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Master's Thesis – MSc Sustainable Development

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Emerging patterns for niche scaling-up processes in socio-technical transitions. Evidence from green shared transport in Amsterdam

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Abstract

It is widely acknowledged that human activities are primary responsible for accelerating climate change at a global scale. Within the societal sectors, transport is one of the main contributors to harmful emission in the atmosphere, and governmental bodies are struggling to provide alternative solutions to reduce the impact of transport sector on both natural and societal systems. The XXI century has witnessed the rapid growth of sharing practices in cities, which affected mobility as well. Among European cities, Amsterdam is taking a decisive step to drive a socio-technical transition by integrating sharing concepts with electric transport, one of the main alternatives to polluting vehicles. Green shared transport can contribute to mitigate both emissions and congestion issues, but the extent to which this innovation can be extended to a larger scale is not adequately addressed yet. The main question is therefore "What are the main explanatory factors of the scaling-up of the green shared transport niche in Amsterdam, in the context of societal transition?". To answer this question, an extensive literature review was first conducted in order to identify the main theories dealing with transitions processes and niche markets, identified in Multi-Level Perspective, Strategic Niche Management and internal niche dynamics. These last two in particular provided a number of conditions to be assessed during the analysis, and a scoring criteria was established to determine the importance of those factors. Second, a methodological approach was developed in order to gather qualitative data from organisations operating in the green shared mobility domain in Amsterdam. The conditions identified within the theoretical approach were addressed to appraise the potential for the niche to scale-up. The main policy approaches aiming at promoting sustainable transport at local level were considered as well. After the coding process, the results were evaluated on the basis of stakeholders' responses and according to the scoring criteria. Results show that in the specific Amsterdam case the main explanatory factors of the potential scaling-up process are infrastructure availability, technological development and policy regulations for companies at local level. Despite the implementation of charging points for e-vehicles and of low-emission zones to promote sustainable mobility, a clear policy approach regulating the activity of companies providing green shared concepts is still lacking. The entire research approach revealed also that focusing on the internal niche development to assess scaling-up processes undermines the influence of major macro-level factors which could enhance or limit the niche development.

Key words: Niche, Scaling-up Process, Multi-Level Perspective, Strategic Niche Management, Socio-technical transition, Green Shared Transport

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1. Introduction

Human population growth, as well as the development of new technologies and the exploitation of resources in the last century, has been incomparable to any other era (Steffen et al., 2011). It has largely been proven that human activity is responsible for increased concentration of greenhouse gases in the atmosphere, by altering several natural processes and causing global warming (Hughes et al., 2003). The Intergovernmental Panel on Climate Change (IPCC), drawing on the published results of leading modelling groups around the world, forecasts an increase in world average temperature by 2100 within the range 1·4–5·8ºC. The increase will be greater at higher latitudes and over land. For example, eleven of the twelve warmest years globally occurred between 1995 and 2006, and climate will continue to change for the foreseeable future.

Even the relatively small magnitude of climate change observed so far has had substantial impacts on many natural and social systems (Füssel, 2007). Global average annual rainfall will increase, although many mid-latitude and lower latitude land regions will become drier, whereas elsewhere precipitation and flooding could become more severe. Climate variability is expected to increase in a warmer world. Climatological research over the past two decades makes clear that Earth's climate will change in response to atmospheric greenhouse gas accumulation. The unusually rapid temperature rise (0·5ºC) since the mid-1970s is substantially attributable to this anthropogenic increase in greenhouse gases (McMichael, Woodruff, & Hales, 2006).

Such threats require an immediate action, if we want to cope with the effects of climate change (Laukkonen et al., 2009). Shift in temperature generates new climatic conditions to which social actors (people, households, businesses, public agencies) respond through managing emerging risks or by exploiting new opportunities. These responses are usually seen as being specific to place and context; partly because of the granularity of climate change impacts over time and place, and partly because of the diverse features of social actors themselves. Actors will have different exposure to the risks and opportunities associated with climate change, as well as varying capacities to confront them (Berkhout, 2012).

To address climate change, there is a need for the implementation of measures that reduce possible risks and capitalize on the affiliated opportunities. Policy and system responses are necessary, considering the urgency of the issue. Ongoing research shows that communities are responding by adjusting economic activities, changing land use practices, introducing public health initiatives to combat heat hazards, and changing the design and implementation of infrastructure. The array of responses to climate change may be spontaneous, or the result of deliberate policy processes (Adger et al., 2011). This implies that the governance structures have direct implications for the level of flexibility in responding to future change as well as variation in local contexts. Governance is also intricately related to questions of scale and the incorporation of appropriate actors at each level (Adger et al., 2011).

Societies, organisations and individuals have adjusted their behaviour in response to past climatic changes, and many are now contemplating adaptation to altered future climatic conditions (Füssel, 2007). The argued response is made up of actions throughout society, by individuals, groups and governments. Individuals can choose how to act, buy, move and consume in a sustainable way, on a daily basis. Such a process of behavioural change concerns governments as well, in the way they implement policies regarding public and private companies. Although the political emphasis has primarily been on developing an international response to global warming through the negotiation of the United Nations Framework Convention on Climate Change and the Kyoto Protocol, countries will

not be able to meet the commitments contained in these agreements without the assistance of city governments (Betsill, 2001). An example is providing financial benefits to those companies which perform in an environmental-friendly manner, or establishing taxes for those who do not conform to regulations.
In order to reach the above-mentioned goal of coping with climate change effects, all societal sectors must undertake a transition towards sustainable patterns.

1.1. Transport sector: challenges and opportunities

Within the societal sectors, transport systems allow people and goods to travel in a relatively easy and efficient way, both for work or pleasure. It is a non-separable part of any society, as the growth of modern communities rely on efficient modes of transport, in order to satisfy the demand of fast and reliable mobility alternatives. Advances in mobility dynamics has made possible changes in the way of living and the way in which societies are organized and therefore have a great influence in the development of civilizations (Lindholm & Behrends, 2012).
As cities are dominant centres of production and consumption, most transport starts and ends in urban areas and often bypasses several metropolitan areas on its way. Urban activities are accompanied by large movements of people and goods, characterised by vehicles moving between industries, centres, retail activities as well as to and from major gateways such as ports, rail terminals, distribution centres and airports. For cities seeking to compete in the globalised economy, effective transport services are a key success factor. Transport hubs often confer benefits on the region in which they are located. Because of their direct connection to many destinations, they are usually a catalyst for agglomeration and scale economies. Hence, urban transport is an important facilitator of economic growth (Lindholm & Behrends, 2012).
Almost the entire transport sector has been targeted as unsustainable (Markard, Raven, & Truffer, 2012). In fact, it is one of the major contributor to greenhouse gas emission (Stephenson, Hopkins, & Doering, 2015). The majority of GHGs from transport sector are caused by road transport, namely CO2 emissions (EPA, 2014). In addition, road transport produces unsustainable levels of waste emissions degrading local air quality and human health and making a substantial contribution to the problem of global warming. This is exposing cities to great risk due to the uncertainty surrounding both the cost and supply of oil in the future (Moody, 2012).
Furthermore, nearly the entire energy consumption of the transport sector consists of fossil fuels, which have been largely exploited by human population for decades. The EU-25 is 98 % dependent on them. Fossil fuel combustion produces carbon dioxide (CO_2) and other emissions resulting from human activity, many of them harmful to human health. The transport share in the EU-25 countries energy consumption, road transport was clearly the largest energy consumer, consuming almost 83 % of the total in 2004, or 290 million tonnes of oil equivalent. This translates as over a quarter of the total final energy consumption in the EU (http://ec.europa.eu/, 2015).
Considering their high rate of depletion, alternative and sustainable sources are required (Betsill, 2001). The multiple ways in which transport and, the car in particular, undermine social, environmental and economic systems suggests that radical change in necessary for a sustainable transport system to become a reality. In fact, dominant transport modes, such as the petrol-based car, represent a social status of well-being, for both economic and social reasons. To have a radical change, meaning a different perception of mobility rather than ownership, providing at the same time

environmental benefits, new economic, policy and technological patterns are needed, such as the development of low-carbon sources for mobility.
The transport sector could become the leader in reducing dependence on oil and carbon, and in reducing GHGs emissions, if ambitious plans to provide low-carbon or zero-impact sources of supply come to fruition (Andersen, Mathews, & Rask, 2009). Due to the above-mentioned challenges, namely CO2 emissions from transport, production of waste, oil depletion and exploitation of fossil fuels, humanity needs to move towards a new paradigm for transportation. Solutions have already been implemented at local level, such as the promotion of public transport and the use of electric vehicles later on to reduce the emissions. An increase in the use of public transport, combined with a decrease in the use of private cars, can reduce traffic congestion and, more importantly, carbon dioxide (CO_2) emissions, as public transport generally causes lower CO_2 emissions per passenger kilometre than private cars. Public transport fares are subsidised in most places, which can be justified by economies of scale and by the fact that public transport can reduce total road transport externalities (Santos, Behrendt, & Teytelboym, 2010).
Approaches to increase sustainable transport use must be part of an integrated policy. Integrated policy refers to integration across different modes of transport, different government objectives (such as the economy, health and the environment), considering the needs of different social groups, and coordinating action between the relevant government institutions (Bratzel, 1999). There is evidence that a lack of coordination can jeopardise the achievement of policy objectives (Santos et al., 2010). Absence or lack of integrated transport policies implies the risk of increasing the net environmental and social threats deriving from unsustainable modes of transport. Integrated transport strategies solutions relate to land use policies aiming to reduce the need to travel. These initiatives are mainly 'forward' policies which create new centres or regenerate brown-field sites, changing the urban fabric and limiting the sprawl of dwellings, workplaces etc. On the other hand, there are transport policies aiming at improving accessibility with a wider range of transport alternatives. These are mainly known as 'backward' policies taking the existing urban fabric as a datum, and changing the transport system in order to improve accessibility by alternative transport modes - public transport, walking & cycling, flexible transport services, car sharing etc. - and stimulating the revitalisation of high-density and mixed-use neighbourhoods within the city (ECCR, 2003). Especially in the last years, innovative approaches emerged in the field of transport.

1.2. Green shared transport alternatives

One of the main above-mentioned innovations in the transport field are 'smart and green transport' initiatives, defined as solutions aiming at a transport system that is resource-efficient, climate- and environmentally friendly, safe for the benefit of all citizens, the economy and society (ECCR, 2003). A solution to this wanton environmental pollution is greening the transport sector, meaning any practice which include vehicles or means that do not have any negative impact on the environment in terms of emissions and congestion (Steg & Gifford, 2005). This means, for example, providing public and private vehicles with electric or hybrid engines. These type of investments require a market which can satisfy the demand for alternative sources of power, and a government structure which facilitates the shifting to the new paradigm by providing infrastructure – e.g. charging points - and suitable policies.
Green transport has ranging benefits. Shifting to green mobility would help rid the atmosphere of toxic gases, since these modes of transportation have few emissions (Stephenson et al., 2015). This

will lead to minimizing social-economic disparities and building up a sustainable economy. In addition, the emissions produced by green vehicles are not harmful to human health (Redman, Friman, Gärling, & Hartig, 2013).

During the last years the whole transport sector has experienced a further change, which is linked to a broader phenomenon, namely the sharing economy. Sharing economy practices have become increasingly popular in recent years. From swapping systems to network transport to private kitchens, sharing with strangers appears to be the new urban trend, as part of a new concept of ownership (Ranchordas, 2015). The sharing economy presupposes two elements: the existence of physical shareable goods that systematically have excess capacity, and a sharing attitude or motivation. The idea behind the sharing economy is that consumers share goods when transaction costs related to the coordination of economic activities within specific communities are low.

Sharing practices have become a widespread phenomenon with the development of information and communication social technology that easily connects strangers (Ranchordas, 2015). Past literature shows that people are turned away from ethical consumption because of economical and institutional reasons (Bray, Johns, & Kilburn, 2011) (Wang, Lo, & Fang, 2008), yet with the development of new ways of consumption through the sharing economy, such as collaborative consumption, these issues are addressed and potentially overcome (Oakleaf, 2009). A growing concern about climate change and a yearning for social embeddedness by localness and communal consumption (Belk, 2010); (Perren & Grauerholz, 2015) have made the “collaborative consumption”/”sharing economy” (defined as “The peer-to-peer-based activity of obtaining, giving, or sharing the access to goods and services, coordinated through community-based online services”) an appealing alternative for consumers.

Such practices have affected the transport sector as well, in the sense that companies embed the concept of sharing economy in their business model. Instead of engaging in the process of production and marketing to sell new vehicles, they started to simply provide short-term transport options. The most famous and maybe successful example is given by Uber, which in the last years created a new trend for companies which provide rental (electric) car services, and it has been copied by other companies. And the trend does not just concern cars, several companies have been founded recently which provide services of electric bike and scooter sharing. Even though it has often been regarded as a niche solution, this practice has gained ground in recent years, to the extent that it is able to contribute actively towards more sustainable patterns of urban development. Car traffic and the pressure on public space caused by private vehicles must be properly managed, and green transport by itself is not able to address these challenges (Huwer, 2004).

The integration of electric transport into sharing strategies gives the opportunity to offer people the whole range of mobility, by reducing at the same time vehicle ownership. However, awareness of green shared transport alternatives is still low compared to the traditional model of vehicle ownership. Supportive policies in this direction are known as soft policies, which are non-tangible aiming to bring about behavioural change by informing actors about the consequences of their transport choices, and potentially persuading them to change their behaviour. These measures include car sharing and carpooling, eco-driving, as well as general information and advertising campaigns (Santos et al., 2010).

A key role is played by these supporting policies, especially at a local level, which aim at promoting this new practice. Several cities, such as Helsinki, Oslo, Copenhagen, Amsterdam, Berlin etc. are acting in favour of this new model of transport, by allowing people to purchase mobility in real time, straight from smartphones. The hope is to furnish riders with an array of options so cheap, flexible and well-coordinated that it becomes competitive with private car ownership not merely on cost, but on convenience and ease of use. Example might be loans and funds for green vehicles, further

taxation on private vehicles owned, increasing the number of parking lots for shared transport means, or establish low-emission zones in the city centre, in order to ban polluting vehicles. Attempts to reach this goal are provided by cities like Oslo (which aims to be car free in the city centre by 2019) and Stockholm, which is following the same pattern. Initiatives like the ones just mentioned are an example of attempting to scaling-up an innovation (Kern & Howlett, 2009).

1.3. Addressing scaling-up processes

Scaling-up is the process of reaching larger numbers of a target audience in a broader geographic area by institutionalizing effective programmes (Hughes et al., 2003). In the context of the current research, scaling-up refers to the growth of the network of customers and providers of electric shared transport alternatives. The expansion of a given initiative, in order to provide benefits to a larger number of individuals and delivered at a large scale, such as promoting public transport to reduce dependency on cars, is a major policy approach adopted to face climate change threats (Amjad, Ojomo, Downs, Cronk, & Bartram, 2015). To reach this goal, government policies have a key role to play in the diffusion of alternative paths, which are needed to foster and scale-up such transformations (Kern & Howlett, 2009).

Adequate planning is an important component of the scaling-up process. Policy support, leadership, networks, and cost all relate to the feasibility of "going to scale." It is critical that all organizations and players who will be counted on to move the programme to scale must be involved from the start to best support expansion efforts (Romijn, Raven, & de Visser, 2010). For example, activities which have been designed as pilot or demonstration projects might not be considered to fulfil the requirements of translating such activities to a broad scale (Bussels, 2013). To expand the service provided by electric sharing concepts, it is essential that the different stakeholders involved in the process are aiming to pursue the same goal, which can be the emission reduction from road transport and the reduction of road traffic. To reach this goal, it is necessary that private companies provide a reliable and efficient service for the customers willing to adopt this new solution, and that the local government facilitates those activities, for example by providing charging infrastructure for electric vehicles.

In order to facilitate the scaling-up process, mutual development and integration of strategies to scale-up green shared transport are needed (e.g. shift in the provision on personal mobility by companies and supportive policies). This implies the involvement of stakeholders at different levels of governance, to enhance the argued scaling-up process (Avelino & Rotmans, 2009).

Sustainable shared transport systems would generally require public financial support for investment, operations and maintenance because of their strong welfare and external benefits. Yet, the size of the challenge, especially in the developing and emerging economies is too large to be addressed solely by the public sector. The private sector, in addition to being a source of finance would be able to provide specific specialized knowhow, for design, operation, and managing reasonable risk.

The process of up-scaling green shared transport alternatives is far to be completed. It has been showed how several variables, such as social, economic, institutional, environmental and regulative factors have a significant impact on the above-mentioned process. In relation to this, the urban context in which the innovation takes place is expected to play a fundamental role, as well as the policy context. Research on scaling-up processes requires to be comprehensive of both external influence of the market, the changing dynamics of climate change, and the decision-making process

of policy-makers - both public and private sector -. The goal of this research project will be to reveal which factors play a key role for the successful scaling-up process for green shared transport, which will be specified in the following section.

1.4. Research objective and questions

The central motivation for this thesis is finding explanatory factors for green shared transport to indicate a potential towards the emergence of a system innovation. This research approach is relevant for many other empirical cases in the field of sustainability transitions research, focusing on technological innovations, such as alternative drivetrains or renewable energy technologies.
A comprehensive research study on the dynamics of niche development as a societal transition is still lacking. This thesis project will provide theoretical background and empirical evidence on evaluation of transition process, as it will assess the factors expected to scale-up current socio-technical transitions. The research will be carried out by applying the regime, niche, system theory (see theoretical part for clarification) and looking at explanatory factors for scaling up. The goal of the research is the study of the socio-technical transition of green transport, in the city of Amsterdam, and to identify the main factors that explain the possible scaling-up of the niche, considering at the same time pressures and opportunities at landscape and regime levels. The following research question has been formulated.

RQ. *What are the explanatory factors of the scaling-up of the green shared transport niche in Amsterdam, in the context of societal transition?*

Sub.1.What are green shared transport initiatives?

Sub.2.What is a scaling-up process?

Sub.3.What are ways to scale up the niche development, to obtain societal transition?

Sub.4.What are learning process and expectations of actors within the green transport niche?

Sub.5.What are the main barriers and opportunities to the scaling up process?

The development of this research has several potential application for both practice and theory. It could be useful for different systems apart from transport, as an evaluation of current transition to assess the potential to scale-up the process to achieve societal transformation. The incorporation of insights from Strategic Niche Management (see theoretical approach) with Multi-Level Perspective is a major innovation of this research project. The main assumption is that the development of a niche and its related process can influence the shaping of transition patterns and the resulting paths. Several results are expected from this research project. Expanding the knowledge on transitions processes and its methods will contribute to decision-making and a more efficient allocation of resources. The theoretical framework developed in this thesis aims at a better understanding of how technological innovations and social practices interrelate and how it can be assessed early on whether emerging system innovations are producing sustainable outcomes. The main stakeholders

who will benefit from this research will be academic researchers, policy analysts and policymakers of the transport sector under study. As a result from the analysis, policy recommendations will be provided on the potential of the already mentioned transition process, and the opportunities to upscaling of the shared green transport in other cities.
The specific case study will offer empirical evidence on the main opportunities for the green emerging sector in the city of Amsterdam and the common challenges to undertake the argued transition. In particular, the niche internal processes will be explored to analyse the explanatory factors that are leading the transition phase.
This research is expected to add further knowledge on the understanding of the scaling-up process of niches. Finally, the benefits of electricity as an energetic source in transport are becoming more and more evident and it is therefore important to steer research to this direction, in order to cope with the consequences of climate change.

1.5. Research framework

Answering the research question(s) involves the following steps (Fig.1.):

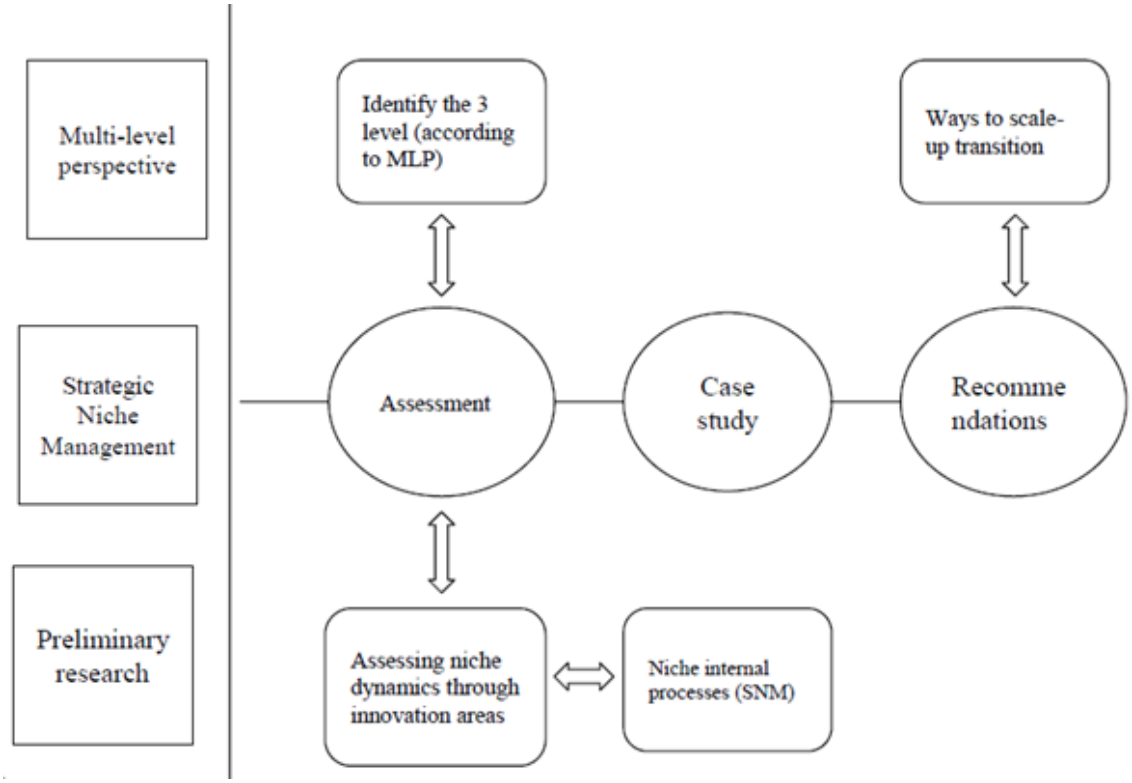

Figure 1 - Research framework

First of all, a preliminary research has been carried out to identify relevant literature on Multi-Level Perspective and Strategic Niche Management, aiming at gaining background and evidence from

previous practices about the main features that characterize transition processes to define the initial problem.
Secondly, the assessment criteria has been determined on the basis of the theoretical framework proposed. This have been carried out both through literature review and expert consultations.
At this point, once the analytical framework for scaling-up transition processes is identified, it will be used to gain empirical evidence from the case study, analysing the insights and inputs from different companies and organizations.
Finally, the last step of the research will include policy recommendations to improve the policy approach to system transitions, and the environmental benefits deriving from it. Further details are included in the method section.

1.6. Research outline

After having outlined the problem definition in the previous section and the research questions, the theoretical framework will be introduced in chapter 2. Chapter 3 will provide an in-depth description of the methodology which is behind the selection of the case study, the data collection process and the evaluation criteria for the results. Chapter 4 presents an introductory chapter on the city of Amsterdam, its main policy approach to promote sustainable mobility and an overview of the main companies providing green shared transport services. The final results will be presented in chapter 5. These results will be discussed in chapter 6, together with an in-depth analysis of the most important factors for scaling-up process and illustration of the main limitations of this study. Chapter 7 contains the derived recommendations for policy makers which operate in the context of green shared transport. The report is ended with concluding remarks, and lastly an answer to the main research question.

2. Theoretical framework

A series of theoretical approaches have been chosen to offer an attempt to understand the scaling-up process. The Multi-Level Perspective (MLP) has been selected as it offers an overview of society by presenting three analytical levels (landscape, regime and niche), which allow to identify different influences of the elements present within the three-level system and to contextualize the societal transition. For the purpose of the current research, external factors at the landscape level will be considered to understand how they might relate to the choice of green shared alternatives, according to stakeholders' perspective. Having said that, for the limited scope of the thesis it will not be possible to assess to what extent landscape factors are influencing the dynamics at niche level.
Strategic niche management (SNM) provides a conceptual framework that determines which specific factors within the niche are expected to play a key role in the scaling-up process. This research perspective has been used as it fits in the focus on assessing the main drivers of the niche expansion in the context of a societal transition.
Finally, in the sustainable mobility paradigm different areas of innovation have been identified. . The main barriers and opportunities to the scaling-up process are also expected to emerge from the combination of those factors. The theories which have been mentioned above are expected to provide insights to understand the most important concepts, in order to build the analytical framework.
The findings will be synthesized into a conceptual model explaining what explanatory factors increase the likelihood of generating a scaling-up process in a situation of transition.
In the next paragraphs each theory will be briefly described, and the analytical framework will be introduced at the end of this section as a result from the merging of the different theories.

2.1. Introducing transition processes

Contemporary environmental problems, such as climate change, loss of biodiversity, and resource depletion present formidable societal challenges. Addressing these problems requires improvements in environmental performance of societal systems which can only be realized by deep-structural changes in transport, energy, agri-food and other systems (Geels & Schot, 2007). These systemic changes are often called 'socio-technical transitions'. According to the research topic, they involve alterations in the overall configuration of transport and energy systems, which entail technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge. Transitions are therefore complex and long-term processes comprising multiple actors (Geels & Schot, 2007).
The term 'societal transformation' is gradually becoming institutionalized in the vocabulary of the scientific and policy communities, and may refer to the redesign of modern societies as a whole (Feola, 2015). The concept of transition, necessary to achieve transformation, refers to alterations of society's systemic characteristics and encompasses social, cultural, technological, political, economic and legal change (Driessen et al., 2013). Transitions are interesting from the viewpoint of sustainability because they offer the prospect of positive environmental benefit, alongside with wider social benefits through the development of systems that are inherently more environmentally benign.

A transition is defined as a gradual process of societal change in which society or an important subsystem of society structurally changes. Some scholars have conceptualized it as a consequence of societal collapse, and therefore considered a negative outcome (Butzer, 2012), while others see the capacity to actively transform as an essential property of long-lasting functioning systems (Folke, Carpenter, Walker, Scheffer, & Chapin, 2010), and consequently view transition as an effective means of promoting ecological sustainability and social prosperity.
As illustrated by Feola (2015), transformation has significant overlaps with other concepts, such as transition. While some authors distinguish the concept of transformation from transition, for others (de Haan, 2010) the former is a building block of the second. The underlying assumption is that a transition phase is a necessary condition to achieve a societal transformation. To make this more concrete, a refinement was given by the Multi-Level Perspective, coming from innovation studies.

2.1.1. Multi-Level Perspective (MLP)

Among the scholars that adopted the approach of transformation being part of a transition process, De Haan and Rotmans (2011) interpret societal transition as the process through which a different constellation becomes the dominant one, shifting the functioning of the whole societal system. Constellations are seen as societal sub-systems, which help to meet societal needs. The Multi-Level Perspective (MLP) can be divided into three levels, the socio-technical regime, the socio-technical landscape and the niche (Geels & Schot, 2007). Originally the Multi-Level Perspective is being used in order to explain the transition from one stable regime to another stable regime but it can also be used in order to explain the transitions of system innovations (Roelse, 2012).

Regimes

The constellation that dominates the functioning of the system is denoted as regime. The functioning of the regime is the typical way societal needs are met, and is the most powerful constellation in a given societal system (Geels, 2002). This refers to dominant practices, rules and technologies (and ensuing logic of appropriateness) that pertain in a domain, giving it stability and guiding decision making. The system of “automobility” is an example of a socio-technical regime as is its local expression in the urban institutions, policies, attitudes and ways of life which perpetuate car dominance.
Regimes change in a continuous fashion but what must be mentioned is that such changes are most of the time technological improvements on the existing socio-technological regime system. These changes can be described as system improvements by competition among firms or by innovations (Geels & Schot, 2007). These changes can have a problem oriented configuration which means that societal preferences are being used in order to compete with firms within the socio-technological regime.

Niches

Within the regime level, there are constellations with novel functioning. These relatively powerless constellations can meet quite specific societal needs. These constellations are called niches. These

"new" technologies can have the potential to change the current system by competing with existing technologies (Hans de Haan & Rotmans, 2011). The niche may be a new market or a niche created by a company (sponsoring a new technology) or government. That is the example of car-sharing companies, which promote the rental practice of electric cars as an alternative to private cars. From the government side, an example could be the implementation of specific policies (such as low-emission zones) to enhance the use of sustainable transport modes.
Niches are being developed by a network of actors that have a strategic vision on a technology or product that could be brought on the market. In the transport arena of our current system, niches are being developed in terms of renewable energy technologies like electric power, hybrid vehicles etc.

Landscape

The sphere of action of societal systems is defined as landscape, which has its own function as exogenous variable, such as the material infrastructure, political culture and coalitions, social values, worldviews, the macro economy, the natural environment etc. External factors can form pressures and create opportunities that involves change of the current regime (Hans de Haan & Rotmans, 2011). Examples of such external factors in terms of energy production is the rising oil prices where companies will create opportunities to transform their production routes in more sustainable ones. Other external factors are fluctuations in energy prices, the emergence of dominant environmental problems, liberalization and changing policies and regulations. Cities are beginning to experience landscape pressures to respond to issues such as climate change and growing resource insecurity in order to ensure their continued economic and social reproduction.
Similarly Nykvist, Kamp & Whitmarsh (2008) argue that environmental problems (notably climate change, air pollution, and resource depletion) are emerging as landscape changes that encourage actors to seek more radical mobility solutions.

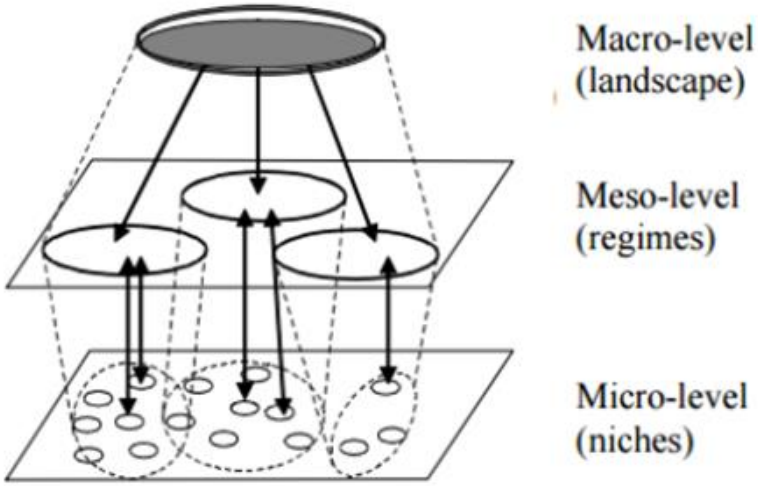

Figure 2 - MLP analytical levels (Source: de Haan & Rotmans, 2011

2.1.2. MLP dynamics

The three analytical levels of niche, regime and landscape form the theoretical basis of the MLP, a model which describes these entities as sitting, and interacting, within a nested hierarchy. Successful niches exert pressure on various aspects of regimes and thereby shape their trajectory against the background of larger landscape developments. In this sense, transitions research is interested in uncovering how socio-technical configurations that might work become configurations that do work among a plurality of transition pathways (Smith, Voß, & Grin, 2010).
In short, a transition in any socio-technical system involves dynamics between multiple actors on multiple levels, and transitions research aims to understand and capture these dynamics. It is important to bear in mind the contested nature of transitions, and to recognize the "contending interests embodied in competing socio-technical regimes" (Berkhout, 2012: p.58). This is of particular importance in the transport sector of a developed country where re-orientating a transport system towards sustainable modes is a reverse of the regressive priority given to the car at present.
Hodson & Kamp (2010) argue that effective responses to existing pressures are predicated on multiple challenges, multiple actors and multiple levels that require effective coordination to inform control of infrastructure systems. This approach suggests that successful socio-technical transition will require a capacity to effectively co-ordinate the various actors within the transport system in the purposive pursuit of a sustainable transport future.

2.1.3. MLP in the context of green shared transport

According to these premises, green shared transport can be considered part of a societal transition process, as it represents a new paradigm for which mobility needs are satisfied within the city boundaries. The reasons of such a change lie in technological innovation, changes in user preferences for mobility patterns (from ownership to sharing), the regulation in favour of clean and shared concepts and the infrastructures. Transition theories are appropriate to study the dynamics of green shared transport in the city of Amsterdam because it has already started to give priority to intermodal transport and alternative mobility approaches rather than private petrol-based cars during the last decades (Ogink, 2001). This was achieved by favouring clean modes with specific policies, and the development of charging infrastructures.

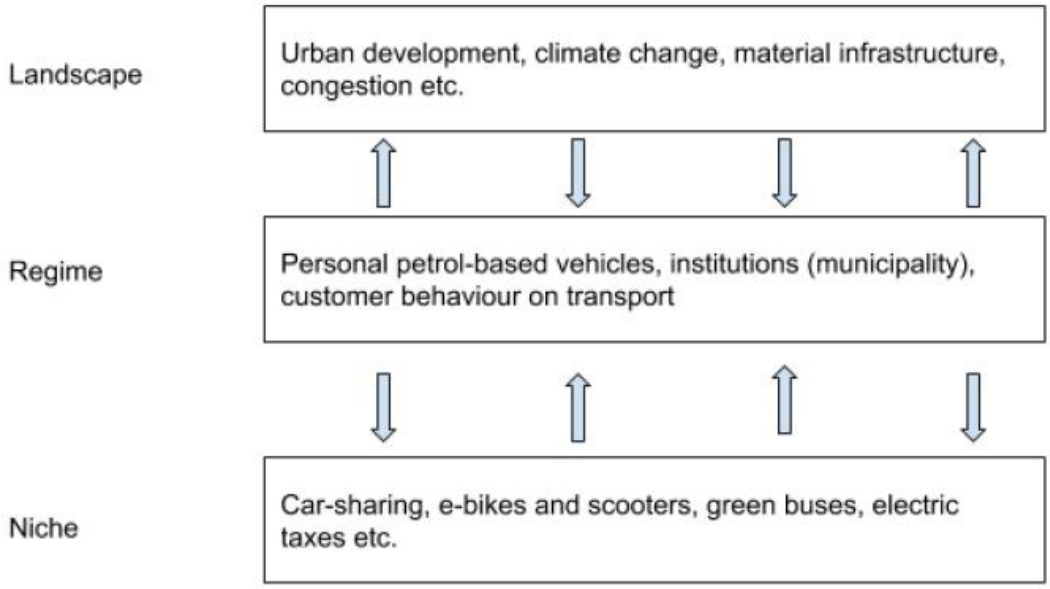

Figure 3 - MLP analytical levels for green shared transport

In the context of the current research, the three analytical levels have been conceptualized for the Amsterdam case study (Fig.3.). At the niche level, green shared transport companies are identified as those which have the potential to change the current system. Being the promotors of change, they have all the characteristics which make them suitable to produce an alternative mobility pattern, by offering a shared concept of transport with the use of electric vehicles.

Despite the potential of green shared transport to provide a valid mobility alternative and its positive impact on climate change, this niche market suffers from the pressure of the petrol-based transport system. In fact at the regime level traditional transport modes, such as private car, public institutions and transport behaviour represent the dominant system which is affecting, and in turn is affected by the niche level. The transport regime has solid basis in the city of Amsterdam, which lie in the market trends influenced by the car industry and the importance of social status in terms of vehicle ownership.

Finally, the landscape level is characterized by the presence of current threats such as climate change, material infrastructure and congestion. They are expected to play a role in conditioning the expansion of the green shared niche, as external factors are influencing the dynamics of the regime and niche level.

2.2. The Strategic Niche Management framework: scaling-up the intervention

While dealing with sustainable transition, one needs to consider how such processes can be enhanced or not. Transition theories and MLP has offered a complete overview of the possible conditions for change for the scaling-up and the resulting patterns, but at this stage is still uncertain how to promote such a process.
The theoretical background of Strategic Niche Management consists of an attempt to import insights from constructivist science and technology studies into evolutionary economics, as developed by Nelson and Winter (1982) and Dosi (1982). From this basis, the early SNM work proposed the idea that the exposure of new sustainable technologies to market through a process of niche development can led to the replacement of dominant polluting technologies. This replacement would take the form of the development of a new socio-technical regime, by co-developing different but interconnected sectors (Raven, 2007).
The SNM theory assumes that "sustainable innovation journeys can be facilitated by modulating technological niches" (Kemp, Schot, & Hoogma, 1998) (Schot & Geels, 2008). Kemp, Schot & Hoogma (1998) argue that sustainable development requires interrelated social and technical change. In this respect, they build on the work of sociologists of technology who argue that technological and social change are interrelated. According to the above-mentioned considerations, three processes were distinguished for the successful development of a technological niche.

2.2.1. Internal niche processes

The three most important internal processes are first the voicing and shaping of expectations and the power of these expectations in turning promises about the innovation into requirements that contribute to the embedding of the innovation, second the importance of creating networks involving different kinds of actors in the niche, and lastly the importance of learning processes in niches. In the following sections these processes will be described.

Process 1: Actors expectations

The voicing of expectations is one of the three interrelated internal niche processes that determine the fate of the niche. Expectations of a certain new technology provides legitimacy especially for investing in a new technology. Actors' expectation would contribute to niche building, if they were made more specific and with higher quality.
They generally have a dual function: they are both resource and actant. When dealing with a new technology, its potential advantages and problem-solving characteristic are not yet fully known (R.Mourik & Raven, 2006). Actors involved in the development therefore need to position this technology and do so by means of making promises and voicing expectations about the innovation and its role in the wider system (Kemp et al., 1998). Expectations are thus a means to facilitate the construction of a shared research agenda, to guide search processes, to increase the quality of

design process through enhancing the specificity and finally to attract resources such as financial and managerial resources, actors, knowledge and expertise.
Expectations of actors can have different visions on technology and its potential. It is clear that actors are important and have the power to affect the innovation process. For example, when companies decide to invest a new technology because it's promising or that users decide to purchase new technologies because they are expecting that it becomes the standard.
Experimentations can create different visions on the technology when it is still in its development phase. Experimentations can lead to a more robust experimentation because, for example the actors share the same expectations which influence the innovations process in a positive way. Also the quality of the expectations from actors can rise because experiments are being more supportive towards the expectations. Expectations can also become more specific, as it becomes clear which steps must be taken in developing the technology that meets the expectations. It must be noted that changes in the expectations of actors are for most cases caused by external factors rather than changes by actors (R.Mourik & Raven, 2006).
Actors that share the same expectations and visions are expected to result in a better cooperation or in companies willing to invest in the new technology. Also time plays a crucial role in niche development because actors can have different visions on different time-frames.
In other words, expectations can be strongly influenced when results of experimentations becomes available (Nykvist & Whitmarsh, 2008). The shaping of robust expectations takes place simultaneously with the creation of a network, since the expectation is also a script positioning actors within a network and defining their roles now and in the future. As such, expectations create and structure interaction between actors in niche, regime and landscape (R.Mourik & Raven, 2006).

Process 2: Network formation

The second process is the building of social networks, which are likely to enhance niche mutual development if the networks are broad and deep, in terms of stakeholders involved. They are important because they influence the development of the new technology, carry expectations and demands of users are being formed.
Network formation is an important element within the SNM framework. A niche is formed by social networks which includes producers, users, policy makers and societal groups. When experimentation takes place, which is in early stage of development, the size of social networks is limited. A few firms are willing to invest in the new technology which limit the users and producers. Also policy makers or regulators are most of the time excluded in this phase of experimentation (Raven & Verbong, 2007).
In terms of network formation, more resources for experimentations become available and the network may also experience a more stable form. The process of expansion can be done by other networks, for example specific platforms. The role of actors in the beginning phase is unclear and users, producers relationships are not established (Schot & Geels, 2008).
From literature, it can be noted that there are two important elements in the outcome of niche development. At first, the characteristics of the network is important because niche development requires investments in order to sustain or to expand the niche. In most cases, large firms are the important factor in niche development because they have the resources to maintain the niche for a long time. On the contrary, these firms can also participate in the niche development in order to slow down the development because of defensive reasons (Loorbach, 2007).

Experiments with the new technology also create social networks. Social networks are already there at a national or state level before even experiments are started. Experiments creates or maintain social networks (Markard et al., 2012). In fact, the approaching niche is accompanied by a social network. In the beginning of the emerging niche, the social network can be limited to only a few participants that are willing to invest in the new technology. When the network is expanding, more resources in terms of knowledge is becoming available and the niche may become more stable. In the emerging stage of the niche, participants' commitment is limited. The role of participants is also not yet determined in terms of relationships among participants (Raven, 2007).
There are two important factors in the outcome of niche development. At first, the composition of the network is important because actors must be willing to invest in maintaining or expanding the niche even when short term profits are not present. In most cases, large companies have the resources to maintaining the niche for a long period of time. Large companies can also take part in the process of niche development in order to slow down the emerging niche because of vested interest in the incumbent technology (Nykvist & Whitmarsh, 2008). Firms that are participating in the niche can also lead to innovations that are more incremental rather than radical because these firms' activities are more structured towards the socio-technological regime. It is therefore important that participants have no strong relationships towards the socio-technological regime because they introduce more radical innovations but have no power to sustain the niche for long period of time because of the lack of resources (Markard et al., 2012).

Process 3: Learning process

Learning is the last of the three interrelated internal niche processes that determines the fate of the niche. Learning in local projects and niches is focused on the changes necessary to couple with opportunities and overcome oppositions/barriers in the environment outside of the local project and or niche with the aim to make the new innovation function properly (R.Mourik & Raven, 2006). This is carried out both by accumulating facts and data and by enabling changes in cognitive frames and assumptions. This step in particular is expected to function as a feedback between policy sectors.
Gaining learning processes of experimentations by new technologies is important. Learning process are being important to learn about technological characteristics and performances or to gain insights in the economic feasibility of the new technology. Learning process are meant to produce results from experimentations and adjust them to improve the technology or societal embedding. Actors which have all different visions and ideas have to recognize possible barriers and opportunities. Even when the interaction between actors in experimentations can be seen as high, it does not have to lead to an adjustment of the socio- technological regime of a technology (Schot & Geels, 2008).
Mourik & Raven (2006) emphasize that the process of learning by using the innovation in local projects and by generating a network aimed at learning needs to be structured to generate the maximum of learning experiences and to generate a specific form of learning: double loop or reflexive learning.
Single-loop or first-order learning is the traditional method that aims at grasping about the effectiveness of the technology to achieve pre-defined goals, and results in verification only (Schot & Geels, 2008). Kemp et al. (2006) also mention that this type of learning aims at understanding instrumental issues, such as the solution to a technical problem or the effectiveness of an incentive. The learning occurs within a given frame of thinking and set of norms and rules.

Double-loop or second-order learning is a reflexive method of learning. Kemp et al. (2006) identify two subcategories in this double-loop way of learning. First they identify conceptual, and second social learning about underlying expectations and visions, changes in societal beliefs, norms and values, responsibilities, questioning the given norms and rules and reformulating expectations, redesigning the technology and restructuring the network to enhance the potential fit of the new innovation with the implementation environment. Kemp et al. (2006) argue that this double-loop learning is reflexive to the extent that it can lead to changes in the frames of thinking of actors on both the level of the niche and on the regime level. The changes entail changes in thinking about the societal functions, norms and values in the existing regime to facilitate the implementation of the technology under analysis.

2.2.2. Integration of the two frameworks

The SNM approach is incorporated in the MLP framework because it is expected to complete the assumptions proposed by transition theory. In fact, transition theories suggest an ambitious goal-oriented approach that places emphasis on the role of the conditions driving the transition phase at different levels, while SNM develops an evolutionary approach that builds on the forces of market and its dynamics to explain transition phases (Geels, 2002). Moreover, this reflection part will help to address sub-question n. 3 of the thesis, namely "*What are ways to scale-up niche development, to obtain societal transition?*".

The Multi-Level Perspective is embedded in the SNM approach in order to analyse the potential of upcoming transitions, considering both the dynamics of the conditions which produce the change and the level of change. By analysing developments at every level - landscape developments, socio-technological regime and niche developments -, insights can be gained in assessing the factors at niche level which contribute to the niche scaling-up, and possible barriers of the implementation and development of the argued scaling-up phase.

Recent SNM work shifted the focus to interactions between the three niche internal processes (learning and articulation processes, building of social networks, articulation of expectations) and how this results in innovation journeys. Actors, embedded in networks, are willing to invest resources (money, people) in projects, if they have a shared, positive expectation of a new technology. Sharing expectation is expected to enhance the scaling-up phase, by creating a broader network of actors. This shared expectation, together with shared cognitive rules, also provides direction to the projects, as different strategies from both public and private companies are led by the same principles - e.g. reduction of emission from vehicles at urban level -. Projects, carried by local networks, provide space for local activities which have the potential to create new opportunities and trends for green shared transport. The outcomes give rise to learning processes that may be aggregated into generic lessons and rules.

The main point is that change and stability in cognitive rules and expectations depend on interactions with learning processes and network building. If outcomes of learning processes are positive (i.e. the initial expectation is validated and accepted as promising for further work) a new development cycle is initiated that enables further refinement within the shared rules.

Technical models, problem agendas and search heuristics can be made more specific, parameters can be refined, and user preferences may become more articulated (Verbong & Geels, 2007). Positive outcomes also make it easier to enrol new actors and expand the social network, resulting in more resources for new projects (Geels & Kamp; Raven, 2003). If outcomes are much below

expectation, faith in the new technology diminishes and expectations decline, followed by shrinking social networks and drying up of resources. In response to these negative outcomes, actors tend to engage in repair work and come up with new expectations that promise better results for search heuristics in other directions. If these redirected promises find their way into the agenda of the field, then non-linearity occurs and the innovation journey changes course, by favouring the scale-up of the niche.

2.3. Niche dynamic process for sustainable transport

Transition researchers have developed the MLP as an analytical frame for the empirical study of socio-technical innovations. At the micro-level, niches have been identified in historical empirical studies of transitions as the typical loci for radical innovation (Nykvist & Whitmarsh, 2008). A niche can comprise new technology, institutions, markets, lifestyles, cultural elements etc. When considering sustainable transport forms, innovative pathways include institutional, behavioural and technological components of the niche dynamic, and therefore the focus is on 'areas of innovation'. In particular, Nykvist & Whitmarsh (2008) identify three areas of innovation, which might contribute to the development of green transport (Table 1).

Concept	***Definition***
Radical vehicle technology	Increased proportion of renewable energy in the transport sector, such as electric vehicles. These alternatives may be more or less radical from the current regime, depending on the extent of new infrastructures, tech development and behavioural change
Product-to-service shift	Cultural, institutional and behavioural changes support new modes of transport utilisation to enable more efficient use of resources and energy, through a shift in the provision of mobility
Mobility management	Green way of living with lower transport congestion and resource consumption, as a result of changes in values of quality of life and institutional changes

Table 1 - Innovation areas sustainable mobility (Source: Nykvist & Whitmarsh, 2008)

Although these areas of innovation will be discussed separately, it is not assumed that any area of innovation alone might be able to reach a socio-technical transition. It is suggested that they will

contribute to the comprehension of the dynamics of the green shred transport system, which is crucial to understand the potential for local experiments to scale-up (Fig.4.).
Nevertheless, the study of the dynamics of the niche is not enough. Within the innovation areas, in order to understand the niche development and potential to scale-up, actor related processes must be included in the analysis. For this reason, the SNM theory is included to give insights on the actor-related processes, by considering the expectations, network formation and learning process of stakeholders involved. Innovation areas will relate to the technical advancements of the niche, the use of infrastructure, the behavioural and cultural change in supporting the new modes of transport.

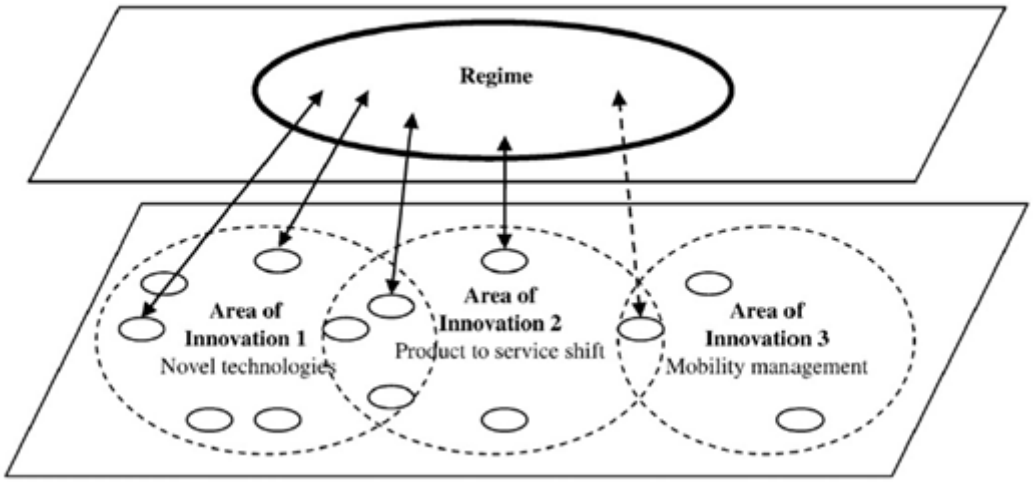

Figure 4 - Innovation areas sustainable mobility in MLP (Source: Nykvist & Whitmarsh, 2008)

2.4. Conceptual Framework

For the end of answering the research question and to fulfil the research goal, theoretical insights need to be translated into measurable units. In order to achieve an operationalization of the identified indicators into units that are measurable, a first step is to synthesize a theoretical model. Such a model gives insight into which variables are dealt with in the empirical analysis.
A conceptual framework (Fig.5.) has been developed to provide theoretical argumentation for the empirical part of the research. In fact, the data collection and the analysis of results is based on concepts and principles which have been retrieved from literature review. The analytical framework is based on the different theories described before, which can be applied to assess the main opportunities and challenge to enhance societal transitions. The core of the model will be the multi-level perspective, in order to identify the main steps to be implemented during the research.
The Multi-Level Perspective is embedded in the SNM approach in order to analyse the potential of upcoming transitions and their dynamics. Including the SNM in the framework of innovation areas mentioned earlier will allow to assess the factors that can contribute to the development of those innovation areas, in the process of niche scaling up.

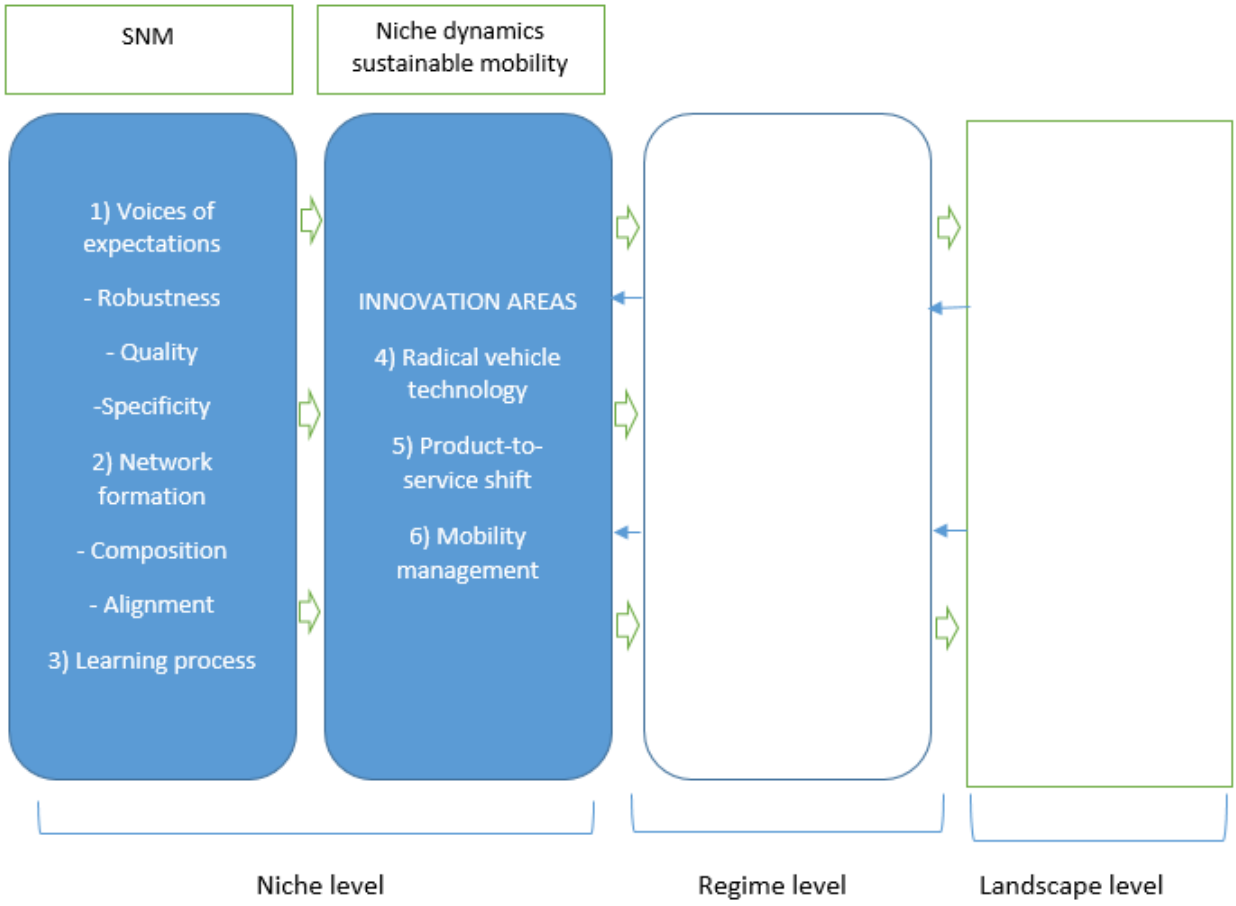

Figure 5 - Conceptual framework

Factors explaining the scaling-up process according to SNM and niche internal dynamics theory form the heart of the conceptual model, namely new technologies, product-to-service shift, mobility management, expectations, network formation and learning process.
Considering the different theories used and their application, it must be specified that the indicators and factors identified for the development of the analytical framework are not solely explaining the possible expansion or growing of the green shared transport system in the city under study. External events and landscape pressure are playing a key role in influencing this market and the relative policies. That is the reason for which external factors were included as possible influencing factors in the questionnaire section, in order to understand the stakeholders' perception on the influence of those factors in the choice of alternative mobility patterns.
To summarize, the different levels at which transition processes take place have been identified, as well as possible factors which might cause major changes in the regime level for transport dynamics. Six main factors have been identified in the analytical model from insights of SNM and internal niche dynamics, which will be operationalized in the methods section.

In the following table it is presented a list of variables and indicators for the research, based on literature review. This provides the basis for the interviews topic lists and the structure of the results section.

Variables (Conditions)	***Assessment criteria***	***Indicators***	***Measurement***	***Source***
1. Innovation areas	1.a - Radical vehicle technology	a) Technological development of infrastructure, political support	● Presence of charging points ● Accessibility to exclusive parking zones ● NL and EU agreements on light vehicles	
	2.b - Product-to-service shift	b) Cultural/behaviour change related to product service shift	● Willingness to accept new transport alternative ● Increased use of electric transport	Nykvist & Whitmarsh (2008)
	2.c - Mobility management	c) Institutional policy change, values, ICT	● Congestion charging ● Vehicle and fuel taxation ● Energy labelling of vehicles ● Use of ICT for mobility	
2. Network formation	2.a - Composition	a) Broadness	● Variety of stakeholders in the niche (public, private)	Schot & Geels, 2008
	2.b - Alignment	b) Deepness	● Regular exchange of information and resources (frequency of meetings between different actors and companies)	
3. Learning process	3.a - Technological development and infrastructure	a) Design, tech and infrastructure	● Degree of information between actors on new tech	
	3.b - Societal and	b) Safety, energy and		Schot & Geels,

	environmental impact 3.c - Policy and regulatory framework	environmental conditions awareness c) Policy and regulation (tech related)	● Awareness of energy, safety and environmental conditions ● Subsidies given by the government	2008
4. Voices of expectations	4.a - Robustness 4.b - Quality 4.c - Specificity	a) Consensus on experiment of actors involved b) Success of experiment c) Are all the steps of the experiment clear and specific?	● Shared vision among actors of future patterns of green mobility ● Positive outcome in terms of environmental and tech conformation to regulations, and customers satisfaction ● Accurate documentation of experiment (reports)	Schot & Geels, 2008

Table 2 - Analytical framework

3. Methodology

The research strategy here described mainly consists of the application of the analytical framework introduced in chapter 2 on a case study, which will provide practical insights on the scaling-up process of the green shared transport niche in the city of Amsterdam. The case study will refer to a series of stakeholders who represent different organizations and companies at the city level, both from public and private side. The area of analysis was selected because it includes a case study dealing with shared electric services for mobility at the urban level, and provides context to address the research questions. The qualitative research is overall structured in two parts.
The second part of the research consists of testing the developed framework on the selected case study of the city of Amsterdam, in order to gain evidence of the application of the conceptual framework in practice. This will allow to implement an analysis to establish which factors of the analytical framework are expected to enhance the development of the green shared transport niche in Amsterdam.
The methods employed in this research, apart from the literature review, will be interviewing and a policy document analysis of the different companies and organizations under analysis. This chapter will deal with the second part of the research, describing the methodological approach for the case study.

3.1. Desk research

The first part of the study was based on desk research, by retrieving the most important literature bodies to be used. This step was carried out in order to obtain both theoretical and empirical knowledge. The objective is to combine two or more theoretical perspectives and data sources to obtain the advantages of triangulation (Bowen A., 2009), a research strategy used to counterbalance the limits of a single strategy, thereby decreasing the risk to misinterpret the findings. In fact, by combining multiple methods and empirical materials, researchers can hope to overcome the weakness or intrinsic biases and the problems that come from single-method, single-observer, and single-theory studies. Often the purpose of triangulation in specific contexts is to obtain confirmation of findings through convergence of different perspectives. The point at which the perspectives converge is seen to represent reality (Yeasmin & Rahman.K.F, 2012).
In addition, online desk research was implemented to get an overview of the current state of the development of the green shared transport niche in the city investigated. For this reason, policy documents of the municipality concerning the mobility plan of the city, environmental targets to be reached at city level, the spread of electric mobility use in the city and private (and public) companies' strategies were identified for further analysis.
In the context of the current project, this was implemented in practice by focusing on several concepts for different parts of the analytical framework. The ongoing research was carried out with the use of search engines such as Scopus and Scholar. Shared transport, green transport policy strategies and ICT for sustainable transport were the key words identified for the internal niche dynamics for sustainable transport. Stakeholder composition, infrastructure development and social and environmental impact were the key words for the Strategic Niche Management part.

In addition, apart from the development of the analytical framework, this formed the basis of my theoretical understanding of urban transport sustainability issues and, therefore, serves as the basic foundation of this research project.

3.2. Case study research

The empirical research is required to produce in-depth information to assess the integration of indicators identified at the policy level and in policy practices, and at the same time identifying opportunities to modify the developed framework with additional indicators.
The case study is described as a research strategy in which the researcher tries to gain a profound and full insight into one or several objects or processes that are confined in time and space (Verschuren, Doorewaard, 2010). Case study research is an appropriate research strategy where a contemporary phenomenon is to be studied in its natural context, and the focus is on understanding the dynamics presented in single settings (Darke, Shanks, & Broadbent, 1998).
Single case study is considered an appropriate research strategy for the current study because the focus is on a specific service provided within the boundaries of the city of Amsterdam in a specific time frame, with focus on the dynamics of the green shared transport process at city level.
For a single case study only one case is thoroughly examined, where the emphasis lies on triangulation. This is to counterbalance the limits of a single strategy and to eliminate chance as much as possible. This is important for this research project as it deals with the use of an individual case. In this way findings can be compared and confirmed by the assessment of different perspectives in the analysis.
If the case study exemplifies a specific situation, some results can be generalized. Generalizability in qualitative research refers to the extent to which theory developed within one study may be exported to provide explanatory theory for the experiences of other individuals who are in comparable situations. This research aims at generating generalizability by providing a theoretical model which can be used for similar studies dealing with the analysis of sustainable transport systems and the process of niche dynamics.
The case study is build on insights from several organisations operating within the city of Amsterdam, as the selected stakeholders for interviews represent different domain areas of the green shared transport concept. The domain of interest can be divided into public, private, market-oriented and policy-oriented. The domains were chosen in order to gain understanding from different stakeholders operating in the green shared transport niche, starting from private companies providing the service, to public-private, and the strategy adopted by the political actors at local level. Private companies are dealing with the market request and provide a service to grow their network of customers in the city, while the municipality has to deal with market regulation. The selection criteria for the different actors will be specified in the following section.

Amsterdam was selected as case study for several reasons. First, the city has a long history of development in smart mobility systems and the promotion of innovative and sustainable transport means. Second, there are several policy approaches promoting the use of electric vehicles to contrast the diffusion of petrol-based polluting modes of transport, in line with the city target of being emission free from transport in 2025. In addition, the city has been identified as one of the

frontrunners at European level for the diffusion of sharing economy practices in several domains such as housing, food, and transport as well. Finally, it is the only city in the Netherlands with the presence of companies providing shared green means for either cars, bicycles and scooters.
For this list of reasons, the current case can be considered an exemplary case. The role of the researcher is external, as he does not live in the city of Amsterdam, so not influenced by the environment, and he is not related in any way to the organizations providing data during interviews. This prevents the risk of steering the direction of the research towards the interest or strategy of a specific company.

3.3. Data collection

The indicators presented in the theoretical chapter are going to be investigated and identified in the empirical data by the use of two methods: semi-structured interviews to stakeholders operating in the Amsterdam area and a policy analysis of city plans.

3.3.1. Semi-structured interviews

The case study was carried out by implementing interviews with key stakeholders. The interviews revolve around a semi-structured format, which has been designed to be flexible enough to be adapted to the specific subject interviewed.
Several key questions, according to the indicators identified within the framework, help to define the areas to be explored, but also allows the interviewer or interviewee to diverge in order to pursue an idea or response in more detail. The flexibility of this approach, particularly compared to structured interviews, also allows for the discovery or elaboration of information that is important but may not have previously been thought of as pertinent for the outcome of the research (Avineri et al., 2010)(Knox & Burkard, 2009). The interviews were conducted with a topic list which was followed (Appendix III.).
Since semi-structured interviews often contain open-ended questions and discussions may diverge from the interview guide, the interview was recorded and later transcribed for analysis. The main benefit of using this type of interview is to obtain reliable qualitative data. The inclusion of open-ended questions and training of interviewers to follow relevant topics that may stray from the interview guide does, however, still provide the opportunity for identifying new ways of seeing and understanding the topic at hand (Knox & Burkard, 2009). The aim of this practice is to acquire in-depth knowledge of the practices regarding green transport and to get an understanding of the main similarities and differences regarding companies' practices and municipality strategies.
In order to identify suitable questions for the interview, the analytical framework developed served as a basis to have indicators and measurement (Fig.6.). From here, it was possible to develop a coherent set of questions related to the identified indicators and their measurement (Fig.7.).

Variables (Conditions)	***Assessment criteria***	***Indicators***	***Measurement***
1. Innovation areas	1.a - Radical vehicle technology	a) Technological development of infrastructure, political support	• Presence of charging points • Accessibility to exclusive parking zones • NL and EU agreements on light vehicles

Figure 6 - Analytical framework sample condition

1.b.) *Radicale vehicle technology*

- Is there a presence of charging points for the vehicles your company offers?
  - If yes, how many charging points are in the city?
- Can your vehicle access to an exclusive parking zone?
  - If yes, how many parking zones there are in the city?
- Does the company fully conform to regulations on light vehicles?
  - To which regulation does your company conform (local, national ,international)? *

N.B. *Consider also financial incentives, such as regulatory framework - positive discriminatory measures such as limited access to certain areas of the city (low or zero emission zones), eligibility for using restricted lanes e.g., bus or high occupancy lanes***

Figure 7 - Related questions to condition of Fig. 6.

At the beginning of the research process, a major issue to deal with was the limited knowledge of transport dynamics in Amsterdam or the individuals and groups involved. Therefore, a systematic process of meeting individuals was implemented in order to gain information and data, as well as contacts for further interviews. A combination of non-probability purposive and snowball sampling was used to identify interviewees (Babbie, 2010). Purposive or judgmental sampling involves the selection of units based on the "researcher's judgement about which ones will be most useful or representative" (Babbie, 2010: 193). For this reason, the initial contacts selected were representative of specific mobility services provided in the city of Amsterdam, namely car-sharing, bike-sharing, scooter-sharing and public transport service.

Nevertheless, the research process had to deal with a series of issues, namely non-willingness to participate to interviews, lack of time of interviewees and lack of capacity to address the questionnaire. In order to face those issues, the duration of each interview was limited and the questionnaire had to be adapted to conform to the understanding of interviewees. This was done by

presenting to the respondents a shorter and representative version of the interview (Appendix III), in order for them to become familiar with it and identify possible issues. It helped them to structure the answers for the interviews and to be prepared for possible issues related to the questions, by illustrating the main topics for the interview and sample-related questions.
Seven semi-structured interviews were conducted with practitioners, with a duration of average 30 minutes (from 25 to 35 minutes). Respondents were representatives of private companies providing shared electric vehicles, public and private companies providing public transport, the local government and consultancy companies for electric mobility.
Considering the different role performed by the above-mentioned organisations, the topic list for interviews needed to be adjusted to conform to the companies' role in the field of electric mobility and transport. This means that some categories had to be excluded from the analysis in some cases (e.g. for consultancy companies the provision of charging points is not a pertinent factor). The different topic lists are attached in Appendix III.

3.3.2. Policy documents

The second method consisted of a policy document analysis of the main aspects related to the issue of the research in the city plan. In order to gain a thorough overview of the literature on the topic, a comprehensive literature search on policy plans at local level was conducted.
The main criteria for the selection of policy documents to be analysed have been the presence of local policies on clean air, mobility plans and electric mobility and subsidies for green shared companies at local level. The research was conducted on the website of the Amsterdam Gementee (in particular in the section MobiliteitsAanpak van Amsterdam), where the documents were retrieved and translated from Dutch to English. The main criteria of selection was the presence of thematic sections within the policy plan, such as "sustainable city strategies", "smart and clean transport", "changes in mobility" and "Innovations".
When documents were not available, websites of the organizations were checked in order to gather additional data and information for the scope of the research. The complete list of policy documents analysed with a brief description is included in Appendix I.

3.4. Data analysis

Data were collected and then processed in response to the problems posed in chapter 1 of this dissertation. Two fundamental goals drove the collection of the data and the subsequent data analysis. Those goals were to understand the explanatory factors identified within the literature for the scaling-up process of the green shared transport niche, and to assess the importance of those factors.
Results are based on an initial round of coding for the interview transcripts and the selected policy documents. This process resulted in a coding scheme of 4 conditions and 11 factors. The indicators of the analytical framework provided the criteria to categorize the different statements from interviews and policy documents.

Because of the amount of empirical data gathered, interviews have been coded through the software NVivo, in order to establish the importance and relevance of the indicators identified in the literature, as well as to categorize the data according to the statements of the interviews. NVivo is software designed to help organize, investigate and find insights in unstructured, qualitative data (NVivo 2017). It is useful for the purpose of this research because it allows to enter the system with a broad set of data and differentiate them into topics and categories, meaning that policy documents and interview transcripts can be analysed according to this principle. Topics and categories have been created according to the analytical framework, by identifying relevant quotes and sentences throughout the interviews text and the policy documents selected. For example, for the areas of innovation part categories related to technological development, behavioural change and ICT development will be created. The parts of the text dealing with these topics will be included in the above-mentioned categories for the analysis.
This resulted in the creation of one additional category, namely city attractiveness. Even though the topic list for interviews varied according to the organisation type, interviews followed the same structure provided by the analytical framework, which allowed to have a cleared and defined categorization of the data analysed.
For each category both sources and references were identified by the program NVivo, which respectively provided an indication of the number of interviews or documents which referred to that particular category and the amount of times the topic was cited. The results of the case study are expected to provide useful insights for cities which aim to enhance the practice of green shared transport.
After categories and relevant topics have been identified, the next step is to evaluate the data on the presence or absence of the factors under analysis, across the set of organisation being assessed. The information available about these factors needs to be carefully compared and benchmarked across the set of cases. This involves qualitatively defining scoring criteria - benchmarks - and then using the qualitative data available for each factor to rate a particular factor against the scoring criteria. The scores are usually one or zero, which mean respectively presence and absence; however there is room for more fine-grained scales with values like 0, 1 or 2 (Baptist & Befani, 2015). This produces a dataset which looks like the example in Table 3.
Considering the overall scope this research project is based upon, the results section is expected to provide an accurate answer to the research question:

"What are the explanatory factors of the scaling-up of the green shared transport niche in Amsterdam, in the context of societal transition?"

In fact, this section provides an operationalisation and a scoring attempt of the factors identified in the literature which are said to enhance the scaling-up process of the niche. Operationalisation of the factors and their measurement is a key step in research, as it is defined as the process of linking a conceptual definition to a specific set of measurement techniques or procedures (Sabina & Khan, 2012). The specific procedures are the constructs operational definition. This process is critical because it is the bridge between the abstract theoretical domain and our observable reality. This section provides an attempt to understand how the identified factors of green shared transport can be translated into observable facts and dimension in the argued scaling-up phase. The use of a precise level of measurement (which criteria is specified in the methods section) will improve the reliability of the research.

Condition	***Factor A***	***Factor B***	***Factor C***	***Outcome***
Innovation areas	*Radical vehicle technology (Presence of infrastructure)*	*Product-to-service shift (Perceived cultural/behavioural change)*	*Mobility management (Institutional change and ICT support)*	Strong capability to enhance innovation
	0 = no information / weak support	0 = no information / weak support	0 = no information / weak support	
	1 = some sources / evidence to support (up to three sources)	1 = some sources / evidence to support (up to three sources)	1 = some sources / evidence to support (up to three sources)	
	2 = average sources / average evidence (four-five sources)	2 = average sources / average evidence (more than three sources)	2 = average sources / avrage evidence (more than three sources)	
	3 = many sources / strong evidence (at least six sources)	3 = many sources / strong evidence (at least six sources)	3 = many sources / strong evidence (at least six sources)	

Table 3 - Scoring criteria

This approach is suitable to answer the research question, as allocating the evaluation 0 /1/2 to each of the indicators allows to identify which of the factors has a preeminent role in the process of niche scaling-up.
This method allows evaluators to identify combinations of factors that are critical to a given outcome, in a given context. This allows for a more nuanced understanding of how different factors can lead to success, and the influence context can have on success. The numerical codes will be used to identify specific piece of data which correspond to different themes.
The findings, to a certain extent, aim to evaluate the current state of the city in the context of green shared transport for the city under study, even though it is clear that it is not possible to include all the factors accountable for this specific innovation niche.
General criticisms have been risen against the evaluation of qualitative research in quantitative terms, by stating that this practice does not allow to consider the broadness and inclusiveness of social factors (Horsburgh, 2003). Nevertheless, the use of numerical evidence for appraisal can provide an interesting and systematic outcome in terms of evaluating the presence or absence of

information for the identified indicators. In addition, the quotes from the findings section will provide an explanation for the outcome evaluation.
What needs to be specified is that the city of Amsterdam has a series of characteristics which make it ideal for the development of this niche, namely policy support for green initiatives, attractiveness for entrepreneurs willing to invest in this market share, a flat landscape which makes it suitable for any type of transport, and an extensive and reliable charging network vehicles can actually use - which was one of the main factors which pushed companies such as Car2go to launch their programme in Amsterdam. For these reasons it must be said that it is difficult for other cities to replicate the same results with similar strategies. Nevertheless, policy recommendations will be provided to suggest to what extent the outcome is replicable and transferable. In the next chapter an overview of the policy approaches of the city of Amsterdam will be introduced, resulting from considerations of policy documents analysed during the coding.

4. Amsterdam electric city

The analysis of every case is context-dependent and requires knowledge of the general institutional setting and the regulatory framework of the location. In this section, the most important institutional aspects and regulations concerning e-mobility of the city of Amsterdam are discussed. To provide an in-depth overview of the case, first the most relevant policies concerning electric transport and environmental targets are briefly discussed. After that, a paragraph introduces the companies providing the service of green shared transport at the city level.

4.1. City targets and policies

An example of good practice for the enhancement of green mobility practices comes from Amsterdam, one of the world's leading cities in the field of electric transport (Giessen & Linden, 2015). The Dutch capital has taken strong action to promote electric shared transport as well as a ban for polluting vehicles during the last years.
According to the analysis of the policy documents, the overall target of the city is to become zero emissions by 2025. Air quality is one of the main concerns for Amsterdam. Research based on the TNO Amsterdam fleet scan (2013) has shown that local hazardous emissions are for the most part caused by company cars, lorries, taxis and distribution vehicles. Business traffic accounts for most vehicle miles travelled in the city, often in polluting diesel cars (Fig. 8.).

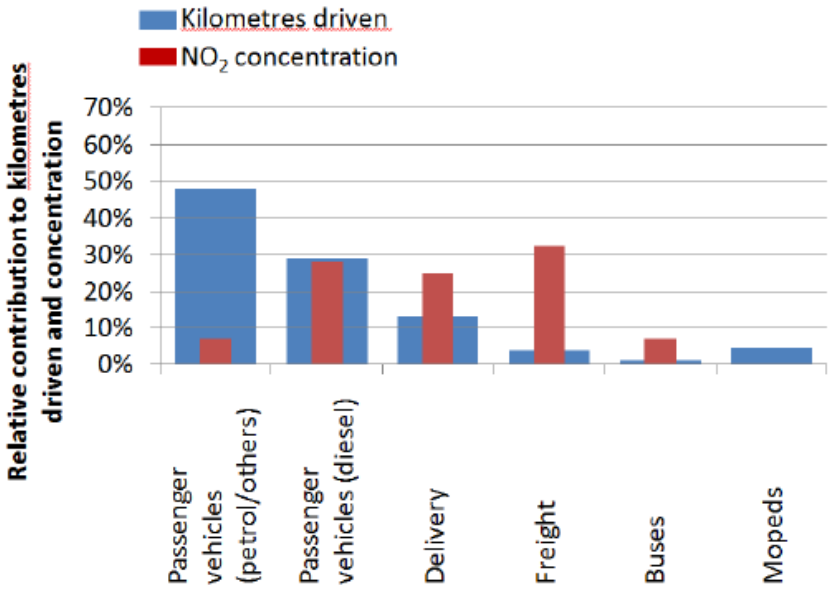

Figure 8 - Contribution to km driven and concentration. (Source: TNO; based on the 2013 Amsterdam fleet scan)

Amsterdam's air quality policy and the accompanying measures also contribute to the city's climate policies by reducing the emission of greenhouse gases from motorised traffic (Trip & Konings, 2014). In order to achieve the goal of being emission-free by 2025, the municipality has determined its own strategy to stimulate, support and regulate, granting privileges and providing many public charging points to make electric shared mobility in Amsterdam practical and enjoyable (Policy maker, Amsterdam Gemeente, 01/08/2017). In fact, the municipality developed a specific programme for electric mobility, named "Amsterdam Elektrisch" (Bott, 2014).
In particular, the three main strategies at local level are resumed in the policy document "Clean air for Amsterdam: towards an emission-free 2025" (2016):

a) Stimulating measures (e.g. subsidies)
b) Facilitating measures (e.g. a privilege policy regarding clean taxis which will be given priority at the Central Station taxi rank)
c) Regulating measures (e.g. environmental zoning)

The city grants subsidies to support businesses to switch to green alternatives. In order to encourage the use of this mode of transport, the city council is giving preference to working with companies which operate an electric fleet (Giessen & Linden, 2015). This means companies will be able to benefit from operating electric vehicles in Amsterdam. It also explains why several entrepreneurs are willing to invest in this specific market, considering the advantages deriving from the above-mentioned policies.
Finally, thanks to regulations such as environmental zones the city is able to ban the most polluting vehicles in certain areas (Giessen & Linden, 2015). It has been specified how the main policy for regulatory measures is the implementation of low-emission zones in specific areas of the city. Since 2009, Amsterdam has had an extensive environmental zone in place for LGVs, which will impose increasingly stricter regulations. The zone will include vans from 2017 and, from January 2018, taxis, coaches and mopeds as well. Environmental zones will ensure that older, more polluting vehicles no longer gain access to the city (Amsterdam Gemeente, 2016). Since 2009, Amsterdam has had an extensive environmental zone in place for LGVs. This will be expanded in several phases to include vans, taxis, coaches and mopeds.

"*For the regulation part, we are developing low emission zones, to be ultimate in 2018. This means that now certain part of the city are only accessible with clean vehicles. For facilitating, we provide quick charging points for vehicles. For the stimulation part we have subsides for specific vehicles*" (Policy maker, Amsterdam Gemeente, 01/08/2017)

"*The main goal of this policy is to prevent the most polluting vehicles to go to the city centre, so citizens in order to avoid fines are looking for alternatives. So people or will buy clean electric vehicles, or using shared concepts*." (Policy maker, Amsterdam Gemeente, 28/07/2017)

Another trend which has to be mentioned in the process of scaling-up e-mobility are changing social values, in terms of inclination towards sharing rather than ownership (Beuckens, Drijver, Koorn, 2013). Especially in cities like Amsterdam with a strong presence of intermodal transport, the need to own a car might decrease. This increases the potential of shared concepts like Car2go, and new

forms of shared transport. The pressure on public space, the changing preferences of residents and visitors and the more limited resources for the coming years ask for different and sharper choices in the mobility policy. The growth in the number of car sharing in the Netherlands was noticeable, especially in the most important cities. Amsterdam is the city with the most car sharing trend (Kpvv, http://kpvvdashboard-4.blogspot.nl/) (Fig.9.)

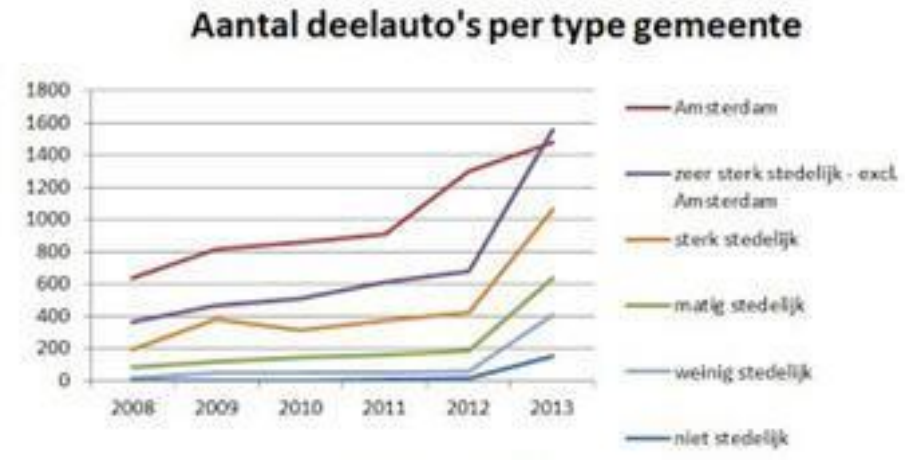

Figure 9 - Number of cars by type of municipality (Source: Kpvv, 2013)

This is why the city supports businesses which want to switch to electric shared transport by offering them purchase subsidies. Fully electric taxis, company cars or delivery vans receive 5,000 euros per vehicle, while for plug-in electric lorries and buses up to 40,000 euros per vehicle is available. At this stage, 450 companies have purchased subsidised electric vehicles worth more than 50 million euros (Giessen & Linden, 2015).
Considering the shared concepts, at this moment solely cars which perform a total amount of 40 km/day are granted a subsidy of 5,000 € (Policy maker, Amsterdam Gemeente, 01/08/2017). Being the concepts of e-bike sharing and e-scooter sharing relatively new in the city and in the market in general, it is expected that policy measures in favour of this new concepts will be implemented in the next years. These considerations need to be taken into account for the understanding of the analysis of the factors and the upscaling conditions.

4.2. Green shared transport companies

The city of Amsterdam is dealing with an increase number of companies willing to introduce their shared vehicles or light vehicles in the Dutch capital. This section provides a brief overview of the most relevant companies operating in this field (Table 4.).
Car2go is a German car rental company which provides car-sharing services in European and North American cities. Its main goal is to reduce the dependence on private vehicles by providing a shared concept. In the city of Amsterdam Car2go is operating entirely on electricity for its vehicles (https://www.car2go.com/NL/en/amsterdam/). Users are charged by the minute, with hourly and

daily rates available. The service forgoes the typical centralized rental office, and cars are user-accessed via a downloadable smartphone app wherever they are parked. There are currently 350 vehicles available in the city.

Taxi Electric is the first electric taxi service in Europe, which has been operating in the city and at Schipol airport since 2014. The company main goal is to make the taxi market more sustainable, and to provide a reliable service to its clients. Therefore it aims to boost the demand for electric transportation. There are currently 167 electric taxis available (https://www.taxielectric.nl/)

The company GVB (Gemeentelijk Vervoer Bedrijf) is the municipal public transport operator, operating metro, tram, buses and ferry services in the Amsterdam Metropolitan Area since 2012. The service they provide is fully electric apart from buses, which they are currently aiming to convert into electric buses in 2025. The main goal of this public-private company is to offer a complete coverage of the Amsterdam area, by providing public transport services at the city level (Fig. 10.). There are 200 buses in the city, and by 2020 the first 28 buses will be converted into emission-free buses (https://en.gvb.nl/nieuws/amsterdam-kiest-voor-elektrische-bussen)

Figure 10 – GVB service map in Amsterdam

Company Felyx was launched last summer, providing e-scooters for customers. They aspire to improve the city's mobility by offering mobile transport which can compete with cars in the city, by

providing an innovative system of sharing, and it will be the first scooter sharing in the Netherlands, (https://felyx.nl/about). There are 100 e-scooters available at this moment in the city.
Sart-up Urbee it is operating at city level since 2016, and in the meanwhile has collected an investment of 2.1 million euros for their electrical parts in Amsterdam. By spreading smart e-bikes throughout the city it aims at providing a shared service which differs from the traditional bike-sharing one. There are 300 Urbee bikes in the city of Amsterdam, which aim at becoming 700 in a few years
Company E-bike-to-go provides the service of e-bike sharing in the city of Amsterdam, both with a private model (for businesses) and with a public one. With their online platform employees can easily share these bikes. It aims at spreading the concept of fully-electric powered shared bikes to perform longer trips in a shorter time. This concept is already profitable, and with investments in the company Cycle BV they are seeking to expand in the Netherlands (https://www.oneplanetcrowd.com/nl/project/155828/description).
Black bikes rental is a company with different locations in Amsterdam, providing several services at the same time (rental, selling spot and repair shop as well), including a small e-bike sharing service. Their availability of two electric bikes makes the company still very limited in this market.

Company	***Start of service in Amsterdam***	***Price/min.***	***Number of vehicles available***
Car2go	2011	31 cent./min.	350
TaxiElectric	2014	1.5 €/min.	167
GVB	2007	Not applicable	200 (buses)
Felyx	2017	30 cent./min.	100
Urbee	2016	0.03 cent./min.	300-700
E-bike-to go	2015	n.a.*	n.a.*
Black bikes rental	2016	0.13 cent./min.	2

* n.a. = non-available

Table 4 - List of companies in Amsterdam providing shared e-mobility

5. Results

This chapter presents the results of the analysis. All the conditions identified in the analytical framework are assessed, which will be resumed at the end of this section in Table 5. The overview with the scoring criteria results is provided in Appendix IV.

5.1. Innovation areas

5.1.1. Radical vehicle technology

The first factor analysed for sustainable mobility innovation areas condition was radical vehicle technology. A coding criteria was established to categorize the information from the interviews into a "node", as defined by the program NVivo.
The factor of radical vehicle technology includes infrastructure availability, namely the availability of charging point infrastructure for shared concepts, and regulation conforming, which is the influence of local or national regulations for companies. The respondents provided answer to the question "Is there a presence of infrastructure/charging points for the vehicles your company offers?" (Appendix III), and the answers were coded as expectations.
The coding criteria for regulation conforming resulted from the question "Do companies have to conform to regulations at local/national/European level?", and the answers were coded as regulation conforming. For policy documents, expected future pathways were identified and reported for the analysis.
In order to receive more accurate and compatible answers for the research, the above question had to be adapted for the municipality and the consultancy interview topic list (Appendix III).

Infrastructure availability (charging points and parking)

Infrastructure availability resulted in a total of 6 sources and 10 references for the interviews and documents considered in the analysis. What was evident from the data analysis is that infrastructure availability is a key factor for the spreading of e-shared mobility. Without the presence of charging points it is not possible to enhance the use of electric cars and by consequence the shared concepts, and available space for parking allow companies to spread their range.
Companies supplying shared transport can mainly use the charging points provided by the municipality (this is valid for cars and taxis first of all). E-scooters and e-bikes do not have specific location for parking. Black bikes rental does not have a permit to leave bikes spread around the city, so customers have to return the bikes at the company's location (CEO, Black bikes rental, 06/09/2017). E-bike-to go specified how they have their own charging points apart from the public ones, which they are allowed to use, as well as Black bikes rental which allows clients to recharge bikes at the company's locations. Company Felyx adopted a different approach for their scooters, as it is reported in the quote below.

"*We believe that a consumer on a scooter does not want to worry whether he can make the trip with the battery capacity or to look for charging points. So what we did is use swapping batteries, in*

this ways customers do not have to worry if they can actually make it because we will do charging for you. We got a smart battery management system, so when the level is under 20% the app will stop showing the scooter on the availability map and we get the signal that the battery has to be swapped." (Founder, Felyx, 06/07/2017)

The city of Amsterdam has been working in the direction of providing the infrastructure, as it has been proven that the implementation of charging points enhances the use of electric concepts (Policy maker, Amsterdam Gemeente, 01/08/2017). In addition, municipality is trying to solve the problem of space availability by providing exclusive parking zones for electric vehicles at the same location of charging points.

"*So if there is a charging infrastructure point there is a spot for electric vehicles.*" (Policy maker, Amsterdam Gemeente, 01/08/2017)

Regulation conforming

Regulation conforming resulted in a total of 8 sources and 10 references for the interviews and documents considered in the analysis. The data collected suggests that regulation conforming is an important factor to enhance the scaling-up process, and the lack of a specific policy is later on in the research identified as one of the main obstacles to the niche expansion.
In fact, for private companies there was not specific referring to regulations, apart from the one established at the national level on the maximum speed, as it was specified by Felyx during the interview. Other private companies did not express any specific compliance to local regulations for the functioning of their light vehicles.

"*One (regulation) concerns the batteries which need to be recycled, as the EU establishes. We pay around 80 euros to get rid of our batteries once they are depleted. But also the maximum speed, how the scooter is built*." (Founder, Felyx, 06/07/2017).

Concerning the general strategy of the city, a large part of the legal and regulatory framework, including tax refunds, is governed by the central Dutch government. Cities in the Netherlands have to stick to a regulatory framework imposed by the national level. For example, the speed of vehicles is controlled by the national government, and so companies at local level have to conform to this, but municipalities still have power in terms of setting targets and choosing how to reach them (Policy maker, Amsterdam Gemeente, 01/08/2017). This is confirmed by the company GVB which outlined how the EU established the general norms for mobility, but local policies have to stimulate specific strategies or targets.

"*The national government in the Netherlands can give subsides to single cities in order for them to stay within the targets. But there is no EU law that plays the role of a positive stimulation, so it has to come from the local level*" (CSR manager, GVB, 11/07/2017)

A local strategy for shared concepts is still lacking though. It emerged the need to regulate this phenomenon, as an increasing number of companies and vehicles could compromise the functioning of the city.

"*I think that car sharing is a great development, I would not want to compete with it but I do think space is the main advantage. For us, the advantage is provided by the people we can transport per square meter, and we do it partially underground so we do not have to compete with cyclists,*

pedestrians, cars. Considering how busy is the city there is not better alternative to move a lot of people. If everyone would start using Car2Go the city would still come to a stand" (CSR manager, GVB, 11/07/2017)

This has also been specified by Back bikes rental, for which knowledge and expertise should be factors which determine a company's strategy. If everyone is allowed to open a shop and starting sharing vehicles, it will result in lower quality and increased space need (CEO, Black bikes rental, 06/09/2016).

Interim conclusion radical vehicle technology

The importance of radical vehicle technology for the development and expansion of the niche has been largely underlined during the interviews from the stakeholders interviewed. The presence of infrastructure was always remarked as a key step in the general development of e-mobility by GVB, EVConsult and e-bike sharing companies. It also emerged how new companies are using batteries to avoid the problem of recharging for customers, but this concept can be used just for light vehicles. The development of infrastructure has been a clear strategy to enhance the presence of shared cars or taxis in the city of Amsterdam, but no clear policies or specific regulations for e-bikes and e-scooters have been implemented. This is also due to other factors, such as space availability and increasing number of shared concepts.

5.1.2. Product-to-service shift

The second factor analysed for the innovation areas was product-to-service shift. The factor product-to-service shift includes perception of change and landscape factors influencing behavioural change. The first one includes the behavioural change related to the shift from ownership to rental, while the second one deals with factors at the landscape level influencing customers' choices.
The respondents provided answer to the question "What is the difference between the service provided by your company and the traditional one?" and "How is the perceived difference?" (Appendix III.), and the answers were coded as product shift. For landscape factors influencing behavioural change the respondents provided answer to the question "Which external factors do you think are influencing customers' choice of mobility alternatives?", and the answers were coded as "landscape factors". In order to receive more accurate and compatible answers for the research, the above question had to be adapted for the municipality and the consultancy interview topic list (see Appendix III.). At the end of this section a more specific factor is discussed, namely intermodal transport, which emerged from the interviews.

Perception of change

Perception of change resulted in a total of 4 sources and 4 references for the interviews and documents considered in the analysis. The data suggest that a change in the perception of mobility is essential to promote shared concepts, otherwise it would not be possible to start using alternative solutions rather than private vehicles.

From private companies' perspective, some of them highlighted the novelty of their service to enhance a change of perspective from customers' side. Felyx for example, is the first scooter sharing concept not just in Amsterdam, but in the Netherlands as well (Founder, Felyx, 06/07/2017). Black bikes rental explained how they are providing several services at the same time to have a competitive advantage compared to other companies.

"*We do operate anyway with a lot of knowledge for our business, we employ a lot of people here. We also hire people with difficulties in their life and offer them a new perspective. And we repair a lot of bikes as well. We do provide three services (rent, sell, repair)"* (CEO, Black bikes rental, 06/09/2017)

Landscape factors influencing behavioural change

Landscape factors resulted in a total of 5 sources and 5 references for the interviews and documents considered in the analysis. According to the interviews, external factors related to landscape are not playing a role in the change of perception necessary to achieve the scaling-up of the green shared transport niche, as more practically-focused reasons have been given to explain customers' choices. From the analysis emerged that private companies are actually looking at this factor in the specific, to understand the criteria for which clients prefer some alternatives to others.

"*We did a lot of research about that, within our audience there are a few streams. A group of people wants to use Felyx because they want to contribute to reduce the CO2 emissions from traffic. Another group of people because they consider it the best ride in town (being smart and fun), while for another one they just want to be as efficient as possible without paying too much.*" (Founder, Felyx, 06/07/2017)

GVB expressed different opinion, as it is stated that environmental reasons such as CO2 reduction are not the main factor explaining customers' choice of using electric buses. It has more to do with the reliability and accessibility of the service provided. Also E-bike-to go claims that the main criteria that is influencing their clients is the availability of a fast and healthy product.

"*We looked into this, the NS has several customers who choose to go by car rather than train sometimes. And they looked at reasons why people make this choice, and they found one of the drivers behind that is the green energy commitment. I do not think this applies to us (e.g. customers using electric buses because of climate change awareness), it is more practically focused. But we still think is important to be environmental friendly, and we want to remain the most sustainable company.*" (CSR manager, GVB, 11/07/2017)

"*We actually asked that question to our users, and we have a survey. One of the main questions is why to choose an e-bike. The main answer is that is fast, and healthy. We have around 20,000 users, and the environmental concerns is at the bottom of the reasons. This is not a reason for people to grab a bike.*" (Director, E-bike-to go, 21/07/2017)

The city provided different argumentations. Having the goal of being emission-free by 2020, the role of the municipality is to promote any other form of transport rather than private cars. Environmental reasons can be an overall goal, but there is no evidence that they will play a key role in vehicles

choice. That is what emerged from the interview with EVConsult as well, as the next sentence reports.

"*What we see is that there are vehicles which are comparable in price and performance, and it is what matters. A city can set goals and policies to promote clean air, and by consequence people will use other means. I do not believe external factors, as you called them, have a key role. No one would buy an e-vehicle or use Car2go because of air quality issues, let's be honest.*" (Director, EVConsult, 01/09/2017)

Intermodal transport

Intermodal transport has been mentioned several times during the interviews, and for this reason was included in the analysis. It has often been remarked how green shared transport is not meant to be the only solution to congestion problems, but can and should be combined with other transport modes. Intermodal transport policy in Europe is based on a co-modal approach, the efficient use of different modes on their own and in combination to achieve a high level of both mobility and of environmental protection (Shakun, 1985).
This factor can be included within the product-to-service shift in the analytical framework (innovation areas), because it relates to a behavioural change related to a service shift, in particular the feasibility and willingness to accept alternative forms of transport.

The analysis of the current factor resulted in 6 sources and 8 references. Having analysed the data, it can be said that this factor can produce a positive outcome to reduce the use of private vehicles, but it is not a key factor for the niche scaling-up. Green shared transport can play a key role in terms of reducing congestion and road traffic, but the city of Amsterdam has already an efficient public transport network and a strong bicycle tradition. What is argued from the public side is that shared concepts do have to provide an alternative to private vehicles, instead of being an alternative to public transport or cycling.

"*But if we want to have the whole city clean we need to have a mix of sharing concepts, public transport and cycling. All modes which do not involve the use of private cars*." (Policy maker, Amsterdam Gemeente, 01/08/2017)

Private companies expressed positive opinion on the potential of integrating their concepts with different transport modes, especially referring to light vehicles which are easier to ride around the city centre.

"*In my ideal situation for the future it will be that within city boundaries you have a fast and efficient transport network. Linking the cities with fast means, and once in to move easily with public and shared means. For example, light electric vehicles which are easy to drive around*." (Director, E-bike-to go, 21/07/2017)

What was also remarked, especially by GVB, is that the answers provided were context-dependent on the capacity of the city of Amsterdam to satisfy intermodal transport requirements. That would not be replicable in different cities in the Netherlands and in different countries. This also illustrates how the city is a front-runner for sustainable transport modes, and the perceived shift from ownership to rental in mobility choices could foster the integration of different transport alternatives.

"*I am 45 years old and I never had a car. And I have a kid. I would have had a car if I could not have the chance to use Car2Go, Snappcar, and of course I cycle and I use public transport. It is really pointless for me to own a car here, and I think is the future. Of course it depends where you live. I realise that I am probably a front-runner as I live in this context, but I do think is going to spread. I do see in my generation too this shift from ownership*" (CSR manager, GVB, 11/07/2017)

Interim conclusion product-to-service shift

An interim reflection on this factor leads to the conclusion that first of all the reliability (and accessibility as well) of transport solutions will produce a positive outcome if in line with the city policies. GVB deserves other considerations, being a public-private company which is operating with and for the city of Amsterdam. It does not have the need to expand, but to deal with increasing number of passengers per day. The perceived shift is of course related to behavioural change, but the extent to which it can be considered a key factor for the adoption of alternative modes of transport needs further considerations.

5.1.3. Mobility management

The last factor for the Innovation areas has been addressed only to private companies which provide e-shared services, as it is related to possible charging sanctions and ICT developments. The respondents provided answer to the question "Does your company provide a smartphone app service?" (Appendix III.), and the answers were coded as "ICT mobility management".
Mobility management resulted in a total of 6 sources and 6 references for the interviews and documents considered in the analysis. According to the respondents' opinion and the subsequent analysis, mobility management through ICT support is an important factor to achieve positive results as a company. Without the provision of an app, a company would lose an important part of the market related to the data potential to share knowledge and information.
While any company has even been fined for violations concerning environmental regulations, almost all of them provide an app service. Felyx shortly described the functioning for the e-scooters, supporting their own assumption that an optimal spreading of e-vehicles in the city is a crucial strategy for the success of shared concepts.

"*You see we are in Amsterdam right now and you have services area where you can pick up scooters, and you select one and you can make a reservation. In general takes 3 minutes to reach the closest one. You activate the scooter and the timer starts running. When you arrive you park the scooter where you want and the app charges you for the trip*." (Founder, Felyx, 06/07/2017)

Also company E-bike-to go underlined their priority in developing app, as data provide useful information for the developing of the company.

"*We have problems with it, some customers cannot lock their bikes or they cannot return it, and we try to fix those problems. That is why the development of the app is one of our n.1 priorities.*"
(Director, E-bike-to go, 21/07/2017).

The only company which stand out from this reasoning is Black bikes rental, which does not provide an app for their product. They do not consider it a key factor for success, while expertise and competence are way more important. And this was also a strategic decision to avoid to enter into the municipality domain for parking bikes all over the city (CEO, Black bikes rental, 06/09/2017).

Interim conclusion Mobility management

What can be concluded for this condition is that companies which provide reliable apps are more likely to spread their product, making it easier and faster to reach. GVB again is not really a factor for this part, as it is the public operator and it does not have to compete with other services. Concepts expressed by Black bikes rental are interesting. They choose not to provide an app and limit their extension within the city to avoid to conform to regulations, and this could be interpreted as a signal of not willingness to adapt their model to the framework imposed by the city concerning parking areas and infrastructure provision (which relates to the factor of radical vehicle technology). Anyway, it does not really provide a case as they only provide two electric bikes at this moment.

5.2. Network formation

The second condition analysed was “Network formation”, which is also the first condition of the SNM framework mentioned back in the theoretical chapter. In this section the network composition and alignment are assessed. Network composition stands for the variety of stakeholders presented in the field of shared electric transport, while alignment refers to the degree of relationship among the stakeholders in the niche.
For the composition factor the respondents provided answer to the question “What are the main stakeholders you are related with?” (Appendix III.), and the answers were coded as network composition. For the alignment factor the respondents provided answer to the question “How to address a growing group of actors/customers?”, and “How do you collaborate with other organisations from your same field and the city?”.

5.2.1. Composition

Composition resulted in a total of 9 sources and 10 references for the interviews and documents considered in the analysis. The data analysis revealed the importance of the dialogue between private companies and the municipality, as well as the positive outcome of having contacts with similar organisations.
Private companies expressed how they are mainly working with suppliers for their products and also similar companies, in order to have mutual feedback processes. Being a public-private partnership, GVB is collaborating with the city of Amsterdam to achieve the city target of being emission-free by 2025, and they have highlighted as well the importance of having contacts with companies from the same field.

"*Our main stakeholders are the city of Amsterdam, as ours it's almost a join project and they are responsible for open space infrastructure. The City Region, which is the government body responsible for tendering the contracts of our company. We of course have operational partners, like our bus suppliers, producers etc. We also speak to other public transport operators in other cities as process of knowledge sharing.* "(CSR manager, GVB, 11/07/2017)

"*First of all we have our IT stakeholder, for the Corporate side we have the company we are working with and of course the provider of the e-bikes. And the government as well. For public side, the main stakeholder is a party who can supply us with locations for our bikes. We also are in strict contact here in Amsterdam with our main competitor (Urbee) and we are in good relationships*"(Director, E-bike-to go, 21/07/2017)

Of course the different strategy and business model of the two companies require different competences and the involvement of different stakeholders.
The city embeds a broader range of actors for the e-mobility market (e.g. Allego company for quick charging points), and most of them are private. This also reflects how at local level there is a certain degree of independence in terms of policy choices.

"*We are working with Tenders, a company which provides the infrastructures for charging points. For the quick charging points we have Allego – which participated and won an announcement promoted by the city of Amsterdam -, and of course we have the parties which offer the cars like Nissan, Tesla, Mercedes etc. Alliander is the provider of energy, and the cap companies which need to make a decisive step. But also governments, so the policy at Dutch level is key. Those are the most important ones*." (Policy maker, Amsterdam Gemeente, 01/08/2017)

5.2.2. Alignment

The network alignment is discussed in this section. The overall coding revealed the presence of 10 sources and 14 references.
According to the analytical framework and the interview topic list, a further categorisation needs to be addressed. Broadness will refer to the variety of stakeholders' presence in the niche, deepness will regard the degree of collaboration between them.

Broadness

Broadness as factor resulted in 7 sources and 9 references during the analysis. The scope and the mission of the company produces different outcomes for the growing of the network. For e-bikes it has been noticed how digital marketing and social media are the main means to reach a broader audience, and it is also the practice companies are investing in to grow their network of clients.

"*We are mainly focusing on social media right now, we have already got some media coverage. Hopefully when we go live we will get the same amount of coverage, as this part has proved to work well enough for our clients (with Facebook, Twitter, Linkedin, Snapchat)*" (Founder, Felyx, 06/07/2017)

"*We have marketing programmes, and we look at digital marketing and social media coverage. Those are our main investments to grow our network.*" (CEO, Black bikes rental, 06/09/2017)

On the other hand, the public side has to deal with different problems. Considering GVB, it does not have to compete with other companies because the city of Amsterdam allowed the company to be the main public service provider. This means as well that GVB has major responsibilities in the city context, as 800.000 people rely on its service on a daily basis.

"*(Growing the network) is not our main problem because we already transport 800.000 people a day, and we are going to reach 1 million, so we are trying to deal with it. We are not the traditional company who focuses on getting new customers, we are facing increasing demand, but it does require that we think strategically ahead, that we anticipate growth. We want to know beforehand if we need to order new vehicles or if we need new infrastructures.*" (CSR manager, GVB, 11/07/2017)

For Amsterdam, collaborating with innovative businesses represents a new step in the development of the smart city: building an innovative, sustainable and thriving community (Giessen & Linden, 2015). This does not involve just mobility companies, but also educational centres, different organizational and governmental levels etc.

Deepness

The coding process for "deepness" revealed the presence of 3 sources and 4 references. What has been underlined from several interviewees is the importance of starting an early collaboration with the municipality, in order to have more defined goals and targets. This was made clear in particular from Felyx.

"*You can try to get local authorities at an early stage of the process and let them help to develop your idea (taking into account their view and perspective) and that is what we did for road safety, as it is one of the main concerns of the municipality*" (Founder, Felyx, 06/07/2017)

Policies at local level are the main incentive to make companies conform at an early stage of their process to environmental standards, and in general to align the actors to achieve the same goal. Subsides could also play a factor, but regulatory measures are expected to produce the best outcome. This was also specified by GVB during the interview

"*The most important is of course the agreement we have with them (municipality). It is not legally binding but it is a joint agreement. There is also the low-emission zone, which might become a problem for us if we do not clean up our buses, but we want to be way ahead of the low-emission zone*." (CSR manager, GVB, 11/07/2017)

Interim conclusion Network formation

Actors have shown a degree of collaboration with the municipality and also among companies from the same field of expertise. E-bike-to go specified their constant relationship with Urbee to have feedback on their activity, and the municipality as well is having relationship with other Dutch cities to have a mutual learning process. Felyx stated how is important to have discourse with the municipality at an early stage of the implementation process to develop the steps of the shared service. This could help to align the goal of company to the municipality target, providing mutual advantages.
GVB has a clear advantage compared to private companies, because it is operating under the municipality control and its role of mobility provider is guaranteed by a public agreement.

5.3. Learning process

The second condition assessed for the SNM framework is learning process. The respondents provided answer to the question “What are, according to you, the main development and lessons in this field?” and “What is needed further to scale-up the shared electric niche?” (Appendix III.), and the answers were coded as learning process. For policy documents, possible collaborations and partnership were identified and reported for the analysis.
The learning process factor includes technological development, societal and environmental impact and policy and regulatory framework. Those factors refer to the importance of each of them for the positive outcome of the learning process.

5.3.1. Technological development

Technological development resulted in 2 sources and 2 references. It is important for the positive performance of a company, but from the data it does not result to be a main concern for the growing of the green transport niche.
The actors interviewed did not focus much on this aspect of the learning process, as technology development comes from the market and the related opportunities to keep growing. It is assumed that once the service is provided the market will grow together with technology (Policy maker, Amsterdam Gemeente, 28/07/2017) The company GVB focused more on the development of infrastructure linked to technology growing, and this is a problem that the city of Amsterdam still has to face.

“*If I focus on buses, our case can demonstrate to other cities is how to develop a service in a busy setting like Amsterdam. There is a problem for infrastructures here in the city, we can give insights to other similar cities who want to move to 0 emission buses. It also shows that is complex to do that, we still have to figure out where we are going to charge our electric buses. We still need to improve*.” (CSR manager, GVB, 11/07/2017)

5.3.2. Social and environmental impact

Social and environmental impact resulted in 3 sources and 3 references for the analysed data. Also this factor was not considered a priority for the learning process, especially from private companies. Being them already providing electric vehicles or light vehicles, there is not any restriction of regulation which can limit their activity at the moment.

From the public side the goal of Amsterdam to be emission-free by 2025 was the main factors leading their argumentation and policy decisions, and as a result companies like GVB can align their economic and business targets to environmental benefits.

“*For green mobility is environmental mostly, but this translates in people being healthier which is the goal. We see that there is a lot of pollution in Amsterdam, and moving to green mobility is not*

because we have to but because we want to help the city. As a developed country we can really make the difference." (CSR manager, GVB, 11/07/2017)

5.3.3. Policy and regulatory framework

Policy and regulatory framework revealed 7 sources and 10 references. Among the three learning process factors, policy and regulatory framework was the main focus of all the stakeholders involved in the interviews. Considering the results of the coding process, this is one of the main important factors for the niche scaling-up. As it will be discussed in this section, the absence of a clear policy for shared concept in the city of Amsterdam is causing an excessive presence of shared companies, which results in increasing pressure on public space.

What emerged from the public side, is that an expansion of the e-mobility market is inevitable and the city is adapting to the trend and it is also promoting policies to accelerate this shift. Having said that, not all forms of e-transport can be considered positive, because the growth can lead to negative outcomes.

"*What we have to learn is to be critic, because not all electric forms of transport are good. We have to choose what needs to be done, as companies want to come to Amsterdam because of the attractiveness of the city, but it is getting more and more crowded*" (Policy maker, Amsterdam Gemeente, 01/08/2017)

From this perspective, it is remarked how clear policies for the city are the key step leading the transition. What is argued is that data are a crucial point for the growing of the niche, as it will help to improve the infrastructure and to manage future investments. In addition, it has been remarked the need for a policy to promote the use of sharing concept in the city. For example, GVB suggests that limiting the access to the inner city only to shared vehicles would be a strong act to enhance those practices.

"*Our strength is to make clear choices. We chose to implement infrastructures, and that is the reason why Car2Go came to the city to launch their cars in Europe. The lessons we learnt is that is fundamental to have data, with data we can see what we need. It is one of the crucial point in our policy. Dialogue with stakeholders is key, and there is the need to be clear with them. This way other parties can make investments in a more precise way.*" (Policy maker, Amsterdam Gemeente, 01/08/2017)

"*There have to be ambitious and plans. Is important to have a goal, like Amsterdam 2025. Enough has been done to stimulate the use of electric private vehicles, the last piece that has not been done yet is make the city less car friendly. You can still get a car and drive until the canals which is crazy. The inner city should be less car friendly. Or only allowing shared cars. That would be a strong policy act to encourage people to use car sharing*." (CSR manager, GVB, 11/07/2017)

Nevertheless, during the interview with EVConsult, which is working with both private parties and with the local government, it resulted evident a lack of confidence in the development of the green shared transport niche. This negative opinion has been linked to the difficulty to have a behavioural change, despite the fact that the city is already promoting sharing concepts (Airbnb, Foodora etc.), but for vehicles it is believed to be much harder.

"*I think the electric shared transport example we have to consider is Car2go at this point. They have been in the city for a long time now but they are not growing, I am curious to know why that project has not been expanded*." (Director, EVConsult, 01/09/2017)

Finally, private companies agreed that is not enough for the city to have plans for clean air and low-emission zones to have a positive outcome for all the parties involved. What is claimed is a policy on shared concept at city level to regulate the entrance of new companies on the market. The city is already facing a huge problem of lack of space, which will get worse in the next years if the current trend continues.

"*The main lesson is from the government. I do not want to blame the government, but if they decide to cooperate in a specific area it will be a lot less chaotic. We had troubles with Uber, because taxi drivers did not agree on that. And now the city is warning that there are too may bike schemes in the city, and they are right. They should have acted sooner to implement a plan to introduce shared transport, and not sit back and let the market work. Because it results in more and more companies providing the same service. They need to come up with a structured plan and support companies with regulations.*" (Director, E-bike-to go, 21/07/2017)

Interim conclusion learning process

Learning process produced interesting results because of the wide discrepancy of argumentations between the first two factors and the third one. While environmental and technological considerations are not considered to have a primary relevance for the discourse (mainly because targets have been set and technology helps to achieve those targets), the policy and regulatory framework aspect offered conflicting arguments. What can be concluded for this category is that a clear policy for shared concepts could from one side limit the growth of the market for this service, but could help to improve the performance of the companies and at the same time it could help solving the problem of public space in the city.

5.4. Voices of expectations

The last SNM condition analysed was voices of expectations. The condition includes robustness, quality and specificity. Robustness is the shared vision of actors on the future patterns of electric shared mobility, while quality refers to expectations in terms of technology, social, policy and economic perspective. Specificity concerns the presence of an accurate documentation for the e-mobility experiment.
For robustness the respondents provided answer to the question "What are your general expectations about the main developments of the green shared transport niche in Amsterdam?" (Appendix III.), and the answers were coded as expectations. For quality, the coding criteria resulted from the question "What are the expectations of the project in the field of technology/social/policy/economic development?". For specificity, the coding criteria resulted from the question "Is there an accurate documentation of the mobility experiment?".

5.4.1. Robustness

Robustness resulted in a total of 2 sources and 12 references for the interviews and documents considered in the analysis. According to the data collected, it can be said that having shared visions about future patterns of electric shared transport can contribute to have shared goals. The results reveal that the expectation of the niche growing differ for the different stakeholders involved, especially if they are part of the public or private side. Although there is a wide agreement of the development of e-mobility and the related infrastructures, visions on shared concepts are not concurrent.
Private companies proved to have positive expectations about the growing of their service, as they are conforming to the overall policy approach of the city. Company Felyx views the role of shared green transport in the context of intermodal transport, meaning that it will be integrated with other transport alternatives (Founder, Felyx, 06/07/2017) .The same view is shared by GVB, which recognised the role of green shared concepts integrated with the opportunity to use public transport (CSR manager, GVB, 11/07/2017).
The municipality expressed optimism for the development of the niche in terms of availability of infrastructure and related policies. It was recognized the growing potential of the market (Policy maker, Amsterdam Gemeente, 28/07/2017), even though it was also mentioned the strong tradition of Amsterdam as a cycling city and by consequence it was questioned if green shared concepts were operating as competitors or providers of alternative solutions. Anyway, it has been recognised the role of the municipality to promote rules and regulation to facilitate the adoption of these solutions, rather than private vehicles. It is not a case that the charging infrastructure will be expanded considerably to 4000 charging docks by 2018 (Policy document 1, Clean air for Amsterdam - Towards an emission-free 2025).
On the other hand, EVConsult did not share the same expectations about the success of the green shared concepts in the city of Amsterdam, questioning if they could provide feasible solutions for the problems the city is facing.

"Sharing a car requires more change of attitude or behaviour. For clients Airbnb is just a hotel, there is no change of attitude really. For sharing vehicles is still far. I believe sharing economy will improve together with transport, but I am not sure green shared transport will be so successful as well." (Director, EVConsult, 01/09/2017)

"I think the electric shared transport example we have to consider is Car2go at this point. They have been in the city for a long time now but they are not growing, I am curious to know why that project has not been expanded. Now I think is working in an inefficient way." (Director, EVConsult, 01/09/2017)

This last observation underlines a lack of confidence in the growing of the market, and even though the city might facilitate the adoption of such new solutions, the behavioural conditions (shift from ownership to sharing) could be a key factor in influencing the success of the niche.

Interim conclusion robustness

Based on the insights of section 2.2.1. (Internal niche processes - Actors expectations), expectations are seen as a means to facilitate the construction of a shared research agenda, to increase the quality of design process through enhancing the specificity, and finally to attract resources such as financial and managerial resources, actors, knowledge and expertise. A shared agenda has been implemented by the city of Amsterdam with the overall goal of being emission-free by 2025, and companies are clearly helping to reach this important target. In addition, the regulatory framework attracts companies to invest in a city which is operating as a facilitators. It can be stated that stakeholders share the same expectations for the development of the green shared niche.

5.4.2. Quality

Expected economic benefits

Expected economic benefits resulted in a total of 6 sources and 6 references for the interviews and documents considered in the analysis. From the data analysis it can be stated that actors share expectations about the economic potential of the niche, in particular focusing on the practical issues which could be solved by shared transport.
Private companies underlined the advantage of using a shared concept in terms of price/time (Felyx scooter is 30 cents/hour) compared to other transport modes, while GVB provided the evidence of a cost-benefit analysis which establishes the yearly social benefits for the introduction of emission-free buses (700.000 € of economic savings for the city), and this is in line with the goal of having all 0 emission buses in 2025 (CSR manager, GVB, 11/07/2017).

"We are quicker through town, we do not have any congestion problems; although we are similarly priced on minute-base (we 30 cents, Car2Go 31 cents), we are faster and cheaper. Final one is that in our view is also easier to use an electric scooter than a car. Our hope is to place at least 500 scooters in Amsterdam." (Founder, Felyx, 06/07/2017)

From the municipality perspective, the sharing concept will help to solve practical issues as well, such as all the costs related to a vehicle ownership and the competitive advantage in terms of price/time (Policy maker, Amsterdam Gemeente, 01/08/2017). This consideration has to be in line with the reliability and the feasibility of using such alternative means.
Insights provided by experts are not in line with the considerations of the general expectations, meaning that they do not see a clear financial benefit of using the green shared concepts, and that it still needs to be subsidised to provide a clear competitive advantage (Director, EVConsult, 06/09/2017).

Expected social benefits

Expected social benefits resulted in a total of 6 sources and 9 references for the interviews and documents considered in the analysis.

From the analysis resulted evident how the company GVB had the predominant discourse for social benefits (Fig.11.), which derive from benefits in terms of improved air quality, noise reduction and space saving, which is one of the main issues the city of Amsterdam is dealing with. These benefits have been included as well in the reflection provided by companies Felyx and E-bike-to go, which consider health benefits the major outcome of the shared concepts, together with the provision of a faster and more affordable solution for customers. In addition, Black bikes rental underlined how the main reasons to choose e-bikes is because of economic advantage and they offer a faster solution.

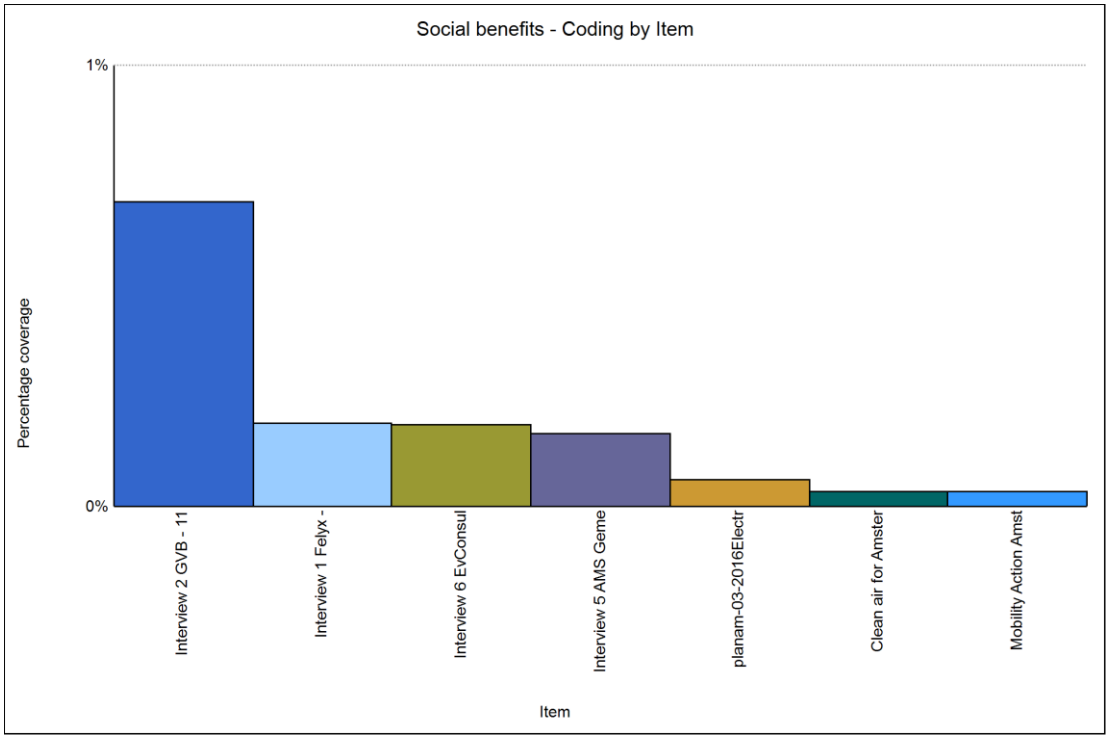

Figure 11 - Presence of social benefits in companies' discourse (NVivo source)

"This is mostly due to air quality improvement (lower health costs), noise and space reduction (one bus can carry the same amount of people as 40 cars). Due to congestion issue, the average person in Amsterdam breathes the same amount of 7 cigarettes per day. If we introduce 28 buses the capacity of charge per vehicle (kilowatt per hour) it doubles, giving a real push to the energy transition from fossil fuels to renewable energy." (CSR manager, GVB, 11/07/2017)

Same expectations are shared by the municipality and experts, which agree on how the concentration of public and private transport in a relatively small area is ideal for the introduction of electric mobility. Vehicles do not need to cover large distances, as average city journeys are frequent but relatively short, and this makes it ideal for the improvement of the traffic conditions (Trip & Konings, 2014).

Transport policies are part of a broader project, which is the smart city plan for the city of Amsterdam. It does not concern just the vehicles or light vehicles, it is mostly about the infrastructure and the energy system which aims at being powered by renewable energy in a few years.

"*0 emission transport allows to have a circular system with smart charging, which might be provided in the future entirely by solar and wind energy. It is all part of our goal to be a model of sustainable city in the future*." (Policy maker, Amsterdam Gemeente, 01/08/2017)

Apart from economic and strategic reasons, what emerges from the overall discourse at the city level is that Amsterdam is taking a leading position in setting environmental targets, by recognising the potential to achieve important results and providing the example for other cities and countries.

"*For green mobility is environmental mostly, but this translates in people being healthier which is the goal. We see that there is a lot of pollution in Amsterdam, and moving to green mobility is not because we have to but because we want to help the city. As a developed country we can really make the difference*." (CSR manager, GVB, 11/07/2017)

Expected policy benefits - subsides

Expected social benefits resulted in a total of 8 sources and 11 references for the interviews and documents considered in the analysis. This part of the analysis reveals the importance for companies to reach public subsidies for the growing of their activity, while the city established a restricted criteria to grant financial benefits.
The GVB wants the national government to fund electric buses (they are more expensive than traditional ones) as they will introduce a lot of social benefits (CSR manager, GVB, 11/07/2017). Being a public-private company which is part of the municipality, they have an advantage from this point of view.

"For the first buses we got some funds for old regulations about air quality, but it does require that we use our buses where the air quality is the worse but we do not have that financing for all our buses (200 in total), so let's hope the government will help us to make the other 172 electric as well." (CSR manager, GVB, 11/07/2017)

On the other hand, company E-bike to go described how for their private Corporate model the city provides some subsides because they are interested in making the transport more green. For the public side the municipality is not helping, and that is because they do not want to give any permits to provide bicycle charging points, which are needed (Director, E-bike-to go, 21/07/2017). The reason can be found in the increasing amount of companies are opening bike sharing systems in Amsterdam, resulting in massive amount of bikes. In addition, neither electric scooters are getting subsides, if not for the electric batteries which they are using (Founder, Felyx, 06/07/2017).

Incentive policy on cabs and e-vehicles

Stimulation policies focus on providing subsidies or advantages for certain type of vehicles, which are supposed to provide a competitive advantage for the city. One of the main advantages of clean vehicles are health benefits, for this reason the city decided to create more space for cyclists and pedestrians, and to promote clean transport. To achieve this goal, apart from promoting low-emission

zones, the municipality decided to implement so-called cab policies for vehicles. This emerged during the interview with one of the policy makers at Amsterdam Gemeente, which described the clean cab policy for taxis at Amsterdam Centraal. At the back of the station there is presence of taxi rank, and the clean cabs has privileges there. In this way they have faster access and they can get more customers. With such incentive, green caps are currently growing in Amsterdam (Policy maker, Amsterdam Gemeente, 01/08/2017).

"*I worked already 4 years on cab policies, and when the incentives started at central station we promoted the use of taxis*" (Policy maker, Amsterdam Gemeente, 01/08/2017)

In addition, from the public side, the municipality in fact granted subsides just for frequent drivers, so for those vehicles performing at least 40 km per day in Amsterdam with 5,000 euro per vehicle (Policy maker, Amsterdam Gemeente, 01/08/2017). Another target group which has been prioritised in investments are electric taxis. The company receives 5,000 euros per taxis, which were also helped with the implementation of special driving zones behind Amsterdam Centraal (Giessen & Linden, 2015).

"*Yes, subsides are for frequent drivers. So it has to be at least 40 km per day in Amsterdam. It is 5,000 euro for the car*" (Policy maker, Amsterdam Gemeente, 01/08/2017)

A similar approach, but at national level, has been used for vehicles bought or imported in the Netherlands, with the introduction of the BPM (tax on passenger cars and motorcycles). Since January 1, 2013, the Government has calculated the BPM for passenger cars based on CO2 emissions. However, there is exemption in paying BPM when a new full electric is imported into the Netherlands. Full electric cars are exempt from BPM until 2020 (http://nederlandelektrisch.nl/subsidies-financiering/bpm). Anyway, controversies were expressed regarding this policy. Diesel cars can still get BPM back, and it would be a strong policy act from the government not to guarantee refunds for polluting vehicles. This would further contribute the use of electric cars at city level.

"*There are some controversial points. Basically you have to pay if you want to import a car, but at the end you can get the BPM back. Electric vehicles are starting to get this incentive as well. It would be interesting to have policies where diesel cars do not get this advantage anymore. It is one of the incentives the government could give to contribute to the shift to e-mobility. But there is still profit to make for diesel cars*." (Policy maker, Amsterdam Gemeente, 01/08/2017)

Expected technological development

Expected technological benefits resulted in a total of 7 sources and 8 references for the interviews and documents considered in the analysis.
Technology development was one of the main factors driving the discourse of private companies, which underlined their potential to provide reliable information and expand the data network (Director, E-bike-to go, 21/07/2017). It is not a case that technological developments in the field of emission-free transport is constantly evolving, and the expansion of the data network is seen as a

key step to develop the niche. It is assumed that the more data are collected, the more knowledge is gathered.

"We invest massive amount of money to make our service possible and available. We use smartphone app to lock and unlock our bikes, this app-driven technology needs to grow. This gives you a lot of opportunities, because once you know who your customers are you can turn it into a profitable model as well. The more knowledge we gather, the more data we collect, the more interesting will be" (Director, E-bike-to go, 21/07/2017)

"*Technology evolves over time, so at a certain point the type of bike needs to be changed and it takes time. E-bikes have seen lots of developments, but some of them are not really up to the task. They are obstacles but they can turn into opportunities*" (CEO, Black bikes rental, 07/09/2017)

The importance of technology development for the future of e-mobility in general, but including green shared mobility as well, was pointed out during the interview with EVConsult. Some key factors were identified to enhance the e-vehicles scaling-up, namely incentives, knowledge sharing, infrastructure, reliable vehicles and technology development.

"There are 5 factors which determine the EV update, namely incentives, knowledge sharing, infrastructure, reliable vehicles and tech development. The importance of each factor really differs per location." (Director, EVConsult, 01/09/2017)

The city of Amsterdam has been preparing to accommodate charging facilities for the increasing numbers of electric vehicles and exploring how to fit these in the public space. New technological developments such as battery capacity and charging times are expected to have a large impact on future charging solutions, but it still has to be determined how this would work for other concepts (e-scooter and e-bikes). For now the evidence has just been provided for cars (Giessen & Linden, 2015).

Interim conclusion quality

To conclude the analysis of the quality factor, different points can be discussed. It seems that all actors generally identified an economic related process for the economic over time, but did not necessarily share the same expectations. Private and public-private companies have the predominance of the discourse for the economic benefits, while the municipality tends to underline the importance if the reliability and accessibility of those means. The applied coding scheme and measurement seem to be valid regarding the identified broad lines of discourse, which is still open to interpretation.
Social benefits are mainly related with health improvements (linked to air quality) and the reduction on space pressure which is heavily affecting the city. All in all, companies seem to be aware of the importance of the city targets and the role they can play to achieve this result. Environmental benefits are the centre of the main policy decisions in the city of Amsterdam, as it was fully discussed in the results part. It could be argued that such benefits are part of social advantages, as clean transport and energy produce positive effects in terms of people health. Environmental benefits have to be understood as the condition to achieve social benefits, in the context of shared transport choices.

According to the analysis of policy subsidy, cars are the only means benefits of subsidies from the municipality, while other categories such as bicycles and scooters do not receive any incentive for their activity. The main reason is that cars or taxis can benefit from the city investments in terms of infrastructure and charging points, which is not useful for e-bikes and e-scooters. Another equally important reason is that the city is dealing with an increasing pressure for traffic and parking, and the e-bike concept has to compete with the increasing number of bike-sharing companies and normal bikes. These two reasons would be suitable to explain the municipality choice of excluding the two categories from subsides. “Cab” policies already produced interesting results, but there are still unclear points. The discussed policies were concerning cars only, which can be due to the influence of the automotive industry and the preference of driving a car rather than use alternative modes of transport. It is nonetheless necessary to point out that if the city is willing to reduce the impact of vehicles (not just in terms of clean air, but also pressure on public space) a different approach should be taken. The increasing number of light vehicles is a problem, but it can be the alternative path to vehicles, if the infrastructure and policies are adapted to this scope. However, the city itself opened to the possibility to have a subsidy scheme for e-scooters in the next years, while for e-bikes seems still not feasible.
Finally, technology development is certainly a key factor for the scaling-up of the niche. This can be explained because of the importance of data coverage for the success of this niche, which is operating through a network of smartphones and apps to provide reliable and qualitative information. What seems to lack at this point of the analysis is a municipal approach to manage and deal with this increasing amount of data. Although, it must be said that this lack of information can be due to the interview structure which influenced the answers. What it has been noticed anyway is that in the policy documents data management was not a key factor in the e-mobility discourse.

5.4.3. Specificity

Documentation available

Documentation available resulted in a total of 4 sources and 4 references for the interviews and documents considered in the analysis. According to the data analysis, this factor is not of key importance for the niche scaling-up. The interviews provided evidence of the three companies which include documentation of their activity.
The company E-bike-to go publishes a yearly report on its economic activity, while the company Felyx expects to produce documentation on its social impact (Founder, Felyx, 06/07/2017). GVB published its agreement with the city in 2015, signed by the vice-mayor and the CEO. It is also planned to publish the social benefit study, which considers the benefits of the public transport (CSR manager, GVB, 11/07/2017).
The city of Amsterdam published an Amsterdam plan, named “Amsterdam electric”, which is about the developments in the electric field. In addition the city is working on other publications, but the number of documents published is not fixed. Considering the amount questions about local policies (also from other countries), English versions for documents are available.

Interim conclusion specificity

The presence of documentation is expected to increase the specificity of the innovation, because it provides a more accurate overview of the stakeholders view and expectation. Even though the city of Amsterdam has a wide range of documents available for e-mobility and clean air plans, specific reports on policy related to shared transport are lacking at this point. However, there is still potential to improve the potential of this factor, especially if companies reporting on their activity would be mandatory. Further specifications in this regard will be provided in the policy recommendations section.

Condition/s	***Scaling-up factor/s***	***Theory***	***Source/s***
1. Innovation areas	1.1. Radical vehicle technology 1.2. Product-to-service shift 1.3. Mobility management	Internal niche dynamics for sustainable mobility	Nykvist & Whitmarsh (2008)
2. Network formation	2.1. Composition 2.2. Alignment	Strategic niche management (SNM)	Schot & Geels (2008)
3. Learning process	3.1. Technological development 3.2. Social and environmental impact 3.3 Policy and regulatory framework	Strategic niche management (SNM)	Schot & Geels (2008)
4. Voices of expectations	4.1. Robustness 4.2. Quality	Strategic niche management (SNM)	Schot & Geels (2008)

	4.3. Specificity		

Table 5 - Conditions and factors assessed in the results section

5.5. Additional factors

The coding process of the data collected (interviews and policy documents) required the creation of an additional factor within the already existing ones specified in the analytical framework. In fact, not all the responses were fitting within the framework provided for the current research, according to the criteria used for the analysis and the definitions given by the theoretical framework. By consequence the creation of one extra factor was a necessary step to embed all the information gathered during the coding process. In this section the extra factor added is discussed. According to the criteria of the results section, for the factor evidence from results and interim conclusion will be provided.

5.5.1. City attractiveness

The extra factor added during the coding process for interviews and policy documents is “city attractiveness”. The factor has been created because the importance of the city of Amsterdam as economic and financial hub, as well as its history of alternative transport modes which makes it suitable for new concepts and solutions. In other words, the assumption is that Amsterdam potential to attract people, goods and companies willing to invest is a key factor to understand the growing of the green shared transport niche.
City attractiveness can contribute to enhance shared vision among actors of future patterns of green mobility, by offering a dynamic market where companies can improve and they can confront with similar organisations and the city.

The added factor resulted in 4 sources and 5 references for the coding process. According to the data analysis, it constitutes an important incentive to enhance the scaling-up process at urban level for shared electric mobility. The main argument supporting this statement is the claim that Amsterdam is the first city in the Netherlands and in Europe to aim towards clean transport and zero emissions by 2025. Furthermore, in April 2016, Amsterdam was voted European capital of innovation, followed in June by their second E-visionary award as the world’s leading city in the transition to electric transport (Trip & Konings, 2014).

“*The city has set a target of traffic being 0 emission in 2025. That’s very ambitious, but my expectation is that we will be a long way there in 2025, in terms of being completely 0 emissions*” (CSR manager, GVB, 11/07/2017)

The city’s leading position in promoting and supporting electric transport has turned Amsterdam into

a living lab with 30,000 unique users, more than 400 electric taxis, 350 electric car-sharing, special courses in electric transport at the city's schools and universities. In addition, there is a growing number of companies which are bringing smart solutions in electric transport to the market (van der Giessen & van der Linden, 2016).
Nevertheless, not all the actors agreed on the success of Amsterdam for transport modes. Black bikes rental claimed the lack of policy intervention from the city in order to improve infrastructure for new concepts. This reasoning is in line with the overall need of having a regulatory framework for shared concepts at local level, which was also mentioned before in the results part.

"*I think we got lazy and we did not improve. I do not see spectacular things which have been done by the city of Amsterdam*" (CEO, Black bikes rental, 06/09/2017)

What must be mentioned here is which problems are related to the attractiveness of the city. Being Amsterdam such an innovative centre, there is a growing number of companies willing to establish in the city to provide shared concepts. The main issue related to this trend is the resulting lack of space as a consequence of the rising number of vehicles and light vehicles. This problem needs to be understood in the context of the city, which is already hosting a huge amount of bicycles and bike-sharing concepts. If not regulated, this trend will result in an inefficient alternative to private vehicles and will contribute to urban congestion and increase traffic.

"*Concerning the electric car-sharing, we now have policies for new parties to enter. But if there are too many parties willing to enter, we cannot let the market operate. Our problem is not just reducing emission, but also saving the space from road vehicles. We want to have less cars, and the ones which are still there we need them clean*." (Policy maker, Amsterdam Gemeente, 01/08/2017)

Interim conclusion city attractiveness

The City of Amsterdam strongly believes that it is the responsibility of the city itself to develop and implement specific urban solutions in order to realize this transition towards sustainability. And especially because urban areas, like the Amsterdam Metropolitan Area, are uniquely positioned to lead the greening of the global economy through improvements in transport, energy, buildings, technology, as well as producing a wide range of economic and social benefits. It is responsibility of the city to develop urban solutions. These solutions are a result of an accurate policy process and strategic decisions, as well as the potential of the city to attract people, customers and new companies willing to invest. Nevertheless, this could be not enough if the municipality does not act to face problems deriving from uncontrolled developments in a specific sector (e.g. shared transport), which can lead to opposite results than the argued ones.

5.6. Obstacles and opportunities to niche expansion

This part of the discussion section deals with the main identified obstacles for the niche scaling-up, and the opportunities emerging from the challenges. This is of particular importance for the current research, because it will provide argumentation to answer sub-question n.4 of the research project "*What are the main barriers and opportunities to the scaling up process?*". In order to gain insights from the stakeholders perspective, during the interviews a specific question was asked about the main obstacles of the scaling-up process, which is "What are the main obstacles for the company/green shared mobility to scale-up?" (Appendix III.).
In this section the results are presented. For the scope of the research, obstacles will be categorised according to the analytical framework presented in the theoretical chapter and results sections. This means that the identified obstacles will be included within the existing conditions and factors for the analysis. During the interviews the obstacles part resulted in a total of 8 sources and 14 categories for the analysis. The obstacles will be now categorised according to the conditions of the analytical framework.

5.6.1. Obstacles innovation areas

Within the innovation areas condition, two main obstacles have been identified during the interview coding. The first relates to infrastructure availability, the second concerns behavioural change.

Infrastructure availability (Radical vehicle technology)

During the interview with the company E-bike-to go, it was clearly stated the difficulty of the company to expand its service, from the public side perspective. What was claimed is the absence of bicycle charging points, and also the presence of specific parking zones for e-bikes, which are actually provided by a private company.

"*For the public side is useless and that's because they (municipality) do not want to give any permits to provide bicycle charging points, and we need them. They decided not to give more permits because a lot of companies are opening bike sharing systems in Amsterdam, resulting in massive amount of bikes*." (Director, E-bike-to go, 21/07/2017)

What clearly emerges once again is the space-related problem that the city has to deal with, namely the pressure of light vehicles on public parking areas their demand for infrastructure. If the municipality decides not to give permits for new infrastructure, it could be interpreted as a signal to limit the amount of companies providing light vehicles shared concepts.

Behavioural change (Product-to-service shift)

The company EVConsult was surely the most doubtful about the success of green shared concepts in the city of Amsterdam. While answering the questions, they provided a list of reasons why is problematic the scaling-up of green mobility in general, and for shared concepts the problem of behavioural change to switch from ownership to sharing makes it even more difficult.

"*Price is still high, as the car is generally more expansive to buy and to run. Looking at the overall price per person, it is still expansive. For the range, it is not sufficient for long trips, but there are new upcoming models for longer trips. Looking at shared electric mobility, it is even more difficult. You have the already mentioned obstacles of price and range for electric cars, and another*

obstacles for shared concepts which is the process of getting used to share a vehicle." (Director, EVConsult, 01/09/2017)

Change of perspective in the way society meets its mobility needs and to what extent local interventions are able to influence it is not the centre of this research, and it would require further considerations. This particular aspect will be discussed in the discussion chapter. However, the results reveal how the behavioural change is a key obstacle to promote the shift to shared concepts for daily transport.

5.6.2. Obstacles voices of expectations

Within the voices of expectations condition two main obstacles emerged from the analysis, which are lack of financing and technology development.

Policy subsides (Quality)

Lack of public funds was already introduced in the categories and factors analysed in the results section, and it was made clear that is one of the main obstacles for the niche scaling-up process. For private companies, subsides have been provided just to Felyx for an electric van which is used in the process of swapping batteries. No light electric vehicles has been subsidised so far.

"*We do not have that financing for all our buses (200 in total)*" (CSR manager, GVB, 11/07/2017)

"*The subsidy area is really difficult to get into, we do get subsides for our electric van which we are using to swap the batteries. For the rest, we are mostly doing it by ourselves*." (Founder, Felyx, 06/07/2017)

The criteria which the city has adopted to grant subsides for e-mobility was already specified, as vehicles which perform a minimum amount of km/day are getting financial aid. In order for e-bike or e-scooter companies to grow and to access to subsides, the municipality is expecting to design a specific policy on light electric shared vehicles (Policy maker, Amsterdam Gemeente, 01/08/2017)

Technological benefits (Quality)

Obstacles from a technological perspective represent both a barrier and an opportunity for the market, as companies are willing to invest in new products to improve performance of their vehicles, as the novelty of the product and its reliability are key factors in the customers' choice.

"*Time and technology. That is because technology evolves over time, so at a certain point the type of bike needs to be changed and it takes time. E-bikes have seen lots of developments, but some of them are not really up to the task. They are obstacles but they can turn into opportunities. But if you want to enter in the rental market is more difficult than the private one, because people tend to pay more attention to their products in general.*" (CEO, Black bikes rental, 06/09/2017)

Also in the citation above it is reflected the mentioned problem of behavioural change, as it is assumed that customers would not be that respectful of a shared product as they are for their own property.

Final considerations on obstacles and related opportunities

It can be argued that the obstacles identified in this paragraph reflected the considerations of the results part. The main areas which represent challenges are identified as infrastructure availability, behavioural change, policy measures, while technology development appears to be less influent for this specific research as companies in any market are facing challenges related to market advancements in terms of ICT and new models.

Infrastructure (Innovation areas – product-to-service shift)

Infrastructure availability obstacles portrait the priority given by the city to car-sharing rather than light vehicles, as charging points are mainly implemented for electric cars. As it was mentioned before, the city has to deal with problems related to lacking of public space and parking zones, and for this reason would seem logical to give priority to e-bikes or e-scooters which demand less space than cars. Nevertheless, Amsterdam is currently dealing with the presence of several private bike-sharing concepts which are invading public space for local cyclists, and spread their bicycles without having dedicated docks for parking (O'Sullivan, 2017). Providing further infrastructure to e-bikes would be an act to bring more bicycles on the road, which does not seem a convenient approach at this moment.

Behavioural change (Innovation areas – product-to-service shift)

A shift from ownership to sharing is already taking place in several sectors, from housing to transport. To achieve the argued scaling-up it is necessary that a wider range of travellers will be choosing different solutions for mobility reasons. Several factors can influence the choice of transport modes, such as the importance of owning a vehicle for personal reasons or social status, availability of economic resources or the need to travel often. What resulted from the previous sections is that the choice of shared concepts is determined by the reliability of the means, the price and the fastness of the trip. The improvement of these conditions, together with specific policy approaches to limit the use of private vehicles could foster the argued behavioural change towards sharing practices.

Subsides (Voices of expectations - quality)

Finally, policy subsides are still reflecting the clear choice of foster the use of e-vehicles over e-bikes or e-scooters. The criteria of such choice reflects the considerations expressed for the infrastructure availability, namely the priority given to car vehicles for financing. This is also linked to the problem of pressure on public space at city level, due to the amount of bike-sharing concepts and private bicycles in Amsterdam.
The main obstacle of the niche scaling-up can be lead back to the absence of a specific policy for private companies providing electric shared transport to enter the market. A strong criteria would be needed to regulate the entrance of new parties and companies, which could limit the potential of investors, especially in a relatively young and dynamic market.

6. Discussion

In light of the previous section, the next paragraphs aim at discussing the validity of the results. The goal of this project is to identify and understand which factors can contribute to a specific niche scaling-up, in the context of societal transitions. For this scope, the research adds to the theoretical assumption of transition theories that transitions are alterations of society's systemic characteristics which encompass social, cultural, technological, political, economic and legal change.
The results imply a steering capacity of policy makers that calls for some points of discussion. In order to steer the discussion, a critical reflection on the theoretical implications of the study and the relevance of the most relevant factors to address scaling-up processes is provided.
The discussion section will be structured as it follows. First, the theoretical implications of the research project are considered. Second, the most important factors for the argued scaling-up process are illustrated and analysed. In addition, this study presents several limitations, which will be discussed in section 6.2. The limitations of this research project will address the theoretical implications, the case study design and the methodology. Finally, a brief consideration on the generalizability of results is provided.

6.1. Discussion of results

6.1.1. Theoretical implications

This section will provide a reflection of the Strategic Niche Management theory in relation to Multi-Level Perspective, and the relationship between the three analytical levels of MLP applied to green shared transport. In addition, a theoretical conceptualisation of the argued institutionalisation process is provided, by reflecting on societal implications of transport as a collective action. Finally, influencing variables relating to behavioural change are discussed.
Multi-level perspective attempts to categorize the different societal levels, and how the shifting of societal systems can produce a transition process. SNM and internal niche dynamics have been the centre of the analytical framework, as they provide the conditions which are arguably enhancing the transition process. Merging these different approaches into a conceptual framework allowed to categorize the different societal levels and to define what was meant with regime, landscape and niche level. To establish which societal dimension pertains to the three MLP levels depends on personal interpretation of the dynamics of the regime and the niches, as there is not a specific criteria to categorise societal systems. Taking into account this limitation, a few considerations can be drawn on the theoretical approach for the research.
Successful niches exert pressure on various aspects of regimes, and thereby shape their trajectory against the background of larger landscape developments. That is the case of the shared green mobility niche, as its development are attempting to produce a change in specific regime transport alternatives. Niche pressure on the regime level derives from the niche internal dynamics process and landscape pressure, which is in turn influenced by the other two levels. In the current case study, the niche pressure is exercised by green shared concepts (electric car-sharing, e-bike sharing, e-

scooter sharing, electric buses, electric taxis), which are threatening the current regime of petrol-based private vehicles. External pressures are influencing travel choices as well, such as fuel price, environmental conditions, changing behaviours etc. It is difficult to assess to what extent the successful expanding of a niche is determined by internal processes and how the external pressures are influencing the outcome, but this is not the scope of the current research.
From a theoretical perspective it has been discussed the composition of the niche in terms of actors network, technology, infrastructure, innovation and learning process. The results provided examples of how the networks within the market niche are formed and what are the relationships among the actors. Technology mainly relates to the demand and supply of infrastructure, and to the main innovation of private companies for e-mobility. Strategies to enhance the learning process are discussed as well.

What seems to be lacking from a theoretical perspective is a process of institutionalisation of the niche. Institutionalisation means that a trend or innovation is merged into a stable pattern based on formalized rules and laws. At this point expected behaviour becomes clearly defined (Pruijt, 2003). For example, if the technological niche of e-mobility and shared concepts is regulated by the public sector, the mentioned issues of having too many companies operating at the same time can be prevented. That is what has been argued in the interview with Black bikes rental, where it was questioned whether any company should be able to offer a service of bike-sharing or car-sharing.
The process of innovation led by technological improvements and the expectations of actors cannot solely explain the scaling-up of a niche market within the existing regime. Once a specific niche market is institutionalised, its growth can be regulated.
What could be questioned is why such a novel market requires an institutionalisation and regulation process, in a society which is moving more and more towards liberalism and capitalism in markets. Social science institutionalism considers social systems to be structured by sanctioned rules of obligatory behaviour. Its perspective is one of governance through regularization and normalization of social action (Rao, Yue, Ingram, Bandelj, & Streek, 2011). An action is defined social if it takes into account actions and reactions of other individuals, and the need of mobility concerns all members of society. Personal travel choices are expected to influence other people choices, and institutionalise this process implies a governance approach which considers the implications of social action and is able to predict its consequences.
In this perspective, capitalism operates as a set of interrelated social institutions, and as a historically specific system of structured as well as structuring social interaction within and in relation to an institutionalized social order (Rao et al., 2011). Even from a capitalistic perspective, economy and society are strongly interrelated as a whole.

In addition, there are important influencing variables that might limit the magnitude of a transition process. In the analysed case, a shift in belief systems of citizens might be the reason for a significant change in travel habits. It is specified that the apparent success of any particular intervention is influenced by the extent to which it addresses deeply embedded habits which are repeated every day (as is the case for some, but not all, commuting trips) or behaviour which is itself volatile and variable from day to day (e.g. leisure trips) (Avineri et al., 2010). The habitual behaviours also change over time, typically over periods of several years during which major life cycle events occur which affect personal and family circumstances (Avineri et al., 2010). Thus, even when there is an appearance of stability, many people will be changing their behaviours in different directions and for different reasons.

The regime level (which embeds behavioural and cultural values as well) is influenced by the niche and landscape levels at the same time, and it is challenging to establish if a change of perception is caused by specific interventions or by external factors (Geels & Schot, 2007). The shift of preference for daily travel choices in Amsterdam can be influenced by the rising price of petrol or vehicles, which might steer personal preferences towards shared solutions or public transport. It is also plausible that for personal reasons for certain societal groups (e.g. family with children or invalid people) owning a vehicle is indispensable. The extent to which interventions at local level are able to produce behavioural change in the long term requires several considerations, which will not be discussed in this research paper.

6.1.2. Discussion of key factors for scaling-up process

The thesis project has provided evidence of how the conditions and factors presented in the analytical framework are perceived by the niche actors. It seems that not all the conditions identified are relevant for the scaling-up process, or at least are less relevant for the outcome. These conditions were mobility management, network formation and the specificity of documentation. Mobility management mainly concerned ICT development, which is not a distinctive factor for companies providing shared transport. Network formation provided an overview of the main relationship among the actors in the green niche, but information about the strength of such relations is lacking. Documentation of activities by private companies is not regular and specific, which is not supporting the learning process.
On the other hand, it has been noted how certain conditions had the predominance in the discourse of the different parts involved, namely radical vehicle technology (infrastructure), learning process and voices of expectations (robustness and quality). Infrastructure had a relevant role in the actors' discourse, and was also the centre of local policies to enhance green transport. Learning process between private companies and between companies and the municipality was a key part of the discussion, and strengthen this process is expected to produce a positive outcome in terms of aligning goals and strategies. Shared actors' expectations is one of the basis to form the niche and to grow it potential, as well as strong policy approaches are needed to improve the quality of the local experiments.
Studies on SNM have been investigating early market introduction of sustainable technologies and identified reasons for success and failure (Kemp et al., 1998). Many sustainable technologies fail because of several factors, namely lack of technical stability, lack of regulation, cultural factors, infrastructure and undesirable environmental effects. The analysis of the results highlighted the importance of the above-mentioned categories identified by Kemp et al. (1998), and in particular the policy institutionalisation appears to be the factor which could bolster the green shared transport niche in Amsterdam.

Technological development (Innovation areas)

There are three points which is worth discussing in this section, namely introduction of new technology in existing regime, the co-evolutionary dynamics of experiments and planning strategies, and embed institutional and cultural practices in the shared green transport experiment.
First, technological development has been briefly discussed during the interviews, and most of the companies rely on their own investments to maintain their service competitive in terms of

performance. The introduction of new technologies usually has to compete with well-established technologies, which are embedded in technical regimes, referring to 'rules' such as cognitions, beliefs, organisational structures and scientific methods, that guide technological development within and between firms (Kemp, et al., 1998; Rip and Kemp, 1998). That is the example of e-vehicles which introduce hybrid or electric solution, while the majority of vehicles are still exploiting fossil fuel sources.

Second, many experiments are organised to push for a certain technology and neglect the necessary co-evolutionary dynamics of societal networks. Complex networks often exhibit co-evolutionary dynamics affecting each other in overlapping time scales (Antoniades & Dovrolis, 2015). That is the case of advancements and development of shared mobility technology, which is in turn affecting and it is affected by the dynamics of personal and private transport. This is why co-evolution has to be considered, as it can play an important role in driving major societal transitions. Furthermore, experiments are often isolated local projects that are not connected to a broader strategy to develop a niche, and this is an important limitation factor for niche scaling-up. In this context, the plan of the city of Amsterdam to promote electric mobility contributes to implement a local strategy or vision on sustainable and shared transport.

Finally, an important policy question is: how can this structural technology push bias be overcome? This is not an easy question, since the bias is deeply embedded in the modernist way of managing the introduction of technology in society. Ultimately, it would require not only a change in the specific practice of organising experiments, but also institutional and cultural changes, particularly in the distribution of responsibilities and the organisation of relations between state, market, civil society and science and technology. This has been partially happening at the niche level for shared green transport, because a distribution of competences results in the city's responsibility to set specific targets for clean air, and companies finding their strategies to meet the goal. In this scenario, technology has to evolve to provide a competitive advantage for shared concepts. In addition, the specific niche of green shared transport requires that the technology advancements extend to infrastructural level as well, because the vehicles' performance is strictly related to the type of infrastructure supporting them.

A broader institutional change in the way technology and infrastructure are supporting the purpose of the niche market needs to be addressed by the actors of the niche. Ideally, a strong policy approach could be involving both policies aiming for the creation of new infrastructure and for destabilising the old. Creating specific parking zones for e-vehicles in correspondence of charging points is an effective approach to reduce space for petrol-based vehicles.

Infrastructure availability (Innovation areas and Network formation)

In this part two points are made clear. The first one is the municipal strategy of infrastructural development to influence the regime level, while the second one is the alignment of actors' expectations on the niche dynamics.

Infrastructure availability is a key factor for the functioning of the niche, and to maintain the network of stakeholders of the niche on the same expectations of development. Technology development is related to the infrastructure network at local level, as it was discussed in the previous section. In order to exert pressure on the regime level, the city has opted to grow the number of charging points to enhance the use of electric vehicles. This strategy also contributes to create public parking spots for e-vehicles, as the charging point areas are reserved to electric cars only. It has also been noted

how the municipality strategy is to facilitate the expansion of e-vehicles over other solutions. In fact, according to interviews and policy documents, the development of specific infrastructure for vehicle charging was meant to enhance the number of e-cars and shared cars, rather than light vehicles. In addition, according to what has been said by E-bike-to go the municipality did not allow the company to have additional charging points, which are needed to let the company grow.
Concerning actors' expectations, theoretical insights on SNM specified in chapter 2 suggest how sharing expectations and views is a key point for the development of the niche, as well as the network formation which derives from the sharing expectations. Considering the results of the study, expectations of the different actors involved in the green shared transport are not properly aligned. The expectations of some actors (namely E-bike-to go, Black bikes rental and EVConsult) do not properly match the municipality view on the growing of the niche, and this could compromise an important part of the niche dynamics. This does not relate just to infrastructure availability, it concerns as well the knowledge sharing and the improvement of the learning process and the dialogue among the different parts. In fact, concepts such as e-bikes and e-scooters are not well embedded within the green shared niche in the city of Amsterdam, as the lack of suitable infrastructures and of a specific policy regarding those concepts is demonstrating. It could be questioned at this point if electric light vehicles constitute a separate niche compared to electric car-sharing, as they share the same principles and rules of sharing concepts but they are not co-evolving in the same direction and at the same speed.
Nevertheless, expectations are not fixed, actors change their views, not only as a result of the coordinated voicing of expectations, but also in reaction to changes in the environment. Being a niche successful when it manages to evolve despite of the influence of the landscape level, an attempt to positively influence actors' expectations is with policy initiatives at local level. Due to an uncontrolled growing of shared concepts at city level (especially light vehicles), which is not helping the niche scaling-up process, future plans to introduce a specific policy on light vehicles have been mentioned during the interviews (refer to: Interview 5, Policy maker, Amsterdam Gemeente, 01/08/2017). This approach seems to reveal the priority of the city to promote electric transport over the diffusion of shared concepts in Amsterdam.

Policy measures and learning (Voices of expectations)

The last factor selected is discussed by providing an in-depth analysis of two main points, which are the legitimate participation of new actors to the niche and the expected policy development within the niche.
An issue which SNM literature emphasizes, and that the current research has confirmed, is that expectations legitimise participation, but they often complicate the participation of outsiders (R.Mourik & Raven, 2006). Participation is typically unproblematic when expectations are shared and viewed as truthful, and to some extent realistic. However, at the beginning of a development trajectory the design specifics and performance expectations are still very much under debate. And when a radical innovation is accompanied by uncertainty, expectations of outsiders can be very different from those of the developers of a specific concept. More in the specific, the city of Amsterdam aims at becoming emission free by 2025, and the electric program which has been developed to reach this goal looks for solutions at local level which are aiming towards the same objective. Companies which provide electric vehicles share the same expectations of the city to

provide a service without having an environmental impact on the environment, but on the other hand not all the companies have the same benefits while operating in the city.
This can be explained by the policies adopted by the city of Amsterdam, which were discussed in chapter 4 and will be briefly resumed here. Geels and Kemp (2000) suggest policymakers should use generic instruments to exert pressure on the existing regime and stimulate different alternative but complementary technologies (for example hybrid or electric technologies) by means of more specific measures. For this case study, several strategies at the local level have been adopted in order to promote the use of electric transport at local level. In Chapter 4 the different policy approaches have been introduced, namely stimulating, facilitating and regulating policies. For stimulating measures subsides are granted for specific electric vehicles which perform a total amount of km/day, facilitating measures are adopted for taxis in specific parts of the city by providing faster access to strategic areas. Finally, regulating measures consist in implementing low-emission zones to prevent polluting vehicles to enter certain areas, which implies the use of low-emission alternatives to access city areas.
These policy approaches are meant to enhance the presence of electric vehicles, and give priority to those means to access certain areas. Nevertheless, any policy on the providers of shared concepts or regulations on new parties entering the market has been mentioned. In turn, implemented policies are reducing the environmental impact from transport, but on the other hand are also stimulating new companies to provide similar services. This is creating several challenges, which could be turned into opportunities with an adequate institutionalisation of the shared concepts. Further reflection on this will be discussed in the policy recommendations section.

6.2. Limitations

In this part the major limitations of the research are discussed. First, there are general limitations of MLP and Strategic Niche Management which need to be specified as well. In addition, general limitations are related to the case study design, which will be described in the following section together with the limits of the methodology applied.

6.2.1. Theory limitations

The theoretical base of this study is narrowly restricted mostly to Strategic Niche Management and Multi-Level Perspective. MLP provides an interesting conceptual understanding of the niche, regime and landscape levels. In this research, the expectations, learning processes and network formation of SNM have been identified by interviewing relevant actors in the field of electric mobility because this information is hard to find among literature, especially when the current status of an emerging innovation is considered. The effectiveness of SNM is due to the fact that there is a clear distinction between the socio-technological regime, the niche and the landscape developments. In that perspective, by analysing these three levels a clear overview is generated.
Nevertheless, this research project was mostly focused on the internal niche dynamics, without considering the specific regime and landscape factors influence. Also, the internal niche dynamics

for sustainable mobility specify the potential of new technology, institutions, markets, lifestyles and cultural elements. Innovative pathways are identified, which include institutional, behavioural and technological components of the niche dynamic, but this categorisation does not apply specifically to green and shared concepts.

Being a specific and relatively new market, it would deserve more in-depth considerations from a theoretical perspective. Also, it is important to note that other theories provide useful insights in political approaches for niche dynamics, such as management theories, as well as transition theories focusing on transition drivers and the conditions for change. The theoretical framework proposed in this research project is far from complete, a more comprehensive theoretical framework of strategies to understand scaling-up process would need further argumentations and more in-depth research. Furthermore, expectations of actors could be better mapped when more interviews are being given at different time-frames. However, this would imply more time available to conduct the research.

6.2.2. Methods and case design limitations

Firstly, a typical disadvantage of case study designs is the limited external validity of results (Verschuren, Piet; Doorewaard, 2010). By choosing a single case study design, it is not possible to be specific in the conclusions about the accuracy of claims made in the theories section. It is not possible to assess whether the identified strategies for scaling-up are indeed important causal mechanisms to explain the niche dynamics described by SNM scholars. Furthermore, it is highly challenging to generalize the results to discussions about green shared transport in Amsterdam in other cities, nor to extrapolate the results to predict how the niche dynamics are going to change in the next future. Nevertheless, the theory-building process of the study could be applied for further research ideas on Multi-Level Perspective and niche dynamics.
The methodological approach applied deserves more elaboration and standardization. Future research might be able to produce tools that are able to precisely measure the frequency of statements and to categorize the statements by importance, given a predefined criteria. In addition, it has been noticed how the problem of institutionalisation of the niche has emerged during the study. More detailed institutional analyses could make the assessment more valid and reliable.
The adding of new conditions and factors for the final analysis was an ex-post process, as factors were added after the interviews were transcribed and coded. What could be helpful for future research is establish an ex-ante criteria for the inclusiveness of new categories or indicators during the analysis. This would help to avoid inaccuracy in the process of selection and interpretation of findings.
In order to conduct a more comprehensive research on the current subject, it would be useful to work with researchers and stakeholders from different backgrounds to gain specific knowledge on the areas investigated (technology, policy, society and economy). Lastly, a comparative case study between two or more cities would be really interesting, in order to analyse the different strategies adopted at local level to scale-up the innovation, and what factors would explain the different degree of success of the two cases.

Secondly, a general problem of qualitative research is the extent of subjective choices and interpretations of the researcher (Starks & Brown Trinidad, 2007). Other researchers might code the data in different ways, or apply different theoretical foundation, or even interpret the results

differently. The choices on how to define actors and categories depend on researcher's interpretation, yet they are crucial for the obtained results. All of these factors are negatively affecting the reliability of the presented results. Nevertheless, I tried to be as transparent and explicit as possible about the choices made and on what factors conclusions were based upon. The NVivo tool used to code the data proved to be very helpful in making the discourse more reproducible, and valid. It has to be nonetheless specified that subjective interpretation, especially during coding, is a major drawback of the applied research design.

In addition, the problem of intentionality must be mentioned. There could be a difference in meaning of a message between sender and receiver (van Dijk, 2006). Especially the possible misinterpretation of meaning of a question from the interviewee, or the answer from the interviewer, further increases this problem. This limitation was tried to be controlled by using a relative large data sources. Differences in interpretation are less likely to prevail over many sources, especially if interview statements are confirmed by policy documents. Furthermore, it is not guaranteed that all the most important statement have been coded correctly. Thus, it might be possible that not all actors and organisations that deserve a place in the discussed niche were included.
Finally, during the research project time constraint was a key factor limiting the outcome of the research. Especially during the data collection part, the available time and the strict schedule did not allow to have more interviews with other companies and stakeholders. Also, several companies did not accept to participate to the planned interviews, which caused delays in the conclusion of the data collection process.

In line with the theoretical approach, the operationalization of factors and the evaluation criteria can be discussed. The main conditions and factors were derived from the theoretical definition of the indicators, and the categorization process during the coding phase reflected those definitions. Concerning the evaluation criteria, the scoring process was not adequate to represent the results. Even though the method offers a quantitative measurement for the conditions, schematic representation is only a rough representation of reality for qualitative research. A coded statement of an actor or a concept cannot represent the full complexity of an argument. Nevertheless, it has been useful to visualize also complex discourses comprehensively.

6.3. Generalizability of results

The generalizability of the results is somewhat restricted. Readers need to consider that useful interpretations of this analysis could only be drawn regarding the particular case study of the city of Amsterdam in this historical moment. Although the research aim was not to generate generalizable theoretical or methodological implications, the combination of Strategic Niche Management and Niche dynamics for sustainable transport in transition context produced interesting insights and ideas for further research that are presented in chapter 7. Moreover, the research design proved to be useful and suitable to generate policy recommendations in the conclusive chapter.

7. Conclusions

The conclusive chapter of this thesis project has a two-fold purpose. First, it will provide policy recommendations for policy-makers and stakeholders operating in the niche of green shared mobility. Second, the main research question will be answered. Finally, remarks on possible improvements of the theoretical approach and methodology will be provided.

7.1. Policy recommendations

The research project is aimed at informing the actors on the conditions expected to positively influence the scaling-up process of the green shared transport niche, in the specific case of the city of Amsterdam. According to the factors identified in section 6.1.2., the following policy recommendations are formulated.

Actors' expectations

Much of the potential of technology and infrastructure development (which have been indicated as conditions which contribute to the scaling-up process) regarding the electric shared transport lies in economic arguments, which are not the centre of the current thesis. What has been analysed are the actors' expectations on the niche development and the local strategies to steer electric transport policies, which do not seem to be converging. In order to align the expectations of the actors involved to strengthen the niche of green shared transport, different approaches can be undertaken, which are establishing platforms for e-mobility actors, regulation of parties entering the market in Amsterdam, and mandatory updates on the companies' strategy at city level.
First, it has been noticed how the development of the infrastructure was aimed at prioritising the use of vehicles. This means that introducing electric light vehicles concepts is not fully supported by the city policies. What would be useful to prevent misunderstanding regarding the expected support of the city is setting-up platforms for electric mobility providers, where the main strategies are explained. The process of knowledge sharing has barely been discussed with the stakeholders, which represents a major limitation for the niche success. This would help to frame actors' strategies in response to the municipality goals and targets. In addition, also from a theoretical perspective this practice deserves far more consideration in the process of network formation and alignment.
Second, clarity from the municipality side is a major element for the current case. Green shared transport services are still not properly regulated from the city of Amsterdam, meaning that any company can provide this service. This uncontrolled growth is contributing to the space problem of the city in terms of lack of availability of parking spots and urban congestion. Regulating the entrance of companies in the market would be a plausible solution to face those challenges, and to secure higher standards of services. This might appear in contrast with the overall concept of niche expansion, which entails growing users and providers to reach a regime level, but it would strengthen the robustness and quality of the niche.
Last, few companies are providing accurate documentation on their strategy. Implementing a preliminary plan where it is mentioned their goal, how they would contribute to solve the problems at city level, how they will contribute to reduce dependency on privately owned vehicles and the extent

to which infrastructure is needed would help the city to evaluate before-hand the feasibility and opportunities for policy support for those companies.

Policy approach

The policy approach adopted by the city aims at reaching a specific target group of the Amsterdam metropolitan area, namely electric vehicles, which are cars and taxis. The extent to which car-sharing and similar concepts are taking advantage or benefit from this initiative has not been discussed in the specific. The specific policy approaches introduced in chapter 4 (low-emission zones and cap policies on vehicles) are not clearly meant to provide a competitive advantage to shared concepts. On the other hand, they are aiming at increasing the low-emission solutions or electric commercial fleets. This strategy would contribute to solve the emission-related problems from traffic, but is not addressing the problem of urban congestion deriving from the increase of vehicles and light means circulating in Amsterdam.

It is known that shared concepts aim at reducing ownership, and households owning one or more cars in transit-oriented and dense neighbourhoods are often seen as a primary target group, since there is a potential to reduce vehicle ownership in these areas. A strong policy approach would be to act in favour of shared e-vehicles in highly-dense populated neighbourhoods, in order to improve viability and reduce traffic. In relation to bicycle ownership, different factors are shaping the discourse. Amsterdam is one of the most bike-friendly cities in the world, where there currently are more bicycles than people living in the city. Prioritising small market like shared e-bikes are is not at all considered by the city, because of the already mentioned reasons.
In order for this niche product to gain a proper role in the local transport dynamics, embedding electric light vehicles to the municipal service of bike sharing could partially contribute to solve several issues. First, the municipality would control the amount of shared e-bikes in the city. Second, it could contribute to release pressure on public space. Furthermore, the city could monitor the quality of the service provided. Such approach would strongly limit the access of private companies providing the same service to the city, which would be an important limitation for the niche expansion.
More in general, when developing infrastructural policies, during decision making processes concerning city planning and land use management, governments should think with a holistic view of carrying capacity with the assistance of system thinking to avoid the unlimited developing phenomena resulting from city sprawl and urban congestion.

7.2. Concluding remarks

Coming back to the research question, namely "*What are the explanatory factors of the scaling-up of the green shared transport niche in Amsterdam, in the context of societal transition*?, the following conclusions are drawn in the following section. The thesis project is concluded by providing suggestions on how to strengthen the theoretical approach, how green shared transport could be improved and what can be learned from the Amsterdam case.

7.2.1. Answer to research question

In order to enhance the niche scaling-up process at societal level, SNM identifies three main conditions, which are network formation, learning process and voices of expectations. Network formation proved to be effective for public-private companies (GVB) operating within the municipality domain, while for private companies the process of networking is more difficult because the process of alignment with overall targets and goals at city level is far from complete. Learning process revealed how a clear policy approach on shared vehicles is required from the niche actors. Actors' expectations are not aligned, due to the lack of a clear policy framework. The city helped the growing of the market by providing infrastructure and by setting ambitious environmental targets. On the other hand, it neglected some urgent problems at city level concerning congestion and public space availability. These problems can be tackled with a clear criteria for companies which provide shared transport in Amsterdam.

Innovation areas for sustainable mobility offered a more specific context for the niche dynamics, considering the importance of infrastructure and technological development, behavioural change and ICT development for mobility management. Infrastructure development resulted to be effective mostly for cars, while light vehicles are not fully supported. Behavioural change is still one of the main obstacles to the adoption of shared solution, despite the city is already embracing sharing economy practices.

To conclude and to provide an answer to the research question, the explanatory factors which can enhance the scaling-up process of the green shared transport niche in Amsterdam can be identified in technological development, infrastructure availability and clear policy measures at local level. Technological development is the key factor driving a socio-technical transition, as innovations have the potential to provide alternative solution to fulfil societal needs, and in this case mobility needs. This is why the improvement of the efficiency of electric vehicles and strategies to provide a reliable service are likely to ensure the success of the concept.

Infrastructure provision is related to technology development, and it depends on the target group addressed. If it is aimed at enhancing the use of electric vehicles, it would contribute to mitigate the polluting emission from vehicles, but it will not solve the problem of urban congestion and pressure on space.

An institutionalisation process is needed to establish the subsidy scheme for shared concepts, and to regulate their presence in Amsterdam. The current subsidy criteria addresses frequent drivers as target group, but does refer exclusively to cars and taxis. The presence of electric light vehicles in the city is one of the main issues the city has to deal with, being a new market in constant expansion. The problems deriving from this growth (pressure on public space and contribution to urban congestion) should not be underestimated though.

Furthermore, it needs to be considered the role played by behavioural change in adopting alternative transport methods. The extent to which local initiatives are able to influence travellers' choices needs several considerations, which exempt from the current research.

7.2.2. Further research: theory

This section provides some ideas to improve the theoretical foundation of this study, namely Multi-Level Perspective, as Strategic Niche Management has already been discussed in section 6.1.1.

The main advantage of MLP is offering a clear division of the three analytical levels (niche, regime, landscape). What has been discussed in this project is the process for which a niche can reach the regime level, when a system experiences tensions. The theory mainly focuses on how new technologies can exert a pressure on the regime level, but it still remains unclear how the model should be applied in practice, and what could be the possible bias towards bottom-up innovations at local level. These considerations are linked to an overall issue of the theory, which is distinguishing conceptual and empirical 'levels' in the MLP (and also the concept and definition of 'niches', and the nature of and boundaries between socio-technical regimes). Furthermore, the pressure which is exert on the regime level cannot be explained solely by technology innovations, but has been proved to be linked to social and cultural value change and adequate measures supporting the innovation. This entails the need to take seriously the role of 'societal' changes in policy, and cultural and market 'elements' of systems innovations.
A possible solution to strengthen the theory could be to address the complementarity of the MLP approach with constructionist approaches such as the social construction of technology (SCOT), and constructive technology assessment (CTA). A focus on co-construction of technology as a complementary method of recreation of technology in society could be employed, by informing and potentially bridging transition theory and social constructionist approaches. SCOT discusses the open-ended character of technology development, and it addresses the specifics of development for any case, by exposing the political processes involved in constructing the notion of best fit between 'technology' and 'society' (Genus, 2008). CTA emphasises prospective of the interrelationship between the social and technical, and it therefore serves to highlight potential alternative choices and emphasises social inclusiveness in shaping the direction of socio-technical change.

Lastly, it is worth reflecting on how future research can contribute to green shared transport. This practice has mainly been analysed by transition theory, and how this specific transport practice is contributing to transition towards sustainable society. It would be interesting to undertake a different approach to contribute to research on shared transport, such as looking at collaborative consumption practices. By this is meant economic models based on sharing or renting products and services, enabling access over ownership. It is reinventing the way daily needs are fulfilled (Selloni, 2017).
Studying the dynamics and choices of individuals, rather than looking at municipal approaches and company strategies, could offer interesting insights on the demand side rather than focusing on supply. Being shared transport practices the result of technology development, community needs, economic global recession and environmental pressure; research on this topic needs to consider all these aspects.

7.2.3. Further research: green shared transport

To conclude the research project, a critical reflection on the future of green shared mobility is provided, with a final consideration on how cities can learn from the Amsterdam case.
One of the most remarkable developments of the 21st century global marketplace is the rapid growth and evolution of the sharing economy, which concerns the transport sector as well. Even though sharing electric vehicles is becoming easier and more acceptable, vehicle ownership will most likely remain the main trend because of several reasons, such as the importance of vehicle ownership for social status, the need to travel long distances, and the expensiveness of the e-vehicles compared to the transitional ones.

It has to be remarked that the development of green shared transport will also depend on the context the experiment takes place. Countries are choosing different policies related to transport services, which is affecting the formation or the growing of the niche. In Europe, for example, municipal authorities are starting to discourage driving in city centres, which creates a disincentive for ownership. At the same time, the social group the innovation is addressing to is important as well. The changing habits of young people might foster the growth of shared mobility. On the other hand, older people are unlikely to get rid of their private vehicles, as well as large families with children. In addition, the urban context is influencing this market as well, because a high population density at city level will make it easier to share vehicles for short trips, which is still a major problem in countries such as the US or the Asian continent.
The growth of the green shared transport niche is inevitably related to the city attractiveness for companies, the infrastructure available and the policy approach to discourage vehicle ownership. If cities manage to strengthen these three points, as Amsterdam did, there is potential for the niche to grow. It can be said that green shared transport can play a significant role in helping to redefine mobility patterns, modal decision making, and mobility behaviour. If mobility service companies guarantee vehicle accessibility and reliability, customers will be more willing to follow this new trend. Nevertheless, it is crucial to keep the following points in mind. First, it is critical to educate customers about new transportation alternatives, such as car-sharing, light-vehicle sharing and mobility services. Second, it is important to anticipate the need for future mobility patterns and services, such as those demanded by modern lifestyles. Finally, advanced technologies should be considered thoughtfully as useful tools for improving the quality of transportation services, modifying current transportation options, and ultimately shaping travel behaviour.

The city of Amsterdam is historically known for its strong cycling-friendly policy, and thanks also to its flat landscape has been able to offer different transport solutions. Cycling and public transport have been the main alternatives to vehicle ownership, which positive outcome is also due to a system with a high infrastructural development. In recent years the city opened to shared concepts and electric vehicles, in order to reach important environmental targets, with several companies offering electric sharing services at city level. Apart from that, the Dutch capital has got several features which make it suitable for the niche development. Is an economically attractive city, already experiencing the potential of sharing economy. In addition, its high population density makes shared transport easier, especially for short distances.
What cities can learn from Amsterdam is how a clear and defined goal (e.g. being emission-free by 2025) can help to shape future trajectories and mobility patterns. Once the target is set, institutions, private sector and society are aware of the future pathways of development for transport. This implies that choices related to financing, infrastructure development and policies are implemented towards the same direction, in order to favour a particular innovation. Having a public-private transport company partially owned by the municipality (GVB) is an example of how shared transport can serve municipal goals, being at the same time reliable, efficient and economically profitable.
Sharing vehicles practice deserves different considerations, as it is still in its development phase and mainly concerns private companies. Amsterdam is facing an increase of vehicles and light vehicles which is causing several issues, and could at the same time limit or foster the practice of sharing vehicles. Which will be the future pathway of green shared transport depends on how effective will be the policies regulating this new market, and how companies and citizens are going to respond to these challenges.

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Appendix I. - List of policy documents analysed

Document	Publisher	Summary
1. Amsterdam Aantrekkelijk Bereikbaar - MobiliteitsAanpak Amsterdam 2030	Amsterdam Gemeente (2013)	Amsterdam challenges, namely more residents, jobs and visitors lead to further growth of mobility in and around Amsterdam and to a greater pressure on the expensive public space. In addition, the available public space in the (inner city of) Amsterdam is a scarce asset. The question then is how we can solve solutions with less resources, in limited space find for the growing mobility demand. In the Mobility Package it exists answer this to give priority to cost-effective and space-saving modes of transport and better utilization of existing capacity.
2. Electric mobility is here	Amsterdam Gemeente (2016)	Amsterdam is one of the world's leading cities in the field of electric transport. Together with its partners, the city has taken strong action to promote electric transport as well as ban polluting vehicles. The target is to become a zero emissions city by 2025, with opportunities for everyone to adopt electric transport.
3. Clean air for Amsterdam: set of measures. Towards an emission-free 2025	Amsterdam Gemeente (February 2016)	Improving Amsterdam's liveability is permanently on the city council's radar. In any liveable city, it is imperative that the air is healthy, making it a pleasure to be in the open air. That is why Amsterdam is now setting a no-holds-barred course towards achieving as much zero-emission transport for the city as possible by 2025. Together with the city's businesses and transport the city is looking into the appropriate approach for both stimulation and regulation.

Appendix II. - Interview list

Company name	**Interviewee**	**Location of interview**	**Date**
1. Felyx	Quinten Selhorst	Amsterdam	06-07-2017
2. GVB	Maurits Hekking	Amsterdam	11-07-2017
3. E-bike-to go	Jelle Visser	Amsterdam	21-07-2017
4. Amsterdam Gementee	Johannes Beuckens	Amsterdam	28-07-2017
5. Amsterdam Gementee	Carla van der Linden	Amsterdam	01-08-2017
6. EV Consult	Roland Steinmetz	Amsterdam	01-09-2017
7. Black bikes rental	Piet van Duijn	Amsterdam	06-09-2017

Appendix III. – Interview questions

Sample questionnaire e-mobility companies Amsterdam

General

1.) Who are you, and what activities do you perform within the organization?

Expectations

4.a.) *Robustness*

- What are your expectations regarding the developments of the green transport niche in Amsterdam (Technology / Infrastructure / Policy / Government regulation / Economic / Social acceptance?)
    - What role does your company play in this scenario?

4.b.) *Quality*

- What are the expectations of the project in the field of technology development?
    - How does X (name of the company) provide and example of good practice?
- What are the project's expectations at the economic level (expected costs and benefits)?
    - How does X (name of the company) provide and example of good practice?
- What are the expectations of the project at policy level (obtain subsidies, know regulations, etc.)?
    - How does X (name of the company) provide and example of good practice?
- What are the expectations at the social level (there are objections from the environment regarding the project and on sustainability)?
    - How does X (name of the company) provide and example of good practice?
- What are the obstacles within the project at technological, economic, social and on laws and regulations?

4.c.) *Specificity*

- Is there an accurate documentation of the mobility experiment (accessible reports)?
    - How often is it published/reported?

Network formation

2.a.) *Composition*

- Who are the main stakeholders you are related with?
    - What is your main topic/field of conversation?

- How do you work with other actors from your same field?

2.b.) *Alignment*

- How is your company conforming to tech development and regulation?
  - How many times did the green company meet regulatory bodies (e.g. Ministry of Transport) in the last 12 months?
- How to address a growing group of customers in the network?
  - What are the main obstacles to the network expansion?

Learning process

3.a.) *Technological development and infrastructure*
- How often are you updated on the last technological improvements from tech companies
  - Have you been updated in the last 12 months?

3.b.) *Societal and environmental impact*

- How often are you updated on the environmental impact of your vehicles?
  - Have you been updated in the last 12 months?

3.c.) *Policy and regulatory framework*

- How often does your company get subsides by the municipality/government?
  - Did you receive any subside in the last 12 months?

Innovation areas

1.a.) *Product-to-service shift*

- How is perceived the difference between the service provided by your company and the traditional one?
  - What are, according to you, the factors that explain this difference?
- How does the service provided by your company fulfill the mobility needs of citizens?
  - What is the main advantage provided by your service, compared to the traditional one?
- To what extent is the service your company provides compatible to public transport system?

1.b.) *Radicale vehicle technology*

- Is there a presence of charging points for the vehicles your company offers?
  - If yes, how many charging points are in the city?
- Can your vehicle access to an exclusive parking zone?
  - If yes, how many parking zones there are in the city?
- Does the company fully conform to regulations on light vehicles?
  - To which regulation does your company conform (local, national ,international)? *

N.B. *Consider also financial incentives, such as regulatory framework - positive discriminatory measures such as limited access to certain areas of the city (low or zero emission zones), eligibility for using restricted lanes e.g., bus or high occupancy lanes***
- Which factors in the external environment (e.g. electricity price, market share, climate change, material infrastructure) do you think are influencing the adoption of e-vehicles?

1.c.) *Mobility management*

- How often is your company charged for emissions from your vehicles?
    - Have you been charged in the last 12 months?
- How does your company conform to energy labelling of vehicles?
    - Does it provide useful information on your service to customers?
- Does your company offer a smartphone app service?
    - If yes, does it provide accurate and reliable information?

Scaling up: final considerations

- What are, in your view, the main developments in green transport in Amsterdam? (Categories to address: economic, social, regulative policies)

- What can be learned from the developments and results in this sector?

- How is it possible to address a growing group of customers?

- What is needed further (at technology, social, political and economic level) to green transport to further develop Amsterdam to a greater extent? (Apart from money)

Sample questionnaire Amsterdam Gemeente

General

1.) What is your name, and what activities do you perform in the gemeente of Amsterdam?

Expectations

2.a.) *Robustness*

- What are your expectations regarding the developments of the green transport niche in Amsterdam (Technology / Infrastructure / Policy / Government regulation / Economic / Social acceptance?)
    - What role does the municipality play in this scenario?

2.b.) *Quality*

- What are the expectations of the development of green shared mobility in the field of technology development?

- What are the expectations at the economic level (expected costs and benefits)?

- What are the expectations of the at policy level (obtain subsidies, know regulations, etc.)?
    - How is the city of Amsterdam dealing with increasing companies providing this service?

- What are the expectations at the social level (there are objections from the environment regarding the project and on sustainability)?

- What are the obstacles of the expansion of this niche at technological, economic, social and on laws and regulations?

- What are the main advantages of providing e-mobility service in the city of Amsterdam?

2.c.) *Specificity*

- Is there an accurate documentation about e-mobility policies (accessible reports)?
    - How often is it published/reported

Network formation

3.a.) *Composition*

- Who are the main stakeholders (of this field) you are related with?
    - What is your main topic/field of conversation?
    - How do you work with other actors from your same field (other municipalities)?

3.b.) *Alignment*

- How many times do you meet regulatory bodies at national level (e.g. Ministry of Transport)?

Learning process

4.a.) *Technological development and infrastructure*
- How often are you updated on the last technological improvements of private companies?
    - Have you been updated in the last 12 months?

4.b.) *Societal and environmental impact*

- How often are you updated on the environmental impact of companies?
    - Have you been updated in the last 12 months?

4.c.) *Policy and regulatory framework*

- According to which criteria do you grant subsidies for green shared companies?
- Which regulations at national level (e.g. policy frameworks) are influencing or determining your strategy as a city?

Innovation areas

5.b.) *Radical vehicle technology*

- Is there a presence of charging points for the vehicles the municipality offers?
  - If yes, how many charging points are in the city?
- Can shared e-vehicle access to an exclusive parking zone?
  - If yes, how many parking zones there are in the city?
- How is the policy of low-emission zones or zero emission zones successful to encourage shared green transport?

- Which factors in the external environment (e.g. electricity price, market share, climate change, material infrastructure) do you think are influencing the choice of e-vehicles?

Scaling up: final considerations

- What are, in your view, the main developments in green transport in Amsterdam? (Categories to address: economic, social, regulative policies)

- What can be learned from the developments and results in this sector?

- What is needed further (at technology, social, political and economic level) to green transport to further develop Amsterdam to a greater extent? (Apart from money)

Sample questionnaire EVConsult Amsterdam

General

1.) Who are you, and what activities do you perform within the organization?

Expectations

4.a.) *Robustness*

- What are your expectations regarding the developments of the green shared transport niche in Amsterdam (Technology / Infrastructure / Policy / Government regulation / Economic / Social acceptance?)
    - What role does your company play in this scenario?

4.b.) *Quality*

- What is the role of technology development in this specific field?

- What are the main benefits at economic level of green mobility for both companies and cities?

- What have been the developments at the policy level in the last years (subsidies, new regulations, etc.)?

- What are the expectations at the social level (there are objections from the environment regarding the project and on sustainability)?

- What are the obstacles for the niche expansion at technological, economic, social and on laws and regulations?

4.c.) *Specificity*

- Is there an accurate documentation of your activity (accessible reports)?
    - How often is it published/reported?

Network formation

2.a.) *Composition*

- Who are the main stakeholders you are related with?
    - How do you work with other stakeholders from your same field?

2.b.) *Alignment*

- How frequent are your contacts with regulatory bodies? How are they influencing your activity?
    - How many times did the green company meet regulatory bodies (e.g. Ministry of Transport) in the last 12 months?
- How to address a growing group of customers in the network?
    - What are the main obstacles to the network expansion?

Learning process

3.a.) *Technological development and infrastructure*
- Is the development of infrastructure charging points for the expansion of green shared concept the most important factor for the niche expansion?

3.b.) *Societal and environmental impact*

- How important is the awareness of environmental conditions for the development of the niche?

3.c.) *Policy and regulatory framework*

- Are subsides from the government the most important factor for the development of shared green companies?

Innovation areas

1.a.) *Product-to-service shift*

- How is perceived the difference between this service compared to traditional transport modes?
  - What are, according to you, the factors that explain this difference?

1.b.) *Radical vehicle technology*

- Which is the preeminent regulation for green shared mobility (local/national)?
- How is effective in your view the low-emission zone policy?

- Which factors in the external environment (e.g. electricity price, market share, climate change, material infrastructure) do you think are influencing the adoption of e-vehicles?

1.c.) *Mobility management*

- How to influence behavioral change for the adoption of green solutions?

Extra factors

1. How do you see green shared transport in the context of intermodal transport (integrated with bicycle, public transport etc.)?
2. To what extent is the problem of space in Amsterdam influencing the development of the niche?

<u>Scaling up: final considerations</u>

- What are, in your view, the main developments in green transport in Amsterdam? (Categories to address: economic, social, regulative policies)

- What can be learned from the developments and results in this sector?

- How is it possible to address a growing group of customers?

- What is needed further (at technology, social, political and economic level) to green transport to further develop Amsterdam to a greater extent? (Apart from money)

One-page preliminary questionnaire sample

General

1.) Who are you, and what activities do you perform within the organization?

Expectations

- What are your expectations regarding the developments of the green transport niche in Amsterdam (in relation to development of technology, infrastructure, policy, government regulation and economy)
    - What role does your company play in this scenario?

Network formation

- Who are the main stakeholders you are related with?
    - What is your main topic/field of conversation?
    - How do you work with other actors from your same field?

Innovation areas

- How is perceived the service provided by your company in the context of green mobility development?
    - What are, according to you, the factors that explain the success of this practice?
- How does the service provided by your company fulfill the mobility needs of citizens?

Learning process

- How often are you updated on the last technological improvements from tech companies about charging infrastructure?

- How often does your company get subsides by the municipality/government?

Scaling up: final considerations

- What are, in your view, the main developments in green transport in Amsterdam? (Categories to address: economic, social, regulative policies and research aspects)

- What can be learned from the developments and results in this sector?

- How is it possible to address a growing group of customers?

- What is needed further (at technology, social, political and economic level) to green transport to further develop Amsterdam to a greater extent?

Appendix IV. - Resume of conditions and factors scoring

Condition	Up-scaling factors	Interim factors	Sources	Overall score
Innovation areas	Radical vehicle technology	Infrastructure availability	6	3
		Regulation conforming	8	
	Product-to-service shift	Perception of change	4	2
		Landscape factors	5	
	Mobility management	/	6	3
Network formation	Composition	/	9	3
	Alignment	Broadness	7	2
		Deepness	3	
Learning process	Technological development	/	2	1
	Social and environmental benefits	/	3	1
	Policy and regulatory framework	/	7	3
Voices of expectations	Robustness		2	1
	Quality	Economic benefits	6	3
		Social benefits	6	
		Policy benefits	8	
		Technology benefits	7	
	Specificity		4	2
City			4	2

attractiveness (extra factor)	/	/		