4.1.5	(Barth et al., 2003)
Lack of compatibility with other systems	Guidance of the search	Actor Analysis (Supply)	20	4.1.5	(Barth et al., 2003; Williams, 2007)
Lack of modularity	Guidance of the search	Actor Analysis (Supply)	20	4.1.5	(Warnke et al., 2015; Williams, 2007)
Technical system dependence on legal/institutional system	Guidance of the search	Actor Analysis (Supply)	20	4.1.5	(Kent & Dowling, 2014)
Car sharing perceived expensive by users	Creation of legitimacy Market formation	Actor Analysis (Demand)	23	4.2.1	(National Academies of Sciences Engineering and Medicine, 2005; Vezzoli et al., 2015)
Limited group of potential users (based on their characteristics)	Creation of legitimacy Market formation	Actor Analysis (Demand)	23	4.2.1	(Dias et al., 2017; Efthymiou et al., 2013; National Academies of Sciences Engineering and Medicine, 2005)
Focus on congestion reduction instead of making car transport more sustainable	Guidance of the search Resources mobilization	Actor Analysis (Politics, policy and institutions)	25	4.2.2.1	(Ministerie van Infrastructuur en Milieu, 2016)
Lack of supporting experimentation	Entrepreneurial activities	Actor Analysis (Politics, policy and institutions)	25	4.2.2.1	(Docherty et al., 2017; Ministerie van Infrastructuur en Milieu, 2016; Wockatz & Schartau, 2015)
Reticence about creating fiscal advantages	Resources mobilization Creation of legitimacy	Actor Analysis (Politics, policy and institutions)	25	4.2.2.1	(Geels, 2012; van de Glind et al., 2015)

Lack of support for integration with public transport services	Creation of legitimacy	Actor Analysis (Politics, policy and institutions)	26	4.2.2.2	(Wockatz & Schartau, 2015)
Lack of harmonisation of local car sharing policies	Resources mobilization Creation of legitimacy	Actor Analysis (Politics, policy and institutions)	26	4.2.2.2	(CROW, 2017a; Gemeente Amsterdam, 2017; Gemeente Rotterdam, 2016)
Dependence on car manufacturers for funding	Resources mobilization Entrepreneurial activities Market formation	Actor Analysis (Support Organisations)	27	4.2.3.1	(Le Vine et al., 2014; Loose, 2010)
Dependence government on car industry for economic welfare	Market formation Resources mobilization	Networks	30	4.3.2	(Cosentino, 2009)
Reluctance of car industry, only using car sharing for hedging	Market formation Resources mobilization	Networks	30	4.3.2	(Spulber & Dennis, 2016)
Blurred ownership structures	Knowledge diffusion Market formation	Institutions (Property rights)	32	4.4.1	(Hazeu, 2007; Loose, 2010)
Negative reciprocity increases uncertainty value property rights	Market formation Knowledge development Knowledge diffusion	Institutions (Property rights)	32	4.4.1	(Bardhi & Eckhardt, 2012)
Lack of internalising negative externalities of private car mobility	Market formation	Institutions (Property rights)	33	4.4.1.1	(Banister, 2008; Chase, 2015)
Lack of harmonisation of short and long term incentives	Market formation Knowledge development Knowledge diffusion	Institutions (Property rights)	33	4.4.1.1	(Jolink & Niesten, 2016)
Lack on collaboration on sustainability	Market formation Knowledge development Knowledge diffusion	Institutions (Property rights)	33	4.4.1.1	(Niesten et al., 2017)
Uncertainty about evolution of car mobility	Market formation	Institutions (Property rights)	33	4.4.1.2	(Bert et al., 2016; Spulber & Dennis, 2016)
Peak car increases uncertainty value property rights	Market formation	Institutions (Property rights)	33	4.4.1.2	(Melia et al., 2012)
Lack of substitutability of conventional cars	Creation of legitimacy Knowledge development	Institutions (Transaction costs)	34	4.4.2	(Henten & Windekilde, 2016)

5 Results of the interviews

In this chapter the results of the semi structured interviews which were held among eleven stakeholders in the innovation system of car sharing in the Netherlands.

5.1 Limitations of the results of the semi-structured interviews

Before discussing the results of the interviews the limitations of these results are presented. First of all it was not possible only discussing stationary car sharing with the respondents. Other forms of car sharing were also discussed, e.g. free floating and peer to peer car sharing. In order to take most of the findings of the interviews into account all the findings for commercial car sharing concepts are taken into account. The findings for non-commercial car sharing concepts are neglected.

All the interviews were held at the workplace of the respondent. Only one interview was held via the phone. However, all interviews were audio recorded and full transcripts were made afterwards. Summaries were sent to the respondents and not the full transcript. These summaries can be found in Appendix B.

Not all the questions presented for the different innovation functions were asked due to time constraints. In the beginning of the interview seven cards with a description of the innovation functions were presented to the respondent. Based on the opinion of the respondent of the most interesting cards for identifying the barriers were selected. Hereby, the focal points were directly identified, but there is also a chance of missing out important information.

5.2 Coding results

There were 11 interviews and they were all related to a part of the innovation system framework of Kuhlmann & Arnold (2001). In the next parts the respective blocks in the innovation system are used to sketch the perspective of a certain block in the innovation system and not the individual respondent in that actor group.

Table 7 Description interviewees and related TIS block

Block in TIS	Organisation	Date interview	Duration interview
National government (Politics)	Rijkswaterstaat	17-01-2018	55:46
	Ministry of Infrastructure and Environment	18-01-2018	41:27
Local government (Politics)	Gemeente Utrecht	30-01-2018	40:11
	Gemeente Rotterdam	06-02-2018	42:05
	Gemeente Den Haag	08-02-2018	45:00
Supply	WeGo	30-01-2018	40:43
	BMW Nederland	18-01-2018	45:56
	Louwman Dealer Groep	24-01-2018	41:48
Demand	Ernst & Young	06-02-2018	48:24
Support Organisation	Natuur & Milieu	02-02-2018	42:57
Research & Education	CROW	08-02-2018	51:01

When the transcriptions and summaries of these transcription were made the transcription were coded. Through transcription and summarising familiarization with the data happened automatically. Coding the transcriptions resulted in 68 unique codes. These codes were then categorized in the seven innovation functions of Hekkert et al. (2007). Some codes belong to multiple categories. An overview of the codes and the related innovation function can be found in Table 17 in Appendix C.

In Figure 12 the data saturation of the sample is depicted. It shows that there is no full saturation of the sample. In other words additional data and barriers for the respective innovation functions can still be found. However, it can be seen that the number of emerging codes decreased through almost every interview. Therefore, sampling can be stopped in order to give a first attempt of defining the innovation system for car sharing. This is not a complete model as the interviews did not result in full saturation (O'Reilly & Parker, 2013).

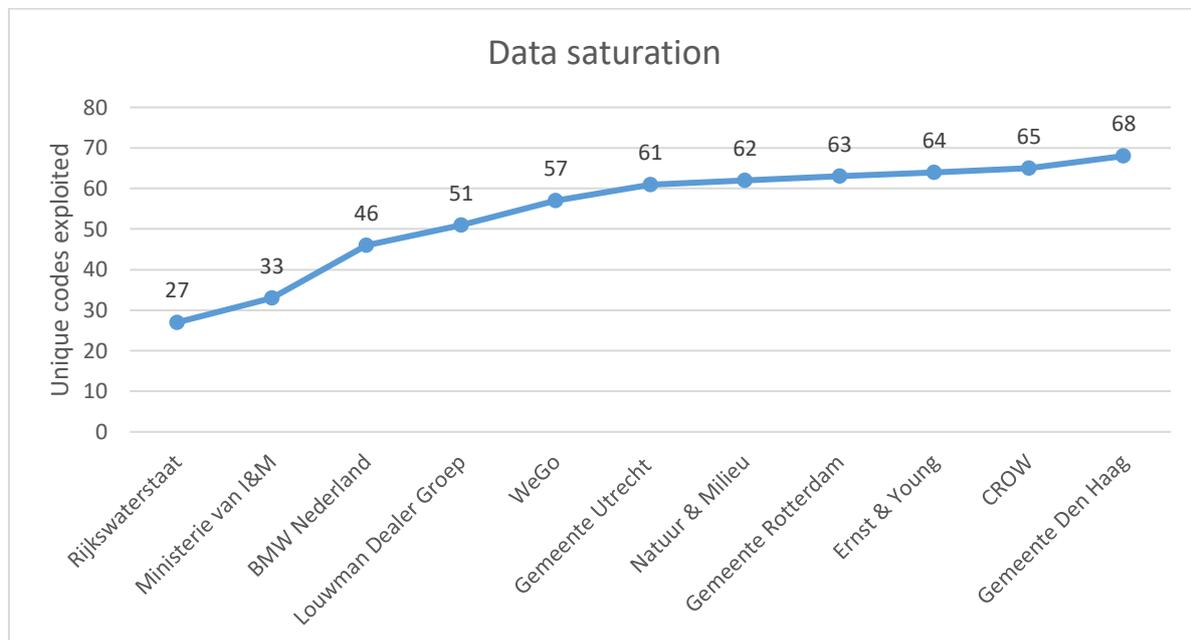


Figure 12 Data saturation interviews

5.3 Achieved functional pattern

As Bergek et al. (2008) and Hekkert et al. (2007) point out it is important to assess what the achieved functional pattern in the current innovation system is. It shows which innovation functions are performing well and which do not. In this case the achieved functional pattern is calculated through the frequencies of codes occurring in the respective innovation function. The frequencies are relatively scaled on a 0-1 scale. The maximum frequency scores 1 and the lower frequency are relatively scaled to the maximum value. If an innovation function is scored 1 it means that the interviewee mentioned more barriers to the related innovation function than to any other innovation function.

The results are influenced by the subjective choices made by the coder to relate barriers to innovation functions. The achieved functional pattern does not give an order of priority for the barriers. The importance and blocking power of barriers in the related innovation function cannot be given through this analysis. There will be also unobserved barriers as both the duration of the interview and size of the sample are limited. Consequently, the achieved function pattern gives an overview the current phase of car sharing and on which's functions need improvement in the future based on the perceptions of the actor groups.

Figure 13 shows that functions which are unanimously underperforming according to the interviewees are: 'entrepreneurial activities' and 'market formation'. Other functions which also perform less are: 'knowledge diffusion' and 'guidance of the search'. However, these functions were not unanimously mentioned by the interviewees as underperforming.

Knowledge development was strongly mentioned by the research organisation in our sample. In the opinion of other organisations this function was not underperforming relatively to the other innovation system functions.

Although the achieved functional pattern is subject to the subjectivity of the assessment of the different innovation functions, it can be explained by some facts. The market formation is underdeveloped and this can be argued by the fact that the number of shared cars is marginal compared to the number of private cars (30.697 vs. 8.222.974 (CROW, 2017a)).

The other innovation function which is underperforming, ‘entrepreneurial activities’, can also be argued why it is underperforming. Currently, it is not the problem that the amount of providers is too limited. Still it is not clear what are the successful concepts and configuration of car sharing. Car sharing is part of network activities. In order to provide a proper network accessibility of shared cars is needed across the entire country. According to the research organisation a successful concept will depend on the ability to exploit this network potential.

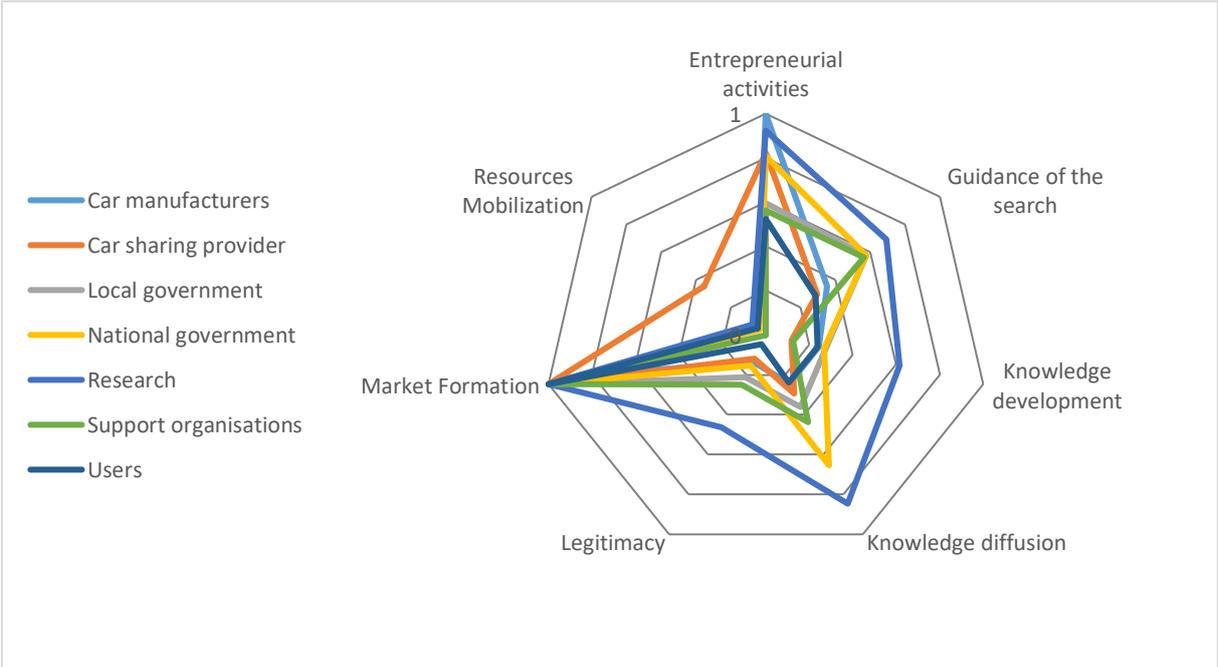


Figure 13 Achieved functional pattern in the TIS for car sharing in the Netherlands

5.4 Barriers in the innovation system for car sharing in the Netherlands

Firstly, the barriers mentioned by all the actor groups in the innovation system are presented in paragraph 5.4.1. Subsequently, the specific barriers of each block in the innovation system of Kuhlmann & Arnold (2001) are discussed. A full list of the barriers can be found in Appendix C.

5.4.1 Barriers perceived by all the blocks in the innovation system

There were five barriers which were mentioned by all the actor groups of the TIS. This does not mean that all interviewees mentioned these barriers. In the national- and local government and car manufactures groups there are 2, 3 and 2 interviewees respectively. It means that at least one interviewee mentioned the barriers which are addressed in this paragraph. The following barriers were mentioned in all the block of the TIS:

Table 8 Overview of barriers perceived by all the actors groups

Barrier	Underlying barriers	Innovation function
Absence of insurance products	<ul style="list-style-type: none"> • Absence of identity checks 	Market formation Resources mobilisation
Creation of new business models	<ul style="list-style-type: none"> • Risk allocation in projects • Transition from retailer to mobility provider • Electric driving has priority • Small size of providers • Car sharing next to car sales • Lack of insight in user behaviour • Lack of transferability of projects 	Entrepreneurial activities Market formation Knowledge development Knowledge diffusion
Lack of scalability	<ul style="list-style-type: none"> • Small size of providers 	Entrepreneurial activities Market formation
National fiscal policy	<ul style="list-style-type: none"> • No critical mass • Private use unattractive 	Market formation
No push for behavioural change	<ul style="list-style-type: none"> • Attractiveness car ownership 	Market formation

5.4.1.1 Absence of insurance products

The absence of insurance products is somewhat more nuanced than real absence of insurance products. The fact is that the offer of insurance products for shared cars is limited. A few insurance companies offer a product for car sharing. At least car sharing providers are not experiencing the benefits of 'economies of scale' when insurance companies would offer these products on large scale. This barrier increases the costs of car sharing as insurance companies have to cover the risks of car sharing users and they are unfamiliar with the risk profiles of these users. Findings in the interview confirm the agency conflict found by Baggio (2015).

Besides, the lack of large scale availability of insurance products users are also unfamiliar with insurance products for car sharing. When insurance products exist, it is still difficult to verify who was liable for which damages. The current identity checks do not solve this liability question according to the respondents (Car manufacturers, 2018; Research; 2018). A barrier related to the 'absence of insurance products' is the 'absence of identity checks'. In which absence doesn't mean complete

absence, but the identity checks are at least underdeveloped compared to identity checks for private car insurances.

5.4.1.2 Creation of new business models

In the car industry there is some uncertainty for creating these new business model in which car sharing plays a role. There is uncertainty if these models will result in the same revenue as car sales nowadays. For the car industry the problem is not the technology. The organisational configuration for car sharing projects is forming a barrier. They admit that for normal car sales the costs are recovered at the moment of selling and in car sharing business models costs need to be recovered during the lifetime of the product and multiple factors are affecting the profit in a car sharing business model. Inexperience in allocating the risks, costs and revenues leads to the biggest barrier for creating new business model with car sharing for car manufactures (Car manufacturers, 2018).

The car sharing provider also supports the fact that it is difficult to make a profit in the current market. At this moment there are 40 providers so the competition is very high. The business model of a car sharing provider is not an established model and proof for making a profit (Car sharing provider, 2018).

The fact that the business model is not established yet makes it important that car sharing providers are included in projects where car sharing can play a role from the beginning of the beginning of the projects. Hereby the risk of a car sharing service not being used for the car manufacturers and car sharing providers is reduced. A risk resulting from the fact that the business case is currently not always satisfying the needs of the user (Local government, 2018). Additionally, according to the research organisation financial incentives are at this moment crucial for setting up a successful business case. These incentives should come from local governments, but local governments need to justify that there are benefits for society by spending public money on car sharing. Being able to give clear insight in these benefits would give local governments a natural 'license to operate' (Research, 2018).

The national government believes that at this moment there are not many car sharing providers making a profit with their car sharing business models. At this moment electric car sharing even has a worse business case than car sharing with petrol or gas cars. This is supported by the support organisation. For both national government and the support organisation electric driving has priority, but there is difficulty to create a successful business case for electric driving combined with car sharing (National government, 2018; Support organisation, 2018).

5.4.1.3 Lack of scalability

Every interviewee admits that the focus in the current phase is on small size projects. On the other hand, the car sharing provider admits that this forms a barrier for making their businesses profitable. It would help if shared cars would replace more private cars when selling the car sharing service with all its functionalities. Instead of 10% of a fleet gets shared, 50% of the fleet gets shared. Interviewees stated that car sharing providers are not dependent on the car industry for their activities, but the car sharing provider admits that for scaling up cooperation with the car industry is essential. Otherwise it is hard to create high volumes in his opinion.

The research organisation also argues that if car sharing is implemented on a small scale. Mobility is a network activity and if the projects are small car sharing will not exploit the full potential as a network mobility solution (Research, 2018). In addition, he mentions that the interoperability of mobility services is important to scale up. If car sharing services are interoperable with other services the network ability of car sharing can exploit its potential. Besides, it interoperability will also enable car sharing providers to scale up their production. The interoperability is not only argued by the research organisation. All the local governments look at the opportunities for MaaS (Mobility as a Service) projects and enabling interoperability of mobility services as well. Given this development scalability

is also an important criterion for, e.g. the municipality of Den Haag, to test the concept of car sharing providers for granting subsidies.

5.4.1.4 *National fiscal policy*

National fiscal policies are a broad theme. Firstly, the national government admits that currently there are no fiscal incentives for car sharing in the Netherlands. They state that this is caused by the fact that there is no critical mass. In order to keep the Dutch taxation system clear it is not possible to create fiscal incentives for marginal developments as car sharing.

According to the research organisation the national fiscal policy should at least result in more conscious mobility decisions. The users support this view as they sketch the scenario that with the current additional cost (Dutch: *bijtellingtarief*) tariffs for business driving users are not stimulated to make these conscious choices (Local government; 2018, User, 2018). Given the market size of car sharing in the Netherlands the users understand the absence of fiscal incentives. However, in their opinion you get in a 'chicken-and-egg situation'. Besides the fact that there is no critical mass it is argued that the additional costs tariff (*bijtellingtarief*) is an important source of income for the national government and especially this tariff is resulting in less conscious travel choices (User, 2018).

The car sharing provider confirms that it is already more attractive to drive a business lease car than a private car. Ernst & Young (User) argue that from employer perspective only looking at the costs it is more interesting to reimburse costs for a privately owned car than offering a business lease car. While for the user it is less costly to drive a business lease car than driving you own car. Especially, when people are allowed to drive more expensive cars based on their terms of employment driving a business lease car is more attractive. Fiscally you get reimbursed the same for every privately owned car, namely €0,19. For more expensive cars the depreciation costs are higher and therefore the standard reimbursement rate is not attractive anymore.

5.4.1.5 *No push for behavioural change*

This barrier partially overlaps the issues for national fiscal policy. In many situations there is no push for behavioural change. For the car sharing provider this means that people do not change their behaviour in driving a shared car instead of a privately owned car (Car sharing provider, 2018). For local governments the shared car is not a goal in itself. For them it is important that people get pushed to opt for more sustainable travel options than the privately owned car (Local government, 2018).

The research organisation argues that the costs for ownership are inelastic. After buying a car the only factor affecting the attractiveness of driving a car is fuel costs. In his opinion the current interventions by the national government are not in favour of new mobility developments like car sharing.

The national government acknowledges that making car ownership less attractive could be in favour of car sharing. The most important factors for the attractiveness which were mentioned during the interviews were:

- **Terms of employment:** a car is still seen as part of conditions of employment. Not offering a car could lead to not hiring a talented employee. Secondly, as was already mentioned it is fiscally attractive to drive a business lease car.
- **Context:** if you don't need to apply for parking license and there is enough public space to park your car. You don't have to question if owning a car is the best choice for your working and living contexts.
- **Accessibility of other services:** when mobility services as public transport and e.g. car sharing are not accessible in a short range there is also no push for changing your behaviour.

5.4.2 Barriers perceived by business actors

Car manufacturers admit that car sharing was not part of their future global strategy, but in 2017 shared mobility appeared for the first time in the future strategy of the BMW Group (BMW Group, 2017). The fact that shared mobility is not part of the incumbents in the automobility market limits the speed of transition from car ownership to shared use. Moreover, there is an overcapacity of cars produced and this puts the market under pressure. This supports the view of the ‘peak car’ phenomenon (Melia et al., 2012). Given the overcapacity the car manufacturers’ intentions are selling shared cars next to private cars, in a way it is not harming their private car sales. This barrier also supports the structural weakness of Spulber & Dennis (2016) that there is danger of lost revenues by the transition from private car mobility to shared mobility. Both car manufacturers mention that shared mobility becomes particularly interesting when it is combined with ‘autonomous driving’.

Another issue mentioned by the car manufacturers and car sharing providers is the fact that operations for running a car sharing service are labour intensive. This is partly caused by the degree of negative reciprocity among users, which was already stated in the research by Bardhi & Eckhardt (2012). Especially in open communities according to the interviewees where responsibility for the vehicle is lower than in closed communities (Car manufacturers, 2018). Given this fact car sharing in the Netherlands can currently not be seen as a ‘marginal cost society’ solution sketched by Rifkin (2014). Connecting new users is leading to additional operational costs.

According to the car manufacturers another complexity also lies in the fact that every user group of the car sharing service is different. This is also supported by the research organisation. Research done till now is always situation and configuration dependent. It is complex to transfer results of a successful concept at one location to a random new location and achieve the same results. There is a lack of transferability of projects and according to the car manufacturers this can be improved through learning, but at this moment limited transferability of projects is limiting diffusion (Car manufacturers, 2018).

The car sharing provider also states that the successful distribution channels are unknown. It is trial-and-error to see which concepts through which distribution channels are successful. In addition, the sales processes are time consuming. The fact that car sharing is both a product and a service (PSS) makes that the service needs to be incorporated in the business. Future users need to get used to this service and are initially unfamiliar with this service.

Table 9 Overview barriers among business actors (Car manufacturers, 2018; Car sharing provider; 2018)

Barrier	Underlying barriers	Innovation function
Car sharing not part of incumbent’s strategy	<ul style="list-style-type: none"> • Car sharing next to car sales 	Market formation Resources mobilisation
Operations car sharing labour intensive	<ul style="list-style-type: none"> • Negative reciprocity among users • Unfamiliarity among users • Ease of use 	Entrepreneurial activities Knowledge diffusion
Lack of transferability of projects	<ul style="list-style-type: none"> • No clear criteria for proven concepts 	Entrepreneurial activities Knowledge development
Sales of products (car sharing) time consuming	<ul style="list-style-type: none"> • New distribution channels 	Entrepreneurial activities Resources mobilisation

Business' barriers dependence on government

Private use unattractive	Market formation
Demand too low	Market formation

5.4.3 Government's barriers

First the barriers mentioned by both national- and local government interviewees are discussed. In the other two subparagraphs distinction is made between unique barriers for national- and local government. In Table 10 an overview of the result for these actors can be found.

One barrier mentioned by both national- and local government is the lack of integrating mobility in spatial development. According to one of the interviewees houses- and apartments were sold easily in the past without good mobility conditions. In the future prices for inner-city properties will rise and to reach high degree of urbanisation alternatives to underground parking garages for apartments and houses are needed. On February 6, 2018 municipalities, national government and private parties have concluded a covenant (City Deal) in which intentions and actions are specified to improve integration of spatial development and electric shared mobility (City Deal-gemeenten, 2018). This covenant shows that involved parties are willing to reduce this barrier. Still, there are some knowledge gaps which need to be reduced to improve integrations. Providers of shared mobility have little experience with these kinds of projects and have difficulties with creating a profitable business model for these applications. Risk allocation in these kind of projects with shared mobility is new for car manufacturers compared to normal car sales (Loose, 2010). Ownership structures are different and have implications and uncertainties for the business models (Car manufacturers, 2018).

Among the local governments there was uncertainty about the applicability of car sharing when, e.g. parking is not regulated or parking pressure is low. They question the ability of car sharing services replacing privately owned cars when these policies are not in place. The perception is that when these contextual factors are not present the demand for car sharing is limited (National government, 2018; Local government; 2018).

5.4.3.1 Barriers perceived by National government

A specific barrier mentioned by the national government which prevents them from taking action in favour of car sharing is the absence of a critical mass. During the interviews they admitted that there is currently no national car sharing policy. Policies for car sharing are only introduced at local governmental level. If a 'critical mass' will make use of car sharing services it will automatically generate political acceptability for car sharing policies. Indeed, they agree that car sharing can be made fiscally more attractive. However, they state that car sharing is a 'marginal development' and there is currently no critical mass (National government, 2018).

Besides, this 'marginal development' is not reaching the goal of the GreenDeal, the goal set in the GreenDeal was seen as unrealistic (100,000 shared cars in 2018 (Rijksoverheid et al., 2015)) and not as the real goal of this project stated by the interviewees. It was a goal set to generate more awareness around car sharing.

Secondly, unfamiliarity among local governments is something limiting the growth of car sharing in the Netherlands (Local government, 2018; National government, 2018). To reduce this barrier an info sheet was made to inform local governments about how they could implement car sharing in their municipality (Metz, 2017). This document was spread by local governments within the GreenDeal and network organisations like ShareNL (Local government, 2018). Still there is a lot unknown which also lead to lock-in failures. The system in some municipalities remains locked into old innovation system.

They fail to take on board new technological opportunities (Kuhlmann & Arnold, 2001, p. 16; Local governments, 2018).

5.4.3.2 Barriers perceived by local governments

An issue for diffusion of car sharing on local level is the undercapacity at local governments. The undercapacity causes variations in local policies and investments of time in effort for car sharing. The local governments in the sample admit that for smaller municipalities the priorities are lower, but they are also unaware of the existence of car sharing as a solution for societal- and mobility problems in their municipality. Unfamiliarity and undercapacity combined result in a limited diffusion of car sharing in these municipalities (Local government, 2018; Research, 2018).

Secondly, the barrier 'only subsidy in exchange of data'. This is somewhat more nuanced than the statement used for this barrier. In Utrecht subsidy is not provided to car sharing providers. In Den Haag subsidy is only provided in exchange of data. Both interviewees admit data is important to calculate to what extent car sharing is contributing to the policy goals of the municipality (Local government, 2018). According to CROW the quality of the data is currently not good enough to estimate all societal and economic effects of car sharing on local level. In the monitoring tool for car sharing made by CROW (2017) there is only information about number of shared cars. They can only distinguish by car sharing concept, e.g. stationary, free-floating etc. and the municipality where the shared car is stationed (Research, 2018).

If local governments could get better insight in the effects of car sharing concepts and visibility of the effects increase it will give local governments a natural 'license to operate' (Research, 2018). A license to operate in the sense of creating legal advantages, e.g. parking licenses, subsidies, with the certainty that concepts contribute to their policy goals and aid for these initiatives is politically justified.

Lastly, the size of current projects is limiting the possibilities for integration. The current phase of car sharing in the Netherlands results in small projects in which learning and experimentation is important, the downside is that interoperability between the projects and different services gets hampered. As Docherty et al. (2017) stated that local governments should 'push for integration and innovation in public transport (e.g. demand responsive services)'. The wishes of local governments for MaaS applications are difficult to fulfil by the large quantity of small size projects which have to be connected to such a MaaS application (Local government, 2018; MRDH, 2016).

Table 10 Overview barriers among governmental actors (National government, 2018; Local government; 2018)

Barrier	Underlying barriers	Innovation function
Lack of integration in spatial development	<ul style="list-style-type: none"> Lack of knowledge about integrating mobility in spatial development Risk allocation in projects 	Guidance of the search Knowledge diffusion Knowledge development
Lack of regulation to ensure effects	<ul style="list-style-type: none"> Existence of tariffs for parking license Existence of parking pressure 	Market formation
<i>Barriers at national government</i>		
No critical mass		Market formation
Unfamiliarity among local governments		Market formation
Lock-in mobility solutions		Guidance of the search
<i>Barriers at local government</i>		
Undercapacity at local government		Resources mobilisation
Only subsidy in exchange of data	<ul style="list-style-type: none"> Uncertainty about effects car sharing Visibility of effects 	Market formation Knowledge diffusion Resources mobilisation
Small projects limit integration	<ul style="list-style-type: none"> Lack of interoperability 	Entrepreneurial activities

5.4.4 Barriers perceived by other organisations

The unique barriers mentioned by the other organisations are shown in Table 11. Firstly, there is a lack of knowledge exchange between users of car sharing services. According to the support organisation the word of mouth promotion of car sharing is essential to create a knock-on effect and accelerate diffusion of car sharing. This is also one of the characteristics in their own pilot for car sharing ('Project testrijders'). Knowledge diffusion among end-users can accelerate diffusion and is currently not always integrated in the value propositions of car sharing (Support organisation, 2018)

Secondly, the lack of network investments. The perception of the research organisation is that as a consequence of the lack of interoperability between car sharing and other mobility services the network potential of car sharing is not experienced. As an analogy the development of telecommunication was mentioned. The best invention after the first telephone was the second telephone so you could actually call someone. For car sharing this would mean that car sharing as modality is connected to other modalities in a network and not used in an isolated system (Research, 2018).

Thirdly, a barrier mentioned by the users is the privacy issue when using a car sharing service. There is uncertainty on their side if car sharing providers can stick to the new European privacy law (GDPR) which will be active from the 25th of May in 2018. Despite this law some data needs to be collected in order to perform a car sharing service (Barth & Shaheen, 2002; Barth et al., 2003).

Table 11 Overview barriers among research organisations and users (Research, 2018; Users, 2018)

Barrier	Underlying barriers	Innovation function
<i>Research organisation</i>		
Lack of knowledge exchange between users		Knowledge diffusion
Lack of network investments	• Lack of interoperability	Mobilisation of resources Entrepreneurial activities
<i>Users</i>		
Privacy issues using car sharing service		Knowledge diffusion Knowledge development

5.4.5 External factors and future scenarios

Since the issues for the different actors in the innovation framework are now clarified some external factors and future scenarios limiting innovation functions are explained. In the structural analysis some expectations about mobility transitions blocking the diffusion of car sharing were found and subsequently discussed with the interviewees. These were the following transitions:

- Ridesharing
- Autonomous driving
- Electric driving

Firstly, in the research by Bert et al. (2016) the idea is stressed that ridesharing will act as a break for the diffusion of car sharing as they both compete for the same set of users. However, the perception of the interviewees was that car sharing and ridesharing can be complementary and are not competing for the same users.

Secondly, the interviewees have the feeling that the implementation of ‘autonomous driving’ can add value to both car sharing and ridesharing models and is not seen as a competitor. The car manufacturers admit that autonomous driving has higher priority than shared mobility as standalone mobility solution. Through the implementation of autonomous driving they expect to serve markets which had no access to car mobility in the past.

Thirdly, the electrification of car mobility. This transition is already bound to the goal that in 2025 50% of the cars sold have an electric propulsion. This goal is set in the Green Deal ‘Elektrisch Vervoer’ by Rijksoverheid et al. (2016). The local governments in the sample therefore admit that electric mobility has priority over shared mobility as it is also important to comply to EU emission standards (European Commission, 2007). Therefore they admit that a combination of electric car and shared mobility is very interesting. However, as already mentioned in the creation of business models it is currently difficult to create a successful business case for this combination.

In conclusion it is unknown when these transitions take place, but those are probable future scenarios given the fact that large consultancy companies sketch these scenarios in their publications (Deloitte, 2017; McKinsey, 2016; PwC, 2018). These developments are potentially complementary, competing or strengthening car sharing. Important for car sharing developers is to be aware of the opportunities of these transitions according to the interviewees as these transitions will probably affect the ‘entrepreneurial activities’ and ‘market formation’ in the innovation system for car sharing.

The external factors were primarily mentioned by governmental parties. They admit if in the context there is a natural demand for car ownership alternatives, car sharing will diffuse more easily than in a context where there is no need for change. The following factors were mentioned by the interviewees:

- Environmentally conscious people
- Political orientation
- Parking pressure
- Public transport

Firstly, the successfulness depends on the characteristics of the end-users. According to the interviewees, environmentally conscious people are more likely to adopt car sharing than others (Local government, 2018). This is also supported in the research by Efthymiou et al. (2013). The municipality of Rotterdam adds that the political orientation also plays a role for the probability to adopt car sharing services. Political acceptability is needed in order to contribute to the diffusion of car sharing services.

Secondly, the local governments state that the probability of success is higher in areas where there is a high parking pressure. Additionally, they expect that high quality of public transport is a precondition to reduce car ownerships and successfully implement car sharing. The lack of these preconditions in some municipalities is forming a barrier for diffusion of car sharing.

5.5 Barriers in motors of change

In Figure 15 a summarized overview of the results is depicted. This figure will be the basis for the next chapter to define the inducement mechanisms to reduce the blocking mechanisms found during the interviews (Johnson & Jacobsson, 2001). In Figure 14 the motors of change model developed by Hekkert et al. (2007) is combined with the achieved functional pattern. Most underdeveloped functions are coloured red and least underdeveloped functions are coloured green. The scaling is based on normalized values.

Firstly, the design barriers in Figure 15 focus on the creation of business models and the difficulty supply actors have to cope with to get profitable. This requires additional effort in entrepreneurial activities and market formation. Increasing the market size of car sharing requires activities which prove the legitimacy of car sharing and creates a natural license to operate and facilitate national policies to form a market competitive to the private automobility market. Based on the achieved functional pattern and the barriers mentioned by interviewees the next best step is to drive change in motor A.

Guidance of the search and knowledge development are of less importance taking the achieved functional pattern into consideration. These barriers can be reduced to drive changes in motor C (Figure 14). A more realistic focus goal, instead of 100,000 shared cars, can potentially make the knowledge needed more explicit. As mentioned by the research organisation it is important to provide better insight in the effects of car sharing.

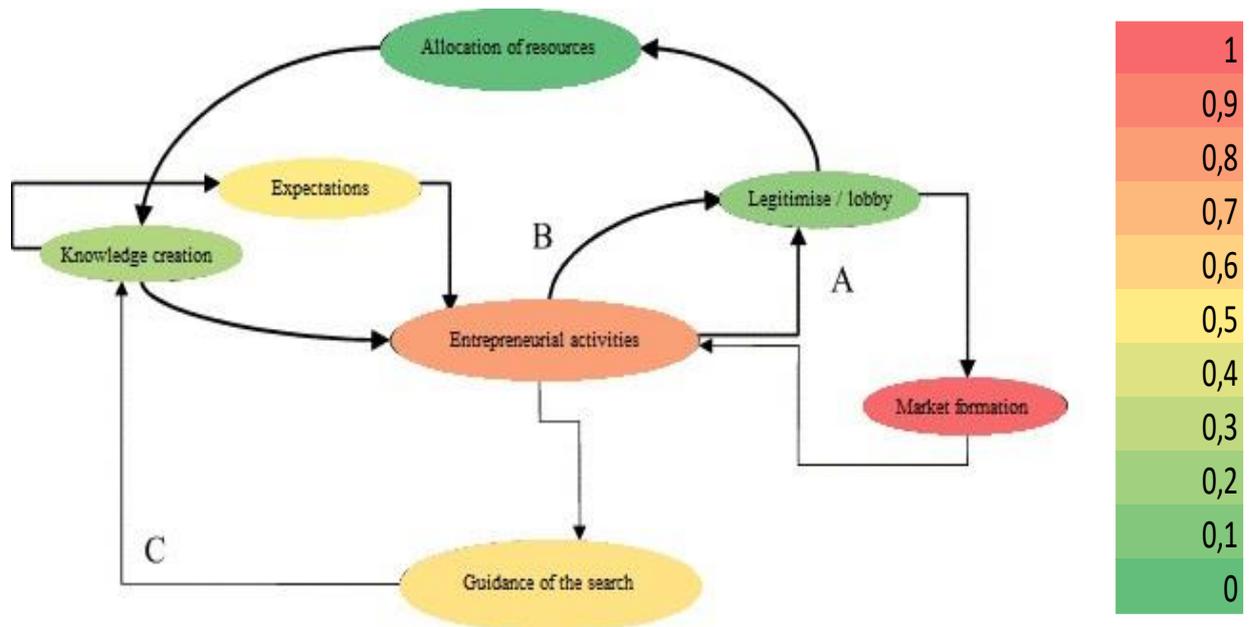


Figure 14 Three typical motors of change combined with achieved functional pattern (Hekkert et al., 2007)

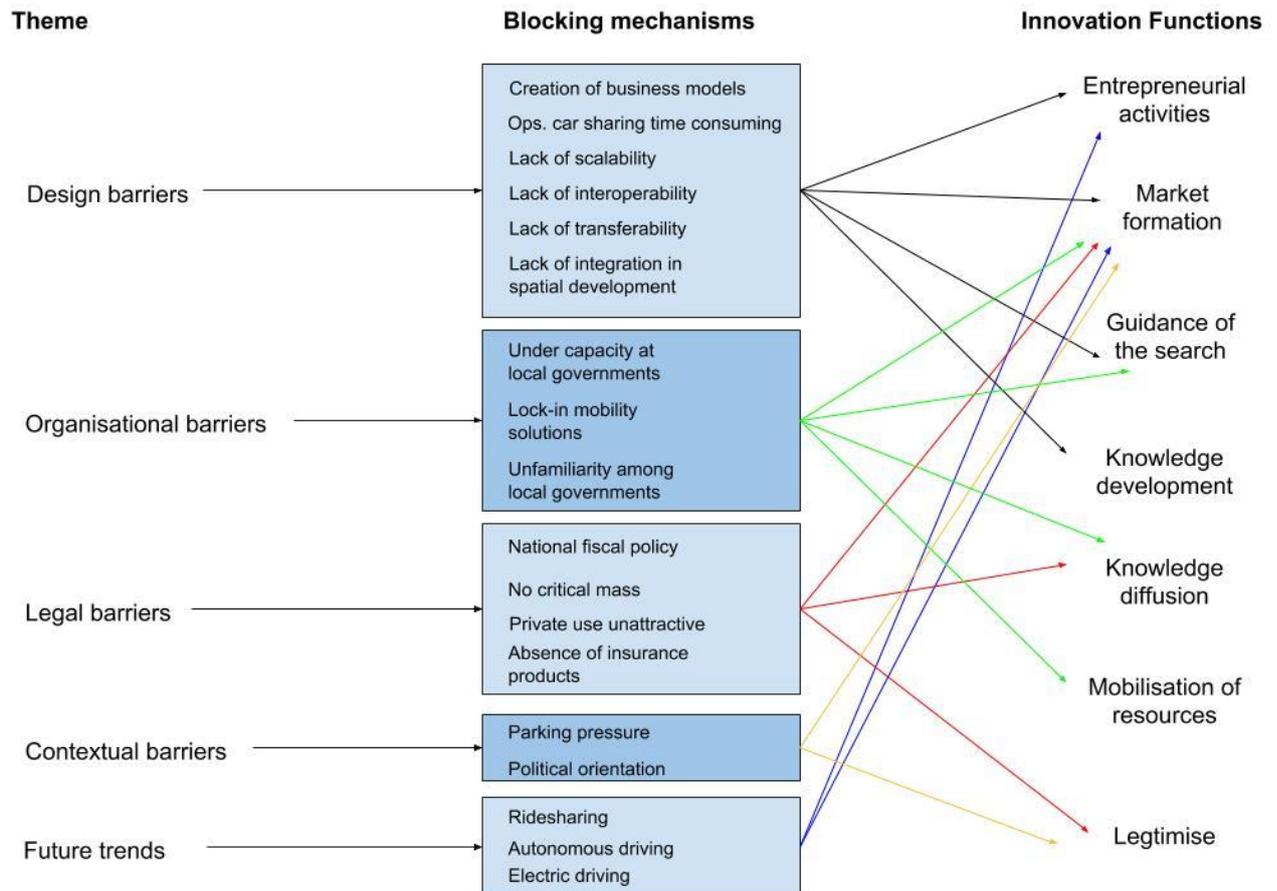


Figure 15 Outcomes of the functional barriers related to innovation functions

6 Synthesis of structural- and functional analysis

In this chapter the link between the structural barriers found in Chapter 4 and the functional barriers found in Chapter 5 is discussed. In the next paragraphs each categorized block in Figure 15 of barriers is explained in a separate paragraph. A graphical representation of the overview of the linkage between the structural barriers and functional barriers is provided through Figure 16 on page 55.

6.1 Design barriers

The structural causes for the design barriers in the car sharing innovation system can be caused by the interdependence of the different subsystems as was stated by Barth et al. (2003). Design of the systems always have to comply to legislation for, e.g. data privacy (The European Parliament and The Council of the European Union, 2016) and liability issues in case of damages. According to the car manufacturers in the sample important structural causes for high operational costs and difficulty of creating business models.

Integrating all the subsystems into one platform owned by the car sharing providers offers advantages. It is easier to comply to legal and liability requirements as you have only one access channel to the platform. On the other hand, it decreases the opportunity of compatibility with other mobility services. It decreases the opportunity of exploiting the network value of the car sharing service according to the research organisation in the sample, also one of the key tasks for local governments according to Wockatz & Schartau (2015). According to Barth et al. (2003) and Williams (2007) reducing those structural barriers will reduce lack of accessibility and increase the ease of use, which are barriers mentioned by the interviewees.

According to the car sharing provider in the sample there is dependence on the car industry to scale-up your services. This supports the findings in the structural analysis of Le Vine et al. (2014) and Loose (2010). If the car industry will allocate more resources, e.g. funding, cars, technology, it will have positive impacts for car sharing providers. According to Spulber & Dennis (2016) the car industry currently sees car sharing not as a mobility solution they need to fully commit on, but as a mobility development they need to hedge for. If shared mobility will be the standard in the future the car industry already hedged for this development and have a position in this market. However, reducing this structural barrier might result in increased scalability and will possibly make the creation of new business models easier.

Finally, car manufacturers admit that the variability in negative reciprocity and demand for car sharing services among users, reduces the ability to transfer projects from one location to another (Bardhi & Eckhardt, 2012). The lack of harmonisation of policies for car sharing also limits the transferability of car sharing projects (Gemeente Amsterdam, 2017; Gemeente Rotterdam, 2016). These structural causes were mentioned by the car manufacturers as limiting the transferability of car sharing projects and hampering the creation of successful business models.

6.2 Organisational barriers

There is unfamiliarity among local governments in the Netherlands when it comes to car sharing according to the interviewees. According to the research organisation an important structural barrier is the poor quality of the data. It doesn't provide enough insights in societal- and economic effects of car sharing in the Netherlands. This was already observed in the performance dashboard for car sharing provided by CROW (also the research organisation in the sample) (2017).

Next to poor quality of data, there is a lack of internalising negative externalities of car mobility, which might cause a lack of action at local governments. There is an undercapacity among local governments

according to local governments in the sample, which in some situation gives low priority to supporting implementation of car sharing.

Lastly, the lack of internalising negative externalities of car mobility. Parking is not regulated in throughout all the Dutch cities. It means in some cities public space for parking is seen as an open-access good. If these negative externalities are internalised in private car use, car sharing as mobility solution becomes financially more attractive. Niesten et al. (2017) stated that internalising negative externalities could also be achieved through collaboration on sustainability. Contracts between car sharing providers and local governments which in a way compensates for the additional value of shared mobility compared to private mobility.

6.3 Legal barriers

As Geels (2012) stated that there is reticence about creating fiscal advantages for alternatives to private car mobility, because of the danger of political defeat. In the current market the national fiscal policy does not create a level playing field. Next to a political defeat, a possible structural barrier is the dependence on the car industry for economic welfare (Cosentino, 2009). Making private car mobility less attractive could result in a loss of economic welfare.

Another possible barrier for the lack of national policies for car sharing can be the focus within the Ministry of Infrastructure & Environment. In the program 'Beter Benutten' the focus was on congestion reduction instead of making automobility more sustainable (Ministerie van Infrastructuur en Milieu, 2016). A shift in this focus could have positive impact on the functional barriers.

6.4 Contextual barriers

The contextual barriers mentioned in the interviews are parking pressure and political orientation. In the structural analysis the research of Dias et al. (2017) and Efthymiou et al. (2013) showed characteristics for which users were most probable to make use of car sharing services. According to the interviewees, next to these characteristics local governments can increase demand through creating a context for the use of car sharing services. If there is no parking pressure nor a political orientation is not towards sustainable mobility it will block the diffusion of car sharing.

6.5 Future trends

All interviewees were aware of these future scenarios sketched by Bert et al. (2016) and Spulber & Dennis (2016) and different consultancy companies. If the uncertainty of this structural barrier could be reduced it will certainly help to better define the future of car sharing. It would give actors active in the innovation system more insight in what current contributions are worth in the future.

The findings in paragraph 6.1 till 6.5 resulted in a new overview depicted in Figure 16 in which the themes are replaced by structural barriers.

Structural barriers (Chapter 4)

Technical system

- Interdependence subsystems
- Lack of compatibility with other systems

Actors & Network

- Dependence on car industry
- Car sharing used for hed

Institutions

- Negative reciprocity among users
- Lack of harmonisation long- and short term incentives

Actors

- Quality of data is lacking
- Lack of harmonisation local policies

Institutions

- Lack of externalising neg. externalities

Actors

- Dependence on car industry for economic welfare
- Reticence for creating fiscal advantages
- Focus on congestion reduction

Institutions

- Lack of externalising neg. externalities
- Blurred ownership structures

Contextual barriers

Institutions

- Uncertainty about future trends in automobility

Blocking mechanisms (Chapter 5)

Creation of business models
Ops. car sharing time consuming
Lack of scalability
Lack of interoperability
Lack of transferability
Lack of integration in spatial development

Under capacity at local governments
Lock-in mobility solutions
Unfamiliarity among local governments

National fiscal policy
No critical mass
Private use unattractive
Absence of insurance products

Parking pressure
Political orientation

Ridesharing
Autonomous driving
Electric driving

Innovation Functions

Entrepreneurial activities
Market formation
Guidance of the search
Knowledge development
Knowledge diffusion
Mobilisation of resources
Legitimise

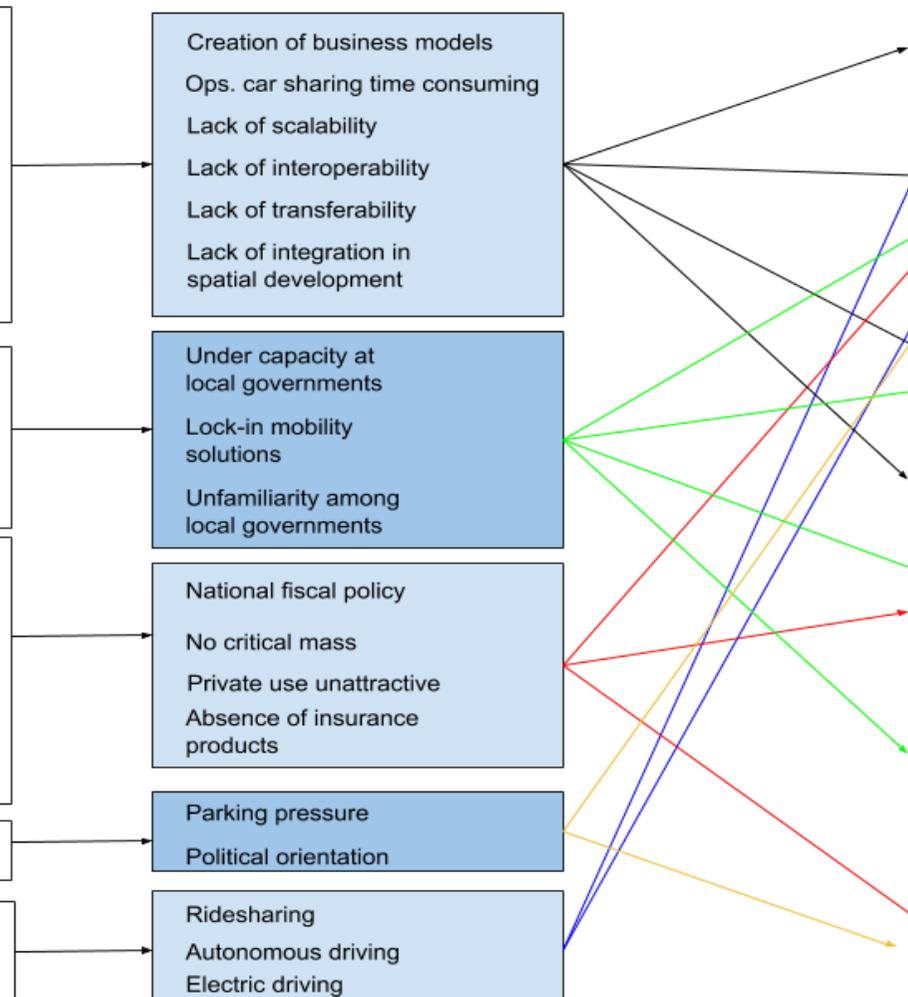


Figure 16 Overview blocking mechanisms related to innovation function

7 Inducement mechanisms (Discussion)

In this chapter the inducement mechanisms for reducing the barrier/blocking mechanisms are discussed. This is step 5 in the scheme of analysis of Bergek et al. (2008). The inducement mechanisms are presented as the discussion of this research. Based on the blocking mechanisms in Figure 16 and suggestions of interviewees inducement mechanisms are suggested.

7.1 Integration shared mobility in spatial development

During the interviews lacking integration of shared mobility in spatial development has been mentioned as an important barrier. Especially, governmental parties mentioned that they were already looking for possibilities to induce this barrier. Since February 2018 a CityDeal is active which intends to integrate shared mobility and electric driving in spatial development and hereby inducing this barrier (City Deal-gemeenten, 2018). In this CityDeal numerous learning goals are specified to increase knowledge in this topic. This City Deal can therefore be seen as a mean already implanted to reduce the barriers of a lack of integration- and knowledge for shared mobility in spatial development.

For car manufacturers these are projects which are interesting as they have the opportunity to sell automobility who would not buy a car. These people can make use of a shared car when it is offered at their apartment complex. It does not harm their car sales. Still, in these kind of projects the car manufacturers address the difficulty of creating a profitable business model. It seems important that governmental parties participate in this City Deal as they have the opportunity to mitigate the risks to a certain level (Bressers & O'Toole, 1998; Docherty et al., 2017).

In this CityDeal public- and private parties actually cooperate on real implementations of car sharing in combination with electric driving and spatial development. It offers the opportunity to define determinants/guidelines for successfulness of these kind of projects. If this can lead to such a 'proof of concept' the barrier of 'lack of transferability' can be reduced. It should in some way define a framework for action, which entails the goals, expectations, actions and means needed to align for a successful project (Cohen & Kietzmann, 2014). If a framework for action for local governments in the Netherlands can be created, it will possibly reduce the lock-in effect of local governments only opting for known mobility alternatives. Moreover, it can possibly reduce the time needed for sales processes. Goals and expectations become visible in the early stages of the sales process.

- Create 'proof of concept (PoC)' for successful integration in spatial development
- Develop standards for defining successfulness

7.2 Creating a fiscal level playing field

In the structural analysis key tasks of the national government for smart mobility were presented. Looking back at these tasks specified by Docherty et al. (2017) the task of "supporting the adoption of transport innovations" is currently with few means facilitated by the national government. They facilitated the GreenDeal, but there is no national policy favouring car sharing over more polluting forms of automobility. The national fiscal policy can be altered according to the interviewees to make car sharing and other forms of sustainable transport more interesting. It is debateable to which extent the polluter-pays principle, based on the European directive (2004/35/EC) set in 2004, is applicable to the automobility market in the Netherlands (The European Parliament & The Council of European Union, 2004). Partially due to the lack of insight and visibility in environmental benefits coming from car sharing, which does not give them a natural license to operate. Moreover, the fact that car sharing has a small market size does not provide political support to make changes to national fiscal policy (Richardson, 2000).

In research by Van Ast, Maas, & Bouma (2006, pp. 41-49) the weakness of the additional cost tariff (bijtellingtarief) was already concluded and supports the view of the user in the sample. They state that the additional costs for a business lease car focuses on cars sold being more sustainable. For a more sustainable car the additional cost tariff is lower. On the other hand they support that there are no marginal costs for use as the variable cost are included in the monthly lease tariff. Through this mechanism an idea among users is created to make optimal private use of the car as you already paid for the additional costs and a perception of zero marginal costs for driving the car arises (Van Ast et al., 2006, p. 47). There is no incentive to limit use of a business lease car for private use. Internalising the negative externalities in the use of a car is not preserved in the current situation. Namely, every additional kilometre is harming the environment, but there is no compensation paid for. According to Chase (2015) and Banister (2008) internalising the negative externalities of automobility is required to make a transition to a more sustainable mobility. A possible inducement mechanism is to create a level playing field through fiscal measures. This implies changes in the current fiscal policies for car ownership and car use.

Companies also have to maintain a competitive rate for car sharing use of their employees (Belastingdienst, 2017). According to users and car sharing providers this is a barrier in the current situation limiting the attractiveness of the shared car. It is not interesting for employees having a business car. Since they own a car where they pay for. For other employees it can be interesting to make private use of a shared car owned by the company, but in the current situation it is as competitive as a rental car. While the shared car is different and less complicated than a rental car, but this cannot be seen in the rates for usage.

In the literature was already found that car sharing is perceived expensive compared to use of the private car (National Academies of Sciences Engineering and Medicine, 2005; Vezzoli et al., 2015). In the interviews this was supported by car manufacturers, governmental organisations and the research organisation. Users make travel choices under bounded rationality and this results in opportunistic behaviour. Given the fact that users are bounded rational and don't have an overview of all the costs for car use. Additionally, the unequal playing field for business lease vs. car ownership through the 'additional costs', 'reimbursement rate' and 'private tariff for business car sharing' makes it difficult to offer car sharing services as an attractive competitor next to the privately owned car. It is questionable whether the polluter-pays principle is adequately preserved in the current fiscal policy for car ownership and car usage.

For the national government to reduce barriers for car sharing in the Netherlands some actions can be suggested: making car ownership less attractive, incentivise use of alternative mobility choices and internalising negative externalities of auto mobility. Banister (2008) and (Docherty et al., 2017) emphasizes that in some stages of an innovation the key for further development is to 'adopt controversial policies in stages'.

In the next two paragraphs gamification to incentivise users and Mobility as a Service are suggested as other inducement measures in which possibly is a role for the national government. This is a strategy for incentives, which can possibly be used in a MaaS application.

- Support sustainable automobility in the mobility market
- Create a level playing field by improving the polluter-pays principle for car usage in the Netherlands

7.3 Increasing interoperability, accessibility and market size

An inducement mechanism mentioned by all the innovation system blocks during the interviews, except by the car manufacturers and users, is Mobility as a Service (MaaS). It was mentioned as a

response to the lack of interoperability between car sharing services and other transport services. All the local governments were already working/familiar with the topic. Mobility as a Service is an ITS application which endeavours to do the following according to Rantasila (2016): “the concept of MaaS means (in a nutshell) bundling different transport means, public and private, into one easy-to-use package for customer”. The belief is that these MaaS concepts can contribute to interoperability and scalability of car sharing and increase the market size of car sharing in the Netherlands. It is also one of the key tasks for local governments mentioned in the research by Docherty et al. (2017). To which extent MaaS concepts can contribute to reduce the mentioned barriers is illustrated based on a case study for MaaS executed in Gothenburg, Sweden by Sochor, Strömberg, & Karlsson (2015).

The goal in this project was to reduce the share of trips with fossil-fuelled vehicles and increase the share of trips by collective transport (including public transport) and by that achieve reduced emissions (noise, CO₂). One of the assumptions was that this cannot be achieved by only focusing on replacing private cars by shared cars or private cars by public transport. In their perception it could only be achieved “by the integration of different transport services, including both public and private solutions, that is, collective transport (Sochor et al., 2015)”. The belief was that an integrated mobility service can increase the use of shared resources and decrease private car ownership.

Nevertheless, there are softer measures for integrating car sharing services to other mobility services to reduce barriers like accessibility and interoperability. Connecting services through the same mobile application or smart card can help to reduce these barriers according to the car sharing provider. Every provider is now developing his own hard- and software. Making subsystems interoperable would increase the accessibility and ease of use for the end-user. These are all effects found in a paper by Blythe (2004) for applying smart cards for public transport. Such a smart card is already applied to public transport in the Netherlands (OV-chipkaart). Car sharing providers as MyWheels and GreenWheels have already connected their services to the OV-chipkaart (CROW, 2017b).

In conclusion, the solution of a MaaS application can possibly have positive effects on the use of car sharing services, but such an application has its own barriers for future success (Sochor et al., 2015). Difficulties for creating such a platform are the commercial viability and adoptability by users (Sochor et al., 2015). However, it is important that public and private parties cooperate and think about future developments as MaaS applications (Little et al., 2014; Sochor et al., 2015). The GreenDeal set up for car sharing in the Netherlands can possibly assist in discussing topics to make car sharing more interoperable with other mobility services. Starting point in these discussions should be the gaps found in, e.g. the Gothenburg case (network coverage, quality public transport). It is not said MaaS is something which has to be done in the future. However, it is a development having active consideration among interviewees (7 out of 11).

- Integrate car sharing services in MaaS applications
- Discuss MaaS applications in GreenDeal
- Support integration and offering of sustainable mobility options through packaging push and pull measures
- Government acts as a procurer to ensure service levels

7.4 Incentivise users to achieve a behavioural push

Based on the unanimous barrier that currently there is no behavioural push towards more sustainable forms of automobility. Fiscal incentives have already been discussed. Therefore a search has been done for non-monetary incentives for achieving sustainable mobility. Gamification can be seen as an inducement mechanism for achieving this behavioural push with limited financial resources. Gamification is an inducement mechanism, which was not mentioned by any of the interviewees. The

article used to illustrate the possible positive effects for car sharing was found using the key words: “incentivising”, “sustainable mobility” in the Scopus database.

In the case study by Kazhamiakin et al. (2015) a pilot was set up in Revoreto, Italy. In this pilot gamification incentives were given to change the mobility behaviour of commuters travelling routinely to the inner city. As Deterding et al. (2011) stated ‘Gamification is leveraged to stimulate specific usage patterns by users or customers of an ICT system in some business domain, by injecting mechanisms and concepts typical of games within the system, even if it was not originally designed with playful intentions in mind’. These gaming elements were implemented in an App similar to the concept of a MaaS application. In Revoreto it resulted in significantly more sustainable route choices than before. It also resulted in less use of the privately owned car than before.

Gamification can be seen as a response to costly policies to stimulate sustainable mobility. These policies tend to be liable to fail, if these are not combined with initiatives aimed awareness and promoting a behavioural change of citizens (Giffinger, Haindlmaier, & Kramar, 2010). One of the goals within the Green Deal was making users more aware of the possibilities of car sharing (Rijksoverheid et al., 2015). However, in the interviews it was stated that there is still unfamiliarity among users.

- Use gamifying to incentivise sustainable travel choices
 - Decreases unfamiliarity among users
 - Supports mobility policies through awareness and promotion

7.5 Overview of blocking mechanisms and inducement mechanisms

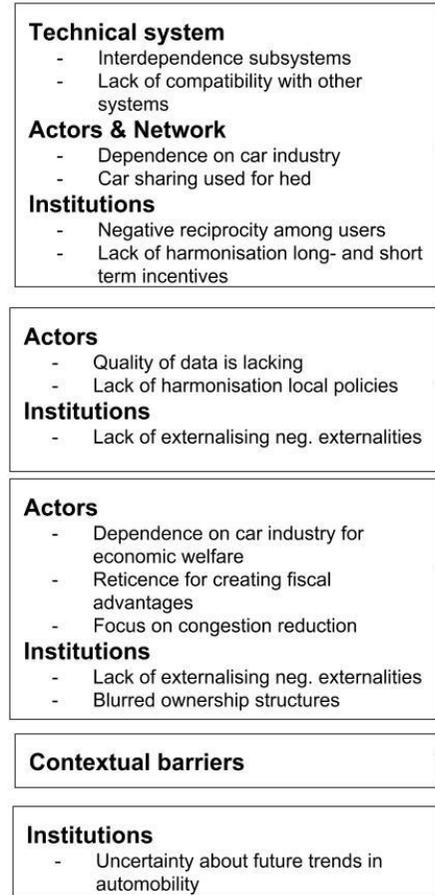
In Figure 17 the results of the analyses executed during this research are schematically depicted. There are 6 inducement mechanisms introduced as possible means to reduce the barriers found in Chapter 5. This is not a complete list of all the possible mechanisms for inducing the barriers.

The potential positive effects of the inducement mechanisms are mentioned in the literature discussing these inducement mechanisms. However, it is not said that these means will have the same effect in the Dutch innovation system for car sharing as in the case studies these means were implemented. Besides, all these inducement mechanisms have their own barriers. Therefore these inducement mechanisms can be best seen as possible directions for future research. There are various means to achieve improved interoperability and accessibility. It is not said that the ones presented are the only means for reducing found barriers. However, scientific contributions show potential positive effects of implementing suggested inducement mechanisms.

Creating a level playing field for taxes for car ownership- and usage requires an in-depth analysis. It is questionable if a level playing field exists in the current system, on the other it is not determined that better alternatives exists to design a tax system. A tax system adequately guaranteeing the polluter-pays principle and pushing society to sustainable mobility (Banister, 2008; Van Ast et al., 2006).

The inducement mechanisms focusing on the Proof of Concept and integration in spatial development offers the opportunity for local governments to get familiar with shared mobility concepts. Hereby, it might give them an action perspective for performing the key tasks to facilitate smart mobility as stated by Docherty et al. (2017).

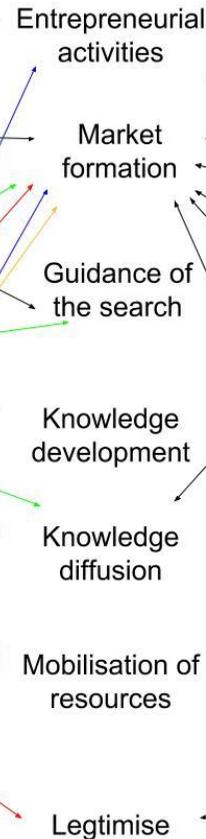
Structural barriers (Chapter 4)



Blocking mechanisms (Chapter 5)



Innovation Functions



Inducement mechanisms (Chapter 6)



Figure 17 Results of introducing inducement mechanisms to reduce barriers

8 Conclusion

The goal of 100,000 shared cars in 2018 set in the GreenDeal of 2015 will most probably not be realised. Previous research provided proof that such an innovation cannot be a success without support and contribution of the elements, e.g. technical, actors, networks, institutions, of the system in which car sharing is implemented. This research has led to an answer to the main research question:

Research question

What are the blocking mechanisms and policy issues that can be reduced to boost the diffusion of stationary car sharing taking an innovation system perspective?

In conclusion there are 68 barriers in the Dutch innovation system for car sharing, based on interviews with eleven stakeholders. These barriers are primarily related to underdeveloped 'market formation' and 'entrepreneurial activities' functions and to a lesser extent 'knowledge creation/diffusion' and 'guidance of the search'. Barriers related to the market formation are, e.g. lack of fiscal advantages, no push for behavioural change, lock-in effects at local governments. Barriers related to the 'entrepreneurial activities' are, e.g. difficulty of creating profitable business models, lack interoperability, lack of transferability and lack of integration in spatial development.

The number of shared cars in the Netherlands increased in the past years and left the stage where it could only be seen as an emergent technology. However, unfamiliarity among users- and local governments still exists and limits the diffusion of car sharing in the Netherlands. The lock-in effect of local governments makes them unaware of the potential of integrating car sharing services in promising sectors as spatial development. This integration is seen as highly valuable by governmental interviewees. However, risk allocation is perceived as difficult in these projects by car manufacturers as it is a new way of selling mobility for them. A factor influencing this risk allocation is negative reciprocity among users. It is affecting the profits of car sharing providers, because this factor can't be determined in advance. It makes car manufacturers reluctant to participate on a large scale in such projects.

Car manufacturers also face other mobility transitions as autonomous driving, electrification and ridesharing next to shared mobility. They admit autonomous driving has higher priority than shared mobility. Through participating in small scale projects they hedge for possible future success of shared mobility and benefit from the learning effect. Car manufacturers do not fully commit to make car sharing the substitute of private car ownership. First and foremost it is private car sales and other forms of automobility like car sharing are in second place.

Internalisation of negative externalities of automobility is lacking in the Netherlands. National fiscal policy is not creating a level-playing field according to business actors groups and does not stimulate a transition from private ownership to shared mobility. National government believes that the current market size is too small for creating fiscal advantages. Although, other structural causes as reticence to create fiscal advantages and risk of losing electorate may also cause reluctance for creating fiscal advantages in addition to a small market size.

The fact that market size is small also means that sustainability effects of car sharing in absolute terms are low. Visibility and verification of the effects of car sharing on a local level is possible to a limited extent. Quality of data is lacking translation of effects to policy goals is impossible and not giving a natural license to operate. However, for small/medium governments where the context, e.g. no parking pressure and parking not regulated, is not as beneficial for shared mobility as in urbanised municipalities where these societal problems play a role. In urbanised areas there is a natural license to operate and facilitate sustainable mobility initiatives like car sharing.

8.1 Implications for business and society

For the involved business- and public parties in the innovation system, visibility of specific barriers for actor groups in the innovation system has been reached. In Chapter 7 some suggestions for inducing these barriers were done. These suggestions can be seen as directions in which solutions should be sought. The analysis also made shared perception on barriers visible and through that collaborations can be formed to further develop these solutions.

Firstly, the national fiscal policy forms a barrier in the sense that there is no level playing field. It is a barrier policy makers might take into consideration for intervention. It is forming a barrier in the innovation system for car sharing and in the research by Van Ast et al. (2006) the unequal level playing field in fiscal incentives for automobility has already been issued. Current policies mainly focus on making purchased cars more sustainable, but usage of cars is not discouraged enough to make car sharing a competitive alternative. Besides the level playing field, internalisation of negative externalities is something which lacks in the current situation. Both barriers obviously might need intervention by policy makers.

Secondly, for business actors like car manufacturers and car sharing providers the exploitation of barriers at public actors and research organisations offers opportunities. The multi-level perspective of the innovation system approach offers involved actors to see, next to their own barriers, the perceived barriers at other actor groups in the innovation system. Policy makers have clear insight in underdeveloped innovation functions as 'market formation' and 'entrepreneurial activities' and which barriers need to be reduced to improve the performance of these innovation functions.

In conclusion, all the exploited barriers have business- and societal value. These barriers can form starting points for future actions of actor groups in the innovation system. Reducing the barriers will according to the innovation systems frameworks and theories result in improved diffusion of car sharing in the Netherlands. Diffusion will lead to a rise in turnover for car sharing providers (Cohen & Kietzmann, 2014). For governmental parties increased diffusion can lead to increased societal benefits in the form of increased sustainability of the mobility system (Cohen & Kietzmann, 2014; Rabbitt & Ghosh, 2013).

8.2 Scientific implications

This research has expanded the knowledge on innovation systems through applying the innovation system framework to the Dutch innovation system for car sharing.

Firstly, the achieved functional pattern for the Dutch car sharing innovation system can be compared to other innovation systems. As Bergek et al. (2008) stated: "we expect further empirical studies – in combination with the research outlined above – to induce several revisions of the framework in the future." This research has contributed to this expectation. However, it is difficult to draw conclusions about possible changes for the frameworks used. The research has consisted of a limited sample and limited research length in which not all the necessary steps were taken.

Secondly, it has been the second time an innovation system approach has been applied to a Product Service System (Hannon et al., 2015). For our case it has been proved that after doing zero iterations a certain level of saturation has been reached, but it is not an exhaustive list of barriers. It has resulted in barriers which can be applied to governance models for smart mobility and sustainable mobility (Banister, 2008; Docherty et al., 2017). Given these findings the scientific methods used can be seen as applicable to the case of the Dutch innovation system for car sharing.

Thirdly, it was questionable whether the innovation frameworks by Kuhlmann & Arnold (2001) and Hekkert et al. (2007) were fully applicable to a product service system like car sharing regarding the

critics by Warnke et al. (2015). It has been seen that with a sample of eleven interviews the data got saturated to a certain extent. Because of this the method can be seen as applicable to the case. However, broadening the notion of key actors after the first interview round could have resulted in a wrong conclusion about this saturation. Namely, during the interviews actors like real estate developers and energy companies have been mentioned as interesting interviewees for this innovation system. These actors have not been interviewed in this research, but could have impacted the results of the saturation.

Fourthly, through the use of NIE as part of the theoretical lens non-monetary motivations were already taken into account during the structural analysis. During the interviews, interviewees also stated that non-monetary motivations block the diffusion of car sharing in the Netherlands. Unfamiliarity among local government- and users were seen as barriers. Lack of knowledge about applying car sharing in spatial development, seen as potentially valuable business model for car manufacturers and local governments, is a non-monetary barrier as well. These examples support the critics by Warnke et al. (2015) that non-monetary motivations can form barriers in innovation systems next to monetary barriers.

Lastly, 'considering new enabling infrastructures and institutions' has been mentioned by Warnke et al. (2015). In the structural analysis these enabling infrastructures were not identified. However, the identified actors were considered to belong to a specific part of the innovation system framework of Kuhlmann & Arnold (2001). In reality the roles are more blurred than the classification of roles in the innovation system provided in the structural analysis.

8.3 Limitations of the research

Initially, it was the goal to capture the barriers for stationary car sharing services only. However, in the interviews it was difficult to stick to stationary car sharing since it were stakeholders practicing with a lot of different forms of car sharing, e.g. free floating and peer to peer car sharing. In order to stick to the scope of the research only barriers for commercial forms of car sharing were taken into account.

Another limitation is that the structural analysis is based on a limited number of iterations. The methodology suggests that after the interviews the structural analysis is expanded based on the outcomes of the interviews and should lead to a new series of interviews to map the innovation functions of these new actors. In the innovation system for car sharing this would imply to interview real estate developers and electricity suppliers for example. These actors are interesting for the development of the innovation system according to some interviewees.

The mapping of the innovation system of the car sharing case in the Netherlands is a first attempt to map all the blocking mechanisms. Although saturation was reached to some extent it is not a full model and some blocking mechanisms will not have been identified in this research, due to the limited number of interviewees. Additionally, the coding of textual statements in the transcriptions is prone to subjectivity. The achieved functional pattern derived from this coding is influenced by the perception of the coder.

The invited interviewees were invited based on convenience sampling. It were all interviewees related to the GreenDeal or to the car sharing provider WeGo. This could have led to socially desirable answers to the research questions, instead of mentioning on the actual situation in this innovation system.

8.4 Reflection on the research method

The choice for the innovation frameworks by Kuhlmann & Arnold (2001) and Hekkert et al. (2007) resulted in findings directly associated to these frameworks. Interpretation of the results must be done with these frameworks in remembrance. There might be more specific and detailed barriers for the

involved stakeholders, but these cannot be found with the innovation system approach taken in this research.

It resulted in structural weaknesses related to functional barriers. Nevertheless, this linking is not embedded in a structured scientific process. Bergek et al. (2008) remain superficial in describing this relation between structural- and functional barriers. In this research the relation between both analyses is discussed in Chapter 6. However, the relations are based on information in the interviews and reasoning by the researcher. It is suggested to strengthen the relation between the structural- and functional analysis. Therefore, an improvement could be to prescribe procedures in the scheme of analysis by Bergek et al. (2008) how the structural- and functional analysis must be related and how these relations can be validated.

Another point topic for reflection is the relevance of the structural analysis. The guidelines for defining the structure of the innovation remain superficial. It should contain the following components: technical factors, actors, networks and institutions. In this research specific choices were made to define the structural components, e.g. the choice for New Institutional Economics. This theory seemed appropriate for defining the institutions in the innovation system. However, there were also other institutional frameworks available to perform the same analysis which might have resulted in different outcomes of the structural analysis and subsequent analyses (Ostrom, 2010). It is unclear how these choices influenced the outcomes of this research. Therefore, from a researcher perspective it is suggested to reduce this freedom of choice. Reducing this freedom of choice might increase the replicability of the research. I also believe reducing freedom of choice can help improving the relevance of the structural analysis to the functional analysis.

Reflecting on the functional analysis in this research there were two innovation functions which were strongly underperforming compared to other functions according to the interviewees. The theory by Hekkert et al. (2007) assumes that these functions need to be improved through inducement mechanisms. After a success of these mechanisms in reducing barriers diffusion of the innovation will increase. However, it is questionable whether it is realistic that such an innovation is viable in the long run when market demand is low and a critical function for this innovation. The only possibility to induce the weak performance on this innovation function might be to put radical interventions, such as changing the fiscal structure, into place. The innovation frameworks in this research do not address the potential impossibility of introducing these interventions. It is suggested to include a step in the methodology which maps this potential impossibility.

8.5 Recommendations for future research

Firstly, a recommendation is executing more iterations for the innovation system for car sharing in the Netherlands. Bergek et al. (2008) suggest after performing step 3, the analysis of the innovation function, the innovation systems might be expanded based on the perceptions of interviewees. Executing multiple iterations will expand the current list of barriers and offer opportunity to involve new entrants in the innovation system. New entrants are parties mentioned by interviewees as relevant to the innovation system. In this research real estate developers and energy companies were mentioned as potentially interesting to involve. In this research only one iteration was executed. Performing multiple iterations will also help to give some guidance in the number of iterations/interviewees needed to make a complete model of the barriers in an innovation system.

Secondly, step 4 in the scheme of analysis by Bergek et al. (2008) suggest comparing the focal innovation system to other innovation systems. They state that: "Based on comparative analyses, a tentative conclusion regarding functionality of the TIS may be drawn, that is, in relation to what it is reasonable to expect taking the phase of development and/or the comparison with other systems into consideration". Performing such a comparative analysis could lead to a more robust answer to which

innovation functions are really underperforming in relation to other innovation systems in a comparable phase. It also offers the opportunity to give an expectation of reasonable development of the focal innovation system based on a comparison. A comparative analysis can be done through a literature study.

Thirdly, inducing the found barriers needs further research. There are some suggestions done based on successful case studies in which the inducement mechanisms were applied to comparable barriers. Implementation of these inducement mechanisms showed reduced barriers in those cases. However, it is advised to bundle a few barriers and perform model/scenario studies to estimate potential effects of inducement mechanisms on these bundled barriers.

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Appendix A Checklist semi structured interviews

Table 12 Standard Values for checklist items in this research

Checklist item	Value
Interviewers/facilitators	Jeroen Kloeke
Credentials	Master student
Occupation	Complex System Engineer with a specialization in Transport & Logistics
Gender	Male
Experience and training	A Bachelor 'Technische Bestuurskunde' at the TU Delft and did a course for developing interview skills
Relationships established prior to study	With none of the respondents
Participant knowledge of the interviewer	The goal for car sharing in the Netherlands, set in a GreenDeal for this topic, is 100,000 shared vehicles in the Netherlands in 2018. In order to reach this goal it is important to find the barriers for growth and design a next best step for reducing these barriers and reach this goal. <ul style="list-style-type: none"> - Innovation system approach is not mentioned - Innovation system functions are not mentioned - Other respondent are unknown for the respondent
Interviewer characteristics	Interviewer was working for 4 months for a car sharing provider in the Netherlands. Applies his previous of knowledge and perspective of his studies to this case.
Methodological orientation an theory	The innovation system framework of Kuhlmann & Arnold (2001), the innovation functions Hekkert et al. (2007) are the most important theories related to the method of Bergek et al. (2008). This method guides this research. Furthermore New Institutional Economics play an important role to describe the deficiencies in the current system.
Sampling	Convenience
Method of approach	Email & Phone
Sample size	11
Non-participation	1 (ShareNL)

Table 13 Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist (Tong et al., 2007)

No.	Item	Guide questions/description
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>
3.	Occupation	What was their occupation at the time of the study?
4.	Gender	Was the researcher male or female?
5.	Experience and training	What experience or training did the researcher have?
<i>Relationship with participants</i>		
6.	Relationship established	Was a relationship established prior to study commencement?
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>
Domain 2: study design		
<i>Theoretical framework</i>		
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>
<i>Participant selection</i>		
10.	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i>
11.	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i>
12.	Sample size	How many participants were in the study?
13.	Non-participation	How many people refused to participate or dropped out? Reasons?
<i>Setting</i>		
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>

- | | | |
|-----|------------------------------|--|
| 15. | Presence of non-participants | Was anyone else present besides the participants and researchers? |
| 16. | Description of sample | What are the important characteristics of the sample? <i>e.g. demographic data, date</i> |

Data collection

- | | | |
|-----|------------------------|---|
| 17. | Interview guide | Were questions, prompts, guides provided by the authors? Was it pilot tested? |
| 18. | Repeat interviews | Were repeat interviews carried out? If yes, how many? |
| 19. | Audio/visual recording | Did the research use audio or visual recording to collect the data? |
| 20. | Field notes | Were field notes made during and/or after the interview or focus group? |
| 21. | Duration | What was the duration of the interviews or focus group? |
| 22. | Data saturation | Was data saturation discussed? |
| 23. | Transcripts returned | Were transcripts returned to participants for comment and/or correction? |

Domain 3: analysis and findings

Data analysis

- | | | |
|-----|--------------------------------|---|
| 24. | Number of data coders | How many data coders coded the data? |
| 25. | Description of the coding tree | Did authors provide a description of the coding tree? |
| 26. | Derivation of themes | Were themes identified in advance or derived from the data? |
| 27. | Software | What software, if applicable, was used to manage the data? |
| 28. | Participant checking | Did participants provide feedback on the findings? |

Reporting

- | | | |
|-----|------------------------------|--|
| 29. | Quotations presented | Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? <i>e.g. participant number</i> |
| 30. | Data and findings consistent | Was there consistency between the data presented and the findings? |
| 31. | Clarity of major themes | Were major themes clearly presented in the findings? |
| 32. | Clarity of minor themes | Is there a description of diverse cases or discussion of minor themes? |

Appendix B Summaries of the interviews

Martien Das – Rijkswaterstaat

Table 14 Characteristics of the interview with Rijkswaterstaat (Martien Das)

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Senior Advisor local climate policy and sustainable mobility Rijkswaterstaat
Data collection		
17.	Interview guide	This was the pilot test (therefore it took longer)
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	56:05 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Er wordt op dit moment veel onderzoek gedaan op verschillende terreinen naar autodelen. Hierbij valt te denken aan stedenbouwkunde, gedragspsychologie. Allemaal om facetten van autodelen beter te begrijpen. Daarbij zijn gebruikersmotieven op dit moment erg belangrijk om de overwegingen van mensen beter te begrijpen. Al zijn resultaten onderhevig aan het moment van toetsen. Gegevens van aanbieders over gebruikers zijn interessant voor beleid, maar wel gevoelig door de concurrentie onderling.

Urgentie speelt een belangrijke rol voor het bestaan van autodeelbeleid van gemeenten. Door urgentie wordt draagvlak gecreëerd. De urgentie is verschillende bij de gemeenten en daarom ook de invulling van het autodeelbeleid. Toch is het belangrijk dat basis randvoorwaarden in orde zijn. Via de GreenDeal proberen we deze inzichten aan de gemeenten duidelijk te maken. Procedures voor parkeervergunningen voor deelauto's moeten sneller verlopen. Ook de zichtbaarheid van deelauto's kan vanuit de gemeenten worden verbeterd door een bord bij deelauto's te plaatsen. Ten slotte, kennis over autodelen in algemene zin, de vormen en aanbieders, is informatie die nog meer moet landen bij gemeenten.

Ik heb 3 kerntaken voor lokale overheid genoemd en gevraagd of deze voldoende aanwezig waren. Allereerst het doen van pilots met autodelen. Op dit moment is dat alleen nodig voor de niches binnen autodelen. Elektrisch autodelen en de vorm lage parkeernorm, nieuwbouw, autodelen. Ten tweede integratie met openbaar vervoer. Autodelen wordt aantrekkelijker als het OV systeem van betere kwaliteit wordt. Daarbij zit in de huidige mobiliteitsmix aanbieders en MaaS Apps vaak maar 1 aanbieder van deelauto's. Het is een goede ontwikkeling, maar om autodelen beter toegankelijk te

maken belangrijk om het aanbod uit te breiden. Ten derde is het inderdaad heel belangrijk om op lokaal niveau knelpunten voor aanbieders weg te nemen. Daarbij kan er ook worden gedacht om restricties op te leggen om bijvoorbeeld geen parkeerplaats aan te bieden op het werkadres, zodat er urgentie wordt gecreëerd.

Het is belangrijk om informatie te verspreiden, maar aanbieders zijn marketingtechnisch te klein om mensen intensief te benaderen. Binnen de autodeelmarkt zijn aanbieders niet afhankelijk van autofabrikanten. Voor de markt is het belangrijk als er verschillende motieven en verschillende samenstellingen worden aangeboden. Het is wel belangrijk dat autofabrikanten en bedrijven binnen de automotive sector worden geïnformeerd over de mobiliteitstransitie. Ga je mobiliteit verkopen i.p.v. een auto?

Belangrijk in mijn ogen is dat fabrikanten auto's softwarematig share ready maken. Dat zou een impuls zijn voor autodelen. Op het gebied van wet- en regelgeving zijn parkeertarieven een belangrijk mechanisme om autodelen aantrekkelijker te maken. Belangrijk is dat er in Nederland een 'level playing field' wordt gecreëerd. De zakelijk- en privé parkeertarieven moeten in verhouding staan en wellicht is er een speciaal deelauto tarief nodig.

Ook verzekeringen vormen een obstakel. Verzekeringen worden al aangeboden, maar door een beperkte groep. Het kan zijn dat er moet worden overgestapt en dit kan een obstakel vormen om een auto te delen. Kennisontwikkeling zou ook zeker helpen om dit punt te verbeteren en verzekeringen op den duur goedkoper te maken.

Concluderend, is het belangrijk om autodelen te faciliteren door push en pull maatregelen. Daarnaast is het belangrijk om elektrisch autodelen te stimuleren en daar wellicht als overheid aan bij te dragen. Vanuit de GreenDeal is het belangrijk om van de 1,5% autodelers, 20% te maken. Kennis verspreiden en de basis op orde bij gemeenten kunnen hier flink aan bijdragen.

Arjen Kapteijns – Ministry of Infrastructure and Environment

Table 15 Characteristics of the interview with Ministry of Infrastructure and Environment (Arjen Kapteijns)

Setting		
14.	Setting of data collection	Home
15.	Presence of non-participants	No
16.	Description of sample	Policy officer of sustainable mobility Ministry of Infrastructure and Environment
Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Phone call
20.	Field notes	After the interview
21.	Duration	41:27 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Autodelen zit op heel veel schalen nog niet binnen de reguliere oplossingen als een bereikbaarheidsvraagstuk moet worden opgelost. Het probleem zit hem in dat mensen een oplossing kiezen die ze al kennen. Het is belangrijk dat je mensen de kans geeft om een nieuwe vorm van mobiliteit kan laten ervaren.

Daarom moet je op slimme momenten informatie verstrekken om autodelen onder de aandacht te brengen. De onbekendheid over autodelen kan op zo'n moment verholpen worden. Momenten waarbij mensen gaan nadenken over hun mobiliteitsoplossingen.

Daarnaast moet er een urgentie worden gecreëerd. Door autobezit te ontmoedigen gaat het mes aan twee kanten snijden. Dit zijn informatie verstrekken en mensen in de richting van de deelauto sturen.

Wat betreft de markt is deze op dit moment in verhouding. De relatie tussen aanbieders en vragers is in evenwicht. Consolidatie is nog niet in zicht. Het is nog afwachten welke concepten echt aanslaan. De rol van de overheid is op dit moment wel om randvoorwaarden te creëren om de effecten in theorie in praktijk te zien.

Om fiscale voordelen te creëren is autodelen op dit moment als markt niet groot genoeg. Autodelen is een marginale ontwikkeling in Nederland. Om autodelen op dit moment verder te brengen ligt de sleutel bij de lokale overheid. Zij kunnen door het aanpassen van parkeertarieven autodelen aantrekkelijker maken. Daarnaast kunnen ze participeren bij gebiedsontwikkeling en daar autodelen onderdeel maken vanaf het begin van de woonsituatie.

Alle automotive bedrijven zullen inmiddels wel erkennen dat een transitie bezig is. Gevestigde partijen zullen alleen geen behoefte hebben om deze transitie zo snel mogelijk te laten verlopen. De andere

trends die bij deze transitie horen zijn ridesharing en autonoom rijden. Deze initiatieven zullen autodelen versterken. Door deze drie bekender te maken zal de taart voor iedereen worden vergroot.

Edwin Brugts – BMW Nederland

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Partnership Manager BMWi at BMW Nederland

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	45:56 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Samenvatting

Autodelen is succesvol als het consequent wordt toegepast en leidt tot een effectievere mobiliteitsinzet. We richten ons op dit moment op kleine groepen. Met DriveNow hebben we al ervaringen met projecten op grote schaal. Daarbij voegen we deelmobiliteit als element toe. Daarbij focussen we ons op gesloten communities daar valt nog veel te leren voor ons. Dit gaat om een andere ‘market approach’.

Voor ons moet deze inzet leiden tot een nieuw soort verdienmodellen. We zien autodelen als mobiliteitsoplossing en daardoor niet als gevaar voor onze autoverkoop. Ik denk dat de nieuwe verdienmodellen voldoende zullen opleveren om het verlies aan omzet te compenseren.

Technisch zijn er niet echt obstakels om tot de nieuwe verdienmodellen te komen. Gepaard met autonoom rijden kan dit alleen maar versterkt worden voor ons. Dit opent voor ons ook markten die eerst geen toegang hadden tot mobiliteit. Onze rol zal gaan veranderen van autofabrikant naar mobiliteitsaanbieder.

Op dit moment zijn elektrisch autodelen en de combinatie nieuwbouw, lage parkeernorm autodelen de pilotvormen. We weten nog niet goed hoe we hier goede verdienmodellen van kunnen maken. Het is een kwestie van trial-and-error. Toegankelijkheid van deelauto's moet goed in orde zijn en we moeten meer leren over de gebruiker hoe we die op continue basis de auto kunnen laten gebruiken. Gebruikersgroepen zijn ook niet 1 op 1 te vergelijken. De complexiteit zit daarom ook erg in de verschillende doelgroepen met verschillende behoeftes en beperkingen. Bij sommige projecten speelt ook mee dat de urgentie voor de deelauto er niet vanaf het begin is. Daarnaast zijn er allerlei factoren die gebruik in de weg kunnen zitten: ontbreken van een stadsbrede parkeervergunning, slechte toegang of beperkende voorwaarden vanuit de arbeidsovereenkomst.

Mensen weten niet wat autorijden kost. Gebruikers kunnen daarom slecht een rationele afweging maken. We zullen daarom de mindset moeten veranderen willen we mensen in de deelauto krijgen.

Daarbij komt dat jonge mensen sneller geneigd zullen zijn om deelauto's te gebruiken. Deze groep is gewend aan het denken in abonnementsvorm. Een gevaarlijke ontwikkeling is de toename in private lease. Tarieven voor kleine auto's zijn laag en het delen van deze auto wordt vaak verboden door de leasemaatschappij.

Verzekeringen zijn niet zo zeer lastig. Het verzekeren van een deelauto is alleen duurder door het verhoogd risicoprofiel van het gebruik. Dit heeft een negatief effect voor de eindgebruiker, de prijs gaat namelijk omhoog. Verhoogd risicoprofiel wordt veroorzaakt door een lager commitment met het voertuig.

Bij autodelen is er een vraag vanuit de markt dat de initiële kosten niet volledig worden gedragen door de eindgebruiker. De traditionele relatie van autoverkoper en autokoper verandert. De kosten worden daarom gedragen door de aanbieders of autofabrikanten. Hier zijn aanbieders dus ook afhankelijk van de voertuigen van de autofabrikant. Het grootste vraagstuk is hoe de kosten tussen de aanbieders, autofabrikant en gebruikers kan worden verdeeld. Het is een kwestie van de risico's te reduceren en te verdelen. Er zal dus kennis moeten worden opgedaan.

Er ligt hierbij een belangrijke rol voor de lokale overheid, omdat zij veel van processen om autodelen aantrekkelijker te maken, kunnen versimpelen. Ten slotte is het belangrijk dat de overheid samen met het bedrijfsleven autodelen het fenomeen autodelen algemeen bekend maakt. Het moet duidelijk worden dat dit een positief effect kan hebben op onze samenleving. Belangrijk is dat het gestimuleerd wordt vanuit overheden om autodelen toe te passen als mobiliteitsoplossing.

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Manager Sales Toyota

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Kennis opdoen en efficiënter gebruikmaken van bedrijfsmiddelen zijn de belangrijkste redenen voor ons om te experimenteren met autodelen. Wij pilotteren niet meer met autodelen, maar gebruiken het echt als verkoopmiddel. Binnen een gesloten community werken de autodeelconcepten op dit moment erg goed. Bij een open community lopen we tegen een aantal obstakels op.

De mensen in een open community willen gewoon een auto gebruiken en niet zo zeer een auto delen. Dan valt het gebruiksgemak tegen, mensen zijn het niet gewend en het registreren is ook lastig. Om het goed te laten werken heb je goede checks nodig om te weten wie er gebruik gaat maken van het voertuig. Daar moeten nog stappen in gemaakt worden om enerzijds de juiste gegevens te verzamelen en anderzijds het proces soepel laten verlopen. De toegankelijkheid van deelauto's moet nog flink verbeteren.

Aan de operationele kant liggen er ook nog veel uitdagingen. Door het korte gebruik moeten auto's vaker worden schoongemaakt en worden er ook vaker schades gereden. Wie gaat dit monitoren? Deelconcepten met goederen die een lagere waarde vertegenwoordigen en simpeler in gebruik zijn, zijn daarom succesvoller. Er zijn weinig ondersteunende processen nodig.

Hier ligt wel een rol voor de automotive retailer. Het businessmodel verandert, maar waarom moeten we focussen op autodelen. Autodelen gaat er voor zorgen dat je minder auto's gaat verkopen. Daarbij komt dat er al overproductie is in de wereld.

Dat private lease opkomt helpt overigens ook niet voor autodelen. Dit is een simpeler product dan autodelen en voor een concurrerende prijs bezit je een auto. Private lease wordt enorm geholpen door de overproductie. Ook is de huidige generatie veel meer geïnteresseerd in dit soort abonnementen. Autonomous driving is een ontwikkeling waar ik meer in geloof voor het faciliteren van incidenteel gebruik dan in autodelen.

Ruimtegebrek is een belangrijke reden om geen auto te bezitten. Alleen is het op dit moment lastig om de tarieven aantrekkelijk te houden. De operationele kosten zijn veel hoger dan voor bijvoorbeeld een huurauto, omdat de auto korte periodes moet worden verhuurd. Dit zorgt er voor dat de auto heel vaak moet worden schoongemaakt etc. Mensen voelen zich niet meer verantwoordelijk voor het voertuig.

Autofabrikanten zijn niet enthousiast over de hardware die autodelers gebruiken. Het implementeren van externe hardware zorgt bij autodelers voor weerstand om het op grote schaal in te voeren in voertuigen. Eigenlijk mag je niet eens inbreken in de systemen van de auto met dat soort externe hardware. Er ligt hier een uitdaging om afspraken te maken met de autofabrikanten.

Er is geen incentive voor autofabrikanten om auto's vanuit de fabriek deelbaar te maken. Een autofabrikant heeft namelijk maar 1 doel en dat is zoveel mogelijk auto's verkopen. Hoe meer auto's je kan verkopen hoe makkelijker de ontwikkelingskosten verdeeld kunnen worden. Een incentive als de bijtelling heeft er wel voor gezorgd dat we in Nederland auto's met kleinere wielen en andere spiegels zijn gaan verkopen. Fiscale voordelen zou er wel voor kunnen zorgen dat er beweging komt in ontwikkeling bij autofabrikanten.

In de binnenstad kan de deelauto echt als substituut voor de privé auto gaan werken. Psychologisch moet er echter nog een stap worden gemaakt om een auto ook echt te gaan delen. Ook in het verzekeren zullen echter nog stappen moeten worden genomen. Je kan namelijk nooit iemand blanco verzekeren.

Als aanbieders niet winstgevend zijn in de huidige markt, zijn er of teveel aanbieders of het businessmodel klopt niet. Er zit een grote variëteit in modellen en ze zijn ook niet allemaal gericht op winst maken. Echter, zullen over het algemeen de systemen gebruiksvriendelijker moeten worden, toch blijft de vraag of er wel genoeg vraag zal zijn in de toekomst. Dat zal ook bepalen of er financiële incentives in het leven moeten worden geroepen. Het is op dit moment meer market push dan market pull. Er moet eerst urgentie zijn voordat er vraag zal optreden.

Toy Hertogh – WeGo

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	CEO WeGo

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Er zijn op dit moment eerder te veel dan te weinig aanbieders (ongeveer 40 in de huidige markt). Het is de vraag of er genoeg vraag komt in de toekomst of dat het weer langzaam uit dooft. Bij bedrijven zou het helpen als ze i.p.v. 10 deelauto's gelijk naar 100 gaan en daarmee bijvoorbeeld hun wagenpark halveren. De vraag is ook welke aanbieders er in de toekomst zullen blijven bestaan. Op dit moment is het jammer dat iedereen bezig is met de ontwikkeling van hun eigen applicaties, eigen hardware en eigen platform.

Een probleem is dat in de huidige markt een auto als arbeidsvoorwaardelijk wordt gezien. Daarbij is het in Nederland gunstiger om een lease auto te rijden dan een eigen auto. De fiscale regels zorgen daar op dit moment voor. Daarnaast zijn de tarieven van private lease erg concurrerend met de tarieven van deelauto's. Het is ook jammer dat werknemers voor het privégebruik van een deelauto een zakelijk concurrerend tarief moeten betalen. Dit is vaak hoger dan de tarieven voor privégebruik door particulieren. Hier zou de overheid wat aan kunnen doen.

Door innovatieve projecten uit te voeren, zoals met de vastgoedontwikkelaar Vesteda, kunnen we leren en deze leringen vervolgens weer in nieuwe projecten toepassen. De auto industrie is daarin ook een belangrijke partner, zeker om massa te creëren.

Subsidies zijn niet direct nodig. Als ze al nodig zijn ook alleen maar voor korte tijd. Lokaal beleid zou wel eenduidiger kunnen. Binnen de GreenDeal is ook geprobeerd om dit te harmoniseren. Alleen zou dit nog wel beter kunnen. Aanbieders moeten dit ook meer eisen van lokale overheden.

Ik zie autodelen in combinatie met autonoom rijden. Een autodeler kan in mijn ogen uiteindelijk de connectie maken tussen de auto, de aanbieders en de gebruikers. Je laat je ophalen voor je huis en de auto wordt een 'people mover' zonder emotie. De autodeel aanbieder moet vraag en aanbod op een slimme manier aan elkaar koppelen. Het is belangrijk om data te verzamelen en inzicht te verschaffen in mobiliteitspatronen. De rol van de autodeler zal dus wel veranderen t.o.v. de huidige situatie.

Autofabrikanten zullen dit soort producten ook zelf gaan aanbieden, maar we moeten zorgen dat dat ons product wordt wat ze aanbieden met hun auto's.

De kosten gaan op dit moment voor de baten uit. Voor de ontwikkeling van platformen zijn gewoon veel financiële middelen nodig. Die investeringen heeft in mijn ogen niemand er nog uit kunnen halen. Er worden nog weinig winsten gemaakt in de autodeelmarkt. Ook de afzetkanalen kunnen nog flink verbeterd worden. Wij moeten ook mensen nog echt bewust maken van de voordelen van autodelen al neemt de bekendheid wel toe.

De huidige informatie die door het CROW wordt verspreid is niet volledig. Het aantal klopt misschien wel, maar het geeft weinig informatie over de daadwerkelijke prestatie van autodelen. Het doel binnen de GreenDeal van 100.000 deelauto's zorgt wel voor een marketingeffect. Een andere KPI kost veel meer moeite om die samen te stellen en het levert nauwelijks iets extra's op. Dit cijfer geeft groei aan dat is op dit moment voldoende.

Verzekeren is ook zeker nog een issue. In open communities hoor je toch nog vaak over problemen over het verzekeren van deze voertuigen. Het is vaak lastig te bepalen wie er gereden heeft en daarmee lastig om schades onder te brengen bij verzekeraars.

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Project Manager at Gemeente Utrecht

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Het doel van de GreenDeal wat is gecommuniceerd is niet de inhoud van het doel waar we daadwerkelijk mee bezig zijn. We willen meer gebruik van deelauto's en daar is het aantal deelauto's ondergeschikt aan. We moeten ons focussen op een groei van het gebruik en een vermindering van autobezit. Dit is ook duidelijk de focus binnen de GreenDeal.

Als gemeente zorgen we ervoor dat autodeelaanbieders hun werk zo goed mogelijk kunnen doen. Dit doen we onder andere door de vergunningen voor deelauto's goedkoper te maken. Ook zorgen we ervoor dat het proces om een auto te plaatsen zo makkelijk mogelijk is. Wij werken ook nauw samen met de aanbieders om campagnes op te zetten om autodelen bekender te maken. De rol van de gemeente is ook belangrijk, want als marktpartijen campagnes houden geeft dit meer de indruk van reclame. We hebben ook een wethouder die het belang van autodelen inziet en daarom kunnen we veel initiatieven helpen.

De effecten van campagnes zijn duidelijk zichtbaar bij aanbieders. Zij zien dat er meer mensen zich aanmelden en ook is de content van de campagnes goed bekeken. We hebben geen onderzoek gedaan hoe de gebruikers het ervaren, maar het is in ieder geval gelukt meer autodelers te krijgen. In Utrecht verstrekken we geen subsidies aan aanbieders van deelauto's.

We proberen autodelen in de hele stad te stimuleren, maar je ziet in wijken met een hoge parkeerdruk een hogere kans op succes. Onlangs hebben we ook de tarieven voor de parkeervergunningen van deelauto's (bijv. Greenwheels) sterk verlaagd. Daarnaast is het tarief van de parkeervergunning van de tweede auto hoger dan de eerste. Deze maatregelen moeten ook een stimulans zijn voor autodelen. In sommige wijken zijn de randvoorwaarden voor autodelen niet direct aanwezig. De toegang tot het OV, de parkeerdruk en type inwoners zijn factoren die bepalend zijn voor die randvoorwaarden.

De toegang tot deelauto's kan nog een stuk beter. Het zou ook heel erg helpen als je bijvoorbeeld via één reserveringssysteem vervoer kan regelen wat voor jou op dat moment het handigst is. Waarbij

ook alternatieven als een deelfiets of Uber in voor kunnen komen. Hier is intensieve samenwerking tussen aanbieders voor nodig. Ik denk wel dat de bereidheid voor samenwerking hoog is.

Op dit moment ontbreekt data over autodelen in Nederland. Er is wel inzicht in het aantal deelauto's, maar om te kunnen bepalen wat het voor je beleidsdoelen kan betekenen hebben we betere informatie nodig.

Vanuit de nationale overheid gebeurt op dit moment weinig. Ze zijn wel actief deelnemer van de Green Deal autodelen. Het autodeelbeleid is hierdoor in elke gemeente anders. Dat heeft onder andere te maken met de politieke kleur van het college en de wethouder mobiliteit. Een taak van de Rijksoverheid kan zijn om informatie te geven over het belang van autodelen, en wat het voor het mobiliteitsbeleid en bijv. de openbare ruimte kan betekenen. Budget vanuit de Rijksoverheid zou ook kunnen bijdragen.

Ik kan me best voorstellen dat niet elke autofabrikant direct instapt. Als meer mensen autodelen dan gaan zij natuurlijk minder auto's verkopen. Het zou kunnen helpen als zij hun auto's 'share ready' maken. Op deze manier is de drempel om je auto te delen veel lager. Ik denk ook dat het toepassen van autonoom rijden veel kan betekenen voor autodelen. Voor ons maakt het niet uit of huidige aanbieders van deelauto's dat toepassen of de autofabrikanten.

Er kan nog veel worden gedaan in de gedragsverandering van mensen. Nog weinig potentiële gebruikers weten veel van autodelen. Dit gaat ook over praktische zaken als bijvoorbeeld verzekeringen.

Ida Sanders – Natuur & Milieu

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Project Manager at Natuur & Milieu

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Wij werken binnen Natuur & Milieu binnen verschillende beleidsterreinen aan verschillende thema's o.a. mobiliteit. Binnen mobiliteit kijken we hoe we de zakelijke markt kunnen elektrificeren en daarnaast kijken we hoe we binnen stedelijke mobiliteit de transitie naar de schone stad moeten

invullen. Daarbij willen we consumenten handelingsperspectief geven om bij te dragen aan deze transitie. Het project 'testrijders' waar elektrische auto's worden gedeeld, zorgt o.a. voor dat handelingsperspectief.

Voor ons ligt de focus op elektrisch rijden en wij gebruiken de combinatie met autodelen, zodat meer mensen kennismaken met elektrisch rijden. Al zien wij ook zeker de potentie van autodelen in stedelijk gebied, want als iedereen daar een elektrische auto aanschaft bestaan er nog steeds problemen in de publieke ruimte. Belangrijk bij het project 'testrijders' is dan ook dat de auto wordt gedeeld en dat mensen enthousiast zijn over elektrisch rijden, zodat een olievlekwerking kan optreden. Het mond op mond effect is heel belangrijk binnen ons project.

Wij kunnen het gebruik niet monitoren aangezien er geen black box aanwezig is in onze voertuigen. We staan wel in contact met de gebruikers en zijn op die manier op de hoogte van ervaringen en frequentie van gebruik. Als we kijken naar gebruik zien we dat het delen van auto's makkelijker gaat op bijvoorbeeld een bedrijfsverzamelgebouw en dat het lastiger gaat in nieuwbouwwijken waar veel mensen hun eigen oprit hebben (Leidsche Rijn). De urgentie speelt dus een rol of er vraag is naar een deelauto.

De gemeente kan ook een belangrijke rol spelen in het succes. De sociale media kanalen van gemeenten worden vaak goed bekeken en via deze weg kunnen inwoners geïnformeerd worden over de kracht van elektrisch rijden en autodelen. Het is belangrijk dat deze boodschap lokaal wordt uitgesproken om draagvlak voor dit soort initiatieven te creëren. Het lastige is wel dat je dit elektrisch rijden en autodelen nationaal wil uitrollen. Alleen mis je bij het nationaal uitrollen van dit soort projecten de lokale betrouwbare partner die bij dit soort projecten kan bijdragen.

Op dit moment is het goed dat er in de huidige fase meerdere aanbieders in de markt actief zijn. Zo kan uiteindelijk door het experimenteren duidelijk worden welke concepten slagen. Gebruik van de deelauto kan ook aantrekkelijker worden als gebruik van de privé auto wordt ontmoedigd. Een kilometerheffing zou een mogelijkheid kunnen zijn om mensen bewuster te laten rijden. Hiermee wordt ook de businesscase voor de privé auto ongunstiger.

In de huidige markt zien wij de grootste potentie binnen de zakelijke markt, omdat elektrisch rijden daar aantrekkelijker is dan in de particuliere markt. Al pleiten wij ook voor fiscale voordelen voor elektrisch rijden binnen de particuliere markt. Daarnaast is het wellicht mogelijk om een verandering in arbeidsvoorwaarden te creëren. Waar nu een lease auto de standaard is, is een goed mobiliteitspakket (OV, deelauto, deelfiets) wellicht een vervanger in de toekomst. Deze zaken zorgen er voor dat wij denken dat er een belangrijke transitie vanuit de zakelijke markt kan worden gemaakt.

Ook zijn er op dit moment nog verzekeringsissues binnen de autodeelmarkt. Zeker de slechte verhalen die rond gaan vormen een belemmerende factor. Deze verhalen verspreiden zich ook sneller dan de positieve verhalen.

Samenwerking binnen de autodeelmarkt is lastig door de sterke concurrentie binnen de autodeelmarkt. Dit wordt mede veroorzaakt door het feit dat het op dit moment nog lastig is om een goed lopend business model te creëren. Daarnaast zijn er nu veel kleinschalige projecten wat past binnen het huidige aanbod. Natuurlijk willen we opschalen, maar daarvoor moet de vraag meegroeien.

Quirijn Oudshoorn – Gemeente Rotterdam

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Advisor Sustainable Mobility at Gemeente Rotterdam

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Samenvatting

In Rotterdam is het aantal deelauto's per hoofd van de bevolking lager dan in andere grote steden. Ten eerste is de parkeerproblematiek niet zo groot als in andere steden en Rotterdam is van nature een autostad. Een parkeervergunning is ook goedkoop, dus er is geen reden om bewust over autobezit na te denken. Ten tweede, de inwoners zijn rechtser dan bijvoorbeeld de inwoners van Utrecht (linkser).

In Amsterdam worden sommige concepten slecht gebruikt en dit kan leiden tot een afbreukrisico voor autodelen. De verwachting is wel dat de jongere generatie meer open staat voor het gebruik van autodeelconcepten. Daarnaast is het belangrijk dat de contextfactoren goed zijn. Er moet een volledig systeem zijn om autodelen goed in te voeren d.w.z. OV en fiets moeten ook goed toegankelijk zijn. De mobiliteitsoplossingen moeten ook betaalbaar zijn en er moet een natuurlijk urgentie zijn, zodat gebruikers min of meer gedwongen worden om gebruik te maken van alternatieven voor een privé auto.

Om bovenstaande zaken goed geregeld te krijgen moet een businesscase goed worden uitgewerkt. Op dit moment is het lastig, omdat er onzekerheid is over het toekomstige gebruik. Er moet geïnvesteerd worden in een totaalpakket door een marktpartij en om dat succesvol te doen moet er nog kennis worden opgedaan over risicoverdeling. Wij vinden dat deelmobiliteit een belangrijke rol binnen gebiedsontwikkeling moet krijgen. Wij als gemeente moeten faciliteren in dit soort processen en dat is ook relatief nieuw.

Wij vragen niet direct om data, maar willen wel inzicht krijgen in de verandering van vervoerskeuze. Daarmee kunnen we effecten voor beleidsdoelen bepalen. Beter inzicht in deze gegevens maakt het

makkelijker om beleid aan te passen doordat draagvlak toeneemt. We zitten op dit moment nog niet in de fase dat we harde criteria hebben om te toetsen of een deelconcept in de stad succesvol is.

Wij denken ook dat het belangrijk is om iets te doen aan het ontmoedigen van autobezit. Parkeervergunningen duurder maken is een voorbeeld, alleen is dat politiek gedreven erg lastig. De parkeernorm in de binnenstad zal wel omlaag gaan, omdat er 50.000 woningen bij moeten komen in het centrum. Er komt een grote mobiliteitsvraag en minder ruimte voor parkeren. Ook in OV moet daarom flink worden geïnvesteerd.

Wat betreft MaaS Apps is het aanbod van deelauto's op dit moment te beperkt. Als je niet lid bent van die aanbieder of je vindt die aanbieder te duur dan valt de optie voor de deelauto al af. Mensen zullen ook nog meer gewend moeten raken aan dit soort applicaties. Voor nieuwe generatie zal dat gewend raken makkelijker zijn.

Ridesharing zoals Uber vormt een bedreiging voor autodelen. Ze hebben een grote marketingmachine en zijn bekender dan autodeel aanbieders die relatief onbekend zijn. Voor ons maakt het overigens niet uit of het ridesharing of autodelen is. Het gaat er voor ons om dat er alternatieven komen die de privé auto kunnen vervangen.

In het huidige fiscale beleid schuilen perverse prikkels voor autogebruik. Als je 400 euro bijtelling hebt betaald voor een auto, zullen bezitters niet snel minder gaan rijden. Ze hebben het geld namelijk al uitgegeven. Verder vormt het gedrag van leaserijders voor een barrière voor autodelen. Veel leaserijders wisselen hun auto naar 3 jaar in en rijden dan weer een nieuwe auto. Hier wordt veel geld aan verdiend, maar om autodelen te helpen zou dit gedrag moeten worden veranderd.

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Facility Manager at EY

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Doordat parkeerplaatsen steeds duurder en schaarser worden stimuleren we mensen om met het OV naar kantoor te komen en daar vervolgens een deelauto te gebruiken. In steden waar de parkeerplaatsen schaars zijn en de bereikbaarheid met de auto slecht is, is het aanbieden van een deelauto succesvol. In steden (o.a. Eindhoven) waar deze randvoorwaarden niet aanwezig zijn, worden deelauto's nauwelijks gebruikt. In steden waar de deelauto populair is, is de deelfiets ook populair.

Om succes te bepalen kijken we naar de frequentie van gebruik. Helaas kan de auto alleen zakelijk worden gebruikt. Door strenge belastingregels is het lastig om de auto aan te bieden voor privégebruik. Ook de verplichting om een commercieel tarief te rekenen voor privé gebruik is een barrière voor gebruik.

Van de 5000 medewerkers hebben 3500 medewerkers recht op een leaseauto of de vergoeding hiervoor. Bijna iedereen kiest voor die lease auto, ook de nieuwe generatie. Om de lease auto te laten verdwijnen uit de arbeidsvoorwaarden zijn er afspraken tussen concurrerende bedrijven nodig. Aan de onderkant van hiërarchische pyramide binnen EY kunnen arbeidsvoorwaarden versoerd worden, bij hogere lagen lopen we door het versoeren talent mis.

Wij gaan binnenkort gebruik maken van Amber (aanbieder deelauto's). Wij zijn bang dat privacy gevoelige gegevens worden opgeslagen om bijvoorbeeld gedragspatronen te analyseren. Privacy is een belangrijk onderwerp binnen EY en ook de toekomstige privacy wetgeving is een issue wat betreft data opslag.

Om meer inzicht te krijgen in ons voertuiggebruik hebben we gekeken naar het installeren van blackboxen in de voertuigen. Alleen zijn er bij dit soort businesscases nauwelijks opbrengsten. Ook zit deze technologie vaak al in de voertuigen, maar alleen de fabrikant heeft inzicht in die gegevens.

Op dit moment worden mensen ook niet gestimuleerd om op basis van hun behoeftes de optimale vervoerskeuze te maken. Het is fiscaal ongunstig om te kiezen voor een kilometervergoeding t.o.v. een lease auto. Als mensen mobiliteitsbudget overhouden, wordt dit gezien als bruto inkomen. Er ontbreekt op dit moment een component binnen het fiscale beleid om mensen een aantrekkelijk mobiliteitsproduct aan te bieden. Ten slotte, staat de kilometervergoeding niet altijd in verhouding tot de auto waar mensen recht op hebben. Dit zorgt voor perverse prikkels en dus voor ongewenst mobiliteitsgedrag.

Als je kijkt naar Uber kan dat zeker een gevaar vormen voor autodelen. Operationeel is het een veel simpeler product. Mensen zijn nu al erg enthousiast over het fenomeen ridesharing. Ze kunnen ook een makkelijker een groot volume creëren dan autodelers doordat er geen investeringen in een wagenpark nodig zijn.

Amber gaat binnenkort bij ons deelauto's laten rondrijden. Het is voor ons lastig in te schatten hoeveel gebruik gaat worden gemaakt. Contractueel is dit lastig aangezien we voor gebruik gaan betalen. Als er veel gebruik gaat worden gemaakt, gaan we dus ook veel betalen. Het levert voor ons wel veel gemak op, omdat de coördinatie van de operationele processen niet meer bij EY komt te liggen.

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Project Manager at CROW

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Summary

Autodelen is geen controversieel onderwerp op dit moment. Het is een oplossing in de vrijheidssfeer die je niet kan opdringen aan mensen.

Op dit moment zijn we aan het focussen op een prestatie indicator die niet veel zegt. Het aantal deelauto's geeft weinig aan. Je wil natuurlijk het matschappelijk effect zo veel mogelijk in kaart brengen. Op dit moment is het heel veel n=1 onderzoek. Daarnaast zijn de doelgroepen die contact hebben gehad met autodelen geen weerspiegeling van de gemiddelde Nederlander. Daarom is het bijvoorbeeld lastig te zeggen hoe de bereidheid van de Nederlander tot gebruik van de deelauto. Het is daarom ook heel lastig om generiek concept overal succesvol toe te passen.

Het delen van data is ook een probleem. Wij monitoren autodelen o.b.v. open bronnen. Daarbij kunnen we ook alleen de verandering in aantal deelauto's monitoren en geen vervoersprestatie. Daarom is het lastig om de maatschappelijke en economische effecten van autodelen in kaart te brengen. In de toekomst is het van belang om de frequentie, kilometers en demografische gegevens van autodelers in kaart te brengen. Dit is essentieel om autodelen onderdeel te laten worden van het mobiliteitsinstrumentarium van alle lokale overheden en nationale overheid. Op dit moment ontbreekt het deze partijen aan de kennis en hebben ze ook te maken met ondercapaciteit. Je moet zorgen dat het inzichtelijk wordt wat autodelen kan betekenen en hoe het werkt, zodat gemeenten een natuurlijke 'license to operate' hebben om autodelen te faciliteren.

Op dit moment is het ook te lastig om 2^e en 3^e orde effecten van autodelen te bepalen. Deze zijn op macro niveau en in onderzoeken vaak al wel aangetoond. Alleen in de praktijk zie je dat gemeenten eigenlijk alleen inzicht hebben in de 1^e orde effecten zoals de vermindering van aanschaf van tweede auto's en afname van parkeervergunningen. Dit zijn effecten binnen het maatschappelijke systeem.

Op dit moment zorgen de rijksoverheidsinterventies ervoor dat ontwikkelingen zoals autodelen met de handrem erop worden uitgevoerd. Als mensen eenmaal een auto hebben aangeschaft, kost het gebruik in relatie tot de aanschaf niet zoveel meer. Alleen brandstof en accijnzen zorgen ervoor dat je nog bewust over het gebruik van je privé auto nadenkt. Binnen de fiscalisering kan autobezit onaantrekkelijk worden gemaakt en autodelen op die manier aantrekkelijker. Op dit moment is de markt misschien te klein voor fiscale voordelen alleen zullen er wel stappen moeten worden ondernomen om een markt te creëren die kan groeien. Belangrijk hierbij is de wisselwerking tussen aanbieders, fabrikanten en nationale overheid.

Vanuit de markt zie je overigens wel dat er partijen met volwaardige oplossingen komen zoals PON. Zij bieden een volwaardig mobiliteitspakket waarbij verschillende vormen van mobiliteit samen komen. Zij hebben daar geen incentive vanuit de overheid voor nodig.

Probleem is op dit moment ook de kleinschaligheid. Hierdoor wordt de potentie die een deelauto binnen een netwerk kan hebben niet volledig benut. Samenwerking tussen aanbieders van verschillende mobiliteitsproducten kan bijdragen aan het benutten van die potentie. Als dit binnen MaaS concepten wordt ondergebracht kan de onbekendheid ook sneller worden weggenomen.

Binnen de verzekeringssector kan ook nog een slag worden geslagen. Je ziet dat er behoefte is aan verzekeringsproduct voor dit soort mobiliteit. Ook hierin moet worden gekeken hoe data kan worden gedeeld met de verzekeraars binnen de wetgeving. De kosten kunnen op die manier worden verminderd.

Ridesharing en autonoom rijden kunnen inderdaad een gevaar vormen voor autodelen. Zeker aangezien Uber op dit moment al probeert om de kosten van een chauffeur te elimineren. Dan is het een kleine stap om autonoom rijden toe te passen. Het zal overigens nog wel een tijd duren voordat die technologie klaar is.

Diede Labots – Gemeente Den Haag

Setting		
14.	Setting of data collection	Workplace
15.	Presence of non-participants	No
16.	Description of sample	Policy officer at Gemeente Den Haag

Data collection		
17.	Interview guide	Yes
18.	Repeat interviews	No
19.	Audio/visual recording	Audio recording
20.	Field notes	After the interview
21.	Duration	39:48 minutes
22.	Data saturation	No
23.	Transcripts returned	Summary of the transcript

Samenvatting

Op dit moment zijn we druk bezig met campagnes om autodelen bekender te maken binnen de gemeente. Wij doen dit in samenwerking met de aanbieders en hebben daarin een faciliterende rol. We proberen op straatniveau projecten uit te rollen en privé auto's te laten verdwijnen en hier deelauto's voor in de plaats te krijgen (Project Vrijstraat).

Autodelen werkt vooral goed op plaatsen waar de parkeerdruk hoog is en waar mensen met een soort duurzaamheidsgevoel wonen. Als deze randvoorwaarden aanwezig zijn, worden mensen automatisch gestimuleerd om meer gebruik van de deelauto te maken. In de buitenwijken is er meer ruimte en is het lastiger om mensen gebruik te laten maken van deelauto's.

Voor ons als gemeente is het belangrijk dat we informatie van de aanbieders krijgen over de vervoersprestatie van de deelauto's. Wij bieden daarom stadsbrede parkeervergunningen aan in ruil voor data. We verstrekken ook subsidies aan aanbieders en monitoren vervolgens of er parkeervergunningen worden ingeleverd op de locatie waar deelauto's worden aangeboden. Onze stelregel is dat er voor 1 deelauto 4 parkeervergunningen moeten worden ingeleverd. We denken dat zeker voor elektrische deelauto's subsidie essentieel is, omdat de businesscase voor elektrische deelauto's op dit moment veel lastiger is. Wij willen elektrisch rijden ook graag promoten.

In onze ogen is het belangrijk om via parkeerbeleid een verandering te creëren van autobezit naar autogebruik. We willen op die manier zorgen dat mensen naar andere alternatieven gaan kijken zoals de fiets, OV of deelauto. Op dit moment worden mensen te weinig getriggerd om over alternatieven na te denken.

Belangrijk is om de deelauto ook te integreren binnen gebiedsontwikkeling. Langs de OV lijnen waar de hele mobiliteitsmix aanwezig is kan je door het aanbieden van een deelauto mobiliteit garanderen en toch een hoge stedelijke dichtheid handhaven. Op dit moment is het alleen lastig hoe dit soort samenwerkingen contractueel moeten worden vastgelegd en hoe mobiliteit voor langere periode kan worden gegarandeerd. In de Citydeal zijn de leervragen voor dit soort projecten vastgelegd.

De kleinschaligheid van projecten zorgt wel voor een barrière voor verdere groei van autodelen. Als deze kleinschalige projecten in MaaS concepten moeten worden ondergebracht, zorgt dit voor een organisatorisch probleem. Wij kijken daarom binnen de gemeente bij initiatieven wel of er mogelijkheid is tot opschalen. De toegang tot deelauto's is niet overal even goed. Als er meer wordt samengewerkt kan de beschikbaarheid van auto's in een bepaalde straal enorm toenemen. Een mogelijkheid zou bijvoorbeeld een nationaal/Europees platform zijn waar de verschillende mobiliteitsdiensten op kunnen worden aangesloten.

Er is ondercapaciteit bij gemeenten. Dit zorgt er voor dat er niet altijd tijd en aandacht aan autodelen kan worden besteed. Daarom is het van belang dat succesvolle concepten tussen gemeenten worden gedeeld. Dit zorgt er voor dat autodelen op grotere schaal op een efficiëntere manier kan worden ingevoerd. Daarvoor is nog wel meer kennis nodig over de succesvolle concepten.

Vanuit de nationale overheid zou autobezit duurder moeten worden gemaakt. Op dit moment wordt dit vooral vanuit lokale overheden gedaan d.m.v. parkeerbeleid. Vanuit nationaal beleid zou je kunnen betwijfelen of iedereen wel een auto nodig heeft. Belangrijk blijft wel dat deelauto's niet een doel op zich zijn, maar we willen dat mensen op een andere manier gaan reizen dan met de auto. Ridesharing kan daar ook aan bijdragen. Wat betreft de concurrentie tussen deze modellen is het nationaal beleid van grote invloed (parkeerbeleid vs. kilometerheffing).

Appendix C Full list of barriers found in semi-structured interviews

Table 16 Characteristics of the Data analysis

Domain 3: analysis and findings	
<i>Data analysis</i>	
24. Number of data coders	1 data coder (Jeroen Kloeke)
25. Description of the coding tree	See Table 17 below
26. Derivation of themes	Themes are based on innovation functions of Hekkert et al. (2007)
27. Software	The R package 'RQDA' by Huang (2017) has been used
28. Participant checking	
<i>Reporting</i>	
29. Quotations presented	There were no quotes presented in this research, only findings out of the summaries presented to the interviewees have been used
30. Data and findings consistent	
31. Clarity of major themes	Major themes are discussed as the barriers mentioned by all the actor groups of the innovation system
32. Clarity of minor themes	Minor themes are presented as the actor group specific barriers

Table 17 Output of codes and related category

Innovation Function	Code	Frequency
Innovation Function	Car sharing next to car sales	7
	Cars not technically 'share ready'	3
	Creation of new business models	25
	Demand too low	1
	Demand when parking pressure is high	1
	Ease of use	6
	Lack of accessibility	20
	Lack of insight in user behaviour	4
	Lack of interoperability of services	17
	Lack of scalability	11
Entrepreneurial activities	Lack of transferability of projects	3
	No clear criteria for proven concepts	3
	No strategy OEM's for car sharing	4
	Operations car sharing labour-intensive	4
	Risk allocation in projects	7
	Size of providers	3
	Small projects limit integration for MaaS	1
	Transition from retailer to mobility provider	6
	Unfamiliarity among local governments	6
	Attractiveness of car ownership	14
Guidance of the search	Autonomous driving has priority	4
	Car sharing only for marketing purpose	3
	Electric driving has priority	6
	Focus Goal unrealistic	3
	Lack of accessibility	20
	Lack of cooperation among providers	7
	Lack of integrating mobility in spatial development	10
	Lock-in mobility solutions	5
	No strategy OEM's for car sharing	4
	Operations car sharing labour-intensive	4
Knowledge development	Private use unattractive	3
	Uncertainty about responsibility for mobility guarantee	1
	Lack of insight in user behaviour	4
	Lack of knowledge about integrating mobility in spatial development	9
	No clear criteria for proven concepts	3
	Privacy issues using car sharing service	3
	Uncertainty about demand	8
	Uncertainty about effects car sharing	13
	Uncertainty about effects when parking is not regulated	2
	Visibility of effects	4
Knowledge diffusion	Absence of identity checks	6
	Bounded rationality users	6
	Knowledge exchange between provider and local government	5
	Knowledge exchange between users	1
	Lack of knowledge about integrating mobility in spatial development	9
	Privacy issues using car sharing service	3
	Subsidy in exchange of data	2
	Uncertainty about effects car sharing	13
	Unfamiliarity among local governments	6
	Unfamiliarity among users	20

	Lack of regulation to ensure effects	3
	Lack of support from local government	8
Legitimacy	Lack of support from national government	6
	No critical mass	6
	Political orientation	5
	Visibility of effects	4
	Absence of insurance products	11
	Attractiveness of car ownership	14
	Bounded rationality users	6
	Competition ridesharing	5
	Cooperation with local governments	3
	Demand too low	1
	Differences in local policies	3
	Environmentally conscious people	2
	Generation of users	5
	High parking pressure required	3
	Lack of cooperation among providers	7
	Lease companies prohibit sharing	3
Market Formation	National fiscal policy	14
	Natural car ownership reduction through good PT	8
	Natural car ownership reduction through lack of public space	10
	Negative reciprocity among users	3
	No critical mass	6
	No push for behavioural change	16
	Political orientation	5
	Popularity of private lease	5
	Private use unattractive	3
	Subsidy in exchange of data	2
	Tariffs for parking license	14
	Terms of employment limiting mobility choice	9
	Uncertainty about responsibility for mobility guarantee	1
	Urgency for change low	11
	Difficult cooperation car man. providers	6
	Lack of network investments	1
Resources Mobilization	New distribution channels	2
	Selling products time consuming	1
	Subsidy in exchange of data	2
	Undercapacity at local governments	2

Table 18 Matrix of code frequencies mentioned by interviewees

Stakeholders in sample	BMW Nederland	CROW	Ernst & Young	Gemeente Den Haag	Gemeente Rotterdam	Gemeente Utrecht	Louwman Dealer Groep	Ministerie van I&M	Natuur & Milieu	Rijkswaterstaat	WeGo
Absence of identity checks		1					2		1	1	1
Absence of insurance products	1	1	2	1		1	1	1	1	1	1
Attractiveness of car ownership		6	4	2	4	2			4	2	4
Autonomous driving has priority	1						2			1	
Bounded rationality users	4	4			2						2
Car sharing next to car sales	1		1		1	1	3				
Car sharing only for marketing purpose					1		1			1	
Cars not technically 'share ready'						1	1			1	
Competition ridesharing		1	1		1		1		1		
Cooperation with local governments	1					2					
Creation of new business models	5	2	2		1		4	1	2	3	5
Demand too low											2
Demand when parking pressure is high				1							
Differences in local policies						1			1		1
Difficult cooperation car man. providers			1				2				3
Ease of use	1						4		1		
Electric driving has priority				2					3	1	
Environmentally conscious people				1		1					
Focus Goal		1				1					1
Generation of users	2	1			1		1				
High parking pressure required				1		2					
Knowledge exchange between provider and local government		2				1				1	1
Knowledge exchange between users									1		
Lack of accessibility	4	4	2	8	4	2	2	2	4	8	
Lack of cooperation among providers					2	6		2	2	2	
Lack of insight in user behaviour	2					2			2		2
Lack of integrating mobility in spatial development		1		1	3	1		2	1	1	
Lack of interoperability of services		5		1	4	3		2			2
Lack of knowledge about integrating mobility in spatial development	4	2		4	4					4	
Lack of network investments		1									
Lack of regulation to ensure effects		1		1	1						
Lack of scalability	1	1	1	1				2	2		3
Lack of support from local government	1	1				2			2	2	
Lack of support from national government	2	1	1			1			1		
Lack of transferability of projects	1	1		1							
Lease companies prohibit sharing	1				1				1		
Lock-in mobility solutions		2			1	1		1			

Stakeholders in sample	BMW Nederland	CROW	Ernst & Young	Gemeente Den Haag	Gemeente Rotterdam	Gemeente Utrecht	Louwman Dealer Groep	Ministerie van I&M	Natuur & Milieu	Rijkswaterstaat	WeGo
National fiscal policy		2	2		1		1	2	1	2	3
Natural car ownership reduction through good PT			2	1			1	2	1	1	
Natural car ownership reduction through lack of public space			2	1	2	1	2		1	1	
Negative reciprocity among users	1		1								1
New distribution channels											2
No clear criteria for proven concepts		2			2		2				
No critical mass		2					2	2	2		4
No push for behavioural change	1	1	3	1	1	1	2	1	2	2	1
No strategy OEM's for car sharing	2						6				
Operations car sharing labour-intensive			4				4				
Political orientation		2			4	4					
Popularity of private lease	1						3				1
Privacy issues using car sharing service			6								
Private use unattractive			2								4
Risk allocation in projects	2		2		1		1				1
Selling products time consuming											1
Size of providers			1							1	1
Small projects limit integration for MaaS				1							
Subsidy in exchange of data				3				3			
Tariffs for parking license			1	1	3	2	1	1	1	4	
Terms of employment limiting mobility choice	1		4				1		1	1	1
Transition from retailer to mobility provider	1		1				1	2		1	
Uncertainty about demand		1		1	1		2			2	1
Uncertainty about effects car sharing	2	8	4	2	2	2			2	4	
Uncertainty about effects when parking is not regulated				1			1				
Uncertainty about responsibility for mobility guarantee				2							
Undercapacity at local governments				1		1					
Unfamiliarity among local governments						4		2	2	4	
Unfamiliarity among users	1	1		2	1	2	1	2	3	5	2
Urgency for change low					2	2	4		1	2	
Visibility of effects		2			2		2	2			

