Closing the gap in urban shared mobility availability: Increasing accessibility in Amsterdam Zuidoost.

Master thesis

'To what extent can shared mobility be implemented in neighbourhoods that are currently undersupplied with shared mobility access, to contribute to an inclusive mobility transition in the context of the city Amsterdam?'

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Abstract

This thesis explores the role of shared mobility as a sustainable and inclusive alternative to car ownership within the context of the mobility transition, focusing on how shared mobility can bridge accessibility gaps, particularly in urban areas where shared mobility options are limited. Using the Multilevel Perspective (MLP), this research analyses the niche replacement potential of commercial shared mobility in relation to the traditional car-ownership regime. A case study in Amsterdam Zuidoost is employed to explore how shared mobility can contribute to an inclusive mobility transition, addressing issues of urban inequality and societal exclusion from sustainable transportation alternatives. Qualitative methods are applied to assess the interactions between three key perspectives: policy, individual, and business. The findings reveal a gap between the societal need for the mobility transition, the mobility needs of residents in Amsterdam Zuidoost, and the business opportunities for shared mobility providers, leading to low implementation potential. This research advocates for a shift away from commercial shared mobility solutions towards to more cooperative, community-based models, such as Mobility as a Commons (MaaC) to empower local communities, diversify mobility options and promote a more inclusive transition towards sustainable urban mobility.

'The system is as strong as its weakest link'

12-12-2024

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1. Introduction

Increased awareness of the negative effects of car-centric societies, has awaken policy makers to the need for a transition towards a sustainable, human-centric transportation system (Luna, Uriona-Maldonado, Silva & Vaz, 2020; Nijland & Meerkerk, 2017; Schor, 2014). Through the late 19th, and early 20th century, many countries have experienced a mass urbanisation and mass automobility, leading to a strong determination of space for the automobile (Petzer et al., 2021). Our urban landscapes have changed tremendously, and with the integration of the car in most of our city plans, our behaviours have mostly adapted to the luxury of car-based transportation and car ownership, also referred to as car dependency. On the contrary, the use and production of combustion engine-driven traditional cars has severe negative impacts on local air quality, noise pollution and congestion, and climate change (Fremstad, 2015). To put this into perspective, for Amsterdam, 11 per cent of total CO2 emissions is a result if road transport (Uitvoeringsagenda uitstootvrije mobiliteit, 2023) and the transport sector is accountable for 23% of total global energy-related CO2 emissions (Jaramillo et al., 2022).

Building upon the environmental impact of car-based transportation, increasing pressure on urban space advocates for rethinking of space allocation. Urban space is increasingly contested, and mobility demand increases along with urban expansion. Despite space in cities being extremely scarce, up to 55% of space in Dutch cities is reserved for cars; consisting of circulatory car space accompanied by dormant car space, with each car confiscating 15 square meters on average (van Liere et al., 2017). Paradoxically, cars are idle 95% of the time and only 37% of all car-trips transport more than one person (Fraiberger & Sundarajan, 2015). Car-dominated space competes with alternative space uses, such as green space, that contribute to healthy and safe urban centres, and whether this current allocation of space to car-based infrastructure is fair can be argued upon (Creutzig et. al, 2020).

Beyond the environmental and space implications of car-based systems, issues arise in terms of fairness, and mobility justice. Mobility is associated with the provision of access to services, goods, and activities (Lucas et al., 2016) and insufficient access to mobility, or mobility poverty, leads to exclusion of vital functions such as healthcare, energy, safety,

education, jobs and other cultural and economic functions. In fact, urban street design is an indicator for the quality of life, and improved accessibility to amenities can function as an equalizer in society (Dover & Massengale, 2013). Whereas the negative impact of the car should not be trivialized, for some groups in society, car-based transportation is the best, or even the only realistic transportation mode, thus essential for participation in society. The high investment costs, accompanied by the fixed costs required for ownership, force car-dependent individuals to devote a large share of their income to car ownership, gridlocking them into car-based transportation. Conversely, those without cars face accessibility challenges, reduced time efficiency, and social exclusion in a car-based regime. It proves to be highly complex to find balance between a movement away from car-dependent society, while not excluding those who are in fact car dependent.

Evidently, our current mobility system needs a transition towards urban districts that are human-centric, more liveable, safe, and healthy. This shift from traditional, car-centric mobility systems to more sustainable, inclusive transportation systems is referred to as the mobility transition (Köhler et al. ,2009). To achieve this, cities around the world are developing strategies for a transition to human-centric urban landscapes. The city of Amsterdam aims to be a front-runner in this transition, attempting to prioritize the need for a mobility system change, while simultaneously prioritizing being an inclusive city.

2. Problem statement

There is vast academic knowledge on the negative externalities and missed opportunities that our current car-centric transportation system produces, including increased pollution, congestion, and social inequalities leading to exclusion in society. In response, new mobility solutions are emerging to facilitate a transition from car-centric to human-centric systems. Within the urban context, pressure on public space, as well as the need for more sustainable and equitable transportation options, further intensifies this need.

One widely recognized framework for advancing sustainable mobility and aims to address the environmental, social, and economic challenges associated with car dependence is the Trias Mobilica, which encompasses three key strategies: (1) improving the sustainability of existing transportation modes, (2) promoting active or cleaner modes of transport, and (3) reducing overall transportation demand. Within this framework, one proposed solution is shared mobility. Shared mobility is underlined by the principle of replacing ownership with access-based mobility solutions (Shaheen et al., 2018). In this research, shared mobility captures for-profit, asset-based sharing and includes the conventional individual transportation modes for which sharing is explored in the Netherlands: shared cars, shared mopeds and shared (cargo-) bicycles.

Shifting from car ownership to shared mobility can catalyse a multimodal transport system, reduce congestion and improve accessibility by (1) increasing the threshold to use a car by nudging people to active transportation or other more sustainable modes of transport (2) limit the space in cities that cars take up and create opportunities for alternative space use, (3) reduce greenhouse gas emissions, (4) catalyse the transition to zero-emission vehicles, (5) complement current transportation options, (6) reduce financial costs when compared with individual private ownership of vehicles and (7) optimize the use of underutilized resources (Guyader, Friman & Olsson, 2021).

Based on the factors that advocate for a replacement of car-based transportation and supported by the findings of Meelen & Munzel (2023) shared mobility is an urban solution in the mobility transition. However, something that is greatly understudied, is the effect of this dispersion of this sustainable transportation alternative, and the extent to which shared mobility really is an urban solution, and not rather a high-income solution, or high-density solution for neighbourhoods where car use in fact is unnecessary.

Currently, more than 5,000 commercial shared mobility options are offered throughout the municipality of Amsterdam, including cars, (cargo-) bikes, and mopeds (Gemeente Amsterdam, n.d.). The Amsterdam region ranks third in terms of shared moped availability and has the highest absolute supply of shared cars in the Netherlands, hosting almost 3,000 out of the 7,920 shared cars nationwide (CROW, 2023). Whereas for shared bicycles and mopeds, the market is relatively young, shared mobility is not a new phenomenon, e.g. GreenWheels has been operating for almost 30 years. Nonetheless, only one per cent of all passenger cars in the Netherlands consists of shared cars, and shared mobility only contributes for five per cent to all transport modes, and it responsible for a diminishable share of distance covered (Jorritsma et al.,2021).

Shared mobility providers face significant challenges in establishing viable business models, with profitability often hampered by high operating costs, regulatory barriers, and fluctuating demand patterns (Shaheen & Cohen, 2020; CROW, 2023). The availability of shared mobility, and the potential expansion to new service areas, depends on the potential business case of commercial shared mobility supply. As a result, commercial shared mobility supply increases in the less risky, higher income neighbourhoods, while shared mobility remains absent in areas that do not align with the business model of a commercial provider.

Figures 1 and 2 depict the unequal distribution of shared mobility supply, where city districts Nieuw-West, Noord and Zuidoost are lacking shared mobility availability. To put this in perspective, only 47, out of the total 1980 shared cars that are indicated on the Dashboard Deelvervoer are found in Amsterdam Zuidoost, and some parts of this district even fall outside the service area (Dashboard Deelvervoer, Gemeente Amsterdam,2024).

The spatial distribution of resources and jobs creates spatial disadvantages, and urban growth creates a core and a periphery, inevitable leading to accessibility gaps (Martens & Bastiaansen, 2019). The 'periphery', defined as neighbourhoods further away from the urban centre, is characterised with lower density, longer travel distances and higher car dependency. The 'periphery', in this definition referred to as Zuidoost, Nieuw-West and Noord, simultaneously show the largest shares of low-income households, score lower than the city average on liveability, self-perceived health, people overweight, education level, housing value, and percentage of non-vulnerable people (Notie Deelvervoer, 2024).

Fig.1. Commercial shared cargo bikes and mopeds (CROW, 14/03/2024)

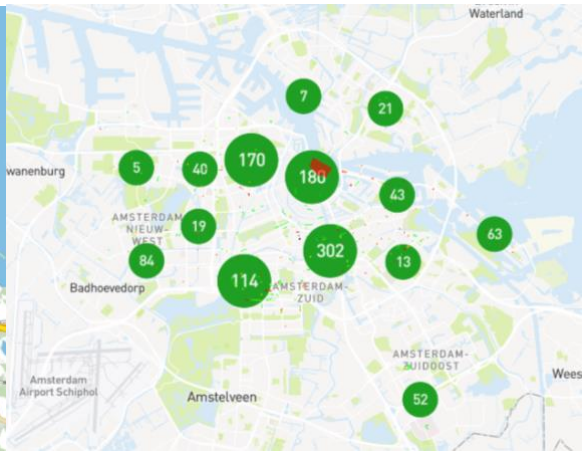


Fig. 2. Shared car supply across city districts, both commercial and private suppliers (Gemeente Amsterdam, 14/03/2024)

Research on transportation disadvantages and their effects on social exclusion goes back to the 1960s (e.g. Kain, 1968). The aim of inclusive mobility systems is to provide all individuals with adequate access to jobs or resources in general. Improving access to amenities in areas that house vulnerable or marginalized residents can increase the chances of climbing the social ladder and thus function as an equalizer in society (Dover & Massengale, 2013). Therefore, the implementation of shared mobility could both improve access to facilities, as well as lower car ownership dependency in those more car-dependent, urban districts.

The municipality of Amsterdam aims for car sharing 'to grow from niche to mainstream' (Nota Deelvervoer 2023) in the upcoming years, indicating an incremental driver to foster sustainable innovations, or weakening of the stability of the current regime in the geographical context of Amsterdam. In the broader framework of the 'Amsterdam Low-Car' initiative, implementing car-discouraging policy measures in areas with high car

dependency can negatively impact accessibility and disproportionately harm individuals who rely on car-based transportation, particularly in the absence of viable alternative mobility options (Boyce, 2010). Moreover, if shared mobility initiatives lack presence in certain neighbourhoods, they might effectively lead to a reduction in relative connectivity for residents of certain neighbourhoods and bear the potential to increase levels of inequality across city districts; raising concerns from a distributional justice perspective (Martens, 2016; Nahmias-Biran et al., 2017; Pereira et al., 2017).

In the context of the mobility transition, concerns regarding mobility justice go beyond the right to participate in society and can rather be defined as the right to participate in the mobility transition. With new mobility schemes emerging, and the mobility landscape changing, there exists a research gap in how newly emerging systems affect individuals. Individuals that can currently be categorized as mobility poor, are vulnerable for system change, and access to combustion engine car alternatives is directly connected to the opportunity to participate in the transition.

As concluded by Pereira & Schwanen (2017), policies should prioritize vulnerable groups, while aiming to enhance overall levels of accessibility. Research on the opportunities of sustainable transportation alternatives often focus on the potential that a solution has for a certain user group rather than proposing holistic solutions, for all. Limited research exists on how new initiatives can incorporate dilemmas in terms of spatial justice, inclusivity and mobility poverty to create just transitions. If shared mobility remains absent in city districts that are characterized as more vulnerable, this represents a broader exclusion of individuals from policy measures that contribute to sustainable and future proof urban districts and inherently hinders the societal transition towards future proof mobility systems.

The mobility transition affects all urban residents. To achieve a successful transition, it is essential that all population groups are included in our future visions. There seems to be a discrepancy between the benefits and barriers of shared mobility supply on different stakeholder levels. Whereas actors intervene on multiple levels, the societal benefits of shared mobility are not simultaneously perceived on the individual level and do not align with the business case of shared mobility providers. Opinions on how to approach this

dilemma differ. Some researchers consider the role of governmental organizations to be essential to either provide additional mobility services or hold commercial actors accountable for determining which city districts are in- or excluded. Others take on a more libertarian viewpoint, support free market forces and are not in favour of government involvement. Additionally, it can be questioned to what extent shared mobility implementation is desirable for city districts that are characterized as more peripheral, as both the travel demand of its residents as well as urban planning of the neighbourhood might be more car-friendly than high-density urban districts where shared mobility currently prevails. It might be the case that shared mobility does not fit the mobility challenges in these neighbourhoods, and it is of even higher essence that we are not producing solutions that residents do not need or want. ''Just because a new technology offers benefits on paper, it does not mean individuals will ultimately embrace it" (Pancratz et al. 2017). The diverging effect of a sustainable transportation alternative poses challenges for urban researchers, and there is a need for tailor-made local implementation of solutions to tackle global challenges in the field of sustainability.

3. Research Design

3.1. Research aim

This research aims to support Amsterdam's efforts in becoming a low-car city and facilitate a mobility transition that is inclusive by closing the gaps in sustainable transport accessibility, thus contributing to a future-proof city.

This study aims to provide a more nuanced understanding of shared mobility's potential in areas with limited current provision. By exploring the status quo of shared mobility availability from a supply and demand perspective, and place this within the political environment, this study provides a deeper understanding of the process in which shared mobility as a sustainable transportation mode arises. Specifically, this research seeks to identify the factors that prevent the adoption of shared mobility in currently underserved areas. By doing so, this research aims to explore the possibilities of implementing shared mobility in those underserved areas to facilitate equal access to car alternatives, particularly for individuals that are reliant on car-based transportation. It is essential to do so, as this contributes to the prevention of sustainable alternatives becoming a high-income solution and car-restraining policy becoming the burden of those that are disadvantaged.
This has led to the research question:

'To what extent can shared mobility be implemented in neighbourhoods that are currently undersupplied with shared mobility access, in order to contribute to an inclusive mobility transition in the context of the city Amsterdam.'

To answer this, the main research question is supported by four sub questions. The first sub question aims to provide the research with a theoretical background and lay a theoretical foundation for shared mobility as a sustainable transportation mode.

SQ1: What theories underlie the development of shared mobility as a sustainable mobility innovation?

In the subsequent sub questions, the three domains in which shared mobility prevails are researched. The policy perspective represents the willingness and the effort of policy makers to stimulate shared mobility adoption. It reflects the municipality's future vision and is hypothesized to reflect the theoretical perspective on shared mobility, that is discussed in sub question one. The user perspective represents the willingness of individuals to adopt shared mobility and aims to capture the individual perspective on the incentives for sustainable transportation modes. The business perspective aims to capture the business proposition and incentives to offer their services.

SQ2: What is the policy perspective towards shared mobility, and in particular: in the case of Zuidoost?

SQ3: What is the perception of shared mobility from a user perspective and what barriers or benefits do there exist?

SQ4: What are drivers and barriers for shared mobility initiatives to offer their services in certain locations?

By analysing the barriers and drivers for shared mobility provision from the supply side, demand side, and the wider political climate, a deeper understanding of the processes that underlie the adoption of shared mobility as an innovative transportation mode is gained. Based on the outcomes, targeted strategies and practical solutions can be developed to ensure equitable access for all residents. As a result, this research contributes to a just mobility transition via the elaboration of policy recommendations based on evidenced research.

3.2. Knowledge gaps

In this research, the societal need for a mobility transition is combined with research on accessibility and within-city inequalities. Whereas research on the need for a mobility transition is extensive, as well as research on the effects of lacking accessibility, and negative effects of high levels of inequality, current literature that combines these processes is lacking.

The need for equal access to sustainable transportation modes is currently understudied, and the potential effect that lagging of certain groups can have on achieving sustainability goals. Even though concerns regarding injustice of accessibility are raised, the effect of certain groups in society not being able to participate on the higher-scale transition are underexposed. Access to these alternatives is a precedent for the 'opportunity to participate in the transition' for individuals, and to achieve real system change on a meso-level, it is essential that all components of the old system are considered.

Even though this need for inclusive solutions in terms of sustainability is gaining importance in the academic debate, knowledge gaps exist. Meelen et al. (2019) and Meelen & Munzel (2023) use the MLP to research the distribution of shared mobility prevalence on the Dutch national level. Inspired by the works of Meelen et al. (2019) and Meelen & Munzel (2023), this study differentiates itself by exploring individual behaviour related to shared mobility through in-depth qualitative methods rather than relying on behaviour aggregates and quantitative data and enriching the analysis with perspectives on car-sharing, (cargo)bike-sharing, and moped-sharing. Additionally, this research zooms into the urban context. The knowledge gaps that this research aims to fill, can be summarized in three main objectives.

Firstly, there exists a gap in the misalignment of car-dependency regime externalities, the perception of individuals, and the business propositions of shared mobility suppliers. This research aims to contribute to this misalignment by translating the theoretical grounds into a real-life context.

Secondly, research on the effects of the differences in access to sustainable alternatives and the generalizability of sustainable measures is limited. Future visions exist on national level, province level, municipality level, and district level. As concluded by Meelen (……), regime strength, and thus the potential of a niche transforming into a regime, differs based on geographical context. There exists a gap in the generalization of urban solutions, and low-car policy visions apply to a heterogeneous city landscape. This research places mobility innovations in the context of geographical heterogeneity, filling the gaps in terms of scalability of sustainable mobility solutions and aiming to close the gap in access to sustainable alternatives to car-ownership.

Thirdly, this research extends the debate on accessibility as a precedent for participation in society towards access to participate in societal transitions. To really achieve system change in the context of an urban ecosystem such as the city of Amsterdam, the more challenging parts of society need to be included in policy measures as well. Moreover, by incorporating everyone in the transition towards a new system, this new system will implicitly be more inclusive.

Concluding, this study contributes to the existing literature by researching the prevalence of sustainable transportation alternative, specifically shared mobility, and places its prevalence into a geographical context. As a result, this research aims to find out whether the theoretical processes are reflected in a real-life urban context and produces location-specific recommendations that contribute to Amsterdam's vision to transition to a human-centric urban landscape.

3.3. Research scope

This research focuses on shared mobility provision and access, based on a socio-geographical context. Inclusivity is approached from a socio-spatial perspective, and the focus will therefore be on socio-spatial inclusion. Considering the socio-spatial perspective, a case-study approach of within-city inequalities in the city of Amsterdam is applied, and this research will use one city district or neighbourhood that is currently undersupplied with shared mobility as an example case. The city district is determined based on an exploration of the demographics and characteristics per city district in Amsterdam, complemented by an exploratory interview with the municipality (CROW, 2024; Gemeente Amsterdam, 2024).

In this research, the decision is made to focus on asset-based shared mobility, and the definition of shared mobility captures the conventional individual transportation modes for which sharing is explored in the Netherlands: shared cars, shared mopeds and shared (cargo-) bicycles. In some shared mobility definitions, ride-sharing and ride hailing are also included in the definition of shared mobility. As these are more service oriented, rather than based on asset usage, these are also excluded in this research. Business to

business (b2b) sharing, which also includes lease plans is excluded from this research, since it is a rather function-based sharing type, or assimilation to permanent ownership. The definition on shared mobility is further elaborated on in chapter four.

Sharing types that are included in this research are Business-to-consumer sharing (b2c) and peer-to-peer (p2p) sharing and from now onwards referred to as commercial shared mobility. This decision was made due to the similarity between commercial shared mobility and car ownership, particularly in terms of its asset-based characteristic. Additionally, commercial shared mobility is frequently referenced in Dutch policy documents as a key component of the transition towards more sustainable and inclusive urban mobility systems (Luna et al., 2020; Nijland & Meerkerk, 2017).

Additionally, the concept of Mobility as a Commons (MaaC) was introduced later in this research, as a response to the growing interest in alternative, non-commercial models for shared mobility. MaaC proposes a shift towards collective ownership and management, emphasising community engagement, inclusivity, and social cohesion.

4. Theoretical Framework

In this chapter, I will examine the theories pertinent to the development of shared mobility as an innovative transportation mode. In the quest for achieving sustainability transitions, understanding how socio-technical systems evolve becomes essential. Transitions are defined as significant changes from one socio-technical regime to another, encompassing the profound shifts necessary to address systemic challenges such as mobility, energy, and infrastructure (Geels & Schot, 2007). First, I will define the concept of mobility, to provide a basic understanding of the main urban challenge this research addresses. Thereafter, this chapter introduces the Multi-Level Perspective (MLP) as the core theoretical framework for analysing such transitions, with a specific focus on the mobility sector. The MLP, as formulated by Geels (2005), offers a comprehensive perspective on how technological transitions (TT) are driven by interactions across three different levels: niche innovations, socio-technical regimes, and the broader socio-technical landscape. By understanding these interrelated dynamics, we can better analyse how innovative mobility solutions, like shared mobility, influence and are influenced by existing systems. The simultaneous involvement of business, technology, and policy innovations at stake, advocate for a socio-technical approach to the impact of shared mobility on system change.

According to the MLP theory, innovations enter socio-technical systems through a combination of (macro) landscape pressures and (micro) niche developments, resulting in a niche becoming a regime, and a shift from one socio-technical regime to another (Geels and Schot, 2007). Geels & Schot (2007) distinguish between competitive and symbiotic relationships of niche innovations with the regime and for landscape development a distinguishment can be made between reinforcing and disruptive.
An important factor in this process, is the stability of socio-technical configurations, and the distinguishment between types of system change. In a stable regime, innovation is mainly incremental and can rather be defined as socio-technical change, whereas in an unstable regime, confronted with challenges and problems, chances are higher that radical innovation provokes a socio-technical transition (Geels, 2002). Depending on the strength of the regime, timing and the nature of the landscape/niche relation, Geels &

Schot (2007) identify four types of transition pathways: transformation, reconfiguration, technological substitution and de-alignment and re-alignment.

Building onto Sheller (2011, p.114), 'a full transition away from the currently dominant automobility system, will only take place when we simultaneously address the issues of social inequality that underpin the un-sustainability of the current system, and begin to promote mobility justice as integral to sustainability'. To capture the ethical aspect of transitions, the multilevel perspective approach to socio-technical innovations is accompanied by a definition of mobility, and placed within the context of mobility justice. This is essential to not only transition towards a new mobility system, but also to allow for a just transition, where inclusivity is aimed for.

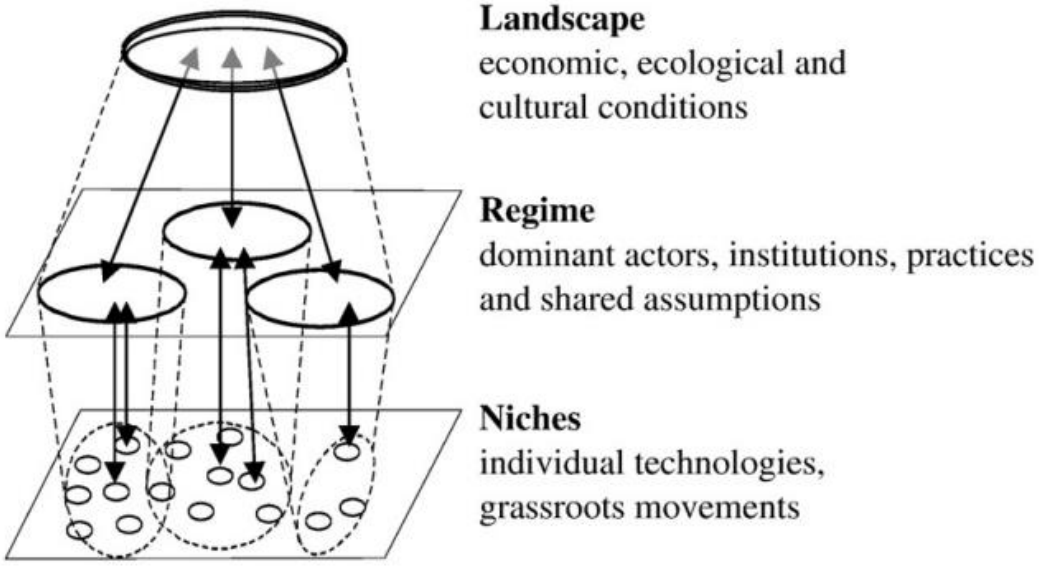


Fig. 3. The multilevel perspective (adopted from Geels, 2002))

4.1. Defining mobility

This chapter aims to conceptualize mobility, as it lays the foundation for this research. Mobility is often referred to as a precedent for participation in society, and creates opportunities for employment, education, leisure and social interaction (Golub & Martens, 2014). Even though often used interchangeable in existing literature, the concepts mobility, accessibility and transportation can rather be understood as mutually interdependent (Nthoki, Nyamai & Schramm, 2023), and a clear distinction exists between mobility and accessibility (Hansen, 1959). Miller (2018) provides a definition of these concepts. Transportation is the act of moving or be moved (Miller, 2018). Access

measures the potential to interact, and mobility captures the realization of this potential to interact and is defined as the ability to freely move or be moved (Miller, 2018). In this research, accessibility and mobility will be used interchangeable.

4.1.1. Defining mobility justice

Mobility justice is at the end of long continuum of discussions aiming to conceptualize the fairness of transport systems, aiming to raise concerns in terms of the social distribution of the benefits and harms of transport systems (Petzer et al., 2020). Whereas the act of moving can be simplified by distance covered, this paints a one-sided picture, and a strong subjective element is involved in the characterization of mobility behaviour. The benefits of more peripheral residential locations could be valued more than the costs of long-distance transportation, resulting in residents deliberately preferring living in the periphery over urban centres. Within this decision-making process, the availability of transportation modes to cover this distance is essential to capture the resource devotion to the commute (Miller, 2018). Allowing for the effect of voluntary choice in residential location and transportation mode, solely focusing on accessibility gaps based on differences in trip distance, transportation mode used, and time travelled overlooks the subjectivity of mobility behaviour. Nevertheless, problems do arise when mobility behaviour is not a result of voluntary decision making and residents of more peripheral neighbourhoods without access to a car are subject to a larger mobility gap (Meelen et al., 2019). Inherent to the embeddedness of the automobile in society, is the distribution of cost and benefits that can be linked to the existing regime. When a city is planned around the automobile, individuals that are either not in the possession of an automobile, either voluntarily or involuntarily, their affectedness by negative externalities that are created by automobile dependency, can be characterized as being injust (Sheller, 2022). Whereas mobility creates opportunities in terms of participation in society, limited access to mobility could lead to lacking choices in terms of mode of transport, having serious implications in terms of health, an individual's financial situation and social life (Golub & Martens, 2014). This research incorporates the interpretation of justice by the definition of justice as "parity of participation", implying that "all (adult)members of society [are permitted] to interact with one another as peers" (see also Fraser1990, 2007).

4.2. The socio-technical landscape

Geels (2002) refers to the sociotechnical landscape as a metaphor, including the wider context that influences, and enables the development of niches into regimes (Meelen et al., 2019). In the context of the sustainable mobility transition, this landscape is dominated by concerns regarding climate change and increasing pressure on public space. Other developments that pressure current car-based systems are health, liveability, air/noise pollution and aesthetics. Other global trends that are specifically relevant are servitization/platformization; digitalization, and the embeddedness of the smartphone, has led to the increase and expansion of car sharing (Ferrero et al., 2018) and access to the internet can be used to exchange unused resources (Laurenti et al., 2019).

Meelen et al. (2019), emphasize the importance of urban form, natural environment, and physical resources, but also societal trends, ideologies and other influences on the niche-regime interaction, and argue for the importance of geographical context.

4.3. The socio-technical regime: car-ownership

In the context of the mobility transition, the dominant socio-technical regime, that shared mobility is tackling, is motorized individual mobility, i.e. car-ownership, automobility or automobilization. In the context of motorized individual mobility, the strength can be captured by the motorization rate (Meelen et al.,2019), and a high motorization rate limits the potential of niche innovations replacing the status quo. Key actors in this regime are car manufacturers, car dealers, car owners and civil servants working on traffic policy (Meelen et al., 2019).

The stability of socio-technical regimes depends on both formal and informal institutions, or 'rules of the game'. Following Scott (1995), these rules are distinguished into regulative, normative, and cognitive, consisting among others of norms, user expectations, legislation, as well as search heuristics of engineers. Low parking prices, larger distance requirements and challenges in terms of public transport connectivity, incentivize car ownership (Amsterdamse thermometer van de bereikbaarheid, 2021).

Geographical heterogeneity implies differences in these 'rules of the game' between regions, thus variations in the strength of regimes, emphasizing the importance of socio-spatial context of shared mobility implementation and the need for the local scale to be considered in transition analyses (Meelen et al., 2019).

4.4. Niche innovation: shared mobility

Shared mobility is a technological solution that is identified as a niche innovation and can shape the future of mobility (Miscolczi et al., 2021). Historically, access or rental, as an alternative to ownership, has been stigmatised to be for individuals with lower purchasing power, and often linked to misallocation of financial assets (Bardhi & Eckhardt, 2012). During the previous two decades, supported by digital technology, a proliferation of access is observed and innovations that are supported by the 'access over ownership' ideology are increasing popularity referred to as 'the sharing turn' in the economy. Part of this 'sharing turn' is the concept of shared mobility (Bardhi & Eckhardt, 2012).
The contemporary concept of shared mobility has emerged in academic literature by mid-2010 and combines the broader concepts of the 'sharing economy', in the early 2010s and 'smart city' concept in the 1990s (Castellanos et al., 2022). Whereas the simple act of sharing can happen between strangers, neighbours, or any combination of ownership, shared mobility is driven by digitalization and allows for sharing resources amongst strangers (Hartl et al., 2024). Shared mobility is supported by the assumption that according the sharing economy, access is more important than ownership (Frenken, 2017), and a shift away from 'you are what you own', towards 'you are what you can access' (Belk, 2014).

Despite the rise of shared mobility as a global phenomenon, ambiguity exists across shared mobility definitions and consensus is yet to be achieved on a common definition of shared mobility in academia. Castellanos et al. (2022) propose an extensive definition of shared mobility, categorizing the type of shared mobility based on market orientation, transaction type and type of solution (asset or service). Machado et al., (2018) define shared mobility as 'trip alternatives that aim to maximize the utilization of the mobility resources that a society can pragmatically afford, disconnecting their usage from ownership'.

			Transaction type		
			P2P (peer-2-peer)	B2C (business-2-consumer)	G2C (government to consumer)
Market orientation	Non-profit	Asset	N/A	*(4)* Public vehicle sharing[1]	*(7)* Public vehicle sharing
		Service	*(1)* Vehicle pooling	N/A	*(8)* Public ride sharing
	For-profit	Asset	*(2a) P2P vehicle-sharing* *(2b)* P2P mobility asset sharing	*(5a) Private vehicle-sharing* *(5b) Private* mobility asset-sharing	*N/A*
		Service	*(3) Ride-hailing/sharing*	*(6) Microtransit / demand responsive transport*	*N/A*

Fig. 4. defining shared mobility (adapted from Castellanos et al., 2022)

Shaheen & Chan (2016) define shared mobility as: shared use of a motor vehicle, bicycle or other means of transport to which a user can access at any time when needed. Others exclude business-to consumer transactions, arguing that business to consumer shared mobility services are rather captured by 'access-based consumption', or 'collaborative consumption' (Böcker & Meelen, 2017; Bardhi & Eckhardt, 2012). Access-based consumption is defined as transactions that can be market mediated but no transfer of ownership takes place (Bardhi & Eckhardt, 2012). In the context of public policy making, a narrowed-down definition of shared mobility is applied, foregoing mobility solutions that have a service-based market orientation, such as ride-hailing, and exclude those from the definition (CROW, 2020). Whereas peer-to-peer shared mobility is argued to resemble the true values and conceptualisation of the 'sharing economy' in the context of shared mobility, the extent to which peer-to-peer sharing fits into the description where a niche develops into a regime can be questioned, and models of commercial mobility providers are criticized to be more resemblant with renting out than sharing (Mouratidis et al.,2021).

This misleading representation of traditional car rental services that are characterised by inflexible longer-term use as sharing is referred to as sharewashing, criticizing companies that utilize the positive image of sharing to unrightfully present their services as sharing (Lehr et al., 2021). In the context of how innovations emerge in socio-technical systems,

the distinguishment between peer-to-peer sharing and business-to-consumer sharing plays an essential role in the niche-to-regime development process. According to the definition by Geels (2002), peer-to-peer sharing is defined as an incremental innovation, generated in regimes, and business-to-consumer sharing as a radical innovation generated in niches (Geels, 2002). Therefore, a distinct difference between p2p sharing and b2c sharing is identified, and both have a different role in regime change. In the case of b2c shared mobility services, car-ownership becomes redundant and is replaced, whereas in p2p sharing, a preservation of the current regime of car-ownership is required.

5. Methodology

This research adopts a qualitative case study approach, focusing on the city of Amsterdam, specifically zooming in on its urban dynamics, shared mobility options, and the challenges faced in terms of the transition towards an inclusive and sustainable mobility system.

Within the urban context of the city of Amsterdam, a case study is performed. The research area is determined based on the current absence of shared mobility provision. In terms of data collection methods and the availability of data, the scale of the research area is on city district level. Three districts in Amsterdam are subject to limited shared mobility provision, in comparison to other city districts: Amsterdam Noord, Amsterdam Zuidoost and Amsterdam Nieuw-West (CROW, 2024). Based on exploratory research, accompanied by an interview with the municipality of Amsterdam, Amsterdam Zuidoost is determined as the research area. A table with a more in-depth comparison of Amsterdam Zuidoost with Amsterdam Noord and city average can be found in chapter nine.

Amsterdam Zuidoost, characterized by its cultural diversity and urban planning ideology as a non-car-oriented district, the city district showcases a high prevalence of car-use in the modal split. Additionally, Amsterdam Zuidoost has a lower average disposable income than city average, percentage of loneliness is higher, parking nuisance is higher, percentage of social housing is higher, overweight people is higher and limited leisure facilities are present. Considering the challenges in terms of urban growth, social cohesion, health and liveability the city district faces, opportunities exist in terms of non-car transportation availability, and the coverage rate of public transport. This exploratory research is depicted in chapter nine and is expanded and accompanied by background information on demographics, neighbourhood characteristics. Data from the municipality of Amsterdam and Statistics Netherlands (CBS) is used for this.

The methodological approach, depicted in figure five aims to visualize the research questions, and decomposes the main research question into four sub questions.

The theoretical framework in chapter four presents a basis for processes underlying the potential development of shared mobility from niche to regime and applies the MLP to the mobility transition, answering *SQ1: What theories underlie the development of shared mobility as a sustainable mobility innovation?* The MLP provides a lens to analyse the evolution of shared mobility services within a socio-technical context, identifying challenges and opportunities arising at different levels of system interactions: niche innovations, socio-technical regimes, and the socio-technical landscape. In this research, the MLP is used to understand the interactions between various societal layers influencing shared mobility implementation. Figure six visualizes the concepts and actors that are hypothesized to be important for the potential of a niche entering the regime and places the three perspectives in which the research question is subdivided into the MLP.

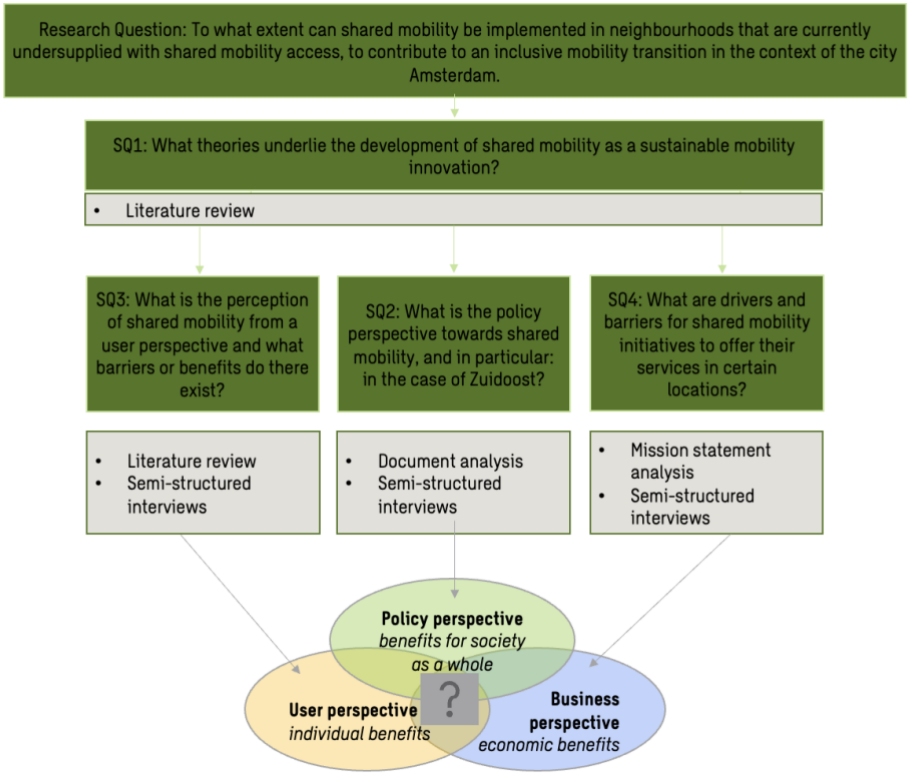


Fig. 5. The three perspectives that are analysed, in the context of the MLP

The focus of this research is on the interactions between the niche and the regime. Within the regime, key actors are car manufacturers, dealers, and others that are responsible for the supply and distribution of privately owned cars; car owners and civil servants working on traffic policy (Meelen et al., 2019). To determine the potential of shared mobility to grow from niche to regime, critical interaction takes place between the policy perspective, the individual perspective, and the business perspective, as depicted in figure five and six. This research hypothesizes that critical interaction takes place between the policy perspective, the individual perspective, and the business perspective; thus, the political perception towards system change, and the willingness of an individual to adapt to a new regime determine regime strength and replacement potential. To answer the main research question, it is essential to find out the incentives of each stakeholder group and indicate the extent to which the three perspectives overlap. In the final stage of this research, the analyses of the three perspectives are combined, to evaluate the current fit of commercial shared mobility to the case of Amsterdam Zuidoost. Based on this, a potential framework in which shared mobility can be applied the specific geographical context of Amsterdam Zuidoost is proposed.

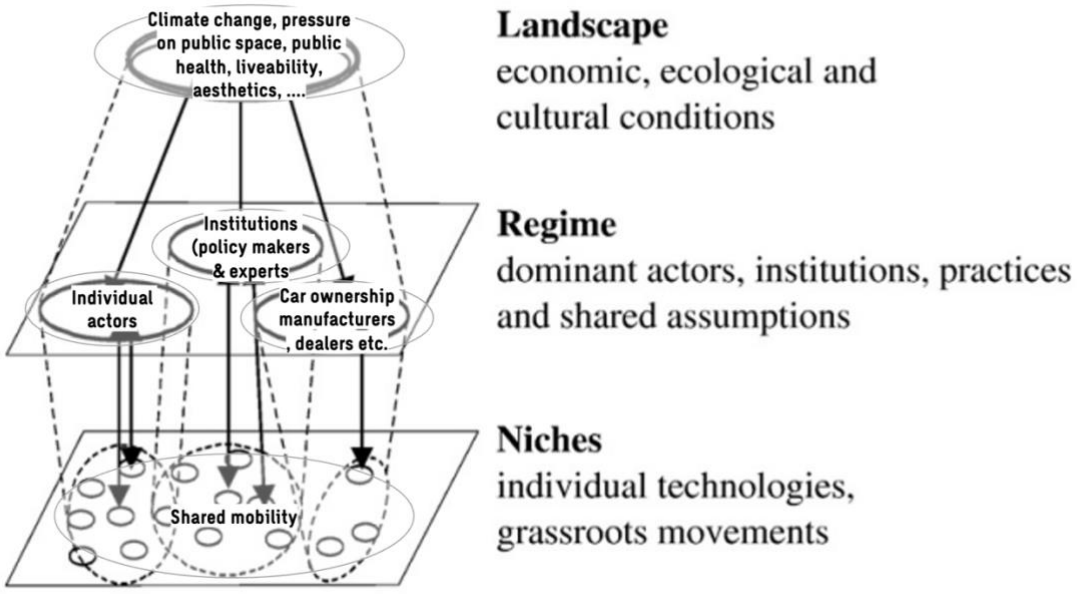


Fig. 6. The multilevel perspective in the context of the methodology (adopted from Geels, 2002 and modified by author)

5.1. Analysis of the Socio-Technical Landscape

The Socio-Technical Landscape (Macro-Level) represents the broader context and reflects the need or urge for system change, including societal trends, regulations, cultural dynamics, and environmental challenges that influence shared mobility. In the context of Amsterdam Zuidoost, the macro-level factors include the growing focus on sustainability, the pressure to reduce CO2 emissions, and the need to reduce car dependency in urban spaces. The socio-technical landscape is covered in chapter one, further described in chapter four, and put into the geographical context of Amsterdam Zuidoost in chapter nine.

The current socio-technical regime (Meso-level) is car-ownership. The characteristics of the current car ownership regime are described is chapter six through a literature review in which the costs of car ownership are outlined and compared to shared mobility. Considering the scope of this research, the decision was made to not go into depth into the car-ownership industry perspective and this research rather shifts focus to the replacement potential of shared mobility with respect to the regime. To capture this replacement potential, a multi-method qualitative approach is applied, see figure six.

This research will examine to what extent socio-technical landscape characteristics are reflected on the individual, business and policy level. This research hypothesizes that the goals set in policy documents can be traced back to the higher-level societal goals of sustainable, future proof mobility systems. On the individual level, it is hypothesized that the awareness of, and the perception towards the societal trends that are captured in the societal landscape differs. From the business perspective, it is hypothesized that shared mobility suppliers differ in terms of landscape factor prioritization. The extent to which these hypotheses hold is tested through qualitative research methods that are elaborated on in the following sections of the methodology chapter.

5.2. Analysis of Regime Strength

To create a multifaceted representation of the strength of the regime, the regime strength analysis is subdivided into the political perspective, and the individual perspective, aiming to capture the strength of the current regime and the current state of the niche innovation.

All interviews follow a semi-structured interview approach, and at least cover the following three sections: perception towards the socio-technical landscape factors, current regime perception and niche potential perception. The interview guides that were used can be found in Appendix B. The interviews were either conducted by telephone, online or in person, depending on the preference of interviewees had a duration of 30-45 minutes. The interviews are transcribed and Atlas.ti is used to code and analyse the results, applying an open coding approach.

5.2.1. Analysis of the policy perspective

Policy is assumed to represent the policies higher-level societal goals of sustainable, future proof mobility systems. The policy perspective is explored in an initial policy document analysis with respect to shared mobility and is complemented with semi-structured interviews.
The policy document analysis is conducted in a three-step approach, covering the following actions.

In the first step, a selection of policy documents is made based on three main criteria:

1. Future vision of the municipality of Amsterdam, both city and Zuidoost level
2. Future vision with regards to (shared) mobility
3. Policy documents that are subject to similar landscape characteristics as for shared mobility.

The second step involves an analysis of the policy documents that were selected in the previous step. First, the policy documents are examined based on direct mentioning of shared mobility. Secondly, the policy documents are examined based on indirect mentioning of shared mobility, through car-ownership regime characteristics, or

landscape characteristics that share a common ground with regime change or shared mobility implementation. The outcomes of this can be found in chapter … and will serve as a basis for the interview guides.

In the third step, the policy document analysis is complemented by semi-structured interviews with policy makers and experts in the field of (shared) mobility. Four interviews have been conducted with policy makers and four with experts from the field. In the policy maker pool, three policy makers were specifically linked to the municipality of Amsterdam, and one was linked to the province of Noord-Holland. For the expert interviews, the expertise included either mobility justice or shared mobility.

Complementary to the focus on shared mobility, three interviews of which two with policy makers, and one expert interview shifted focus from commercial shared mobility to cooperative sharing and go into depth on the concept of Mobility as a Commons (MaaC). This part of the research introduces the concept of MaaC as a newly emerging shared mobility system in which communal ownership replaces the current regime of individual ownership and residents own a mobility fleet together. MaaC is currently explored through small scale pilot projects, both in Amsterdam as well as in other Dutch cities, and considering the conceptual phase of MaaC, it is elaborated on based on the outcomes of the interviews.

By combining the outcomes of the policy document analysis with the interview results, this part of the research aims to answer *SQ2: What is the policy perspective towards shared mobility, and in particular: in the case of Zuidoost?*

5.2.2. Analysis of individual perspective

In the second part of the regime strength analysis, the embeddedness of the current car-based regime, and the potential to switch to a shared mobility scheme is analysed through the lens of individuals. This part of the research aims to capture the perception towards the current regime and adaptation potential of residents of Amsterdam Zuidoost to shared mobility as a niche development. This is essential to gain a broader perspective on

the mechanisms that underlie shared mobility services or maintain the current car-ownership regime.

The individual perspective and the applicability of shared mobility to different user types is covered in chapter eight. This is based on the exploration of shared mobility in chapter seven, a literature review and desk research on the technical requirements for shared mobility usage. Thereafter, in-depth interviews are held to explore the characteristics of the demand side of shared mobility services, and, more importantly, of those who are not. This research aims to determine the perception towards shared mobility, the embeddedness of the current regime, and the perception towards the need for regime change.

Seventeen semi-structured interviews with residents of the case study area are conducted. Social networks have been used to find interviewees, and a snowball-tactic is applied to reach a larger audience, aiming for a representative interviewee pool. In the selection process for interviewees, two conditions were imposed: a) residential location being Amsterdam Zuidoost, and b) physically being able to cycle. This second condition was considered as the minimum requirement for an individual to make use of shared mobility.

The residential interviews go into depth on the values, neighbourhood characteristics, drivers and barriers of mobility behaviour and are structured based on the characteristics of the current system and perception towards the benefits of a potential new system. The following topics were covered: sustainable behaviour, perception of costs of car ownership, perception towards sharing, satisfaction with neighbourhood, mobility behaviour. All interviewees followed a semi-structured guideline, starting with a description of the neighbourhood (landscape), following by a more in-depth conversation on mobility behaviour and ending with shared mobility specific questions. This approach was applied, to be able to identify car-system related externalities that exist on the landscape level, before discussing mobility behaviour specifically, and go into depth on regime strength and niche replacement potential.

As a result, these findings will contribute to answering *SQ3: What is the perception of shared mobility from a user perspective and what barriers or benefits do there exist?*

5.3. Niche replacement potential

In chapter thirteen, the replacement potential of the niche to break into the regime is researched from the perspective of shared mobility providers, referred to as the 'business perspective' in this research. This analysis is twofold. Initially, desk research is computed in which the shared mobility initiatives that are active in Amsterdam are listed, including an examination of their mission statements, and identify the urban challenges each shared mobility provider aims to tackle. In the second phase, this is complemented by interviews with commercial shared mobility providers.

Six semi-structured interviews are conducted with commercial shared mobility suppliers, complemented by a written statement from one car-sharing supplier. In this part of the research, a deeper understanding of the playing field of shared mobility is gained, and the factors that underlie the decision-making process of shared mobility provision. The aim is to determine the niche replacement potential in the case of Amsterdam Zuidoost, by discovering why one location is more attractive than another for commercial shared mobility provision, and other areas stay behind. Additionally, this part aims to capture the willingness of commercial shared mobility providers to expand to new service areas, or in the context of this research, Amsterdam Zuidoost. It is hypothesized that the extent to which the societal trends, and other characteristics of the socio-technical landscape are captured in the shared mobility business propositions differ, and heterogeneity exists in the applicability of shared mobility on the local scale. For niche replacement potential to be high, the urban challenges (socio-technical landscape characteristics) that shared mobility providers aim to tackle, should resonate on the individual perspective.

The desk research, combined with the outcomes of the interview results lead to answering *SQ4: What are drivers and barriers for shared mobility initiatives to offer their services in certain locations?*

6. Costs-based approach to the ownership-sharing trade-off

This chapter aims to provide the reader with a broad picture of the car-ownership regime and places the ownership-sharing trade-off in the context of cost, and cost perception. By doing this, this chapter lays the foundation for the qualitative research that is done in the next phases. A cost-based structure is applied to quantify and concretize the characteristics of the current regime, and this cost and benefits approach is repeated in the interviews. Costs are categorized into individual and societal costs, and subdivided into costs of ownership, costs of idleness and cost of usage.

6.1. Individual cost

In European member states, the private automobile ranks second in terms of household expenses and is only exceeded by costs of housing (EC,2020). Simultaneously, the cost of car-based transportation is structurally underestimated by individuals as well as policy makers (Gössling et al., 2019).

6.1.1. Individual costs of ownership

In a system where car ownership is the regime, vehicle costs are dominated by fixed costs (Gösslings et al., 2022). These costs include the cost of car ownership captured by depreciation, accompanied by recurring costs, including insurance, road tax, maintenance and repairing. Additionally, the high investment costs that characterize car-ownership implies the requirement of having sufficient capital access to acquire a privately owned vehicle, creating a barrier to participate in the ownership-based regime for individuals that do not have access to these funds. Moreover, the high investment costs, accompanied by the fixed costs that are required for ownership, force car-dependent individuals to devote a large share of their income to car ownership, thus gridlocking them into car-based transportation. On the other hand, not owning a car while being in a car-based regime, can have serious implications in terms of accessibility, time efficiency of individual transportation and exclude individuals from participating in society, and access essential functions.

6.1.2. Individual costs of usage

For private car usage, the cost of usage can be simplified to the costs of fuel. For shared mobility usage, the cost of usage depends on the tariff that is linked to membership type and user frequency. The cost of usage depends on the sharing scheme and varies between all-in tariffs to deconstructed pricing. Depending on the shared mobility service, there might be additional costs, such as registration costs. Beyond the monetary costs of usage, non-monetary costs include journey time, as well as the opportunity costs of wasted time allocated to travelling (Marletto, 2019).

6.1.3. Individual costs of idleness

The individual costs of idleness can be captured by the costs of parking and play an important role in the ownership-sharing trade-off. Parking is inevitable linked to the system of car ownership and parking prices are widely used as a policy instrument to reduce the number of car trips in urban areas. Following Ostermeijer et al. (2021), based on a parking price elasticity in the city of Amsterdam, an increase in the costs of a parking permit with €100, leads to an average decrease in car ownership with 1.7%. A 10% increase of destination parking costs, decreases parking demand with 3%. Nevertheless, this effect is not homogeneous across districts, the relative price increase to the initial tariff, thus in districts where the pricing level is lower, an equal absolute tariff change will have a larger effect. Other factors that determine the price elasticity of parking are purpose, timing, location, length of stay and day of the week.

6.2. Societal costs

6.2.1. Societal costs of ownership

A substantial amount of water, and other resources is devoted to enable the urban mobility of a single person, and ownership-based systems involve inefficient resource allocation that is related to the production of the private automobile (Mercier, 2009). The sunk costs that are related to vehicle purchase and ownership nudges individuals towards the use of their self-owned vehicle, producing a failure where individuals do not use the most optimal transportation mode for the journey, e.g. in terms of sustainability or health

(Gösslings et al., 2022). Not having a car, while being in a car-based regime produces societal losses by excluding individuals from adding value to society.

6.2.2. Societal cost of usage

Combustion-driven cars contribute to climate change by emitting GHG. In addition, car-based regimes produce air and noise pollution, congestion, delays to other vehicles, cost of infrastructure, healthcare costs that are a result of traffic accidents, and safety. Whereas some of these costs are covered by taxes and fees paid by vehicle users, costs in terms of air or noise pollution. Most of the negative externalities that are captured in the societal costs are difficult-to-quantify, and no markets exists for negative effects.

6.2.3. Societal costs of idleness

Even vehicles that have a high efficiency, promising movement and flow, have a certain rate of idleness, or referred to as dormancy by Spurling (2020). These costs of idleness, as referred to in this paper, are interwoven with alternative space use and loss of habitat. Another element includes the maintaining costs of public space that is allocated to parking, and the opportunity costs of these assets not being allocated to alternatives that increase liveability. In urban landscapes, space is scarce, and parking facilities compete with other space allocations, such as urban greenery. Urban green space benefits residents by improving liveability, aesthetics, pollution and heat stress, and improve health.

The societal costs are strongly related to the sociotechnical landscape, and the pressure that a car-based transportation scheme has on society. The misalignment between individual costs and societal costs, are supported by tragedy of the commons.

One of the drivers for system change, is the increasing pressure on public space, and concerns on liveability. Space scarcity is directly related to alternative space use of current car-dominated space, and space usage is linked to liveability and neighbourhood aesthetics.

6.3. Cost of ownership compared to shared mobility

6.3.1. Individual costs

Transport demand and mode choice is predominantly determined by the individual costs of transportation (Gösslings et al., 2022). As exemplified in the previous sections, the cost structure for car ownership is multifaceted and subject to complexity. Whereas the pay-per-use system that is common in shared mobility nudges individuals towards alternative, more sustainable transportation modes, it creates financial awareness of transportation costs. Since costs of car ownership is structurally underestimated, costs of sustainable alternatives are unrightfully perceived and stigmatised as expensive, hindering rational decision making and obstructing the transition towards sustainable transportation choices.

To overcome this, calculation tools are offered through the NS website or the ANWB. Based on a new Volkswagen up!, 10.000 kilometres a year is the threshold in which individuals are indifferent between sharing and ownership based on transportation costs (see; GreenWeels.nl). Even though a calculation tool aims to overcome the misperception on costs of transportation, it still simplifies the ownership vs sharing dilemma. Car ownership is linked to a sense of freedom and the potential unavailability of a car, when being dependent on sharing, increases the willingness to abandon car ownership.

6.3.2. Societal costs

Switching from car ownership to car sharing leads to a significant reduction of total vehicle distance covered and triggers an overall change to a non-ownership lifestyle (Dorner& Berger, 2020). Replacing the ownership-based regime with usage-based regime, catalyses the transition towards zero-emission transportation modes, thus reduces the environmental impact of car-based transportation. This is twofold: Enabling individuals to switch from combustion-engine vehicles to zero-emission vehicles by overcoming the high investment costs that form a barrier for acquiring zero-emission vehicles, as well as automatically nudging individuals to zero-emission alternatives (Jung & Koo, 2018). Simultaneously with the expansion and diversification of the mobility supply, multimodal

transportation is stimulated, and individuals are enabled to use healthier transportation modes, both in terms of individual health as well as public health.

6.3.3. Potential drawbacks

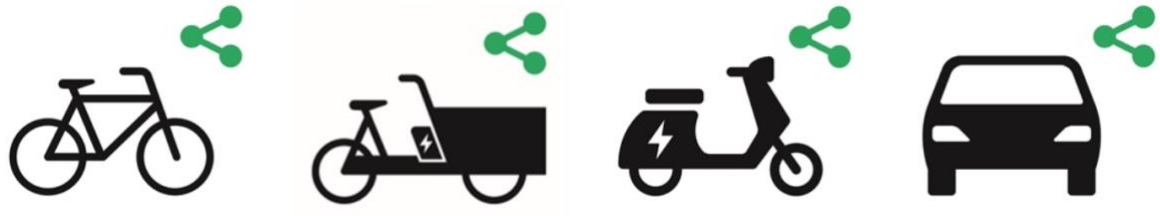
The sharing economy replaces ownership with access. Since previously non-owners are now enabled to own or use a car, car-based transportation gains presence in the mobility mix and replaces other modes of transportation; 15% of shared mobility kilometres would not have been driven without shared mobility access (Nijland & van Meerkerk, 2017). However, this is offset by the decrease in car-based distance covered after replacing ownership with sharing (Nijland & van Meerkerk, 2017).

One of the main arguments underlying the sharing economy is that by increasing the efficiency of underutilized assets, the required number of vehicles to match transportation demand decreases. However, improving the utility of under-utilized assets lowers the costs of ownership, potentially stimulating investments in more assets to make profit (Frenken, Schor, 2017). De facto, asset-holding is rewarded with the possibility to invest in more assets, and the hub- or the platform economy intensifies the concentration of supply (Perren & Kozinets, 2018). Owners could potentially earn back the economic costs of owning a car by offering a privately owned vehicle through peer-to-peer sharing, o thus increase purchasing power (Fraiberger & Sundararajan, 2015; Klein et al., 2022). De facto, a mechanism in which the possibility to share privately-owned vehicles stimulates overall consumption, questioning sustainability implications. The potential to partially recoup investments and build capital, might create a gap between access-based consumers and ownership-based consumers, in which ownership-based consumers are rewarded with the opportunity to build capital, whereas non-owners are dependent on owners, or commercial parties.

The high investment costs of transport modes in combination with the profound relation between the adoption of car-sharing and the environmental awareness of users, advocates for a rejection of this mechanism, diminishing the potential harm of shared mobility to stimulate overconsumption (Meelen et al.2019).

7. The shared mobility landscape

The supply of shared mobility in the Netherlands consists of shared mopeds, shared bicycles, shared cargo bikes and shared cars. The initial focus of this research is with for-profit commercial shared mobility provision: through business-to-consumer sharing structures, and in peer-to-peer sharing platforms. Service-based mobility sharing and Business-to-business (b2b) structures are not considered in this research. Informal sharing, or as earlier referred to as lending out, is not included either.



In peer-to-peer sharing, the act of sharing amongst strangers is facilitated by a commercial actor. The initial function of the vehicles that are offered through peer-to-peer sharing, is private transportation, and participation in p2p sharing is driven by the opportunity of potentially lowering the costs of private car ownership or driven by intrinsic values that are similar to the ones that underlie the need for a mobility transition (Rijkswaterstaat, 2024). The availability of peer-to-peer car sharing services is thus driven by the willingness of individuals to share their privately-owned transportation assets. P2p sharing is only available for car sharing.

Commercial actors, driven by business models, will only supply neighbourhoods where a sufficient demand is present, and a positive business case can be created. Therefore, business-to-consumer shared mobility services limit their service area to (urban) districts that meet certain characteristics, and depend on the attractiveness, riskiness, and feasibility of a potential service area. A stronger socio-technical regime, measured by the motorization rate, decreases the likelihood of business-to-consumer presence (Meelen et al, 2019).

This difference in drivers of both types of commercial shared mobility provision, plays an essential role in characterizing the shared mobility landscape. P2p sharing is overrepresented relative to b2c supply. To put this into perspective, peer-to-peer sharing is overrepresented in relation to business-to-consumer sharing. To put this into

perspective, 88% of the total shared car mobility fleet in the Netherlands consists of peer-to-peer sharing cars (Jorritsma et al., 2021). Since the threshold to offer B2C services is higher, B2C sharing services showcase a higher utilization rate as well as a higher positive environmental impact in comparison to P2P sharing (Nijland & van Meerkerk 2017; Meelen et al., 2019). On the B2C level, higher efficiency of resources fosters sustainable innovation since it creates an incentive for commercial parties to expand their services, thus increasing the availability and therefore reliability of shared mobility services.

7.1. Shared car suppliers

GreenWheels and MyWheels offer station-based car sharing and dominate the shared car market in terms of market size and national coverage, respectively with a car fleet of 2800 and 3000 cars in the Netherlands and 850 and 1000 in Amsterdam (GreenWheels; MyWheels). Pricing depends on the distance travelled, rental time, and whether or not a subscription-discount can be applied. Instead of aiming replace the existing network, GreenWheels aims to be an addition.

The car fleet of GreenWheels mainly consists of small four-seated cars, of which approximately 30% is electric-driven. MyWheels' car fleet is more diversified, and 27 different car types are available: small (5), medium (10), special (12).

GreenWheels: *'Make streets more liveable." We achieve this by offering a sustainable alternative to car ownership: with shared cars. In so doing, we create more space in cities and on our roads.*

MyWheels: *'Keep the Netherlands on the move with just one million cars." We can do our bit by promoting the use of shared cars. Because the more cars we share, the fewer cars we need to own.'*

ShareNow+Free2move is active in 17 European cities, offering free floating car-sharing with a total car fleet of 400 all-electric cars in Amsterdam. Pricing depends on distance and time. and an additional drop-off fee applies to Noord and Zuidoost. It is possible to rent per hour and pay per kilometre, as well as multiple-day discount is available: thus, accommodating short-term as well as long-term carsharing**.**

ShareNow+Free2move: *'It is your personal freedom: To make it possible for you to drive in the city without breaking the bank – or the environment. With just one app, we put thousands of the world's coolest cars at your fingertips'*

Snappcar facilitates peer to peer sharing by enabling individuals to share their privately-owned vehicles amongst each other. 10.000 cars are available through Snappcar

throughout the country. Instead of offering a shared service through supplying individuals with vehicles, individuals are shared mobility suppliers Therefore, Snappcar distinguishes itself from the other providers listed above, since Snappcar does not directly offer vehicles.

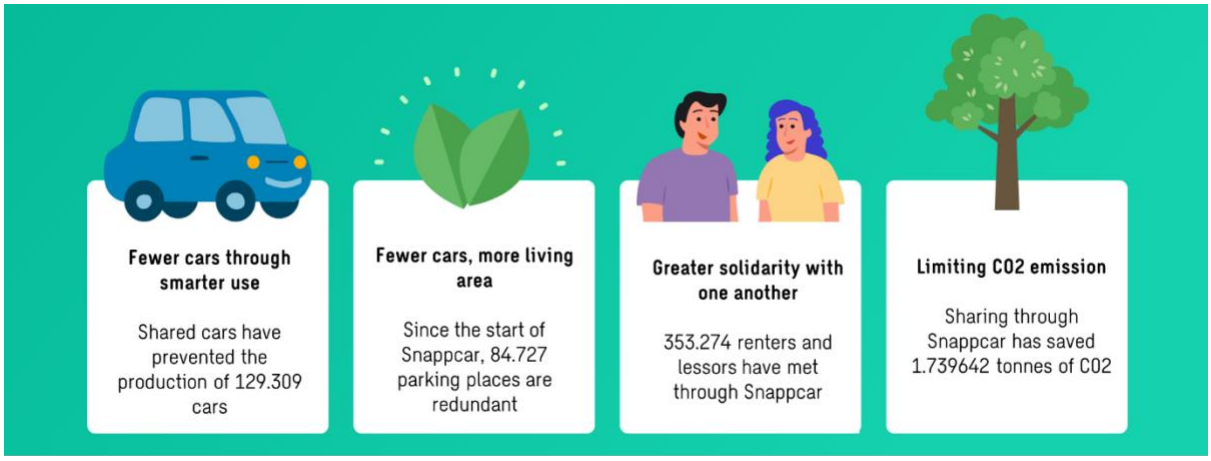


Fig. 7. The added value of Snappcar (adapted from Snappcar.nl and translated)

Snappcar: *'Get 50% of all cars off the streets through car sharing. For our planet, our society and for you. Imagine a world where 5 out of 10 cars on your street would no longer be needed. Start car sharing and do your bit!'*

7.2. Shared moped

Approximately 12.500 shared mopeds in the Netherlands, and the prevalence and composition of suppliers differs across neighbourhoods (CBS,2022). As of 2024, Check and GoSharing are responsible for the supply of 1200 shared moped in the city of Amsterdam.

Check: *'Making cities more liveable.' Creating alternatives for the private car, to create more space, less (combustion-engined) vehicles. More quiet living environment and cleaner air.'*

Felyx: *'Actively contribute to shaping the cities of the future by providing a more sustainable, safe, convenient and fun mode of transport.'*

GoSharing*: 'Creating a world where urban mobility is convenient, affordable and sustainable through innovative and efficient shared transportation solutions.'*

7.3. Shared bicycle

In the Netherlands, the shared bicycle market can be subdivided into conventional or electric bike-sharing and cargo bike sharing, and these two market segments are covered by different operators. For bicycle sharing, only a small share of bicycles is electric-driven, and most are conventional bicycles. For cargo bicycle sharing, all cargo bicycles are electric driven.

7.3.1. Shared conventional bicycle

OV-fiets offers station-based bicycle sharing and holds the largest market share, operating in a total of 283 locations, with approximately a total of 25.000 shared bicycles. OV-fiets is part of Dutch railways (NS), and predominantly operates in railway stations. In the city of Amsterdam, there are nine OV-fiets locations, offering a total of 3500 shared bicycles. 44 shared bicycles are present in Amsterdam Zuidoost (ovfietsbeschikbaar, n.d.). In the urban context, shared bicycles substitute local public transport, or private bike usage, thus accessibility effects are limited (Jorritsma et al., 2021). In four locations, OV-ebike is currently explored. To make use of an OV-fiets, a personal PT card with a free-of-charge OV-fiets subscription is needed, and costs of OV-fiets are incorporated in public transport car expenses. To facilitate multimodal travel behaviour, OV-fiets, as part of NS, has a partnership with GreenWheels and Check.

OV-fiets: *'The primary goal of OV-fiets, is to stimulate public transport usage by facilitating last-mile transportation.'*

DonkeyRepublic is an internationally operating shared mobility supplier, with a reach of 71 cities in 8 countries. Approximately 800 shared bicycles, of which 200 are electric-driven are available in Amsterdam, of which none are available in Zuidoost. Donkey Republic operates through a station-based back-to-many system. Besides Amsterdam, Donkey Republic is active in six other cities in the Netherlands. Pricing is structured through either a subscription or daily use prices. The price structure follows a flattening price curve, and price per hour decreases with rental time increase, up until a rental term of fourteen days. In comparison to OV-fiets, longer term rental is economically attractive, and there is more flexibility in terms of pick-up and drop-off locations. Donkey Republic

usage requires an app, and payment can only be done through credit card, making it more accessible for tourists, while simultaneously being a barrier for usage.

Donkey Republic: *'Save money, save time, go green. Besides providing convenient, affordable, flexible and sustainable transport, we want to connect with our customers and encourage them to participate in the transformation in urban mobility.'*

7.3.2. Shared cargo bicycles

A newly emerging sustainable transport alternative is the electric cargo bike. In the Netherlands, the shared cargo market is dominated by **Cargoroo and Baqme.** Currently, the implementation of electric cargo bikes in the shared mobility is explored through small-scale experimentation (n=100) in the pre-defined neighbourhoods Oost and Rivierenbuurt. As of 2024, Baqme will hold a monopoly position in Amsterdam envisioning to expand the service area to all city districts, with a total supply of 750 shared cargo bikes. The cargo bikes that are offered for sharing follow rules and regulation of e-bikes, are limited at a speed of 25 km/h, and do not require a driver's licence.

Cargoroo*: 'A clean, safe and congestion-free city.'*

Baqme: *Reducing the need for private car ownership by providing active, accessible mobility to urban areas*

7.4. Conclusion

All shared mobility suppliers target car-ownership and share the aim to contribute to more liveable urban areas. Nevertheless, differences exist in transportation purpose, distance to be covered and travel composition.

First, shared mobility services vary based on the distance they are designed to cover. A distinction exists between options suited for within-city transportation and those intended for longer trips that extend beyond urban boundaries. Shared micro-mobility, captured by shared (cargo-)bikes and shared mopeds, offers a sustainable, convenient, and more affordable alternative to car-based transportation for within-urban trips. As shared cargo bikes can transport up to three children, they aim to replace the car for shopping, parcel carrying, or family activities. From the cargo-bicycle perspective, it becomes clear that by offering electric cargo bicycles through sharing schemes, cargo-bike usage is facilitated for individuals that are not in the position to acquire a cargo-bike. This particularly holds for the cargo bike, since an electric cargo-bike is subject to high investment costs, while only applicable for within-city boundary destinations and therefore only partially substitutes car-based transportation. Shared mopeds can transport up to two individuals, and do not require physical effort. Whereas less incorporated in their mission statement, shared mopeds target either multimodal transportation, or rather trips within the urban context, and differentiate their selves by including 'fun' in their mission statements.
Shared bicycles target private transportation, for within city destinations. Electric shared bicycles create potential for longer distances. OV-fiets shares the distance to be covered with shared mopeds, shared cargo bikes and bicycle sharing facilitated by Donkey Republic For destinations beyond the urban residential area, OV-fiets aims to enable individuals to substitute privately owned transportation with public transport (train) by facilitating last mile transportation. Shared car suppliers aim to replace car ownership with shared car usage, for incidental trip purposes to non- or other- urban destinations. Therefore, OV fiets and shared car suppliers share a common mission to replace privately car ownership and target the substitution of using privately-owned cars for trips that go beyond the urban residential area.

8. The shared mobility user profile

8.1. Current users

The shared car user is typically characterized as the high-income, higher-educated urban dweller. 77 per cent was younger than 55 and either couples with kids or singles (Source: GreenWheels report). 86 per cent of shared car users do not own a car, and on the average distance covered by shared car users is 5000 kilometres a year, for leisure purposes, visiting family/friends, transportation of things, or incidental purposes. However, the user profile for car sharing is broadening, and the early adopters are now accompanied by the early majority (This refers to Roger's well-established theory on the Diffusion of Innovations, see: Rogers, Diffusion of Innovations, 2003). There is still a lot of terrain to win in terms of potential users of shared mobility, especially considering that only seven percent of all people has ever used shared mobility.

According to a report published by KiM (2023), specifically researching p2p car sharing, young adults are clearly overrepresented, and older individuals are underrepresented. Nearly half (47%) p2p car-sharing users in the Netherlands are within the 26 to 35 age group, whereas fewer than five per cent of p2p users is over 60 years old. 53% of P2P users live in the four largest cities, compared to only 14% of the general population. These users are typically better educated, earn higher incomes, and own fewer cars than the average Dutch citizen. P2P users are younger and slightly less concentrated in dense urban areas compared to business-to-consumer (B2C) car-sharing users.

For shared micro mobility usage, similarities exist with broader trends observed among shared car users: concentrated in urban areas and typically exhibit a preference for convenience and flexibility in their travel choices. Shared moped users in the Netherlands are predominantly young adults that do not own a car, including students, tourists, expats, freelancers, and commuters, and shared mopeds are used for short trips, such as visiting family, leisure activities, or commuting. (KiM, 2020).

Cargo bicycles can be placed in between conventional bicycles, mostly used for individual trips of average, and cars, that can be used for all purposes and distances. According to

Cargoroo, more than 50% of urban car-trips can be replaced by cargo bikes. For within city transportation, electric cargo bikes can replace car purposes of parcel carrying, transporting children and shopping, thus decrease car-dependency (Carracedo & Mostofi, 2022). However, research finds that the cargo bike does not replace the car for commuting purposes (Carracedo & Mostofi, 2022). Barriers that exist for cargo bike usage are high acquisition costs, low awareness of its existence and limited opportunities to explore the potential of this innovative transportation mode (Dorner & Berger, 2020). The limited substitutionary power of electric cargo bikes compared to cars, combined with the high acquisition costs, negatively incentivize consumers to choose of cargo bike ownership over car ownership. In a study on registered cargo-bike sharing operators, Becker & Rudolf (2018) found that users of e-cargo bikes held strong intrinsic values regarding environmentally sustainability and more than 84% identified to be rather to very concerned about climate change and air quality. The intrinsic drivers for cargo bike users, combined with the high costs create a foundation for cargo bike elitism. This is also reflected in the user characteristics of cargo bike users and the perception of the Amsterdam residents towards cargo bikes as an elite transportation mode. The concept of sharing creates opportunities for the expansion of cargo bicycle usage and infiltrate in the mobility mix, by overcoming the acquisition costs.

8.2. Future users

On average, a Dutch resident of six years and older travels 11.4 thousand kilometres a year, of which 68 per cent of is covered by car-based transportation (CBS, 2022). In the Netherlands, 58 per cent of the car fleet is owned by individuals that are 50 years or older (CBS, 2022). Only seven percent of travellers has indicated to incidentally use shared mobility services, 33 per cent of these users has indicated to use shared mobility once a month, and 27 per cent has indicated to use a shared car less than five times a year (Rijkswaterstaat, 2024). Considering the threshold of ten thousand kilometres in which shared mobility is considered as a cost-efficient alternative to car-ownership, the potential user group for shared mobility can be estimated to be larger than the current user group. This paper categorizes the potential user groups of shared mobility into car-owners with a driver's licence, non-car owners without a driver's licence, and non-car owners without a driver's licence.

8.2.1. Car owners

A certain threshold of mobility alternatives within a reasonable distance is required for car owners to abandon their privately owned vehicle, and exchange ownership with sharing. Under this assumption, the variation or the quantity of available mobility options needs to equal or exceed mobility supply that is present in an ownership regime, and a diversification of the mobility mix increases accessibility. The most important barrier for individuals to refrain from car sharing is the inability to spontaneously use a car, and car sharing lacks flexibility and freedom, additionally, cost efficiency or intrinsic values and belief may play a role (Rijkswaterstaat, 2024).

The car seems to be the only transportation mode that fulfils households' need to reach a variety of destinations and allows households to reach different activities at different locations in tight time slots (Jeekel, 2013). Moving away from car-ownership and car-based transportation, requires a change in travel behaviour, and a movement towards multimodality. The willingness to combine different modes of transport, low affinity with technology and low reliability on new mobilities as the main barriers in the behavioural intention of individuals to uptake a newly emerging mobility system (Lopez-Careiro et al., 2024; referring to Mobility as a Service). It is assumed that if car owners decide upon sharing through p2p platforms, these barriers are partially overcome, and it can be assumed that if suppliers are familiar with the concept, operationalisation, and the possibilities, these individuals are more likely to make use of shared mobility services.

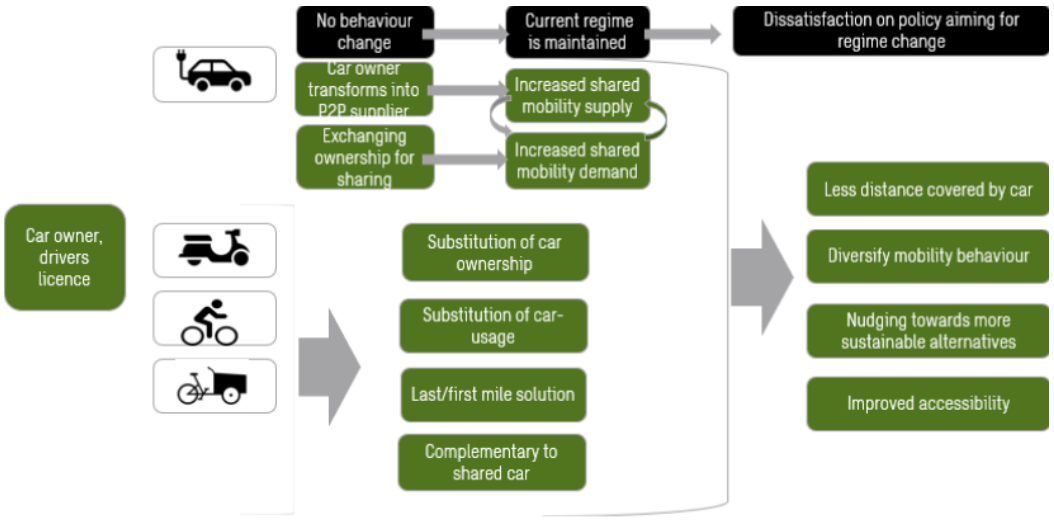


Fig. 8. The impact of shared mobility services on car owners

8.2.2. Non-car-owners with a driver's license

In the Netherlands, 11.7 million individuals possess a driver's licence (CBS). Not having a car, while being in a car-based regime, can have serious implications for time efficiency of individual transportation, and overall accessibility levels. Shared mobility enables non-owners to use a certain mode of transportation and reduces the societal losses that are a result of exclusion from society.

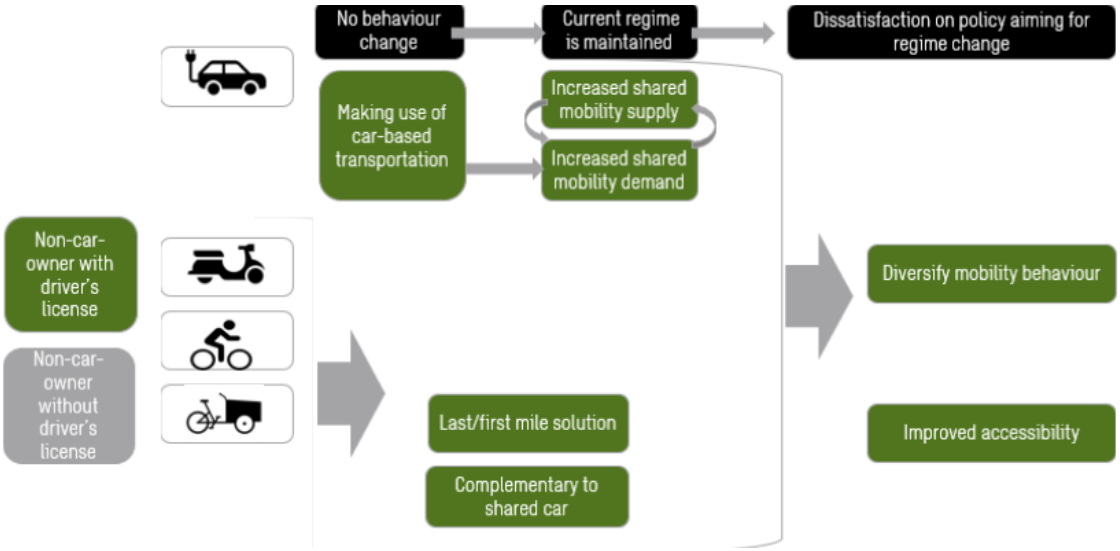


Fig. 9. The impact of shared mobility services on non-car-owners with a driver's license

8.2.3. Non-car-owners without a driver's license

For individuals without a driver's licence the expansion of the mobility mix is limited to shared (cargo-)bikes. Considering the substitutability of shared cargo bikes in comparison to the car, shared mobility access can stimulate overall accessibility levels. Additionally, last/first mile transport is improved.

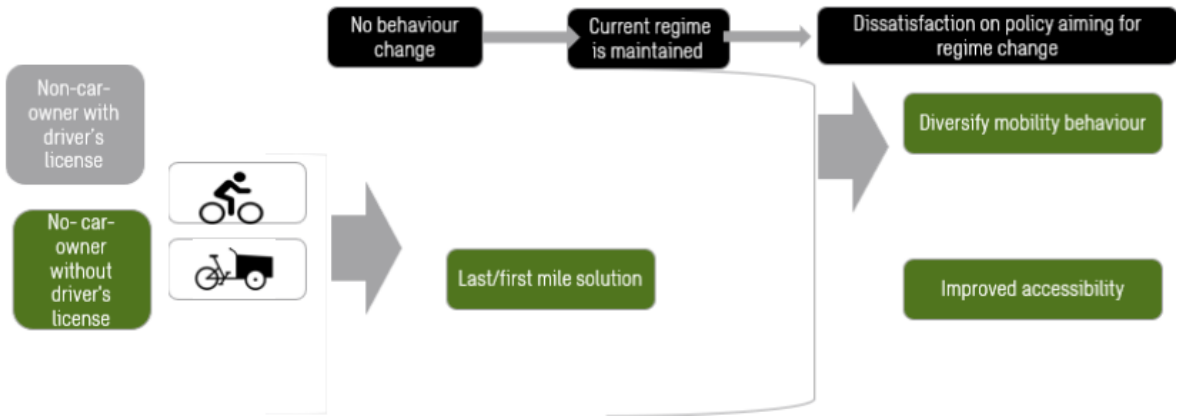


Fig. 10. The impact of shared mobility services on non-car-owners without a driver's license

9. Case description

This research covers Amsterdam Zuidoost, typically recognized by the well-known 'Bijlmermeer' as the city of the future, which was developed on the southeast bound, in the 1960s and 1970, and not adjacent to the rest of the city of Amsterdam. Originally characterized by high-rise buildings that are structured in a honeycomb set-up and elevated 'autostradas' and metro lines, pedestrians and cyclists were separated from motorized transportation, with separated functions of residence, work, transportation and recreation, aiming for green living, collective space and safe roads (for more information on the development and history of the Bijlmermeer; see: Aalbers, 2010). Due to multiple factors (see Blair & Hulsbergen, 1993), the Bijlmermeer 'failed', and transformed into a city district with a high concentration of marginalized groups, resulting in the stigmatisation of the Bijlmermeer.

However, throughout the years, the Bijlmermeer has been subject to redevelopment, and a large portion of the high-rise buildings have been demolished and replaced with low-rise housing, aiming to revitalise the district. Currently, the population counts to approximately 100.000 resident, and by 2050, this is expected to exceed 125.000 residents (Gemeente Amsterdam). Most of this growth is driven by transformation areas on the western bound of the railway (Mobiliteitsplan Zuidoost).

The initial urban planning of the district, combined with larger distance requirements, and lower prices for parking permits, has led to the modal split for residents of Zuidoost being dominated by motorized transportation. 33% of all movements are done by car, and public transport usage is significantly higher than in other districts, covering 31% of all movements. Whereas three metro lines connect Zuidoost to other city districts, within Zuidoost public transport is limited, and the districts lack a tram connection. On the contrary, active transport is significantly lower than the city average of 60% and counts to 30% (cycling 11%, walking 19%).

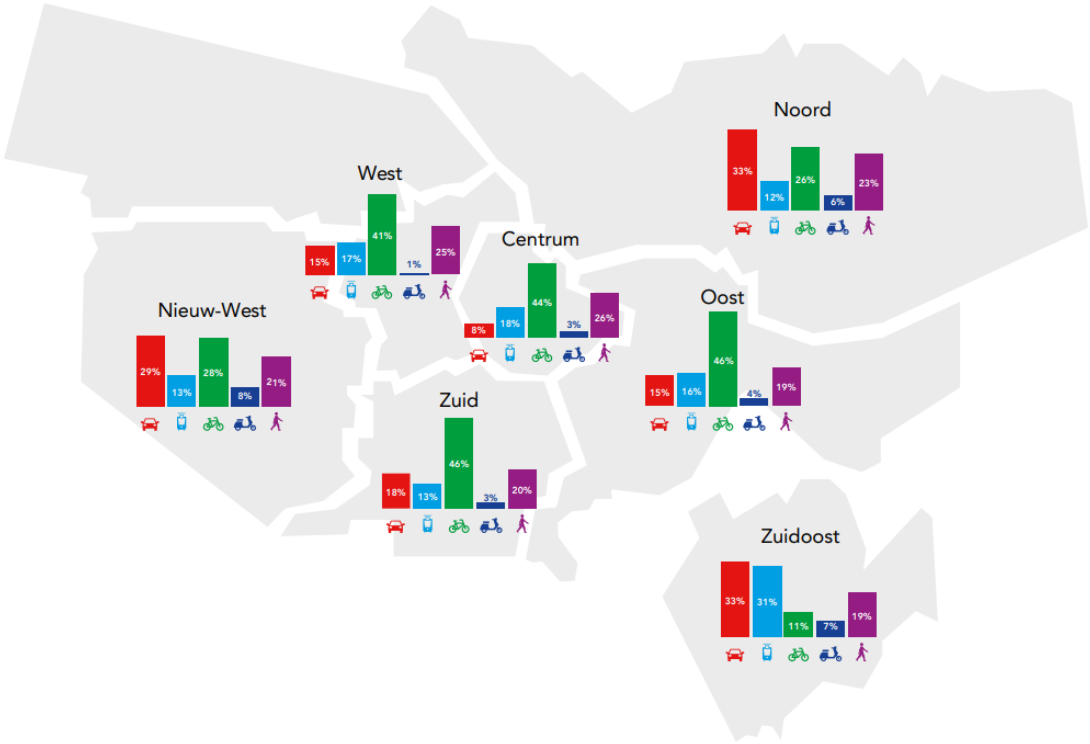


Fig. 11. The modal split for different city districts in Amsterdam for 2019 (adapted from monitor Autoluw)

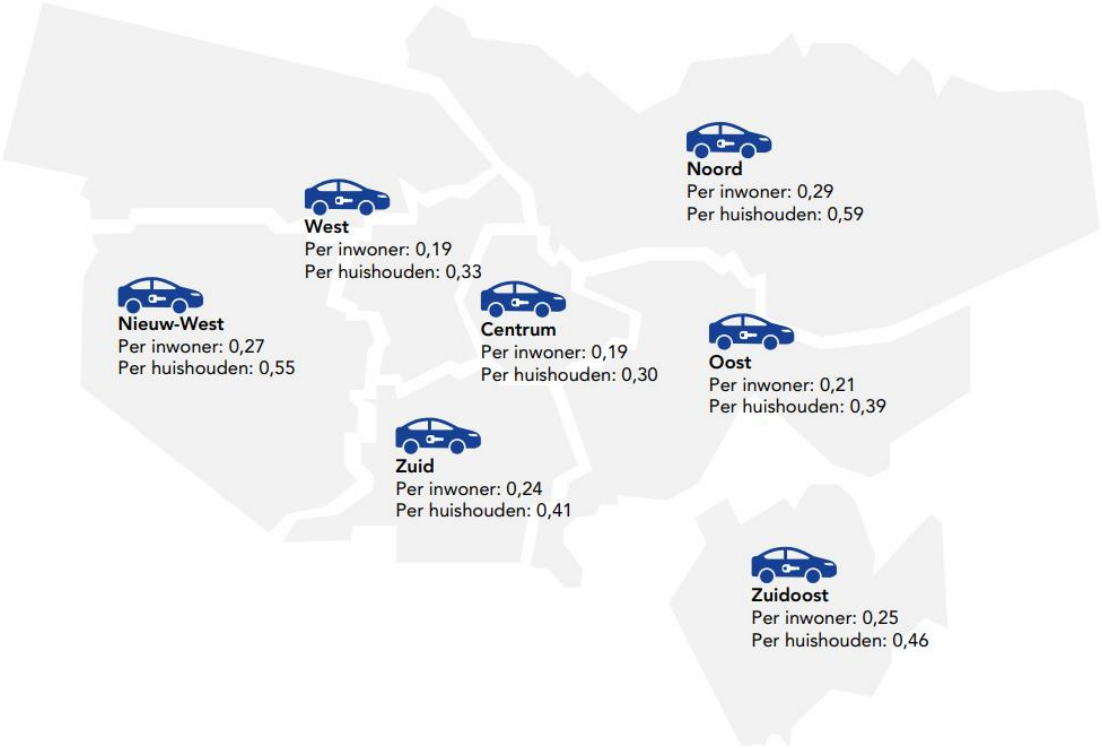


Fig. 12. The motorization rate for different city districts in 2019 (adapted from monitor Autoluw)

Currently, no parking fees apply to most neighbourhoods in Zuidoost, and paid parking will be gradually applied to neighbourhoods in Amsterdam Zuidoost as of 2024, see figure thirteen. Table 1 indicates the costs of a parking permit across the Amsterdam districts. Both the costs of a parking permit as well as variable destination parking costs of parking are substantially higher in Zuid, Centrum, Oost and West than for Noord, Zuidoost and Nieuw-West. On top of this, the municipality discourages second car ownership by not allowing for a second-car parking permit in some districts. Note: these prices exclude prices of indoor parking.

	Noord	Zuid	West	Zuidoost	Nieuw-West	Centrum	Oost
Yearly rate first car	34.42	372.58	-	74.58	110.14	631.20	372.58
Second car	86.04	X	-	186.46	275.36	X	X

Table 1. The price level of parking across city districts (source: Gemeente Amsterdam, 2024)

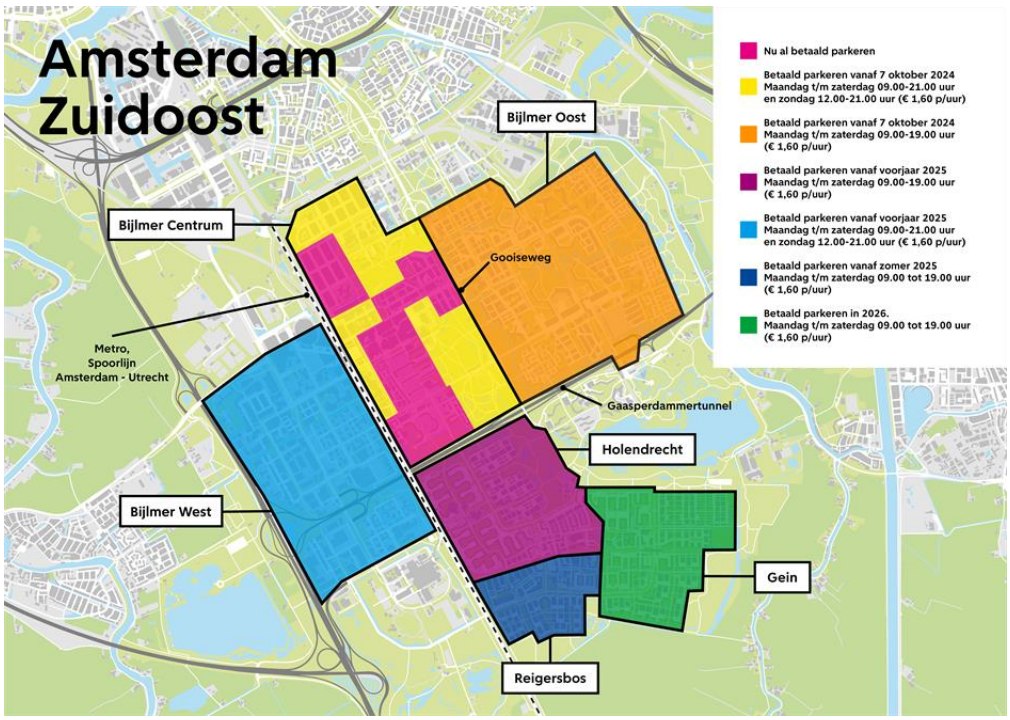


Fig. 13. The implementation of paid parking across neighbourhoods in Amsterdam Zuidoost

Table 2 compared Amsterdam Zuidoost with the city average, and city district Noord. For Zuidoost, average disposable income is lower than city average, percentage of loneliness is higher, parking nuisance is higher, percentage of social housing is higher, overweight people is higher and limited leisure facilities are present. Additionally, a higher percentage of people with a migration background live in Amsterdam Zuidoost.

	Noord	Zuidoost	Amsterdam
Residental density	2186	4555	-
SES avg.	5.8	5.4	6.4
% overweight	46	56	41
% social housing	57	62	48
% nuisance parking	23	25	20
% Lonely	24	34	23
% Havo/vwo recom.	45	32	53
Avg. disp. Income 2021	42.100	35.800	48.700
% lowincome 2021	25	27.8	21.7
GINI 2022	0.357	0.32	0,4
Horeca 2023	625	478	8011
% no migration background 024	44.1	21.2	40.4
% 1 person household	48.2	55.1	54.1
% 1 parent family	10.7	14.4	8.1
% couple no kids	20.5	15.5	21.5
% couple kids	19.7	13.6	15.2

Table 2. Data for Noord, Zuidoost, and city average (Dashboard kerncijfers, Bureau voor Onderzoek en Statistiek)

10. Policy document analysis

This chapter presents an analysis of policy documents that aim to capture measures contributing to Amsterdam Zuidoost becoming future proof. As stated in the previous chapters, our current mobility system is subject to challenges in terms of space allocation, inclusivity, accessibility, public health, and climate change. This chapter captures a list of policy documents that envision the future of mobility in the geographical context of Amsterdam (Zuidoost). The mobility-related documents are complemented by document capturing socio-technical landscape factors that pressure the current car-ownership regime. As a result, this chapter captures the integration of shared mobility in policy visions, and the potential of shared mobility in contributing the transition for Amsterdam to become a future proof city.

10.1. Omgevingsvisie Amsterdam 2050: A Human Metropole

The Omgevingsvisie guides Amsterdam's long-term spatial planning, focusing on sustainable urban development, inclusivity, and resilience. The broader vision for Amsterdam in 2050 is summarized into the six ambitions: inclusivity, sustainability, vitality, health, liveability and compactness, and is supported by five strategic choices, aiming to envision the holistic pathway towards achieving these ambitions. Chapters 10.2 to 10.8. elaborate on the foundation for this wider urban vision.

1. ‘Meerkernige ontwikkeling’ Amsterdam aims to host its growth ambition in Noord, Zuidoost and Nieuw-West. Accordingly, the number of jobs and residents is expected to grow most in these city districts. Limiting mobility streams by creating jobs.
2. Growing within urban boundaries by increasing urban density and pressure on public space.
3. Provoking a modal shift, towards sustainable and healthy transportation
4. Rigorous green: higher quality and quantity of greenery
5. Cooperation in creating the city. ‘Samen stadmaken’

The mobility transition is covered in the vital city chapter, and the need for the mobility transition is summarized as to 'lead to reduced CO2 emissions, less noise pollution, and improved air quality and contribute to 'an inclusive, sustainable, vibrant, healthy, liveable, and compact city and region.' To accomplish a mobility transition, four measures are highlighted: zero emission vehicles, smaller-sized vehicles, shared mobility, and a transition towards multimodality. Additionally, the STOMP principle is mentioned as the guideline for prioritizing space allocation in urban planning, and the municipality aims to decrease parking space allocation by limiting parking permits, parking pricing policy and stimulation of shared mobility; particularly in new (re)development areas.

Amsterdam Zuidoost is characterised as a 'green city district' and envisioned to transform into a strong urban core with a distinct identity. On the western bound of the railway, regeneration areas are present, and residential neighbourhoods prevail on the eastern bound of the railway. Additionally, the current car-dedicated space is envisioned to transform into boulevards accommodating various modes of transportation while serving as vibrant public spaces. This vision is further elaborated on in Masterplan Zuidoost.

10.2. Agenda Amsterdam autoluw

Pressure on public space indicates the urgency for low-car policy, forming the foundation for a low-car future Amsterdam. The pathway towards a low-car Amsterdam is summarized into five main goals, illustrated in Figure 13.

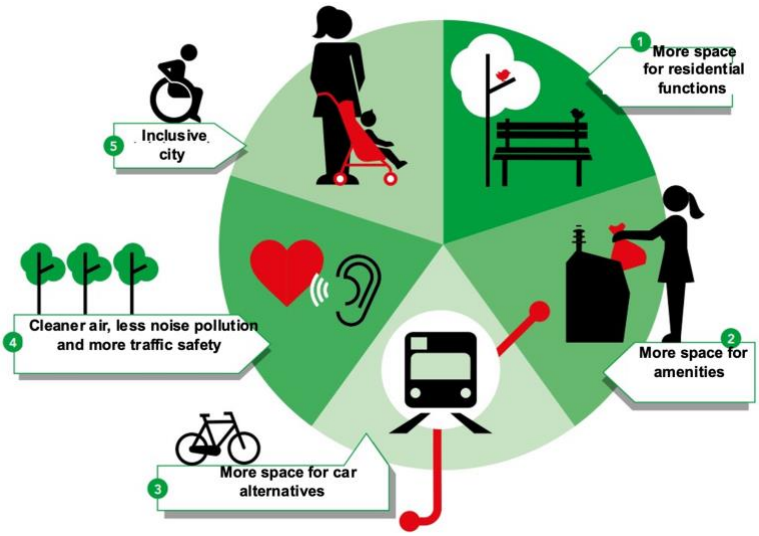


Fig. 14. The five main goals for Agenda Autoluw (adapted from Agenda Autoluw 2020 and translated)

The implementation of these goals is supported by 27 measures. These measures are grouped into categories: Clean and Active Travel (CH3), Public Transport (M1–M7), Pedestrians (M8, M9), Cyclists (M10, M11), Car Trips (CH4, M12–M20), and Car Parking (CH5, M21–M27).

Implementation of shared mobility, or specifically mentioning of Zuidoost came forward in a total of six measures. As stated in the Agenda Autoluw, *'If the network of shared cars is expanded throughout the city, the shared car will become an interesting alternative for more car owners. This certainly applies to areas where there are still few shared cars, which is often an obstacle for car owners to choose car sharing. In consultation with providers, we will discuss what is needed to expand the supply in these areas.'*

Measure 6: utilizing moments of change to stimulate mobility behaviour change.
Measure 7: Support for small-scale neighbourhood initiatives and improved public transport coverage to foster social connections.
Measure 10: shared bicycles at metro stations
Measure 12: more room in (city)streets for cyclists & pedestrians.
Measure 20: Development hub strategy: room for hubs
Measure 26: Realising better and more attractive supply of shared mobility by: a) lowering tariffs b) stimulate city-wide coverage of shared mobility supply c) creating municipal entities for support, subsidies and questions.

10.3. Programma Smart Mobility 2021-2025

Following three ambitions, the transition from ownership to usage is complied with, and this document identifies the role of participation, and working together with individuals to contribute to a more efficient organisation of transportation in the city, aiming for high-quality, affordable and comfortable mobility, and alternative supply must improve and be accessible to all.

1. Amsterdam as Smart Mobility city number one
2. All Amsterdam residents, visitors and goods travel cleaner and smarter
3. Amsterdam is in control of the digital mobility system

In order to achieve these goals, the Amsterdam Approach is applied:

1. From small scale testing towards scaling up to city-wide applicability
2. Pro-actively design and usage of instruments: financially, policies, communication & information and smart regulation.
3. Strengthening cooperation between individuals, the government, knowledge institutions and businesses

Digitalisation in mobility, allows for new transportation technologies and holds opportunities to contribute to solving challenges in the Amsterdam context and provide every individual with the opportunity to make use of individual mobility and improve the travel experience. The role of digitalisation, and the threats and benefits of digitalisation in mobility solutions are listed in figure 13.

Fig. 15. Threats and Benefits according to Programma Smart Mobility 2021-2025

10.4. Uitstootvrije mobiliteit Amsterdam

'Clean air is one of the core conditions for the quality of urban life, however everyone should be able to participate, and therefore not all emission can be banned.'

This policy document addresses air quality, and therefore the cleaner mobility components of the Trias Mobilica is emphasized. Currently, the air quality is low in Amsterdam, having serious implications for health. Road transportation ca be held accountable for a large portion of both air pollution, as well as noise pollution. Approximately 75 per cent of vehicle trips are done by passenger cars, and these are

responsible for 70 per cent of CO_2 emission, 36 per cent of NOx emissions and 53% of PM2.5 (particulate matter) emissions are produces by transportation. To adhere to the aim to become a liveable and future proof city of Amsterdam, this policy document proposes a pathway towards an emission-free Amsterdam, supported by four general principles.

1. Everyone is partially responsible, thus everyone contributes in the transition
2. Sufficient public support is required to realize future ambitions
3. Charging infrastructure
4. In cooperation with the industry

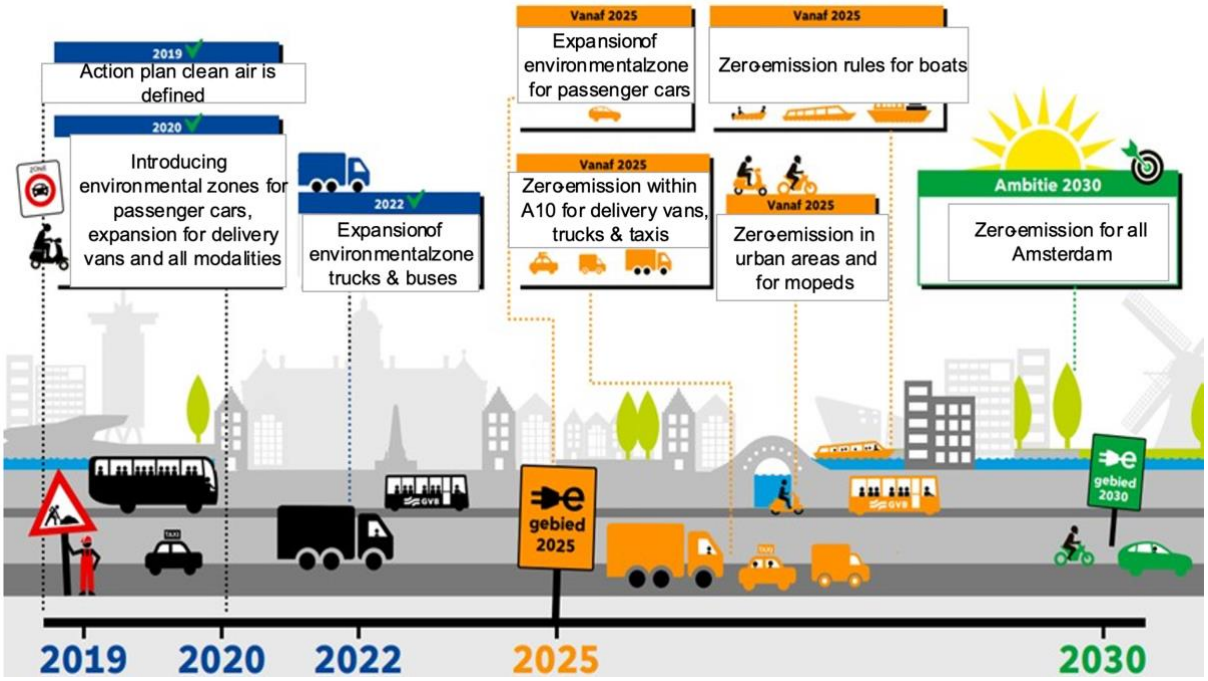


Fig. 16. Roadmap to a zero-emission Amsterdam (adapted from Uitstootvrije mobiliteit Amsterdam and translated

Stimulating shared mobility is considered as an important pillar for facilitating access to zero-emission mobility, and stimulating shared mobility contributes to zero-emission mobility. For the specifications of shared mobility, this policy document refers to 'Nota Deelvervoer 2023'

10.5. Amsterdamse gezondheidslogica

Seven health themes are identified: moving, meeting & social connection, peace & quietness, healthy food supply, smoke free, clean air and a climate and heat resilient living environment. These have led to twelve principles for a healthy city:

Twelve principles for a healthy city

1. Space for cyclists and pedestrians
2. A healthy city is a green city
3. The city is a playground
4. Proximity to sports facilities
5. Space to meet and connect
6. Business is alternated with quietness and peace
7. Healthy food
8. Neighbourhoods for elderly
9. Healthy school areas
10. Clean air for everyone
11. Climate-resilient city
12. Buildings and public space contribute to health

Fig.17. Twelve principles for a healthy city according to the Amsterdamse Gezondheidslogica

Even though shared mobility is not explicitly mentioned, Low-car cities are considered as a measure to reach the goal of healthier cities (1, 3, 5, 6, 8, 9, 10). Moreover, the drivers for a mobility transition recur in the principles for a healthier city. Stimulation sustainable mobility behaviour (1), allocation of scarce space (2, 3, 5, 12), accessibility an inclusivity (3, 4, 8) environmental sustainability (10, 11).

10.6. Nota deelvervoer 2023

'Easier than you think, cheaper than you think, more supply than you think'

As stated in this policy document, the main goal of shared mobility in the upcoming four years is 'a liveable, safe and accessible city. By gradually reducing car journeys and car parking, we create more space for walking, cycling, public transport, green spaces, amenities, playing and staying. Shared mobility is part of the solution, because 'it contributes to space, cleaner air, less noise pollution and an inclusive city for now, soon and later.' Parking prices are used as an instrument in current disadvantaged neighbourhoods to stimulate mobility behaviour change as well as stimulate shared car providers to expand their service areas.

This has been divided in four subgoals:

1. Suitable mobility choices for all Amsterdammers: Also in parts of Zuidoost, Noord and Nieuw-West.
2. Public mobility (=public transport +shared mobility) as an alternative to the self-owned car.
3. Shared mobility contributes to reducing pressure on public space.
4. Shared mobility as part of the regional mobility system.

And 6 concrete policy measures.

1. Increasing supply, and better spread across the city to overcome the three main barriers for the transition: Availability, costs and accessibility.
2. Clustering supply in hubs to reduce nuisance
3. Experimenting with shared bicycles, incorporating shared cargo-bike and mopeds pilots in policy, and facilitate a growth from niche to mainstream for car sharing.
4. Towards fully zero-emission in 2025
5. Stimulate shared mobility spreading and growth by implementing paid parking, proximity to public transport and communication channels.
6. Data collection to monitor

10.7. Masterplan Zuidoost 2021-2040

Masterplan Zuidoost aims for three sustainability goals and five accompanied ambitions, depicted in figure 14, taking on a more holistic approach to the future of Zuidoost. Ambition one and three elaborated on as: fully-fledged, accepted and respected citizen of Amsterdam (1), and as a resident having all chances and opportunities to develop, grow and deploy talents (3). Ambitions two and four rather apply to spatial context, and the characteristics of the city district: Good and safe living and public space conditions (2) and economic prime location, with entrepreneurship and creativity and invest in this (4). Ambitions one and five underlie these ambitions, and Masterplan Zuidoost aims to achieve its sustainability goals through cooperation, participation, and a government that is transparent, flexible and effective (5): creating policies based on the needs of the area and its residents (1).

Cooperation and participation are essential in the transition towards a future proof Zuidoost. The sustainability goals and ambitions that are elaborated on in the Masterplan Zuidoost showcase a focus on sustainability, safety, liveability and inclusivity, and equal opportunities and the ability to participate in society; whereas these goals show a strong resonance with car-low ambitions, either mobility, accessibility, reachability, transportation nor the car are mentioned even once throughout the Masterplan Zuidoost.

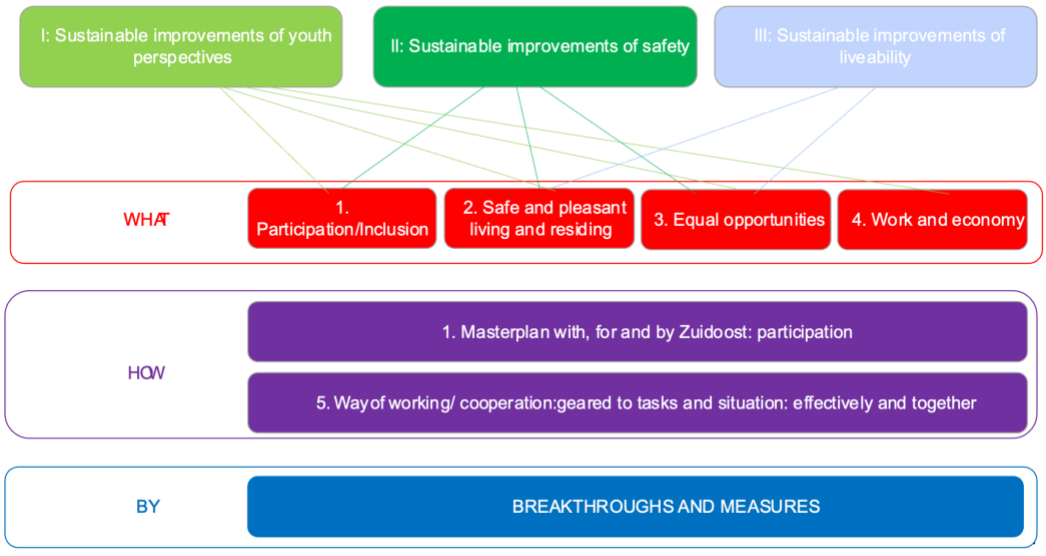


Fig. 18. Visualization of Masterplan Zuidoost (Adapted from the Masterplan Zuidoost, and translated)

10.8. Mobiliteitsplan Zuidoostflank

'Cooperating towards an accessible and liveable Zuidoost: now -2040'

Zuidoost and two adjacent developing areas, referred to as the Zuidflank, are expected to grow with 51.000 new houses and 33.000 new jobs up until 2040. This urban growth is accompanied by increased mobility streams from residents as well as visitors, creating pressure on public space and bottlenecks in infrastructural capacity. To ensure the accessibility of Zuidoost, preventing car-growth as much as possible is essential. Either by policies that discourage car usage or through promotion alternatives such as active transportation or public transport usage. The quality of public transport connection is high; however, it is inner-city orientated and the quality of the stations, combined with lacking first and last mile solutions challenge the attractiveness of public transport. In addition, the current capacity of public transport supply is unable to absorb the expected increase in demand. Most of the new developments, are subject to stricter parking regulations and shared mobility is incorporated in development plans to lower parking requirements. In transformation areas, new residents voluntarily choose for a new mobility situation with lower parking targets. For current residents, it is more challenging to discourage car-usage, as it has serious implications for one's life.

The four urban mobility goals that are included:

1. Stimulating sustainable transportation, thus contributing to urban climate goals
2. An urban area connected with the region and other city districts
3. Stimulation of healthy, active transportation
4. Improving traffic safety, social security and inclusivity

The policy that is applied is divided into the following:

1. Behaviour change
2. Facilitation bicycle usage (shared bicycles at trainstations)
3. Attractivity of PT
4. Limiting and regulation car usage

Within the listed measures, shared mobility was explicitly mentioned once: shared bicycles at stations. Throughout the policy document, other applications were:

1. Using shared mobility to increase the attractivity of PT by improving the quality of first and last mile transportation.
2. Specific Park & Bike facilities, dedicated to multimodal transport
3. Shared mobility implementation in development areas

10.9. Conclusion

This section has aimed to create a foundation for the subsequent qualitative interviews, and partially answers SQ3: What is the policy perspective towards shared mobility and in particular in the case of Zuidoost?

In the general policy document Omgevingsvisie Amsterdam 2050, strategies, measures and ambitions towards Amsterdam in 2050 are discussed. Amongst the five pillars supporting this pathway, one particularly addresses Amsterdam Zuidoost, and the substantial share of Amsterdam's total growth it is expected to host. Shared mobility can play a role in provoking a modal shift towards sustainable transportation, and contribute to an efficient space allocation, while focusing on the quality and quantity of green and transportation. The fifth pillar of 'Samen Stadmaken' recurred in the Masterplan Zuidoost, where participation is considered as the key to achieve a connected, healthy, safe and sustainable city district.

To ensure the accessibility of Zuidoost, preventing car-growth as much as possible is considered as essential. Within the policy document capturing the transition towards a low-car city, shared mobility is specific mentioned in six out of 27 measures. The Nota Deelvervoer further elaborates on the implementation of shared mobility and integrates shared mobility as a solution to space reallocation, cleaner air, less noise pollution and an inclusivity. To adhere to the ambition of becoming an inclusive as well as sustainable city, shared mobility has a key role in facilitating access to zero-emission mobility, since the transition from ownership to sharing coincides with the transition towards zero-emission vehicles, under the condition that the shared vehicle fleet predominantly consists of zero-emission vehicles.

The similarities between the effects of shared mobility implementation and the principles for a healthy city lie in stimulating cleaner transport, promoting sustainable mobility behaviour, allocating scarce space, ensuring accessibility and inclusivity, and advancing environmental sustainability, all of which are key drivers for a mobility transition towards healthier urban environments. A recurring theme in the policy document, is carrot and stick approach that is applied to mobility policy. The carrot-alike policies include behaviour change, and promotion of alternatives such as public transport, bicycle use and shared mobility availability. The stick-alike policies discourage car use and ownership, and in particular target parking availability and pricing.

As specifically stated in one of the four subgoals, shared mobility implication aims to contribute to suitable mobility choices in Amsterdam Zuidoost. Notably, whereas shared mobility in the context of Zuidoost is explicitly mentioned in the car-low vision document as well as in the Nota Deelvervoer, shared mobility is not once mentioned in the Masterplan Zuidoost. Moreover, 'the car' is not once directly mentioned in the nor does the Masterplan Zuidoost mention mobility, accessibility, reachability or transportation. Moreover, apart from mentioning shared bicycles in station-areas, shared mobility remained absent in Mobiliteitsplan Zuidoost. Rather, the Masterplan Zuidoost elaborates on a holistic future vision of the city district.

11. Results of individual perspective

This research hypothesizes that replacing a car-ownership regime with a shared mobility scheme, can positively affect liveability, neighbourhood aesthetics, reduce air and noise pollution, decrease heat stress, and improve public and personal health. Other externalities that specifically relate to the current car-based regime include congestion, delays to other vehicles, cost of infrastructure, healthcare costs that are a result of traffic accidents, and safety. The extent to which these are experienced on the individual level influence the need and perception towards socio-technical change, and by examining this, this chapter aims to answer SQ3: What is the perception towards shared mobility from a user perspective and what barriers or benefits do there exist in the implementation of shared mobility? This chapter incorporates quotes to capture the subjective nature of the individual perspective, given that individuals are inherently influenced by personal perceptions. The residential locations of all interviewees are scattered across the district, and therefore the interpretation of the neighbourhood description represents Zuidoost as a whole. Figure 19 depicts the characteristics of the interviewees, for which the input information can be found in Appendix A.

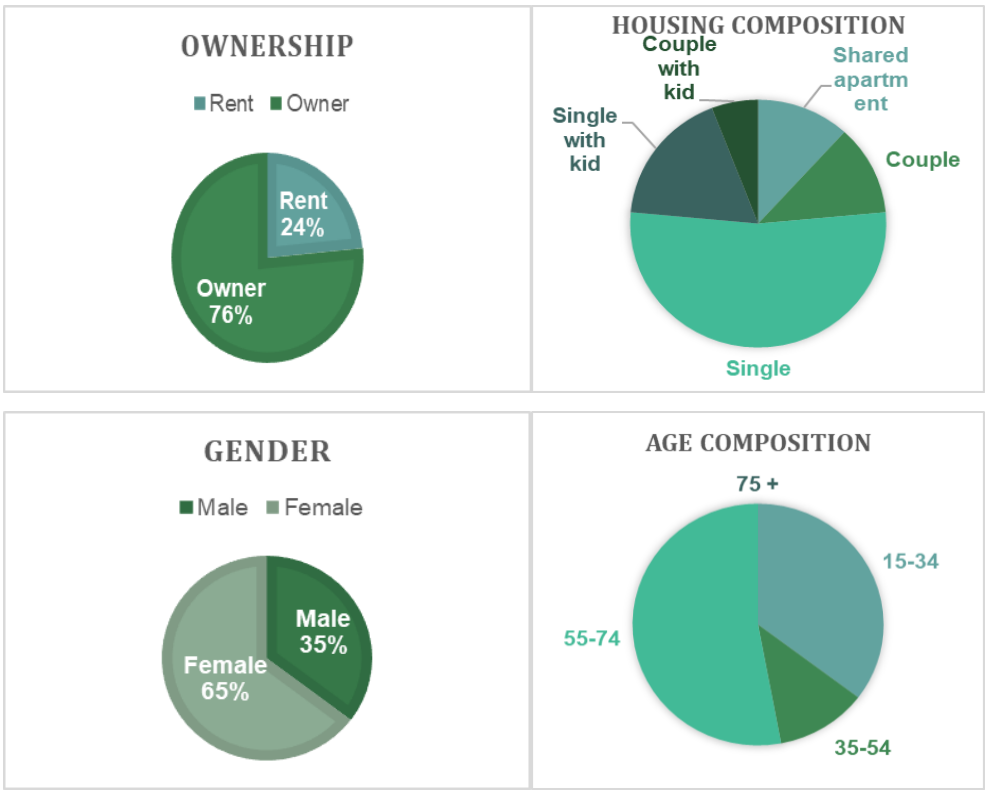


Fig. 19. The characteristics of interviewees

11.1. Characteristics of Amsterdam Zuidoost

By replacing car-ownership with shared mobility, it is hypothesized that less space is taken up by cars, and therefore, more space can be allocated to alternative space use. This subsection aims to explore to what extent space scarcity is experienced by residents of Zuidoost, and to what extent shared mobility can enhance the current level of liveability. Figure 20 depicts the residential distribution of interviewees across the district, with the green, yellow and red lines depiction the metro routes.

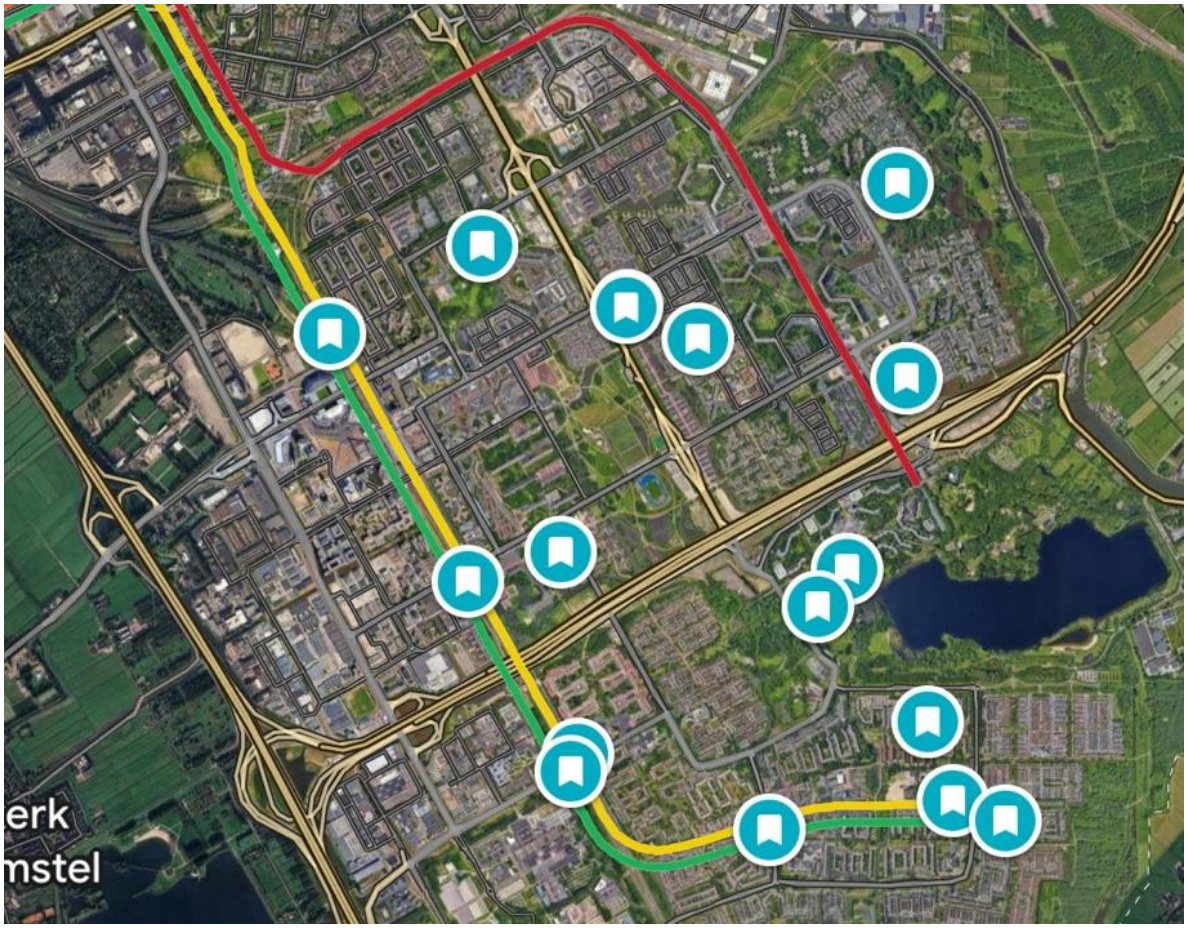


Fig. 20. The distribution of residential locations of interviewees

Most residents expressed satisfaction with the general accessibility of the district. Several highlighted the convenience of reaching key transport hubs:

'From Reigersbos, if I exit my street, I enter the A9 highway in a minute. Then at Holendracht, there is a train station, metro station and bus station. And in Duivendrecht, there is a train station as well. I am very satisfied.' Interviewee 14

The design of Amsterdam Zuidoost, shaped by its urban planning ideology in which a seperation of function is at the heart of the design, strongly resonated with the values and opinions of the residents.

'The neighbourhood is very cleverly designed. Cars upstairs, cyclists downstairs, that idea.' – Interviewee 2

Some residents specifically appreciated the "car-low" nature of the area:

'I live in a kind of car-low neighbourhood. So cars cannot be parked in in front of the houses. And I appreciate that. It's nice and quiet. You can hear some birds and canaries and that kind of things. So I like that, yes.' – Interviewee 16

The separation of transportation modes was considered to have a positive effect on perceived traffic safety. Roads were perceived as safe and cycling paths were considered to be of high quality. Whereas three interviewees occasionally mentioned to experience noise from car racing, other car-related nuisances were not mentioned. Some also identified that the speed differences in cycling paths, due to electric bicycles, sometimes leads to unsafe situations.

Even though some interviewees mentioned to occasionally experience issues with parking during Amsterdam Arena events, parking scarcity was not seen as a significant problem or a barrier for car ownership of usage. Some interviewees were in possession of an indoor parking spot, and others did not experience inconvenience in finding a parking spot:

'I mean, I have never experienced that people can only find a parking spot for example five streets away.' – Interviewee 7.

Both car owners and non-car owners were hesitant in replacing parking spaces with alternatives:

'You'll create scarcity. That's what I think. You will have less choice in parking places. So I would not be in favor of that. No.' - Interviewee 7

Thirteen interviewees mentioned the abundancy of greenery as something they particularly appreciated about the neighbourhood, as well as enhanced their transportation comfort.

'I live next to the park so I can go to the park as much as I like. Also, when I am walking to the bus stop, or the metro station. It feels like I'm walking in a park.' – Interviewee 16

Other residents compared the neighbourhood to a forest (Interviewee 9) or described it as '*the Green Lung of Amsterdam*' *-Interviewee 4.*

Most interviewees indicated to make use of the public space incidentally, however public space use for recreational purposes was limited. Three interviewees identified never to make use of the public space.

'If the weather is nice, when it does not rain, I sometimes go for a walk, because I think the neighborhood is beautiful.' – Interviewee 14

In concordance with the green characterization of the neighbourhood, the vast majority describing the neighbourhood as quiet or peaceful, and only one interviewee identified the neighbourhood as vivid.

'Well, at night it's pretty quiet in the streets. I mean, people always think like… For example, after 22:00, it's just really quiet around here. You here nothing, you see nothing… But in general, it is safe, I am not afraid to go outside at night'- Interviewee 11

'It's relatively quiet in the neighborhood, especially in comparison to the rest of Amsterdam. So that is a positive thing.' – Interviewee 1

Whereas peace and quietness were perceived as an advantage of living in Zuidoost, the absence of eyes on the streets was also associated with a feeling of unsafety, particularly at night. Lacking social ties, or lacking sense of community contributed to these feelings of unsafety, and multiple interviewees linked unsafety to the persistence of anonymity. Waste nuisance was also mentioned as a consequence of the anonynous character of certain neighbourhoods.

'It's not always as clean, which is caused by the lack of social cohesion. People do not express their annoyance n the stairway. You don't know each other, so you would not know who is to blame.' – Interviewee 11

'Anonymity, resulting in not knowing who lives where. I do not use the galleries for example, so you do not bump into each other.' – Interviewee 13

Not all interviewees considered this anonymous as harmful, and some considered the anonymous character of a neighbourhood to be desirable.

'I'm like invisible. So I don't feel unsafe there.' – Interviewee 9

Others expressed a desire for more social interaction, noting that familiarity with neighbors contributed to a sense of community. Some interviewees identified that being a dog-owner or having children in the school-going age coud contribute to this sense of community. The lack of community centers or meeting points was also identified as a factor driving this lack of community, as resindents currently are required to travel for leisure activities:

'It's just a residential area with a good connection to the rest of the city.' – Interviewee 1

11.2. Sustainability and intrinsic motivation to contribute

Travel behaviour decision-making is influenced by a range of factors, including environmental considerations, personal health implications, economic concerns, and other individual circumstances. As environmental awareness is indicated as one of the main drivers for shared mobility usage, this section goes into depth on the perception of individuals towards sustainability and the extent to which environmental impact is considered as a determinant in travel behaviour.

In total, 15 out of 17 interviewees identified to take sustainability into account in their daily life activities, which can be classified into six categories: transportation, waste, gas/water use, food (in particular less meat consumption), clothing, and general lifestyle choices.

'Transportation, Travels and Nutrition, the three T's' – Interviewee 15

Specifically narrowing down to the extent to which sustainability is taken into account in travel behaviour decision making, interviewees indicated to reduce distance travelled or replace car-based transportation with more sustainable alternatives.

'If you always take the bike instead of the car, then CO2 emissions are lower, not as if my travel distance reduction makes a drastic impact... But yes, that is one of the reasons I choose to cycle if it's possible.'- Interviewee 4

However, the effect of individual travel behaviour change was also questioned.
'We don't have any influence on that, nature does what he wants' - Interviewee 14

Another example of a reduction in distance travelled was indicated by interviewee 13, describing this shift as part of a broader change in mindset.

'So we invested to reduce travel distance, by making a home office. And that is sustainable. What else? Moped, bicycle, walking. To not always needing to use the car. We notice that we use the car less for leisure. There has been a change in mentality.' – Interviewee 13

However, sustainable behaviour was driven by factors beyond environmental impact and cost awareness, or personal health were often mentioned to play a role in sustainable decision making, as well as specifically for transportation decision making.

'For me, the main driver is rather economical.' – Interviewee 11

While there was a strong commitment to sustainable practices among many participants, there was also a noticeable divide in attitudes towards the broader issue of climate change.
'Personally, I think it's one big marketing stunt.' - Interviewee 11

'I have no interest in climate change' – Interviewee 17

A total of seven interviewees questioned the existence of climate change, the role of individuals in battling climate change or felt confusion about sustainable policy.

'I used to separate my household waste, But the city of Amsterdam has abolished that policy.' - Interviewee 7.

The implementation of low-car policies, particularly the newly implemented paid parking policies in Zuidoost, provoked a strong sense of injustice, frustration, and incomprehension among residents. Many expressed that such policies disproportionately affected them, creating a feeling of being undermined by local authorities.

'So that's how municipalities overrule ordinary residents. Who they actually have to represent. By their policies. Which is weak-minded at times, I sometimes think. Which is only after money and economics. And then making more money. And then even more than they already have. And then I think, yes, that's where we just have to be as a district and as residents. We just have to take more action against that. And not swallow everything easily.' - Interviewee 7

11.3. Regime strength

Fifteen interviewees held a driver's license, of which eleven interviewees were car-owners. Two interviewees were moped owners, and only one interviewee (interviewee 4) owned two cars. None of the interviewees were in possession of an electric car, nor owned or has used an electric cargo bike. (Shared) moped use was low, apart from the moped owners. The reasons for car ownership varied amongst interviewees, however two recurring themes were a sense of freedom, and low-cost perception of car ownership. For those interviewees owning a car, status, or cultural values did not emerge as significant motivations, and these interviewees described their car as old, tiny, or not very special.

'It's a cheap car, not an expensive one.' – Interviewee 12

The findings indicate that the attachment to car ownership is more related to the concept of car ownership in general, rather than to a specific vehicle.

I love my car, yes, but if I would have to get rid of it, I'd just buy another one' - Interviewee 2

Most interviews perceived the costs of car ownership to be low, often comparing the user costs of car-based transportation to its overall ownership costs, while not considering the investment costs, fixed costs of car-ownership, or the broader societal costs. For many, especially when traveling to city centre destinations, the availability of parking facilities and parking costs were significant factors transportation mode decision making.

'Because if you want to go into the city center, you cannot park your car.' – Interviewee 5

In addition to inconveniences linked to parking, time efficiency played a role in car-based transportation. One resident explained:

'If I go to the city centre, I really avoid going by car. Because… Not only parking is expensive. But also that... I have calculated it once. If you want to go to central station by car, it will take you approximately 45 minutes.'- Interviewee 11

Car ownership was primarily indicated to be for leisure purposes, and for incidental use. The preferred mode of transport for Zuidoost-city centre trips, was foremost public transport, considering the well-established connection to the city centre. Nevertheless, public transport was limitedly considered for within Zuidoost trips as the city-centre orientation of the metro system does not allow for efficient 'cross-over' Zuidoost movements. Two interviewees mentioned alcohol consumption as a driver for PT usage, whereas the limited availability of PT during the night is considered as a barrier for PT usage.

'Free time. If I want to go to my grandchildren. If I go out and come back home at night. If there are no night buses. Those kind of things. And just... That I can go wherever I want'- Interviewee 12

The willingness to cycle, differed across interviewees and depended on the interviewee's personal preferences and fitness level. Some individuals refrained from cycling alltogether, whereas others preferred cycling as their primary mode of transportation. Weather conditions formed a large barrier in the decision to use a bicycle or moped, and for car owners, the car was often used as an alternative mode of transport in case of bad weather conditions for within Zuidoost destinations, and PT for inner-city destinations.

'*I use my bicycle to go to East. But I haven't been to the city centre often, no.' - Interviewee 2*

11.4. Niche replacement potential

Shared mobility played a diminishable role in mobility behaviour, and when asked to define shared mobility, this research identifies a gap in terms of awareness of shared mobility existence, perception of characteristics, and usage knowhow.

'Those [shared cars] often are relatively small and I doubt whether a closet or a couch would fit' – Interviewee 15

Individuals were asked about their perception towards commercial shared mobility, and towards sharing amongst friends, family members or strangers. Legislation, complications in case of damage, or insurance were mentioned as barriers for sharing through p2p platforms. Digital competences did not appear as a barrier, and all interviewees felt confident in using digital tools. One interviewee indicated the cleanliness of shared transport modes was a barrier, especially regarding sharing with strangers. Another interviewee explicitly mentioned other users bringing pets in the car to be a barrier. Most interviewees indicated that they had some experience with sharing amongst relatives or friends. Others were hesitant in sharing with friends, and indicated to refrain from doing business with friends or family considering the complications that can arise in terms of conflicts.

11.5. Conclusion

From the outcomes of the individual qualitative research, it can be concluded that the largest barrier in terms of niche replacement potential is the absence of perceived landscape factors, and a misalignment of potential benefits that shared mobility aims to bring from the perspective of residents of Amsterdam Zuidoost.

As hypothesized in this research, shared mobility is a cost-efficient alternative to car-ownership for incidental car-users, and implementation can increase accessibility levels. From an individual perspective, the accessibility effect was not experienced. Both car-owners as well as non-car-owners were hesitant in using shared mobility car alternatives, and for non-car-owners, shared car awareness and usage was limited.

Additionally, costs of car ownership are perceived as low, and shared mobility is perceived as expensive; thus, confirming the misperception of costs of car ownership, or indicating financial willingness for car ownership.

Section 11.1 aims to examine the embeddedness of landscape factors on the individual level, by examining the neighbourhood characteristics. Based on the outcomes presented in this research, liveability, neighbourhood aesthetic, and the need to reallocate car-designated space is barely experienced on the individual level. Car owners indicate to use the car for leisure purposes, and the societal cost of the car-ownership regime, that is elaborated on in chapter six: congestion -delays to other vehicles, cost of infrastructure, healthcare costs that are a result of traffic accidents and safety- are limited to not considered on the individual level.
Whereas individuals take environmental considerations into account in daily life and transportation decision making; heat stress, air- and noise pollution, and other effects of climate change are limitedly experienced by individuals, and while limiting car-based transportation, none of the interviewees indicated to consider abandoning car ownership.

The resistance towards car-discouraging policies highlights the complex interplay between public policy, local governance, and community well-being. Paid parking policies, that are currently applied to Amsterdam Zuidoost, increase the individual costs of idleness, provoke frustration amongst residents. This frustration goes beyond the financial effects imposed by these policies and rather reflect a perceived lack of consultation or consideration for the lived experiences of those directly affected. Additionally, the indignation regarding paid parking policy can be placed in the wider context of absence of landscape factors capturing space scarcity.

Regarding barriers for shared mobility usage, the high motorization rate in Amsterdam Zuidoost, which is also reflected in car ownership amongst interviewees, creates a barrier for shared mobility demand. Moreover, the low applicability of shared mobility usage to car owners combined with the limited prevalence of shared mobility services, resulted in low awareness and know-how of shared mobility usage. For car-owners to engage in p2p sharing, legislative barriers dominate the decision, and the potential financial compensation that could be collected by sharing a privately-owned car was neglectable.

12. Results of policy perspective

In this chapter, the results from the interviews with policy makers and mobility experts are discussed. The interview guide was structured based on the outcomes of the policy document analysis that is presented in chapter 10, and in combination with the findings from the policy document analysis, this chapter will answer SQ2: What is the policy perspective towards shared mobility, and in particular: in the case of Zuidoost?

12.1. Characteristics of Amsterdam Zuidoost

As shortly discussed in section six and nine, Amsterdam Zuidoost is home to large (re)development projects. The expansion of Amsterdam Zuidoost is part of the 'Zuidoostflank' redevelopment plans that are extensively described in the Masterplan Zuidoost policy document.

Amsterdam Zuidoost can be divided into the eastern and western bound of the railway, where the western part includes most transformation areas, and the eastern part includes the more established parts of Zuidoost (Policy maker 4). The expected population growth of the city district challenges the current mobility system and the city district's growth ambition is expected to induce a growth of car traffic with 40 per cent, provoking everything to be gridlocked, and stressing the necessity of a reduction in pressure on mobility infrastructure (Policy maker 4). The municipality has agreed upon a 9% growth rate to be 'just acceptable' and to achieve this, a transition to other modes of transport is aimed for. To adhere to this nine per cent growth rate, most potential lies within redevelopment areas as a change-in change approach can be applied. Life changing moments can be used, such as a change in residential location, to catalyse a transition to other modes of transport and thus bear the potential to provoke a change in mobility behaviour (Expert 2). For residents of the more established parts of Zuidoost, mostly in the eastern bound of the railway, it is more complex to induce behaviour change, as it lacks a change-in-change opportunity and requires municipalities to impose regulation on existing systems.

'*In behaviour change, the starting point is that people prefer not to do it. The more conservative and the lower income, the lower the willingness to really change something.' - Expert 2*

Whereas limiting car-based transportation relieves pressure on car-based infrastructure, people will still have a mobility demand that needs to be fulfilled, and individuals will divert to alternatives. Thus, a reduction of car transportation is accompanied by an expected increased pressure on public transport networks (Policy maker 4). Moreover, shared mobility is incorporated in development plans to bridge the gap in accessibility.

12.2. Regime strength

'The car is rooted in our society. That we use it for both going to the supermarket, as well as travelling to the South of Spain, and everything in between.' - Expert 2

This statement resembles the embeddedness of the car in society, and the strength of the current car-ownership regime. The inefficiency of this current system is exemplified by a parallel with an elderly home, drawn by Expert 3. Considering the essential role that access has in participation in society, all individuals that are part of a vulnerable group can apply for additional funds. In the case of the elderly home: All residents that are eligible to apply for a scoot mobile, will own one to maintain a certain level of mobility.

'50% of urban public space is devoted to cars. If you need to build, and also want additional space to move around, you should think about less cars. Then thinking about shared mobility is a logical thought.' - Expert 2

As a result, the elderly home is now filled with sporadically used scoot mobiles. Whereas in the elderly home, the goal of accessibility is achieved, space is allocated inefficiently, there are serious implications for fire safety, as well as a loss of alternative use of public investments.

Beyond the misallocation of space, there are public expenses that are related to the creation of parking places, its maintenance, and building streets (Expert 4). The allocation

of public space to parking is undesirable, and 'per definition lost space', and can provoke a sense of injustice.

'That space cannot be used as a cycling path, the sidewalk is tighter, there is no space for greenery, a playground, or an outside terrace belonging to a café.' - Expert 4

'Public space should be able to breath, it should be green, pure. It should lead to meeting up. If you fill it up with parking, it's no meeting point anymore.' - Expert 3

12.3. Niche replacement potential

A shift away from dependency on car ownership, is inherent to a shift towards a dependency on other mobility services, amongst which shared mobility. In line with the definition of shared mobility that is presented in the theoretical framework, the definition for shared mobility varied across experts. As also came forward from the literature review, a critic that came forward from the results, is that shared mobility in its current form leans more towards a rental model rather than true sharing:

'Shared mobility as it is now, is not really shared mobility; it rather is renting from a commercial party.' - Policy Maker 3

Or took on a more pragmatic view towards shared mobility, and supported the more extensive definition of shared mobility by comparing shared with ride-hailing services:

'A shared car in fact is a taxi without a driver' - Policy maker 1

Others rather emphasized shared mobility as a valuable component of an integrated transport ecosystem, reducing reliance on private vehicles and enhancing urban mobility options.

'Shared mobility is considered as an alternative for car-based transportation in cities, and the availability of shared cargo bikes, shared mopeds, shared bicycles and shared cars complement public transport and cycling.' - Expert 2

12.3.1. Shared mobility in the context of Amsterdam Zuidoost

The municipality of Amsterdam has a specific department for shared mobility in the Amsterdam context, and a general mobility department for the Zuidoost context.

The shared mobility department took on a more holistic approach, considering the potential of newly emerging forms of transport and focusing on the 'how' of transportation, for any individual living in Zuidoost, serving the higher goals of creating space, and getting people to use electric mobility. Even though not explicitly mentioned, the principle of 'STOMP' was described as the desired future situation: cleaner mobility, more often not involving self-owned cars, but also more walking, and cycling and public transport, and more sharing. Additionally, the quality of public transport was subdivided into the public transport corridor itself, and the quality of first and last mile transportation facilities; there is room for improvement of walking/cycling routes to get to and from public transport locations. To catalyse the zero-emission transition, shared cars are aimed for to be electric earlier than regular cars (Policy maker 4).

The Zuidoost mobility department applied a laissez-faire approach to shared mobility implementation and took on a more practical approach towards shared mobility prevalence. Limited restrictions in Zuidoost apply, and the only thing that is required for shared mobility suppliers is 'to apply for a parking permit'. In the more profitable service areas, e.g. de Pijp and the city center, slightly more restrictions apply, such as designating specific parking spots for cargo bikes and mopeds. Whereas the municipality aims to stimulate shared mobility expansion across districts, it leaves the responsibility to the commercial actors as much as possible and takes on a guiding role in shared mobility provision.

12.3.2. Policy-individual interactions

Currently, only five to seven per cent uses shared mobility, and the debate on shared mobility supply, and potential target users, is often distorted by the idea that everyone should become a shared mobility user. Higer-income individuals are more likely to own a second car, and shared mobility bears potential in replacing the second or third self-owned car (Expert 2). Instead of focusing on the 80 per cent that does not consider

him/herself part of the target group, we should try to reap the potential of that 15-20 per cent, for example, by reaching a younger target group, to which the flexibility of shared mobility is useful (Expert 2). If you can reach 25% of the >10.000 km/year group to switch to shared mobility, that's gigantic. (Expert 2). A barrier in reaching this potential is the misperception on the real costs of ownership, in combination with lacking transparency in the cost structure of shared mobility (Expert 2).

People either do not have the financial means or are not willing to own a cargo bike, a large car, and potentially another transportation mode. Additionally, the awareness of shared mobility options is low.

'If you want people to make use of particular modes of transport, you just have to make it easy for them' – Policy maker 2.

If the cargo bike is just in front of your house and you can use it for 1,5 euro, for going to the supermarket or something, this lowers the barriers for engaging in shared mobility (Expert 4).
The willingness to use shared mobility alternatives depends on availability, and having to cover 500m to reach a cargo bike is too far (Expert 4). Other barriers for system change include costs of shared mobility, but also the need for digital skills. Or because people don't know about its existence (Expert 2).
If one has made the decision to engage in shared mobility, a mixed supply is hypothesized to be valued more than a homogeneous supply (Expert 3). Access to a heterogeneous supply is underwritten by Expert 2, indicating that people now question why they would limit their selves with the ownership of one car, when there is the potential access to ten. It might be more fun and interesting to manage a car park instead than being responsible for cleaning and maintaining one self-owned car that is parked in front of the house.

Replacing ownership with shared mobility is considered as a precedent for a sense of freedom by overcoming the rigidity of ownership, and creating room for variations in mobility decision making, or multi-modal movements.

'*Freedom of choice, for example using the metro in the morning, and walking back in the afternoon which is not possible with 'self-owned transportation modes'* – Expert 3

On the other hand, a certain threshold of shared mobility needs to be present in a neighbourhood for the freedom-argument to hold, and shared mobility needs to be financially accessible for individuals.

12.3.3. Policy-business interaction

Free market mechanisms create variances in the availability of shared mobility services. The urban planning of districts on the edges of the city, characteristics of residents, and the level of space scarcity in the streets, limit the supply of shared mobility on the edges of the city (Policy maker 4). The desirability of free-market forces can be questioned, as it facilitates a widening gap in urban contexts (Policy maker 2). On the other hand, imposing additional burdens on shared mobility providers might increase operational costs and thus tariffs for the user, or lead to the provider not being able to offer their services at all if the user is not willing to pay the higher tariff (Policy maker 1).

Moreover, the absence of ownership fosters reliance on commercial providers, with the availability of shared mobility contingent on the financial feasibility for shared mobility suppliers. If the neighborhood is not considered as profitable enough, and the shared mobility supplier decides to leave, we will have a situation with many houses, without parking facilities and without shared cars (Expert 2). This directly links accessibility of residents to profitability of commercial actors and potentially threatening accessibility levels of residents, raising concerns on where the responsibility of commercial parties ends, and the responsibility of individuals or policy makers begins. It can be questioned whether being dependent on business models of commercial actors for the supply of a basic need is desirable (Policy maker 2).

This is exemplified by Expert 3, stating that 'shared mobility is a relative expensive transportation mode', expressing concerns for individuals with smaller wallets.

'No one is aware of the real costs of car ownership, per month. And if you compare that with shared mobility, it's very likely that shared mobility is more favourable. But I think the costs structure of shared cars is not very transparent either.' - Expert 2

The limited supply of shared mobility on the edges of the city is a result of the overall absence of barriers for car ownership, resulting in the preservation of a system in which car ownership is the regime. The municipality can invest in the availability of charging infrastructure, costs of energy, parking regulation and cost of parking, to influence the profitability of a potential service area and stimulate shared mobility service provision (Expert 2). Implementation of stricter parking policy directly boosts shared mobility (Expert 4) and increased costs of driving a car, or increased difficulties in parking in the city induces individuals to think about alternative: for example, a shared car (Expert 2). However, increasing parking tariffs to induce the inflow of shared mobility, distorts the view of shared mobility as being a solution, while it rather is a potential instrument in the transition towards cleaner and just mobility. 'Separation of cause and effect is essential' - Expert 2.

We need a shift from the current policies focusing on parking rights, towards a prioritization of getting from A to B as a fundamental right (Expert 3). Stricter parking norms, that are for example applied to newly developed apartment buildings, create parking space scarcity and leave room for financial drivers to overrule parking access. When a project is realised, the high social class has a private parking space, while individuals that rely on car-based transportation, for example individuals that work during the night, are not eligible to a parking space (Expert 3). It could be questioned whether this allocation of parking space based on financial means instead of necessity can be considered as fair, or desirable. Individuals belonging to disadvantaged groups, have less room and time to think about mobility behaviour change, and the barriers to participate in a transition are higher, whereas these people might be more vulnerable to change.

'*Partly because of income requirements, since there are a lot of costs related to the energy transition, many people feel that they are not able to keep up. And if many regulations are applied to combustion-engine cars, a lot of people will get in trouble.' - Policy maker 2*

12.4. MaaC

'It could also go beyond the intervention of commercial parties, that you just lend out your car to a neighbour. And then without inconveniences regarding keys, but that your neighbour can open the car with a phone' - Expert 4

A newly emerging shared mobility type is Mobility as a Commons (MaaC). The essential difference between MaaC, and shared mobility supplied by commercial parties, is that MaaC is not-for-profit, and instead of replacing ownership with shared usage, shared usage is accompanied by shared ownership. Mobility as a Commons proposes a shift from commercial responsibility of shared mobility, towards a situation where residents organise ownership and be in responsible for their own mobility (Policy maker 3).

'We don't wait until a commercial party decides to place many cars in the neighbourhood.' - Expert 1

In DEEL The Hague, consists of 70 families, together owning six cars, with the ambition to grow in terms of participant size and vehicle fleet. The management board and a membership council consist of neighbourhood volunteers. The participants of DEEL the Hague, and of the neighbourhood in general, are mostly thirty-something people, but also retired people, families with children, all relatively high educated, and well-to-do. This neighbourhood is characterized by 'high parking pressure, not enough trees, actually shortage of everything', and in addition MaaC enables resident to get to know each other. In particular, this neighbourhood houses a lot of expats, and individuals that are rather footloose, but like to have more contact with neighbours. Expert 1 also identified to appreciate the absence of brand recognition on the vehicles and expressed a sense of ownership and attachment to the car fleet.

'I really like that it is our own car. That is really what it is, we just own six cars. I would bet that only 25% of our cooperation would participate in MyWheels for example. Because we organize this together.' – Expert 1

To overcome potential unavailability, DEEL Den Haag has a collective MyWheels membership that participants can draw upon in case all cars are in use. The cost structure that is applied to the commercial shared car usage is equal to that of cooperative owned cars, and these costs are absorbed in the revenue model of the cooperation. Diversification across MaaC participants and including individuals with other travel behaviours increases the efficiency of vehicle use, lower the costs of usage and limit the chance of vehicle unavailability.

'We also want participants that need to travel at night, to a distribution centre for example. Because at those specific times, the car is idle. So that can be targeted by the way in which costs are distributed.' - Expert 1

In the context of Amsterdam, MaaC came forward in a participatory process for hub creation, identifying demand for a more communal organisation of mobility. Tuindorp Oostzaan (Noord), Spaarndammerbuurt (West), DEELcentrum (Oost) and Meerdelen.
A pilot project took place in the Watergraafsmeer, a neighbourhood in the city district Oost, where the cooperation owned cars as well as a cargo bike. Through a pricing structure where short car trips were charged more than longer car trips, cargo bike were financed and active mobility was stimulated (Policy maker 3)

Whereas Policy maker 3 is cautious on making statements about the financial benefits of MaaC, Expert 2 states that cooperative sharing is 30-40% cheaper than commercial sharing. Beyond the financial benefits, both identify that cooperative vehicle sharing would create social cohesion and facilitate getting to knowing fellow neighbours (Policy maker 3 & Expert 2).

'MaaC adds value on three levels. For participants, cost of transportation is lower. For the neighbourhood, less space is taken up. For the planet, we drive electric.' – Expert 1.

'If individuals share, they automatically cycle or walk more, because of cost awareness.' - Expert 1

However, setting up a MaaC neighbourhood initiative requires individuals that are willing to, or enjoy participating in social initiatives and contribute to the neighbourhood (Policy maker 3). As often with bottom-up initiatives, 'computer says no' is very common, and the regulatory framework of the city, in particular parking permit regulations, leave little room for communal ownership (Policy maker 3). It is time costly and sometimes also requires financial investments for printing flyers, renting space to organize an information session, or organisational things such as visiting a notary. However, not everyone has the know-how and the time to engage in a project as such (Policy maker 3) and in neighbourhoods where social cohesion is limited, setting up social initiatives proves to be very difficult (Expert 3).

In a neighbourhood where there is organisational knowhow, money, and sustainable awareness it is easier to achieve this, since those are the people that might want to put more effort in it (Expert 1). It is essential to make it is as easy as possible to manage a cooperation as such, and limit administrative barriers (Expert 1). To not only make this possible for people that do well, but it might also be possible to organise this with housing cooperations for example (Policy maker 3).

12.5. Conclusion

Prioritizing the role of mobility in human life, the importance of accessibility and the essence of mobility system change, was acknowledged in all conversations with experts. The loss of space that results from a car-ownership based regime, is emphasized by multiple policy makers and experts. Nevertheless, opinions on the extent to which shared mobility can contribute to a more optimal use of space, and the perception towards shared mobility in the context of Amsterdam Zuidoost differed.

According to the outcomes of this chapter, the willingness to use shared mobility alternatives depends on availability, price perception, awareness and need for digital skills. In the context of Zuidoost, its urban planning is linked to a strong car ownership regime and create a barrier for shared mobility supply. The municipality aims to anticipate on this, and stimulate shared mobility expansion across districts; however, it leaves responsibility to the commercial actors as much as possible. Shared mobility is hypothesized as to potentially absorb the growth in mobility demand that is caused by the city districts' growth ambition. The potential absorption is expected to be in

(re)development areas, since a change-in-change method can be applied and shared mobility provision can replace the parking requirements incorporated in the new building plans. Applying stricter parking policies in existing neighbourhoods is viewed as a potential strategy to disrupt the car-ownership regime and facilitate the adoption of shared mobility. However, the use of increased parking tariffs to achieve this objective has been critiqued. Moreover, linking residents' mobility access directly to the profit motives of commercial actors has been questioned for its long-term desirability and equity implications.

Whereas shared mobility is a potential instrument in the transition towards cleaner and just mobility, the policy perspective towards commercial shared mobility in Amsterdam Zuidoost, is enhanced with MaaC as an alternative to commercial shared mobility. MaaC contrasts with commercial shared mobility by being not-for-profit and promote shared ownership and management of vehicles by residents. Similar to commercial shared mobility, MaaC reduces transportation costs, minimizes space usage, and supports environmental goals. However, MaaC enhances social interaction and community resilience, with shared fleets bearing the potential to incorporate a variety of transportation modes. Nevertheless, implementation of MaaC faces regulatory barriers, such as parking permit rules, and requires organizational capacity, which may be limited in neighborhoods with low social cohesion. Administrative burdens and resource constraints further hinder scalability.

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13. Results of Business perspective

This section aims to answer SQ4: What are drivers and barriers for shared mobility initiatives to offer their services in certain locations? This chapter is structured based on the three main categories of shared mode availability, and considering the critical interactions for niche development taking place between the business, individual and policy perspective, and business-individual interaction, captured by costs of shared mobility, and business-policy interaction are elaborated on.

13.1. Shared cars

Shared car supplier 1 aims to offer a sustainable and financially accessible alternative for car ownership, by offering a shared car for incidental use. Its core business, is providing station-based car sharing, based on the principles of visibility, security of parking space, recognizability and certainty. Building on their core values, the 'One is none' principle is applied, aiming to supply a service area with multiple cars to decrease the chances that there is no shared car available, when a shared mobility users requires one.

Shared car supplier 2 seeks to reduce emissions associated with car production, decrease the number of vehicles on the streets, and thereby create more space for greenery and cleaner air, ultimately improving urban liveability. The company aims to substitute private car ownership and complement other transportation options, including preventing second car ownership. Looking ahead, their future vision involves addressing net congestion by utilizing shared vehicles as neighbourhood batteries.

'If people own two cars, why would they use a [shared car]?'- Shared car supplier 1

'If you attach status to car ownership, or need a car for work, you should not engage in car sharing' - Shared car supplier 1

In principle, a shared car is very suitable to adhere to forces in supply and demand. and since it is difficult to predict whether a shared car will be used or not, removing it after a trial period if underperforming. However, car acquisition requires a large investment,

accompanied by institutional barriers that need to be overcome, such as the requirement of a designated parking place, preferably with a charging station for electric vehicles. Thus, simply acquiring a hundred cars and selecting suitable service locations based on trial and error is not feasible. 'Instead, of policy makers subsidizing the supply of shared mobility in inefficient locations, they should smoothen the bureaucracy that is incorporated in supplying shared mobility services. charging infrastructure, parking permit structure, easing rules and regulations.' In addition,

'As a car sharing company, we need a certain quality of parking places. If those are underneath a tree, and constantly pooped by birds... No one prefers that, but our car is our business card, and you're offering a service.' - Shared car supplier 1

High density areas, or railway stations make up a good business case. The more people, the higher the chance a car is used (Shared car supplier 1). Free and unlimited on-street parking, in combination with car-oriented cities lead to low demand from residents, and policies such as car-low Amsterdam, are a condition for the success of car sharing (Shared car supplier 2). Even though often approached by municipalities to offer their services, sometimes in exchange for financial compensation, this is beyond the shared mobility supplier's scope. In case of expansion with an additional car, the less risky, or most profitable location is chosen. New development areas are prioritized over neighbourhoods where car ownership is high, or where people drive 9000km/year.

'It is not that we refrain from operating in Zuidoost, it is rather that there are other locations that are a better fit.' - Shared car supplier 1

The essence of a shared car is to a higher occupation rate of cars. We aim for a reduction of idleness from 96% to 80%. If a shared car proves to be idle 96% of the time as well, what value does it then add? We want to relocate the car to a place where it is used more frequently. So if a municipalities asks whether we can offer our services, in exchange for a compensation, we do not support that (Shared car supplier 1).

13.2. Shared mopeds

Cities are clogging up especially if everyone has its own car, and accessibility is jeopardized. Shared moped supplier 1 aims to become *'the bol.com of shared mobility'*, supplying people with the fastest way to get from A to B, in an efficient and sustainable way. all vehicles in our fleet being sustainable. While in the meantime making the most efficient use of space (Shared moped supplier 1).

Shared mopeds are used within municipal boundaries, and for short distances. Mopeds are an alternative to public transportation, thus public transport being our main competitor (Shared moped supplier 2). The use of shared mopeds overcomes barriers in place with the use of public transport: the need to go under the ground for the subway, tap your card or buy a ticket, and being dependent on the timetables (Shared moped supplier 2).

Private ownership is our biggest competitor. There are three shared mobility providers active in the Netherlands, however these are only limitedly considered as competition. Since Amsterdam is not a car-friendly city and most car-trips forego city boundaries, shared mopeds do not directly compete with car usage (Shared moped supplier 1).

'There is a tradeoff in costs of transportation and time efficiency. For short-distance trips, mopeds are more time efficient, and only slightly more expensive. The longer the distance, public transport increases in cost and time efficiency. For suppliers, there is the dilemma in operation: enough supply lowers the threshold for usage, however underperforming mopeds are costly, as well as produce more complaints, because of their low user frequency/idleness.'
- Shared moped supplier 1

Mopeds are used because it's easy, close by and people want to be fast. According to analyses performed by Shared moped supplier 1, the likeliness to use a shared moped decreases after 250 meters. Hub creation in shared moped supply creates a barrier for usage, since the flexibility of sharing is partly lost. In particular virtual hubs create barriers through invisibility (Shared moped supplier 1 & 2). Individuals cannot park the mopeds directly and are required to find a parking location, which is costly, and

inconvenient. Having to spend two minutes on searching for a hub, does not match our proposition (Shared moped supplier 1).

'If you book a moped and drive into town, you actually want to be able to put it down there quickly and not have to spend an extra two minutes looking for that hub.' - Shared moped supplier 1

The willingness to walk to a shared mobility mode, is in close relation with the average trip distance, and the characteristics of the trip. For shared mopeds, the average distance averages 2.5 – 4 kilometers, depending on weather conditions and the season. Approximately one third is combined with public transport, and multimodality, is promoted (Shared moped supplier 1). The target group for moped users is considered as everyone above the age of 18. But most users are between 25-35, and predominantly urban (Shared moped supplier 1). Old people are used to it in their old solutions and additional efforts are needed to change their mind (Shared moped supplier 2).

'Bad weather conditions and helmet requirements are considered as barriers for shared moped usage. Shared mopeds suppliers have been subject to a declined demand, increased costs of operation and a necessary increase in tariffs.' –Shared mobility provider 2

13.3. Shared bicycles

13.3.1. Shared cargo bikes

The shared cargo bike has sought to expand their reach beyond Dutch borders, allowing the shared cargo bike supplier to solidify its market leadership, particularly in the European market for shared cargo bikes. Large differences exist in terms of bicycle habituation, and therefore the application of shared cargo bikes. By expanding geographical coverage, shared mobility providers can learn from other urban areas.

From the perspective of shared cargo bike suppliers, privately owned cars remain the most significant competitor. Depending on pricing and convenience, shared cargo bikes sometimes compete with other shared mobility modes such as shared cars.

For the shared cargo bike, the early adopters are always families with young children, creating peak pressure in the afternoon and in weekends. To create a business case, it is necessary to expand the use cases to different kind of user groups and this target group is expanded by dog owners and students for weekday usage. Sometimes it's a cheaper way to transport and with the public transport because you can go with two people on one bike. As is the case for mopeds, cargo bike density is very important because there's a limited amount of distance that people are willing to cover to reach a cargo bike.

'Our service areas are characterized by the presence of kindergartens, and where there's lots of families with young kids. If the average age is above 60 and it's not a good neighbourhood for us.' – Shared cargo bike supplier

13.3.2. OV-fiets

'People consider it as expensive, but in comparison to a two-way regional transportation ticket, OV-fiets is almost always cheaper. That is our guideline, that it is same price or less expensive.'

The target group of OV-fiets includes everyone that uses public transport and knows how to ride a bicycle. Over 90 percent of OV-fiets user cases preceded a public transport journey, with slightly more recreational purposes than business commuters. OV-fiets is not profit-driven, and its main proposition is to facilitate and stimulate train usage and offer the most attractive door-to-door journey. Considering the limited space availability in station areas, OV-fiets competes for inside bicycle storage facilities with other bicycle suppliers such as Tier and Donkey Republic. Beyond the competition for space in and around station areas, the target audience for shared bicycles is slightly different and OV-fiets does not consider other bicycle sharing suppliers as competition. Moreover, OV-fiets aims to contribute to the larger goal to get people out of their car, regardless of how individuals organise their last mile. Whereas OV-fiets aims to replace car usage, the biggest competitor for OV-fiets, is private car use and *'any alternative is an accomplishment'*.

To increase their coverage, OV-fiets is also experimenting with e-bikes in peripheral areas, or hilly landscape. Partly because of emission, but also because active mobility is healthier. Moreover, cycling is considered to contribute to people's happiness level, and thus positively affect the quality of life.

'By replacing all those idle cars, we can literally create space in the streets for housing, playgrounds, greenery, bicycles.'

As is the case for the shared car supplier, OV-fiets has observed a yearly growth of 20%, and demand is exceeding supply. To grow efficiently, OV-fiets prioritizes the operational quality by replacing the outdated bicycle locker boxes with staffed locations and subsequently aims for nationwide coverage by expanding to new, mostly smaller or more rural railway stations and currently abstains from operating in other locations than train stations.

13.4. Policy-business interaction

The municipality of Amsterdam a large organization, consisting of multiple teams, resulting in a lot of organisational barriers that need to be overcome, and accompanying costs. Sometimes processes are slightly chaotic, but in general, public private cooperation is considered as constructive and efficient (Shared moped 1). Additionally, conversations about topics such as charging infrastructure are important, however every FTE devoted to communications, is one less shared car (Shared car supplier 1). It could be a bit smoother. The high costs that are related to service areas in the city of Amsterdam, impact the ability to scale up, and/or offer sustainable and affordable supply (Shared car supplier 2).

For shared mobility providers, one of the largest barriers in operations is related to bureaucracy, the variety of rules and regulations that applies across municipalities or even city districts, and the high level of insecurity. Shared cargo bike providers, as well as shared moped providers face significant bureaucratic barriers, including navigating complex regulatory frameworks and obtaining permits required for operating in urban areas. On the one hand municipalities embrace shared mobility and on the other hand,

they are frightened and want to imply regulations (Shared moped supplier 1). This high level of insecurity is considered as barrier for long term strategy development, tempering the growth of shared mobility (Shared cargo bike & Shared moped 1).

'The whole future depends on quite arbitrary decisions of the city [..], you can expect in two years from now when the license expires, that it might go to somebody else and then you lose all your investments.' - Shared cargo bike

A specific barrier identified by Shared cargo bike, was the reluctancy of Dutch policy makers towards shared (cargo)bike implementation, based on the misperception that Amsterdam is 'the best cycling city in the world'. In comparison, the situation abroad is very different because they come from a much different level of cycling, and they see the importance of getting people on a cargo bike out of their car.

'It's like going to the US and saying that they don't need shared cars because they have so many cars.' – Shared cargo bike supplier

Instead of exploring the opportunities of shared bicycles, the political debate is rather on containing the number of bikes, and there exists the fear that shared bicycles will increase this number. Nevertheless, if we add 100 cargo bikes tomorrow then there's 100 more cargo bikes on the street tomorrow, but in the longer term that 100 shared cargo bikes will replace 500 cargo bikes that are not being bought, and the same goes for cars, of course (Shared cargo bike).

A conflict exists between zero emission policy goals, and shared mobility implementation. There is room for human error in charging electric vehicles, or malfunctioning of charging infrastructure, and therefore electric vehicles are more prone to challenges in terms of reliability,

'If the car I planned to use is low on gas, it's annoying and should not be the case but it can be fixed in a short amount of time. However, if an electric car is not charged, for example because of a defect in the charging station or because the prior user forgot to connect the

car to the charging station, it takes me more than 15 minutes, and I need to find another car' - Shared car supplier 1

Additionally, Amsterdam's zero emission goals have serious implications for the operations of Shared car supplier 1. Currently, 25% of the operation car fleet is electrified in Amsterdam, whereas this is 7% in the rest of the Netherlands. Achieving a 100% electrical fleet in Amsterdam is not feasible. For every electrified vehicle in Amsterdam, there is one fossil-fueled car to be relocated.

13.5. Costs of shared mobility

Shared mobility provision is not a lucrative market. In 2023, every supplier lost money. However, the shared mobility industry is often unrightfully thought of as a lucrative industry, and shared mobility are misrepresented as reluctant to grow (Shared car supplier 1, Shared cargo bike, Shared moped supplier 1). Expansion of the car fleet is expensive, and for an organisational to grow, operational challenges and costs exist (Shared car supplier 1). Both OV-fiets, as well as Shared car supplier 1 have identified that they do not have the capacity nor the financial means to place a shared vehicle for every policy maker that requests one.

'We have the social responsibility to reduce poverty and could facilitate welfare redistribution by allocating public budgets for specific target groups. However, we do not have the financial freedom to provide these discounts ourselves.' – Shared car supplier 2'

Costs of car ownership are automatically taken off people's account every month, whereas in shared mobility, the moment that you use it you pay for it. This results in a distorted perception of the costs of transportation (Shared cargo bike & Shared car supplier 1), and shared mobility being stigmatized as expensive. Shared car supplier 1 describes its pricing as not too expensive and 'fairly priced', and both car sharing companies state that at the current price levels, it is worthwhile to share if the covered distance is less than 10.000 a year.

'People only see an invoice, based on a couple of hours usage, however this includes fuel, insurance, parking permits, road tax, costs of depreciation' - Shared car supplier 1

In addition, individuals are relatively unfamiliar with shared mobility, and shared mobility modes are not always recognized as shared mobility (Shared moped supplier 1). Additionally, there is little awareness of the existence and operations of shared mobility, and visibility of shared cars is essential to create awareness and stimulate usage (Shared car supplier 1). If cars are hidden in parking garages, this creates a barrier for usage. In concordance with the visibility of shared mobility, the availability of shared mobility is often overestimated. Shared car supplier 1 has an operating fleet of 3000 vehicles, and in the case of shared cargo bikes, owning a fleet of 110 bikes in Amsterdam, respectively, there are approximately 250.000 self-owned cars and 30,000 private cargo bikes in Amsterdam.

To overcome the misperception on costs and increase its user group, Shared cargo bike supplier has set up a membership structure, where discount-based memberships create user-friendly prices, and attract new users, even though it is accompanied by a loss of margins.

Shared moped supplier 1 aims to overcome challenges in terms of profitability by broadening its supply to shared cars and e-bikes to facilitate multimodal transportation and considers expanding to cargo bikes in the future.

'*We believe in the sharing of vehicles. Whether that is a moped, bicycle or a car, that does not matter. That is the future we need to go to, more efficient use of space*.'- Shared moped supplier 1

13.6. Conclusion

A common ground amongst shared mobility suppliers is the aim to target either private ownership, or specifically car ownership. For all shared mobility providers costs play a large role, and all share a common challenge in terms of profitability. The acquisition costs of vehicles create a barrier for increasing the size of the vehicle fleet, and therefore limits the velocity in which shared mobility suppliers can scale up. Building onto the operation costs barrier, shared mobility providers identify the misperception of the cost of mobility from a user perspective as a large barrier. To overcome this and increase its user group, shared mobility suppliers have set up a membership structures, to be more alike the costs structure of car ownership.

Whereas the municipality was considered as constructive, bureaucracy is simultaneously identified as a barrier for shared mobility providers. For car sharing, the designation of parking places for shared cars, the debate on free-floating versus station-based car sharing, and the transition towards zero-emission vehicle fleet are pressing.
For shared moped and shared cargo bicycle suppliers the bureaucratic barrier particularly relates to uncertainty and short-term operating permits.

For car sharing, a high motorization rate is considered as a barrier for shared mobility supply, and the higher the motorization rate, the lower the attractivity of a service area. High parking costs, or the prevalence of low-car city policy induce shared car demand. Instead of expanding to new areas shared car providers rather aim to increase their coverage in areas showcasing a net-zero or positive business case. Additionally lacking visibility of shared mobility modes, awareness and user know-how creates a large barrier whereas by increasing it, it can spurge shared mobility usage.

The demographics of a potential service area are important in deciding upon offering their services. Shared cargo bicycle suppliers specifically target families and have now enlarged their user profile to dog-owners, or students, moped sharing targets urban residents aged 25-35, and shared car providers target urban dwellers. Generally, shared mobility supply service areas are characterized as high-density or locations where shared mobility users can switch modality, such as railway stations, or mobility hubs.

14. Discussion

This section integrates the business, individual and policy perspectives and places them in the context of the socio- technical mobility transition. As a result, this chapter will include implications for the applicability of shared mobility in the context of Amsterdam Zuidoost. The discussion is structured as follows. First, the general outcomes of the three perspectives are outlined. Then, the outcomes are applied to b2c shared mobility, p2p shared mobility, and lastly MaaC is elaborated on.

The motorization rate can serve as an indicator for regime strength. In the case of Amsterdam Zuidoost, the motorization rate (see chapter 8) is higher than for other city districts. Moreover, the embeddedness of the car is observed by its dominance in the modal split of Zuidoost. Whereas in other city districts, active transportation is dominant, active transportation is underrepresented in Amsterdam Zuidoost and a gap exists in creating suitable policy that stimulates active transportation. The strength of the current car-ownership regime can be complemented by car attachment, reasons for car ownership and the perception towards niche development and landscape factors, as underlying the transition towards a more sustainable transportation system. According to the findings presented in this study, most of the car-dominated trips cover leisure purposes, or are for within Zuidoost destinations. For city centre destinations, car-based transportation is avoided, and public transport is the preferred mode of transport for inner-city destinations. In the current situation, the abundancy and low-price of parking facilities in Amsterdam Zuidoost, the low quality of within city district public transport and the comfort, or ease of self-owned car usage, stimulates car-based transportation for within-district trips and strengthens the regime. Moreover, intrinsic drivers to abolish the current regime of car-ownership and to engage in sustainable mobility behaviour are limitedly present in Zuidoost.

There is a misalignment between the vision of the public domain, missions of shared mobility providers and the needs of residents, and there exists a gap between the societal need for a mobility transition and the individual need to change mobility behaviour.
The question that should be asked is rather: How can the attractiveness of car-ownership be targeted, while not impacting those that are dependent on car-based transportation?

14.1. Business-to-consumer shared mobility

Grounded by theories, shared mobility is considered to hold potential for a) improving liveability and accessibility of individuals by broadening and enabling mobility availability and b) replacing the current state of ownership and therefore decreasing the pressure on public space and c) catalysing sustainable transition. From the individual perspective, pressure on public space is not experienced, car-related nuisance is diminishable, the perceived costs of car ownership are low, and sustainability is not a core value. The core value of freedom, as perceived from a residential perspective is the ability to use your self-owned car whenever you want, whereas from a policy and business perspective, freedom is rather the possibility to make use of any transportation mode that is present in your neighbourhood.

By increasing parking costs within the district, the municipality aims to stimulate mobility behaviour change as well as stimulate shared mobility supply, both in areas where parking pressure and nuisance is high, as well as in neighbourhoods where shared mobility supply is low (Nota Deelvervoer; Agenda Autoluw). Whereas stricter parking regulations might nudge people towards sustainable alternatives, these regulations directly affect all car owners, including those that are dependent on car-based transportation, and vulnerable people. Additionally, it can be questioned to what extent shared mobility will emerge in a neighbourhood as Zuidoost. The shared mobility market is characterized by low profit margins, high investment costs, and large barriers in terms of scaling up. Shared mobility is still in the incubator phase and is subject to low awareness in terms of existence, definition and properties of shared mobility. Considering the low level of awareness, a barrier exists on the niche replacement potential on the individual level. Additionally, the determination of shared mobility service areas is characterized as inflexible. Consequently, commercial shared mobility is present in areas where a positive or net-zero business case can be realized, characterized as high-density, predominantly urban areas, where pressure on public space and costs of car ownership is high (Meelen et al., 2019), and shared mobility provides prefer expanding their supply in existing service areas instead of expanding in terms of geographical coverage.
Following from this, stricter parking policies negatively affect residents of the periphery, when the desired effect of emerging alternatives remains absent. Other side effects of

stricter parking regulations include a waterbed effect where stricter parking regulations in other areas indirectly increase parking pressure in areas where parking costs are relatively lower (Omgevingsvisie 2050).

Both the policy perspective, as well as the business perspective indicate that shared mobility holds potential in terms of replacing car ownership. Shared cars are claimed to replace nine to fourteen privately owned cars, thus addressing space scarcity and enables urban space to be redesignated to other functions' (RWS, ….) From the replacement argument, it can be derived that commercial shared mobility is targeting the motorization rate and for shared mobility to decrease the motorization rate, this implies that the target group of commercial shared mobility consists of previous car-owners, or in other words, future non-owners. In areas where the motorization rate is higher, the percentage of potential previous owners is higher, and thus reaps a higher replacement potential. Nevertheless, shared mobility prevails in low-motorization rate neighbourhoods where the percentage of current- or previous- non-owners is higher. Controversially to the replacement potential argument, as concluded by Meelen et al. (2019), a stronger socio-technical regime, measured by the motorization rate, decreases the likelihood of business-to-consumer presence. For a district where car ownership is high, and consequently car usage is higher due to comfort, allocation of money, and accustomedness to car-culture, the replacement potential of shared mobility is larger. However, replacing ownership with sharing requires intrinsic motivation, awareness of the existence and usage know-how, and/or costs awareness. The extent to which this holds for Amsterdam can be questioned, and the principal drivers for intrinsic motivation for shared mobility implication: environmental consciousness, scarcity of space, costs efficiency of shared mobility are absent from the residential perspective.

Therefore, whereas the replacement effect is high in an area such as Zuidoost, the potential business case for shared mobility providers is weakening with the motorization rate. Building onto the replacement potential, the added value of shared mobility depends on the substitution effect of shared mobility. Ideally, shared mobility substitutes car ownership, and complements public transport/ active transportation. However, if shared mobility replaces the modes higher up in the mobility pyramid, it's desirability can be questioned. Nevertheless, considering the increasing pressure on public transport (Policy

maker 4), shared (micro-)mobility could partially capture the growing pressure on public transportation and even though replacing public transportation with private transportation, still positively contribute to the mobility composition of Zuidoost by reducing pressure on public transport.

In addition to the replacement argument and under the assumption that shared mobility prevails in neighbourhoods with a low motorization rate, there is an additional effect in terms of accessibility. For this, it is essential to distinguish between the difference in motorization rate, and access to motorized mobility to determine the role of shared mobility. Rather than replacing car-ownership with shared mobility usage, shared mobility increases the accessibility of a certain neighbourhood by adding a transportation option to the mobility mix.

This accessibility effect, where shared mobility enables access to a non-owned mode of transportation, is larger if a variety of shared mobility modes are made available, since the possibility that an individual owns all the available shared mobility modes decreases with the variety of shared mobility supply. Non-car transportation modes that are offered through shared mobility create alternatives for car- ownership, as well as for car usage. Therefore, the accessibility effect of shared mobility is twofold: it enables the use of certain transportation modes, and ideally it leads to an efficient allocation of transportation modes to transportation needs. Nevertheless, this accessibility effect is not retrieved in the business perspective analysis and based on the business perspective analysis, improving accessibility is a side effect rather than the primary goal.

Subsequently, shared mobility holds potential to be of added value on the individual level, under the condition that it either replaces car-ownership or increases accessibility levels. Car-owners are both used to car culture, as well as bound to the costs allocation to car ownership that cannot be allocated to other forms of transportation. Therefore, shared mobility is considered as a measure that contributes to overall accessibility levels and increases flexibility. Access-based mobility usage can create awareness of mobility behaviour, and the costs that are in place. Under the assumption that shared mobility is a cost-efficient alternative for individuals, switching to sharing holds the additional societal benefits by nudge individuals to more sustainable other modes of transport. E-bikes can

increase the distances that residents are willing the cover by bicycle, and thus serve as a sustainable and healthy alternative for car-based transportation. Bicycle theft was indicated as a barrier for e-bike acquisition on the individual level, and there is potential for shared mobility suppliers in overcoming this barrier. Another factor in stimulating active transportation, is to limit within city movements dome by car by restricting parking policy or increasing the price of car ownership. Whereas switching from a car-ownership based regime to a usage-based regime may lead to a diversified and more efficient allocation of transportation modes to transportation needs, it requires a certain level of commitment. The high fixed costs that characterize the car-ownership regime create a financial barrier for low-income individuals to become a car-owner and participate in society that is based on car- based transportation.

Simultaneously, the embeddedness of the car in daily life, and the high level of commitment creates a barrier to switch from ownership to sharing. The high fixed costs that characterize individual car-ownership are structurally underestimated by individuals. Nevertheless, shared mobility providers are subject to the high fixed costs of car-ownership as well. In contrast to individuals, there is less room for subjectivity from the business perspective and commercial parties are bound to profit-driven business models. Costs of car ownership and usage are part of the business models of shared mobility providers, and directly transformed into price per distance covered. This distorted cost perception on the individual perspective adds to the 'shared mobility is expensive paradox' and paints an unrealistic picture of cost-based decision making.

Considering the required commitment, and the challenges that exist in switching from ownership to sharing, participating in a sharing scheme requires a certain level of shared mobility availability, as well as the assurance that this mobility supply will remain in the future. This threat of reliability on shared mobility is exemplified in the incorporation of shared mobility in building plans and applying stricter parking regulations. The city district is expected to grow with 51.000 new houses and 33.000 and consists of large redevelopment areas. Whereas for current residents of Amsterdam Zuidoost, implementing policy measures in favour of low-car vision might harm them, a change-in-change approach utilizes moments of change to provoke a change in behaviour and replace ownership with shared mobility usage. Nevertheless, incorporating shared

mobility in the foundations for redevelopment areas, implies a high level of dependability. It can be argued to what extent it is desirable to depend on profit-driven commercial parties for the essential role that mobility has for participation in society. The potentially withdrawal of non-profitable shared mobility supply from non-profitable service areas, threatens accessibility levels, creates insecurity, and can have serious implications for individuals' ability to participate in society.

The potential interference for commercial shared mobility to intervene in the mobility mix is limited as the principal drivers for shared mobility implication are absent from the individual perspective. Additionally, commercial shared mobility providers are bound to tight profit margins, and improving accessibility is not the main goal for shared mobility provision. Considering the absence of individual perceived benefits to shared mobility schemes, it can be questioned to what extent it is then desirable to implement sustainable transportation alternatives.

14.2. Peer-to-peer shared mobility

Intuitively, the initial relatively strong car-based regime in Zuidoost points towards peer-to-peer sharing. This is also supported by the findings of Meelen et al. (2019), indicating that compared to b2c sharing, the availability of p2p sharing is not affected by the strength of the regime. Rather than placing a focus on the replacement potential, p2p shared mobility can increase accessibility while keeping all else equal. Moreover, in p2p shared mobility, car-owners are transformed into shared mobility suppliers by offering their privately owned vehicle to share through platform such as Snappcar. Therefore, the principal driver for car-ownership is a p2p sharing scheme is private ownership, rather than making profit. Nevertheless, p2p availability depends on the willingness of individuals to share their privately-owned assets, as well as the awareness and know-how of shared mobility. Both suppliers as well as users are represented by individuals and based on the user profiles in chapter eight the individual perspective is subdivided into car-owners and non-car-owners.

User perspective:

1. Non-car-owners: increasing accessibility levels by facilitation car-based transportation
2. Car owners: either abandoning car-ownership and switch to a sharing regime or complementing current car-ownership by utilizing the variety of motorized vehicles.

Supply perspective:

1. Current car-owners that are either already car-owners and intrinsically motivated to contribute to the mobility transition, or to offset the high costs of ownership by sharing in return for financial compensation.
2. Soon-to-be or new car-owners that are attached to car-ownership but are looking for a solution to finance the costs of car ownership, which is characterized by high investment costs, monthly or re-occurring payments, or fuel costs.

The extent to which p2p shared mobility is applicable to the case of Zuidoost depends on the motives for car-owners to offer individual ownership in p2p sharing and depends on the extent to which the drivers for the mobility transition resonate with an individual.
In the current situation, the low perceived costs of car-ownership create a large barrier for potential shared mobility implementation, both for b2c shared mobility as well as for p2p sharing. People do not consider the financial compensation to weigh up to the insecurities and constraints of sharing with strangers. Multiple interviewees expressed a resistance to lending out their car to strangers, and legislative barriers were indicated to be important. Whereas some interviewees identified to already share or lend out their car to relatives, this could rather be traced back to an act of friendship or collateral actions. In case of sharing amongst friends or relatives, none of the interviewees received a financial compensation for this, or has considered asking for one, since it is a 'family service'.
Car owners are worried about legal consequences in case of damage, and a lack of user know-how exists. Policy interference and information exchange that close the gap in uncertainty and could enable p2p shared mobility, and therefore contribute to higher levels of accessibility. Considering the potential overlap between p2p suppliers and users,

it can be hypothesized that individuals that offer their privately owned car in p2p sharing, are more likely to be p2p users as well, as it overcomes the lack of user know-how.

Moreover, the high level of attachment to self-owned transportation modes and lacking intrinsic drivers for engaging in p2p sharing, results in the case for p2p sharing in Amsterdam Zuidoost to be weak. Whereas the implementation of parking tariffs might affect the costs perception of car ownership, this research finds that the potential financial compensation that offering a self-owned car in p2p sharing is not necessary to finance car ownership and it can be questioned to what extent parking policy is a desirable and effective instrument for p2p sharing stimulation. Additionally, p2p sharing as currently facilitated by SnappCar, only exists for car-sharing, thus limiting the accessibility effect to facilitating car usage for non-car-owners, stimulating car owners to switch to car sharing or diversifying the supply of shared cars.

14.3. The potential of MaaC in Zuidoost

This section proposes an alternative to commercial shared mobility that can potentially be applied to neighbourhoods where commercial shared mobility does not fit the characteristics of a neighbourhood. Communal ownership stimulates the empowerment of communities, facilitates a system of sustainable ownership, and prevents communities becoming dependent on business models to participate in society.

From a societal perspective, MaaC enables individuals to participate in the mobility transition, as well as improves accessibility and therefore participation in society. By replacing individual ownership with communal ownership, MaaC reduces the strength of the regime, which could have a positive effect on the business case for commercial shared mobility and incentivize shared mobility supply and fill-in potential gaps in MaaC supply and demand. Based on the results of this research, MaaC is believed to hold potential for filling in the shared mobility gap in Amsterdam Zuidoost.

The extent to which a car is embedded in a neighbourhood, reduces the demand for car-alternatives, thus discourages the supply of alternatives. Based on this assumption, abandoning car-ownership, and switching to alternatives would imply a loss in

accessibility, and exchanging ownership with access requires a strong intrinsic motivation. The added-value of MaaC participation for residents is believed to be unlocking 'new' transportation modes, thus increasing accessibility, for neighbourhoods where the current car-ownership regime is strong and car-related externalities are limited.
A paramount condition for MaaC to be successful is that it includes cars, as well as a sufficient mix of car-alternatives such as cargo bikes, electric bikes and mopeds. Under this condition, MaaC broadens the mobility mix, improves accessibility and incentivizes individuals to participate in MaaC. Additionally, diversification of the user type can lead to a better allocation of resources since differences in users imply differences in mobility demand. Larger-sized cooperations allow for economies of scale, professionalization of the cooperation, diversification of the mobility fleet and hold the potential for diversification of the user type. However larger-sized cooperations could lead to anonymity and a loss of the sense of ownership, as well diversification implies differences in norms, values and user behaviour, potentially leading to friction.

Elements of the foundations of the original Bijlmermeer recur in the residential perspective: segregating mobility modes in urban planning, high quality public transport connections and the abundancy of greenery. Residents appreciate the anonymous character of Zuidoost, while simultaneously missing incentives to create social ties. Ironically, the ideology of 'Using communal facilities to encourage neighbourliness and collective life', which is based on the initial development of the Bijlmermeer, can be applied to communal sharing of mobility systems. The crucial difference: MaaC has already proved to be successful and indeed induce a sense of community and belonging, as is observed in DEEL Den Haag; one of the pilot projects for MaaC. Instead of anonymity, which is rooted in shared mobility services, MaaC provides residents with a sense of neighbourliness, while prioritizing essentialism to a certain extent.
Additionally, the urban planning that is typical for Zuidoost, with centralized parking facilities, and car-determined infrastructure isolated from residential areas, lends itself for the creation of (MaaC) mobility hubs.

Data indicates that social cohesion is lower in Zuidoost, and this research finds that an increase in social ties would lead to an increase in the sense of safety and liveability. This also recurred in the outcomes of the resident perspectives, that are presented in the results section of this research. MaaC builds onto existing social structures embedded in neighbourhoods or bears potential to induce social cohesion in socially weaker neighbourhoods through citizen participation and create a sense of belonging. However, social cohesion balances on a thin line between social security and on the other hand a preference for anonymity. Residents indicated that they valued the live-and-let-live mentality, and a rather functional neighbourliness.

MaaC follows a more business-like framework, where there is room for additional social interaction, whereas no obligations are present. Some individuals might feel the need to find social contacts or business contacts through MaaC or seize the opportunity for personal development, where others make use of the vehicle fleet. Following the example of MaaC in The Hague, participants can freely decide on the extent to which they are invested in the organizational practices of the cooperation and through incidentally meeting other residents and sharing ownership as a connecting factor, MaaC creates a social safety net. Whereas social cohesion can be a result of shared ownership, it could also be a precedent of sharing. The implementation of MaaC requires residents that are willing to participate in a concept as such, as well as a group of individuals that are able and willing to contribute time and effort to the organisational practices. Switching from car ownership to MaaC requires an individual to commit to a new mobility scheme. Participating in a transition involves risks and uncertainty, and especially in regard to the strong relation between perception of freedom and car ownership, it is essential that transparency and clarity is provided in this transition.

15. Potential ethical dilemmas

An ethical consideration to this study is that it aims to apply solutions for global challenges on the local scale. It can be questioned whether MaaC creates a solution for an existing problem. Being classified as 'transport poor', can unrightfully marginalize individuals or create resistance, or a sense of (in)justice, especially when the current system is not experienced as lacking by residents. Policies that aim for more sustainable transport, might harm communities, or parts of society that are depended on traditional schemes or have the flexibility to adapt, and the possibility should be considered that shared mobility solutions might not fulfil current residents' needs. Researcher and policy makers should be cautious in top-down decision making and the misunderstanding of the local context, or a lack in bottom-up challenge-based thinking could result in forcing solutions upon people.

Therefore, the researcher will be cautious for this and explore the widespread variety and interpretation of shared mobility initiatives and go beyond conventional shared mobility solutions in the final step of this research. Additionally, since one of the methods that is used for this research is conducting interviews, the researcher should keep its researcher's bias in mind while creating the interview guide and conducting interviews. After data collection, the anonymity of respondents is safeguarded, and all interviewees have been anonymized.

16. Limitations

Qualitative research methods are used, allowing for analysing human behaviour in the context of the sustainable mobility transition in Amsterdam. The goal of qualitative data collection is to gain a deeper understanding on the processes that are in place, rather than to provide a statistically representative sample of reality. However, it should be considered that qualitative research leaves more room for researcher bias, misinterpretation and subjectivity. Regarding representativeness of the interviewee sample, an under- or overrepresentation of certain characteristics could lead to different results, and for this research, it should be taken into consideration that some differences exist in comparison to Amsterdam Zuidoost, potentially harming the representativity of the research. The sample does not show a representative distribution of age groups. The 55+ age group is overrepresented in this research, and people in the age group 35-54 are underrepresented. In concordance with this age average, most interviewees have been living in Zuidoost for a large portion of their live, on average 20 years, and families with children are absent in the interviewee pool. In terms of gender composition, female interviewees are slightly overrepresented.

Only a limited number of policy documents is analysed, all applying to the Amsterdam context. The case study approach also has implications for generalizability, and in concordance with the spatial importance that underlies this research, this should be considered when applying this research to other neighbourhoods, either in the Dutch or in the international context. Amsterdam is exceptional in the willingness to limit automobile space and speed and its national cycling presence in the modal split, and together with Copenhagen the only city where cycling has a dominant modal share (Petzer et al., 2021).

Lastly, the concept of Mobility as a Commons (MaaC) was introduced at a relatively advanced stage of this research. Consequently, the findings related to MaaC are primarily conceptual and warrant further academic exploration and empirical validation. Nevertheless, given the anticipated potential of MaaC as an innovative mobility system, it was deemed important to incorporate this concept into the study.

17. Conclusion

This research has aimed to examine the potential role of shared mobility as a sustainable alternative to car ownership in the context of the mobility transition, emphasizing the complexity of system change, as is repeatedly found in academic literature. Shared mobility can be found at the intersection of the transition towards a more sustainable and a more inclusive mobility system, where ownership is replaced with access. Beyond the initial drivers for abandonment of current car-centric systems, shared mobility could enable individuals that are not in the position to own a car, to use a car if needed and thus improve accessibility for those with a lower income, and positive affect overall accessibility levels.

However, the extent to which shared mobility as an emerging mobility solution is available to everyone is limited and residents of car-dependent low-income neighbourhoods are presented with limited opportunities to discard car ownership, thus forced into a car ownership regime. Therefore, this research, grounds disadvantaged on a geographical context, and residents of neighbourhoods without access to shared mobility provision are defined as vulnerable for system change. If sustainable transportation alternatives are unevenly distributed across city districts and parts of society are structurally excluded from access, ensuring equitable inclusion in the transition becomes challenging, rendering a sustainable mobility transition infeasible. The core question is how to get disadvantaged individuals to also participate in the transition, to provoke a mobility transition at all, and for all. To find out how, and to what extent shared mobility can play a role in this, this research has distinguished between the three main perspectives: policy perspective, individual perspective and business perspective.

From the policy perspective, it came forward that the city of Amsterdam is faced with increased pressure on public space, population growth, increased transportation demand and there is a societal need to replace the current car-ownership system. Shared mobility can play a role in this transition by optimizing space use, support zero-emission goals and close the gap in accessibility and fulfil a crucial role in enhancing participation in society. Nevertheless, shared mobility is only limitedly incorporated in policy documents that envision the future of Amsterdam Zuidoost, and the municipality takes on a reluctant

position. Regarding the interaction between policy makers and shared mobility suppliers, policy makers aim to stimulate shared mobility implementation by incorporating shared mobility in redevelopment areas, however, take on a guiding role and leave responsibility with shared mobility suppliers.

From a business perspective, it came forward that commercial shared mobility suppliers are constrained by operational barriers and face high operating costs and low profit margins. Geographical heterogeneity leads to variations in the profitability of shared mobility services across different areas, resulting in unequal distribution of shared mobility provision. Consequently, commercial shared mobility tends to concentrate in neighbourhoods where pressure on the current regime—particularly on public space—is high, and motorization rates are low. Whereas the replacement potential of shared mobility is higher for a more car-dependent city district such as Zuidoost, shared mobility arises in neighbourhoods with a lower motorization rate, and therefore a higher level of current non-car owners. Building onto the concentration of shared mobility, limited availability of shared mobility availability is accompanied by limited awareness, and user know-how. Consequently, a situation is achieved with little incentive to abandon a car-ownership dominated regime on the individual level, and little incentive for commercial shared car suppliers to expand their service area to Amsterdam Zuidoost.

From the individual perspective it came forward that a gap exists between the societal need for a mobility transition, the individual perception towards the current car-ownership regime, and the potential of shared mobility in filling this gap. On a societal scale, the major drivers for the mobility transition include space scarcity, emission, pollution, environmental sustainability. In the case of Amsterdam Zuidoost, this research finds that there is low perceived pressure on public space, diminishable car-related nuisance, low influence of sustainability on mobility behaviour and low perceived costs of car ownership. If the individual perception towards the need for replacing a car-ownership regime with a shared mobility regime is not experienced by residents of Amsterdam Zuidoost, it can be questioned whether there is a gap for shared mobility to fill in neighbourhoods such as Amsterdam Zuidoost, and to what extent a transition away from a car-based regime is desirable if there is no support from the residential point of view.

As an answer to the research question, *'How can shared mobility be used to facilitate an inclusive mobility transition in areas where shared mobility provision is currently limited as a result of low feasibility?':* This research finds that even though the technology is there, barriers exist in the supply and demand of shared mobility.

In the current situation, it can be concluded that commercial shared mobility suppliers do not have the capacity or the willingness to expand to Amsterdam Zuidoost, whereas the demand for shared mobility from an individual perspective can be questioned. Additionally, the desirability of depending on profit-driven business models for participation in society can be questioned. The system is as strong as its weakest link, meaning that if the city of Amsterdam aims to become a car-low city, while policy measures only apply to a privileged subset of society, real system change will be hard to accomplish. Beyond the fact that it can be questioned to what extent real system change can be achieved by partial policy, theories on mobility justice and transportation advocate for individuals to be entitled to the right to have access to alternatives, and opportunity to participate in the mobility transition. In a world where inequality is rising, and polarization is happening, while facing enormous crises, it is essential to develop policy frameworks that adhere to a city-wide vision and involve all residents. To overcome the barriers that prevent system change, this research proposes a movement away from the focus on commercial shared mobility, towards empowering communities and replacing individual ownership with communal ownership. Rather than emphasizing the challenges of our current system, the potential and strength of newly emerging mobility solutions should be found in identifying the potential benefits that a newly emerging mobility solution can have on society. As an alternative to commercial shared mobility, this research proposes a shift towards communal ownership, or recognized as MaaC by some policymakers and academics, a concept building onto the three pillars of empowerment, social cohesion, and diversification of mobility supply. MaaC enables more sustainable travel behaviour choices and allows individuals to actively participate in the mobility transition as well as in society, thus catalysing the transition to a more sustainable mobility system that promotes a sense of belonging and inclusivity of Amsterdam's future vision.

17.1. Policy recommendations

Based on the outcomes of this research, this research proposes a set of policy recommendation, aimed to assist the municipality of Amsterdam in the transition towards a more inclusive and future proof city. In the process of this research, Mobility as a Commons has arisen as holding potential to fill the current gap mismatch between commercial shared mobility suppliers and residents of Zuidoost. Some of the recommendations will therefore apply to the concept of MaaC.

- **Enhancing public awareness** of shared mobility options and overcome the lack of user know-how by developing targeted campaigns and implement educational programs to improve user familiarity with shared mobility platforms.
- **Explore the role of shared mobility in the transition to zero-emission vehicles** and aim for closer collaboration with shared mobility providers. Replacing privately owned combustion-engine vehicles by shared vehicles can enable individuals that do not have the financial room to acquire a zero-emission vehicle and enable participation in the transition to zero-emission vehicles, with a focus on ensuring accessibility for individuals most vulnerable to system change.
- **Focus on the benefits of shared mobility rather than the costs of car ownership**, to foster a shift towards a sustainable mobility system. Highlighting advantages such as improved accessibility and reduced emissions can help drive adoption and bridge the gap in individual mobility behaviours.
- **Be aware of creating dependency** on profit-driven business models of commercial actors by incorporating shared mobility in redevelopment areas.
- **Apply 'Samen stadmaken' and aim for a local approach** to close the gap in sustainable alternatives by (Omgevingsvisie Amsterdam 2050), reaping potential from community initiatives, and using local knowledge.
- **Create policies that facilitate communal ownership, and overcome bureaucratic barriers** for concepts such as MaaC to stimulate emerging mobility solutions. It is essential that an overarching organisation is present to create clear guidelines and guidance, to overcome legislative barriers and support in the complex task of creating a cooperation, especially in the initial phases.

18. Recommendations for further research

In this research, the applicability of commercial shared mobility has been analysed within the urban context of Amsterdam and specified to the city district Amsterdam Zuidoost. Based on the findings that came forward from this research, four the recommendations for further research are

First, the case study approach that is applied in this research has implications for the replicability of this research and limits the findings. Controversially, conducting a case study on city district level can be argued to produce general results, and a more in-depth reproduction of this research on neighbourhood level might lead to more concrete conclusions. In regard to the case study approach, repeating this research in the context of a city district where shared mobility is more prevalent, by comparing the outcomes of the two case studies, lessons can be learned from the barriers and drivers of shared mobility in other urban contexts.

Second, this research has excluded business to business shared mobility, and service based shared mobility from the definition of shared mobility. By expanding the definition of shared mobility or shifting focus from residential mobility behaviour towards the mobility behaviour of visitors, or destination-based mobility, new insights could be gained into the dynamics of shared mobility usage, its broader impacts on urban mobility systems, and potential strategies for fostering its adoption in diverse contexts.

Third, this research finds that costs play a large role in mobility decision making, whereas the perception of costs is distorted. Therefore, a quantification of the qualitative analysis is needed, to gain more insights into the costs and benefits that are present in the shared mobility-ownership trade-off. Calculation tools for car ownership-sharing exist, however access to a mobility mix is proposed, there is a gap to fill, considering the three shared mobility modes that are most common: cars, cargo bikes and mopeds. The outcomes will produce insights in for whom and to what extent sharing holds financial benefits and to identify the turning point in which people are cost indifferent between car ownership and sharing.

Lastly, the concept of MaaC is introduced as an alternative to commercial shared mobility. Building onto existing MaaC initiatives such as DEEL Den Haag, further research can contribute to the realisation of newly emerging mobility concepts. Further research should focus on the requirements and implications for a mobility innovation as such and include an exploration of drivers and barriers of individuals to specifically engage in a concept as MaaC, as well as incorporate research on a potential framework and legislative barriers. Moreover, since this research urges the potential added-value of MaaC to go beyond replacing car-ownership with car-sharing, but rather broadening an individual's access to a diversified mobility supply, further research should address the size, mobility mix composition and other properties of MaaC.

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Appendix A: Table listing all interviewees

Interviewee	Dutch native speaker	Gender	Occupancy	Housing composition	Age	Driver's licen	Car own	Neighbourhood	Living duration
Interviewee 1	yes	m	rent	1	24	yes	0	D buurt	2
Interviewee 2	yes	v	rent	1	60	yes	1	Gein	28
Interviewee 3	yes	m	rent	4 shared appt	30	only moped	0	Bijlmerdreef	<5
Interviewee 4	yes	v	rent	2, couple	74	yes	2	Nellenstein	44
Interviewee 5	yes	v	owner	1	42	yes	1	Bijlmerdreef	16
Interviewee 6	yes	v	rent	2, couple	29	no	0	Bullewijk	3
Interviewee 7	yes	v	rent	1	70	no	1	Gein 1	24
Interviewee 8	no	v	rent	1	24	no	0	Bullewijk	1
Interviewee 9	no	m	rent	4, shared appt.	31	only car	0	Bijlmerdreef	1.5
Interviewee 10	yes	m	owner	3, family	65	yes	1	G buurt	19
Interviewee 11	yes	v	owner	2, family	56	yes	1	K buurt	18
Interviewee 12	yes	v	rent	1	57	yes	1	Holendrecht	28
Interviewee 13	yes	v	owner	2, family	59	yes	1	Gein	54
Interviewee 14	yes	v	rent	1	68	yes	1	Reigersbos	27
Interviewee 15	yes	m	rent	1	25	yes	0	Holendrecht	0.5
Interviewee 16	yes	v	rent	2, family	60	yes	1	Nellenstein	5
Interviewee 17	yes	m	rent	1	25	yes	0	Holendrecht	0.5

Policy maker	Division
Policy maker 1	Shared mobility, Municipality of Amsterdam
Policy maker 2	Province of Noord- Holland
Policy maker 3	Project manager Smart mobility, Municipality of Amsterdam
Policy maker 4	Mobility and neighbourhood development Amsterdam Zuidoost

Expert	Division
Expert 1	DEEL Den Haag
Expert 2	Goedopweg
Expert 3	Natuurlijk!Deelmobiliteit
Expert 4	We-all-Wheel

Shared mobility suppliers
Shared car supplier 1
Shared car supplier 2
Shared moped supplier 1
Shared moped supplier 2
OV-fiets

Appendix B Interview guides

Expert Interview Questions:

- Could you please introduce yourself and share your expertise in the field of shared mobility?

Mobility Transition:

- How do you perceive the role of shared mobility in the mobility transition?
- Do you believe shared mobility is a viable alternative to private car ownership?
- Where can shared mobility make the most significant impact?
- What are the key challenges in scaling up shared mobility offerings?
- Can shared mobility contribute to addressing transportation poverty?

User Perspectives:

- How would you describe the target audience for shared mobility?
- Is it necessary to broaden the user base?
- Should shared mobility be accessible to everyone?

Shared mobility supplier perspective:

- What is your perspective on different types of shared mobility services?
- How do you view various service models?
- What is your perception of commercial shared mobility providers?

Policy Considerations:

- What are your thoughts on the current mobility policies?
- How do you envision the municipality's role in shared transportation offerings?
- Currently, Amsterdam leaves shared mobility to the free market. What is your opinion on this approach?
- What role should the municipality ideally play in shared mobility?

Policy makers

- What is your vision for the future of mobility in the city?
- How does the municipality contribute to this vision?
- What innovative approaches are you taking in the field of mobility?
- What obstacles do you face?

- Where do you see potential for alternatives to private car ownership?
- How does the municipality view shared mobility?
- What characteristics define shared mobility users from your perspective?
- Are you actively expanding this user type?
- Does this vary across different modes and neighborhoods?
- Which type of shared mobility do you believe has the most potential?
- How does this potential vary across different parts of the city?
- What challenges do you encounter in implementing shared mobility?
- How do you collaborate with shared mobility providers?
- Why is shared transportation left to the free market?
- Are you working to level the playing field?
- What policies are in place to stimulate shared mobility?
- Is the municipality aware of the effects of its non-unilateral policies?
- How do you define mobility justice, and what actions are you taking?
- How does this play out specifically in Amsterdam Zuidoost?

Innovatieteam Gemeente Amsterdam:

- What is MaaC (Mobility as a Commons), and how does it differ from MaaS?
- How would such a Mobility as a Commons (MaaC) concept look?
- What role would the municipality play in such a concept?
- What obstacles exist in rolling out MaaC?
- How is the collaboration with the rest of the Amsterdam Municipality?

Questions for Mobility Service Providers:

Can you introduce yourself and describe your role within the organization?

<u>Performance</u>

- What services do you offer and where?
- How do you determine service areas?
- What are your future goals?
- What challenges do you face in providing shared mobility services?
- Who is your biggest competitor
- Is there any collaboration with other mobility providers?
- What sets you apart from competitors?

- What do you think is the role of shared mobility providers

User characteristics:

- What characteristics define shared mobility users?
- Are there differences among shared mobility user groups?
- How do you differentiate your services from other providers?
- How do you address the perception that shared mobility is expensive?
- How do you tackle other barriers to shared mobility adoption?
- Are you actively working to expand your user base? If so, how?
- Do you see your services as complementary or replacements for private car ownership?

Policy:

- How do you perceive your interactions with the local government?
- What are the regulations set by the municipality?
- Do you find the municipality helpful or a barrier?
- Do you think the municipality should do more?
- What would facilitate the expansion of shared mobility services?

Future Outlook and Role:

- How do you envision the future of mobility in the city?
- How does … fit into this future?

Questions for residents of Zuidoost

- Demographic aspects: Age, income (?), neighbourhood, household composition, housing preferences, duration of residence in the neighbourhood, and overall satisfaction with living there.
- Do you have a driver's license?
- Are you in possession of a smartphone?
- How comfortable are you with digital technology use?
- Perception of auto externalities.

Experiences of car-related externalities:

- How do you view climate change?
- What are your thoughts on Amsterdam Zuidoost?
- How would you describe this neighborhood?
- What is your opinion on the public spaces in the area?

- How safe do you feel in the neighborhood?
- Do you experience any car-related nuisances?
- What do you feel is missing in the neighborhood?

Mobility Behavior:

- How do you usually get around?
- What percentage of your transportation involves “active travel” (e.g., walking, cycling)?
- How satisfied are you with your mobility behavior?
- How much do you spend on transportation per month (including vehicle ownership costs)?
- Do you own a car? If so, why?
- How do you feel about car ownership?
- What motivates you to use a car?
- What do you like and dislike about having your own car?

Shared Mobility:

- When you hear “shared mobility,” what comes to mind?
- Have you ever used shared mobility services (e.g., shared bikes, mopeds, cars)?
- How about specific modes like shared cargo bikes, shared bicycles, shared mopeds, or shared cars?
- Would you be open to sharing your car (e.g., via platforms like Snappcar)