

# The arena of shared mobility

The influence of shared mobility on the accessibility of citizens of Groningen & Assen



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**Abstract:** Shared mobility is the shared use of a vehicle. An innovative transportation strategy that enables users to gain quick access to transportation when required, Shared vehicles are becoming increasingly visible in Dutch cities. The market for shared mobility has a lot of potentials to address several sustainability challenges in regions such as Groningen and Assen. Both municipalities are in an early phase of large-scale shared mobility development. This research aims to investigate the influences of shared mobility on the accessibility of citizens of Groningen and Assen. Three domains of shared mobility have been investigated. This research discusses the central question: *'How does the availability of shared mobility opportunities influence the accessibility of citizens of Groningen and Assen?'*

The results have shown that shared mobility covers a complex and dynamic arena of providers, vehicles, and operating schemes. The availability in Groningen is sizable and Assen is small. The business models of the shared modes do not offer options for traveling between the cities Groningen and Assen. Most vehicles are located around the city centers and therefore less accessible for citizens that live in the outskirts of the municipality. Shared vehicles are rolled out before policy is developed. Groningen has adjusted its policy and can regulate the market. Years of facilitating policy have led to growth in shared vehicles in Groningen. The questionnaire shows that people use shared vehicles to enhance mobility. The vast majority of the residents experience the vehicles as a good addition to the environment, but find it to a lesser extent important as part of their accessibility. In addition, residents do not travel more frequently due to the presence of shared vehicles. Repeating this research with a larger sample size after the COVID-19 measures can provide deeper insights into the importance of the vehicles.

# Colophon

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# 1. Background

Increased proximity is believed to raise individuals' quality of life and promote environmental, social, and economic sustainability (Gil Sola and Vilhelmson, 2018). Spatial policy has changed from car-oriented towards an emphasis on reduced travel distance and walkability, cyclability, and public transit (Banister, 2008). To this day the 'private car' is still seen as the most desirable travel option, globally. More needs to be done to increase the reliability and efficiency of transport services. Private vehicles remain parked around 95% of the time ("Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013 | UN-Habitat," 2013.). In both the European Union and the United States the transport sector is accountable for approximately one-third of the entire energy consumption. But on the other hand, in the EU the amount of travel in private cars with only one occupant is also high (Gabrielli et al., 2014). Machado et. al. indicated that 'are still many obstacles for reducing pollution, traffic jams, and for lowering the personal, social, and environmental costs of switching to more sustainable models' (2018, p. 3). These kinds of proposals oftentimes emphasize on convincing citizens to adopt more conscious and sustainable behavior.

Local authorities have fostered a shift to mass transit, bicycles or walking, through an increased and improved supply of alternative modes. Private vehicles may best respond to individual needs (availability, comfort, flexibility) but may overlook collective needs. On the other hand, mass transit may respond best to collective needs, but leave out individual needs. As such, shared vehicles have a significant role to play within an efficient transportation system (Drut, 2018). Litman affirms that a well functioning mobility system requires 'significant reduction in the use and circulation of cars, and migration towards more efficient modes of transportation such as public transit, cycling, walking, and with that shared modes' (2011, p. 83)

The Netherlands is increasingly concerned with the environment and it is time to rethink the issue of urban mobility. Shared economies offer the possibility to endorse the distribution of underused assets and services and at the same time popularize consumption with more sustainable business models. This creates positive associated economic, social and environmental impacts (Cherry and Pidgeon, 2018). Shared mobility (e.g. bikes, scooters, and automobiles) is booming in Dutch cities (I Amsterdam, n.d.). In the northern part of the Netherlands, shared mobility has gained popularity and support in recent years. In the municipality of Groningen, two private parties have started offering 400 electric share scooters (Gemeente Groningen, 2020). Shared mobility is not strictly limited to populous municipalities like Groningen or Amsterdam. In the municipality of Assen GoSharing has started offering share scooters as of 2021 (Gemeente Assen, 2021a).

The amount of private companies characterize modern shared mobility models. A limited amount of these companies are local initiatives and a to a less extent exclusively public shared models. The growing popularity of shared modes is caused by technological and economic advances and social and environmental problems related to vehicle ownership and city life (Machado et al., 2018).

Shared mobility by private companies can play an important role in the approach to traffic sustainability-related concerns. In recent years, the attention and demand for shared modes have grown rapidly, as has the need to construct an unified contemporary urban transportation system (Machado et al., 2018).

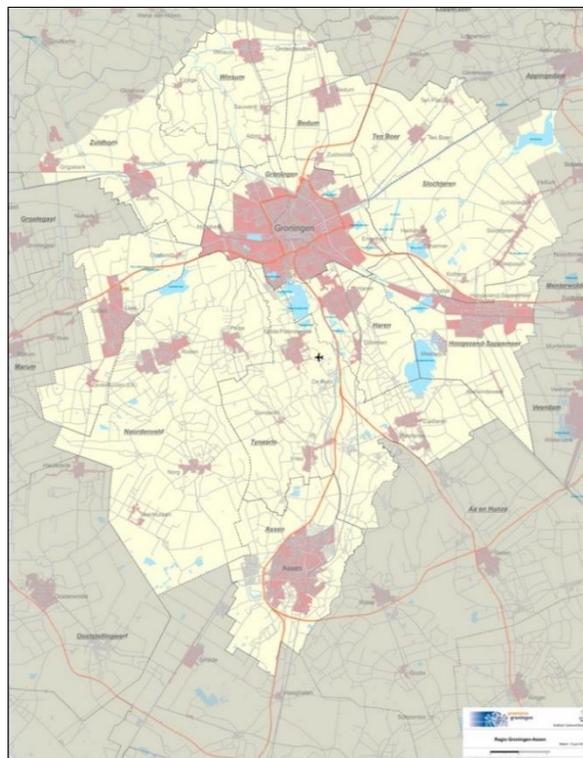
## Research Problem

Shared mobility has the potential to address several contemporary challenges in urban regions such as Groningen and Assen. The potential of shared transport is the centerpiece of the research and must be filled in by the players of the game which consists of local government, providers, and users. This research aims to investigate the influences of shared mobility opportunities within the urban transportation network *Groningen-Assen*. The regions of Groningen and Assen are strongly linked to each other. According to the steering group *Region Groningen Assen*, the strength lies within the combination of different modes of transport, known as intermodality (Regio Groningen-Assen, 2015). There is however little to no policy on shared mobility. The lack of policy and the potential for improved accessibility results in the following research question.

*How does the availability of shared mobility opportunities influence the accessibility of citizens of Groningen and Assen?*

To answer the main research question, the following secondary questions have been formulated:

1. *What is the availability of shared mobility opportunities within Groningen and Assen?*
2. *What (spatial) policy are or could be implemented to facilitate shared mobility?'*
3. *How do citizens of Groningen-Assen experience and use shared mobility, as part of their accessibility?*



**Figure 1** Groningen-Assen (Regio Groningen Assen, 2015b)

# 1. Theoretical framework

In this chapter, the most relevant concepts and theories will be defined and discussed with the use of relevant research literature. Relevant concepts consist of the definition of shared mobility including the categories, and points of criticism. Subsequently, the conceptual model and the hypothesis will be presented.

## 1.1. Definition shared mobility

Shared mobility is a segment of the sharing economy. ‘Shared mobility is the shared use of a vehicle. It is an innovative transportation strategy that enables users to have short-term access to transportation when required’ (Machado et al., 2018, p. 5). Shared modes can increase multimodal mobility, reduce vehicle ownership, distance traveled, and provide users alternative paths accessing goods and services (S Shaheen and A Cohen, 2016).

Shared mobility has the potential to reduce traffic congestion, parking spaces, and car ownership. Shared modes offer the opportunity to function as ‘intermediate modes’ between personally owned vehicles and publicly accessible means of transport like public transport. Shared mobility is often considered as an important factor of efficient and comprehensive urban mobility systems (Machado et al., 2018).

Within inner-cities with soaring motorization rates, shared mobility is deployed to supplement existing mass transit opportunities. But generally shared modes are not considered as a solution to city-wide transportation problems, but oftentimes deployed as part of existing mobility strategies that can help to reduce the consequences of air pollution and traffic jams. This is achieved through shrinking the amount of vehicles. Consequently, by introducing sustainable mobility concepts such as shared mobility cities can effectively increase its overall competitiveness, social equality of cities and above all, the quality of life of citizens (Rode et al., 2017). Furthermore, shared mobility has the potential to increase mobility for users who are unable to access private vehicles and allow users who own private vehicles to drive them at higher occupancy (Shaheen et al., 2018).

‘Shared mobility modes can be contextualized within a wide socio-technical transition, driven by the mass use of the internet and the emergence of smartphones, which have transformed several aspects of everyday life in less than a generation, leading to dramatic changes in the way people communicate, socialize, work, shop, and travel.’ (Machado et al., 2018, p. 4). Shared mobility schemes have involved in an array of consultations between local governments (municipalities) and private sectors focused on, for example, regulations and feasibility (Machado et al., 2018). The current digitalization is the primary driver of the shift towards shared mobility in smart cities. Shared mobility is a way of rethinking and repositioning transport in the urban landscape (Nikitas et al., 2017). Private companies are leading the current shared mobility market, but this raises concerns about citizen’ acceptability and feasibility (Nikitas et al., 2017).

It is widely agreed that shared modes are able to tackle multiple sustainability challenges. For instance reducing air pollution by incentivizing citizens to make use of cleaner electric counterparts. (Akyelken et al., 2018). The future of urban mobility is therefore the integration of on-demand transportation services: multiple transport companies, publicly and privately, are brought together on a single umbrella service platform. Which eliminates the need for a unnecessary and complex ticketing systems, an example of *Mobility as a Service* (MaaS). Machado et al. (2018) categorize shared mobility into the following categories.

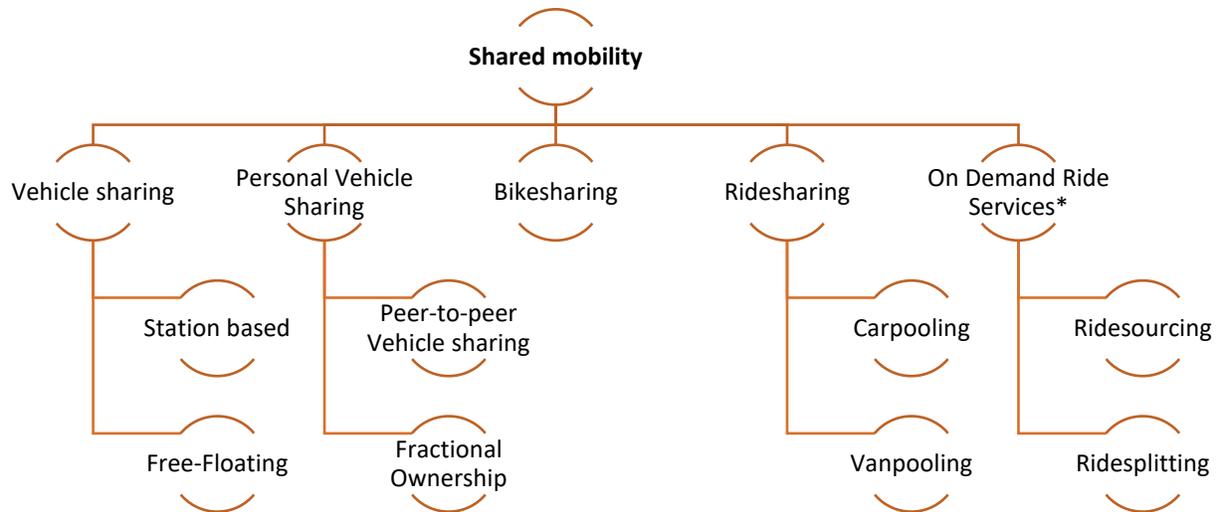
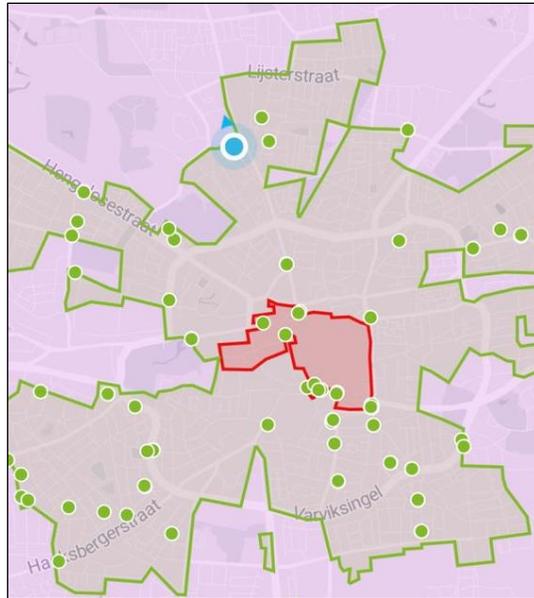


Figure 2 Shared mobility categorized (Machado et al. 2018)

Vehicle sharing can be divided into two categories: station-based and free-floating. In the station-based model, available vehicles (often cars) can be picked up at designated so called ‘pick-up stations’, pre-defined locations. In general, customers need to reserve the vehicle in advance (Heilig et al., 2018). Free-floating vehicle sharing allows users to book a vehicle through their phone, use it and return it anywhere within a designated area. This service is mainly used for shorter trips. Rental times are generally shorter than the equivalent walking time (Sprei et al., 2019).



*Figure 3 Free-floating zone in Enschede (Dijkgraaf, 2020)*

Peer-to-peer (P2P) vehicle sharing schemes make use of owned vehicles by P2P members which are made available for shared use to other individual. The members of the P2P platforms both agree on times and prices. The vehicle owners profit from transactions with the renters, but in most cases a peer-to-peer third-party company facilitates the rental (Ballús-Armet et al., 2014). The fractional ownership scheme is a model of dividing the ownership of a vehicle across a group of people. For example, the residents of an apartment complex or local communities. The participants each take up a fixed portion of the costs of the vehicle. This model is less popular than P2P schemes because its lack of flexibility. If a member decides to hand in his ownership, the remaining members have to take over the extra costs.

Bikesharing schemes (BSS) are similar to vehicle-sharing models. Users can access bicycles for use when they require. Bikesharing is concentrated in urban settings. Members join bike-sharing organizations on per period (annual, month, etc.), or per-trip basis (S. Shaheen and A. Coheb, 2016). Ridesharing pools multiple travelers in the same vehicle. Ridesharing systems can provide transportation, infrastructure, and environmental benefits (S Shaheen and A Cohen, 2016).

On-demand-ride services are services for people to gain quickly and relatively cheaply access transport through online platforms, usually a mobile app. These services are a counterpart and competitors to classic taxi services. The drivers of these services are mostly individuals who use their private vehicle. Shaheen (2016) defines ridesourcing ‘as services where drivers and passengers can link up using smartphone applications’. Public policy continues to evolve as on-demand ride services, such as Uber and Lyft, gain popularity. Ridesourcing includes so called ‘ridesplitting’ a service that brings customers in contact with drivers who drive part-time and use their own car. The customers can decide to split

the costs of the ride in one of these vehicles. The scope of this research includes all previously discussed categories of shared mobility, except for on-demand ride services.

Shared mobility and MaaS are increasingly being confronted with criticism. MaaS aims to break the determining role of car ownership, travelers are presented with a variety of travel options tailored to their needs, either as a subscription package or in a pay-per-use approach, by an integrated mobility provider (Becker et al., 2020). Uber is the most well-known MaaS platform.

An essential part of using shared mobility services are online platforms. Users must therefore have a smartphone (with internet connection), understand the platform and have access to online banking. This may exclude people with less technology knowledge or with lower incomes. Besides that, citizens who live in peripheral regions may face difficulties accessing shared modes a concern addressed by Machado et al (2018).

## 1.2. Conceptual model

Based on the earlier mentioned concepts, a conceptual model has been created. Availability has an influence on the experiences and usage of shared mobility, whereas spatial policies could facilitate the availability of the shared modes for citizens. All these variables could influence the accessibility of citizens. The geographical scale is the region Groningen and Assen.

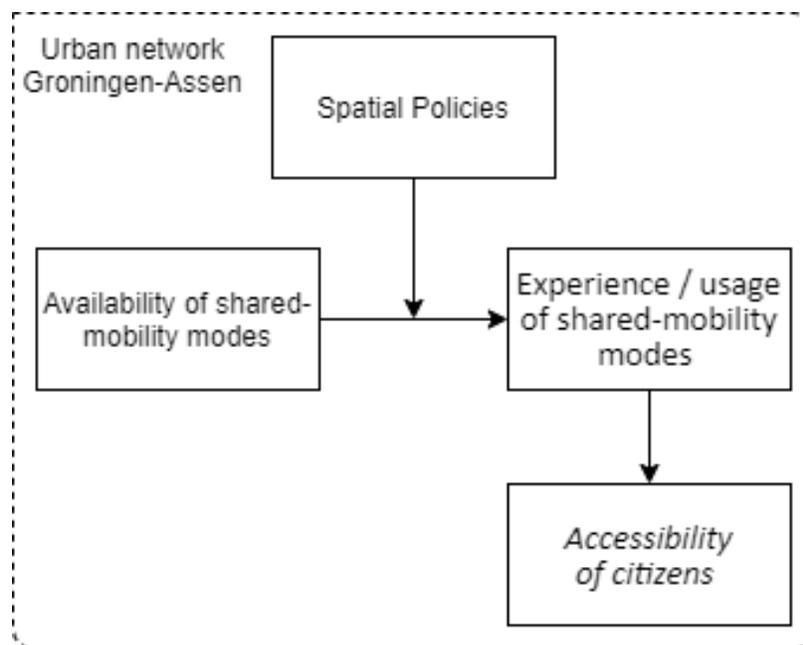


Figure 4 Conceptual Model

Based on the theoretical framework it is hypothesized that ‘A higher availability of shared mobility modes, influenced by a facilitating regional policy, will lead to a better accessibility of the residents of Groningen and Assen within the urban area and especially the city centers.’



## 2. Methodology

In this chapter, the methodology will be discussed. The research aims to investigate the influences of shared mobility on the accessibility of residents of Groningen and Assen. The methodology will focus on two areas: the municipalities Groningen and Assen. The research questions and the corresponding methods can be read in table 1.

MAIN QUESTION	TYPE OF DATA	METHODS
<i>HOW DOES THE AVAILABILITY OF SHARED MOBILITY OPPORTUNITIES INFLUENCE THE ACCESSIBILITY OF CITIZENS OF GRONINGEN AND ASSEN?</i>	Quantitative / Qualitative	Outcome of sub-questions
<b>SUB-QUESTIONS</b>		
<i>WHAT IS THE AVAILABILITY OF SHARED MOBILITY OPPORTUNITIES WITHIN GRONINGEN AND ASSEN?</i>	Quantitative / Qualitative	Deskresearch
<i>WHAT (SPATIAL) POLICIES ARE OR COULD BE IMPLEMENTED TO FACILITATE SHARED MOBILITY?</i>	Qualitative	Desk research
<i>HOW DO CITIZENS OF GRONINGEN-ASSEN EXPERIENCE AND USE SHARED MOBILITY AS PART OF THEIR ACCESSIBILITY?</i>	Qualitative	Questionnaire

Table 1 Overview research questions

### 2.1. Availability of shared mobility

The first sub-question ‘*What is the availability of shared mobility opportunities within Groningen and Assen?*’ is researched through secondary and field research. Secondary will consist of mapping out all the available options of shared mobility within Groningen and Assen, including all the categories of shared mobility with the exception of on-demand ride services. The data consists of the locations of the vehicles available on the platforms (websites or mobile applications) of the providers. In the first sub-question, the playing field of the players is mapped out. Secondly, the claim made by Machado et al. (2018) will be investigated, which indicated that availability is unevenly distributed across neighborhoods within cities, oftentimes citizens who live in peripheral regions face difficulties accessing shared modes, compared to citizens in the inner city.

## 2.2. Spatial policies

The second sub-question ‘Which (spatial) policies are (or could be) implemented to facilitate and regulate shared mobility?’ is answered researched through literature review and will include secondary data. E.g., policy documents from the local and national government, literature review from case studies abroad, and local news sources.

## 2.3. Citizen experiences and usage

The third sub-question ‘How do citizens of Groningen-Assen experience and use shared mobility as part of their accessibility?’ will be researched via a questionnaire. This research will use an online questionnaire. The questionnaire will ask users of shared mobility modes in Groningen and Assen about how they experience and use shared modes. The residents who will be approached are residents that have used shared mobility modes before. Due to COVID-19 measures in the Netherlands, interviews face-to-face were not a possibility. That is why an online questionnaire was chosen.

### 2.3.1. Questionnaire design

The questionnaire *Shared mobility Groningen-Assen* is the core of the research and has been designed with the use of the book *Key Methods in Geography*, chapter 8. McLafferty (2016) writes that ‘Questionnaire surveys are useful for gathering information about people’s characteristics, perceptions, attitudes, and behaviors.’ Given that the third sub-question emphasizes on experiences and usage of citizens, a questionnaire survey is, therefore, an appropriate tool. The questionnaire consists of 15 questions in total. Multiple questions allow participants to craft their responses through open-ended questions, the majority of the question exists of ‘fixed response’ questions with the use of fixed Likert scales (e.g., fully disagree – fully agree) and multiple-choice questions. Lastly, it was also possible for the participants to choose ‘no opinion’ or ‘I’d rather not say’.

The questionnaire is carried out using the *Qualtrics XM* software, a tool provided by the University of Groningen. All the data as a result of the questionnaire is processed in *SPSS-Statistics*. The questionnaire is offered in the research area, the municipalities Groningen and Assen. Mainly Dutch-speaking people live in both municipalities. But because shared mobility is mainly used by young adults including students (and international students) the survey is also available in English. Three themes form the survey design. An introductory theme inquiring basic information about the respondent. The second theme is intended to give data about user usage of shared modes. The third theme focuses on citizen experiences.

### 2.3.2. Recruiting participants

Participants are recruited through letterbox invites have been spread out. Including an introduction to the research, a link to the website<sup>1</sup>, and a scannable QR-code. The invitations have been distributed at locations where many shared vehicles are parked. In addition, many invitations have been placed in the vehicles. Finally, invitations have been sent through my LinkedIn network. To participate in the questionnaire, participants had to have used a shared vehicle within the research area. It is therefore plausible that the respondents are also around this age average. This is not a major problem for the research as it does not investigate discrepancies between age groups.

## 2.4. Analysis

Sub-questions one and two both yield secondary data. Sub-question one maps out all types of shared vehicles, based on this the 'playing field' of the research area can be derived. Sub-question two is answered through of a combination of literature review (news articles and scientific articles). Concepts, relationships, and locations can be identified on the basis of secondary data.

The analysis process of the third sub-question is the most extensive, the questionnaire is intended to gather empirical data. Raw data emerges from the three themes and associated questions. This data is then filtered. Respondents who do not belong to the research group (e.g. residents from different municipalities) and incomplete answers are excluded. After this, the Qualtrics data is exported to an SPSS-file and analyzed. The independent variables consist of motives for the use of shared vehicles. Dependent variables consist of the actual use of the vehicles and the experiences. Finally, the findings from the secondary and empirical parts of the research are brought together in the conclusion. Figures five and six visualize the research and analysis process.

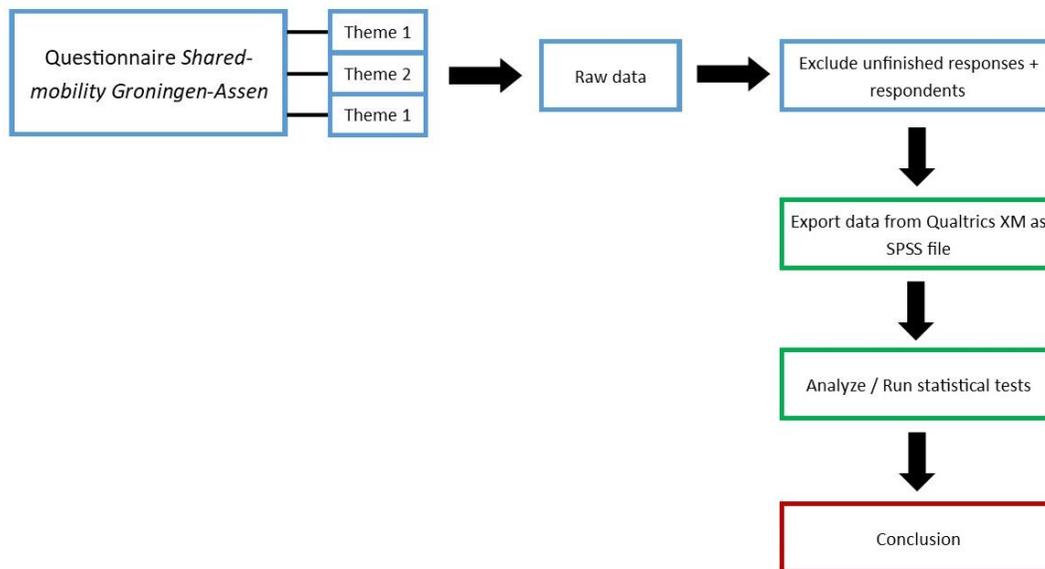


Figure 5 Data Analysis Questionnaire

<sup>1</sup> [https://rug.eu.qualtrics.com/jfe/form/SV\\_6YhcTecI0CZJXmu](https://rug.eu.qualtrics.com/jfe/form/SV_6YhcTecI0CZJXmu)

## 2.5. Research overview

In figure 6, an overview of the research is visualized. The findings from secondary research and the empirical part of the research are brought together in the conclusion.

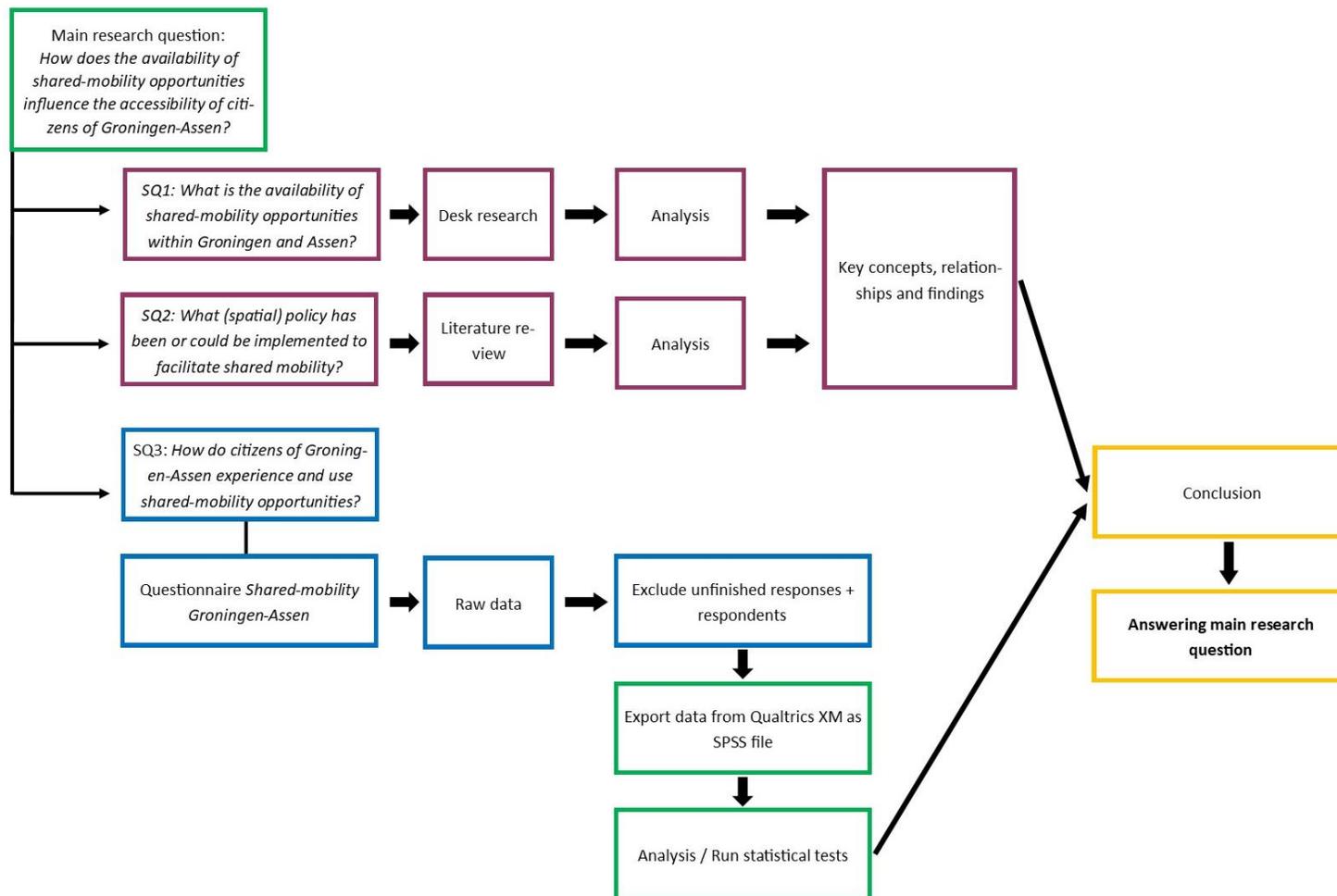


Figure 7 Visualization of the research process

## **2.6. Ethical considerations**

Regarding ethical considerations on positionality. I am an outsider in the research field, I have never used a shared mobility vehicle before. With this, I am objective towards the theme, although I realize as a resident of this area I could also be considered as an insider. To protect the respondents, their responses are anonymized, and I will not ask for their name. It should be taken into account that, individuals who respond to the questionnaire, could give a distorted picture of reality. Given the low letterbox response rate, it must be taken into account that responses may be lost because people missed the letterbox invites.

Due to the current coronavirus pandemic, this research avoided physical contact as much as possible. The pandemic still has a major impact on daily life in the Netherlands. To prevent the spread of the virus, a lockdown is active. The measures to fight the pandemic are to stay at home as much as possible, to keep a distance from others, and to avoid all social activities (RIVM, 2021).

### 3. Results

In this chapter, the outcomes of the case study will be discussed. Starting with an assessment of the availability of shared modes within the municipalities of Groningen and Assen, followed by an overview of current policy and developments regarding shared mobility, and finally, the results of the empirical research are presented.

#### 3.1. Availability of shared modes

In the municipalities of Groningen and Assen, there are numerous shared mobility providers. These providers are divided into three categories of vehicles: bicycles, cars, and scooters, of which publicly accessible and closed models. All these providers form a diverse arena of shared vehicles. A complete map of all providers can be found in Appendix 1.

##### 3.1.1. Bikesharing

There are currently three publicly available bike share schemes (BSS) active in Groningen and one in Assen. The companies: Sharebike NL, Go About, and the bikes from the Dutch Railways. The table below provides an overview of the providers. (DeelFietsNederland, 2020) (Campus Groningen, 2018) (Nederlandse Spoorwegen, 2021).

Table 2: Overview Bicycle share providers

Provider	Model	Units Groningen	Location Groningen	Units Assen	Location
Sharebike NL	Station-based Roundtrip	7	Hoogkerk	-	-
GoAbout	Station-based One-way	16	Zernike Campus	-	-
PublicTransit bike	Station-based Roundtrip	900	Train stations P+R Locations	200	Train station

Sharebike NL's shared bicycles are stationed at park-and-ride and hub location Hoogkerk on the outskirts of the city. The bicycles of GoAbout are stationed at park-and-ride and hub location Reitdiep and two locations on the Zernike campus.

Public transit bicycles are an initiative of the Dutch Railways, a government organization. Public transit bicycles can be rented mainly at train stations throughout the Netherlands, and also available at various park-and-ride locations. The bicycles are located in clusters of high quantities at train stations in the municipalities of Groningen and Assen. More than 900 bicycles are available in Groningen, making it by far the largest provider of shared bicycles in the municipality. About 200 bicycles are available in Assen, the public transit bicycle is the only provider in the municipality here. The purpose

of the public transport bicycle is to improve connections with train stations. An overview of all bicycle-sharing locations in the municipality of Groningen is shown in figure 7.

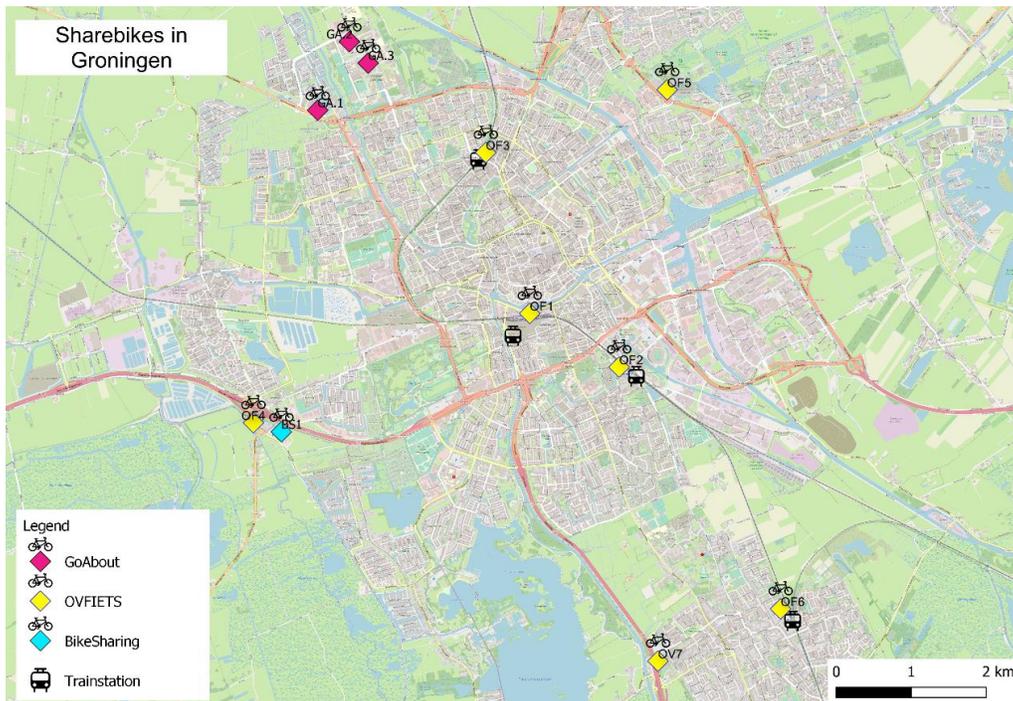


Figure 10 Overview of shared bicycle locations in the municipality of Groningen

In addition, there are also initiatives from large organizations. Shared bicycles aim to connect different modes of transport and are therefore clustered at locations such as public transport and parking locations. These locations are, besides the train stations, located on the outskirts of the city, outside the residential areas and the city center. All providers use a station-based model, which makes it impossible for residents to take over a bicycle from other users. The accessibility for residents who live far from a station is therefore limited. This is in contrast to bicycle sharing systems in foreign cities. In cities such as Montreal and Washington DC, there are many small pick-up stations spread around urban areas and the city centers, making them accessible to its citizens (Bauman et al., 2017). The low popularity of bicycle-sharing systems in the Netherlands is caused by the fact that most Dutch people already own a bicycle (1.3 bicycles per capita) (Kennisinstituut voor Mobiliteitsbeleid, 2020).

### 3.1.2. Carsharing

Currently, there are three publicly available carshare providers active in Groningen and one in Assen. The table below provides an overview of the carshare providers (GreenWheels, 2021), (MyWheels, 2021) (Witkar, 2021).

<b>Provider</b>	<b>Model</b>	<b>Units Groningen</b>	<b>Units Assen</b>
GreenWheels	Station-based roundtrip	52	2
MyWheels	Station-based roundtrip	27	-
Witkar	Free-floating one way	3	-

*Table 3 Overview carsharing providers*

Both GreenWheels and MyWheels make use of the station-based roundtrip model. Witkar makes use of a free-floating one-way model.

GreenWheel's shared cars are the most well-known shared cars in the Netherlands. The cars are part of the Dutch Railways and are offered nationwide. With 52 cars, GreenWheels is the largest car-sharing provider in Groningen. In Assen, it is the only provider with two cars. The cars are located at dozens of locations throughout the municipality, generally located adjacent to the city center, but are also stationed in the neighborhoods. The cars are part of the Dutch Railways, but not clustered at train stations and, dissimilar to the public transport bicycle, do not by its very nature aim to improve connections with train stations. The shared cars additionally do not act as a replacement for the train, considering it is not possible to park a car at a different station.

MyWheels shared cars are parked at 27 locations in the city of Groningen and are located in the neighborhoods adjacent to the city center. The pick-up locations consist of parking spaces and charging points for twelve electric cars. Witkar's shared cars are parked in a free-float zone which consists of the municipality of Groningen, except for Haren.

All three providers make use of a subscription model, the customer pays an hourly rate that varies depending on the type of car. In addition to the publicly accessible providers, there are also initiatives from employers and peer-to-peer carsharing platforms (e.g., *SnappCar*).

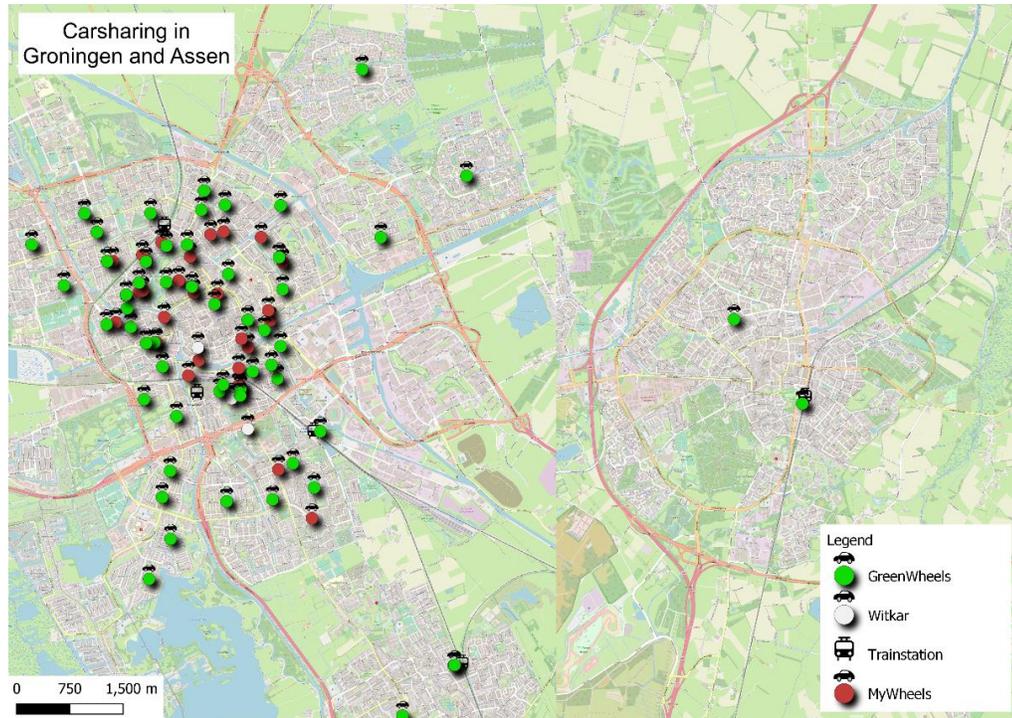


Figure 8 Overview of shared cars in the municipalities of Groningen (L) and Assen (R)

There is a significant difference in the availability of carsharing between the municipalities of Assen and Groningen. In Groningen, there is a choice of more than eighty cars from three providers more than forty times the supply compared to Assen, with merely two cars. Availability within a municipality differs, neighborhoods on the outskirts of the municipality of Groningen often have a very low or no availability of shared cars within their neighborhood.

### 3.1.3. Scooter sharing

There are currently two publicly available scooter-sharing providers active in Groningen and one in Assen. The table below provides an overview of the two providers (“Scooter locations,” 2021), (Felyx, 2021)

Table 4 Overview scooter-share providers

Provider	Model	Units Groningen	Units Assen
Go Sharing	Free-Floating one way	100-200 <sup>2</sup> ≈	150 ≈
Felyx	Free-Floating one way	150-200 ≈	-

Both Go Sharing and Felyx make use of the free-float model one-way. A maximum of 200 scooters is allowed from both parties in Groningen. In the municipality of Assen, there are currently 150 scooters available, all scooters are electrically driven. Red zones are areas where parking or stopping is prohibited. These zones mainly consist of busy locations like train stations and shopping areas. The purpose of these zones is to prevent congestion and to keep the area clear of these vehicles. Congestion takes place on the outskirts of inner cities, train stations, high schools, and universities.

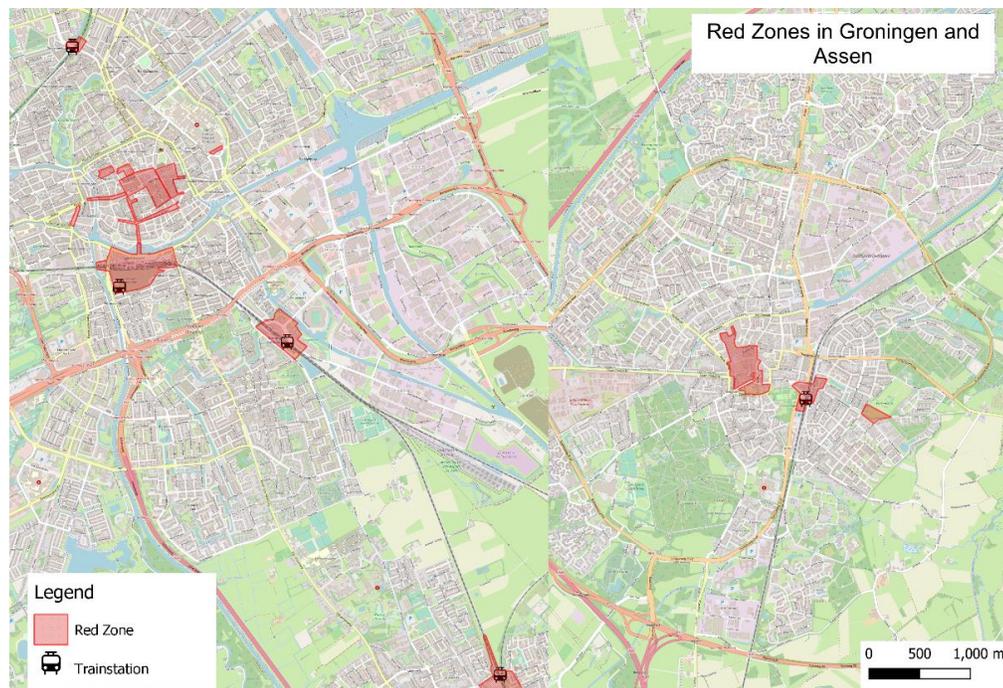


Figure 9 Overview of red zones in Groningen (L) and Assen (R)

<sup>2</sup> GoSharing has started removing scooters, the provider has lost its permit and has to remove the scooters from the municipality of Groningen. This reduces the number of available units significantly. Competitor Check Technologies takes over the license.

There is a noticeable difference in the availability of scooters between neighborhoods. For instance, the neighborhood Marsdijk in Assen has little more than 4% inhabitants than neighborhood Kloosterveen (Gemeente Assen, 2021b) but more than three times as many scooters. Appendix 2 contains an overview of the number of scooters per neighborhood.

### **3.2. Shared mobility policies**

This section answers the second research question: *What (spatial) policy are or could be implemented to facilitate shared mobility?* The Dutch policy regarding shared mobility is characterized by national recognition and regional interpretation.

#### **3.2.1. National recognition**

Literature repeatedly indicates that a clear and consistent definition of shared mobility is important to avoid confusion among policymakers and the public (S. Shaheen and A. Cohen, 2016). The sharing economy and shared mobility are relatively well-known concepts. However, there is no general definition of what activities really constitute the sharing economy (Corciolani, 2018). In addition, it is important to integrate shared mobility into mobility planning. The Dutch government does this through long-term policy plans. Solutions like new infrastructure or additional funding for public transport are outdated and ‘no longer effective’ (Ministry of Infrastructure and Water Management, 2019a). For the coming decades, the Ministry sees shared mobility as a solution to several challenges (Ministry of Infrastructure and Water Management, 2021). The national position on shared mobility consists of ambitions and future plans. There is currently no specific national policy on shared mobility. Case studies abroad have shown that cities are adjusting their policy on shared mobility often insufficiently and too late (Roukouni and Homem de Almeida Correia, 2020).

*Many cities are thus facing challenges in understanding whether shared mobility would be able to effectively bring any substantial benefit to their territories, and how the existing urban transport system would react when demand for the new mode(s) starts to grow. The difficulty in forecasting and evaluating the impacts of shared mobility can create stress for the decision-makers and can lead to the introduction of blurred policies to avoid “staying behind”.*

Municipalities' fear of ‘staying behind’ results in shared vehicles entering municipalities without any proper policy. Clear comparisons can be drawn concerning the municipalities of Groningen and Assen.

#### **4.2.2. Regional interpretation, and lagging policy**

In the spring of 2020, the municipality of Groningen opened the market to providers of scooter sharing through a pilot (Gemeente Groningen, 2020). The municipality of Assen followed in early 2021 (Gemeente Assen, 2021a). The scooter-sharing providers are the first major party to use a free-floating model. Providers of shared bicycles and shared cars use a station-based model and are therefore less present in the street scene.

The high quantity of share scooters leads to new problems. The scooters are often parked incorrectly and are an obstacle for pedestrians (Langeler, 2020). The municipalities have placed the responsibility for these problems on to the providers. The providers pass on some of these responsibilities to their users through fines and warnings.



Figure 130 incorrectly parked scooter, Grote Markt, Groningen

Maintaining incorrectly parked scooters and setting up red zones are examples of *command-and-control incentives*. Another example of a command-and-control policy is the restriction on vehicle circulation in the cities Bogota, Athens, and São Paulo in order to reduce air pollution (Santos, 2018). In multiple Dutch municipalities this is already known in the form of *environmental zones*, areas in which certain vehicles are prohibited (Ministry of Infrastructure and Water Management, 2019b).

During the rollout period of the scooters, no policy was included in the General Local Regulations (GLR) of Groningen or Assen. This lack of regulation means that share scooter providers are allowed to introduce their scooters anywhere when no specific policy is active. The municipality of Groningen indicated in 2020, after the rollout period: ‘we have no legal instruments to be able to impose requirements on the providers of scooter sharing.’ (Gemeente Groningen, 2020). The municipality of Groningen has now adjusted its policy accordingly.

Ma et Al. (2018) divided the collaborative dynamics of bike-sharing schemes in Shanghai, China into three phases. A comparison can be drawn with shared mobility schemes in the municipalities of Groningen and Assen based on this model. Groningen has entered the second phase, the municipality has developed and enforces policy where necessary, while Assen is still in the first phase, the GLR is under development but not yet completed.

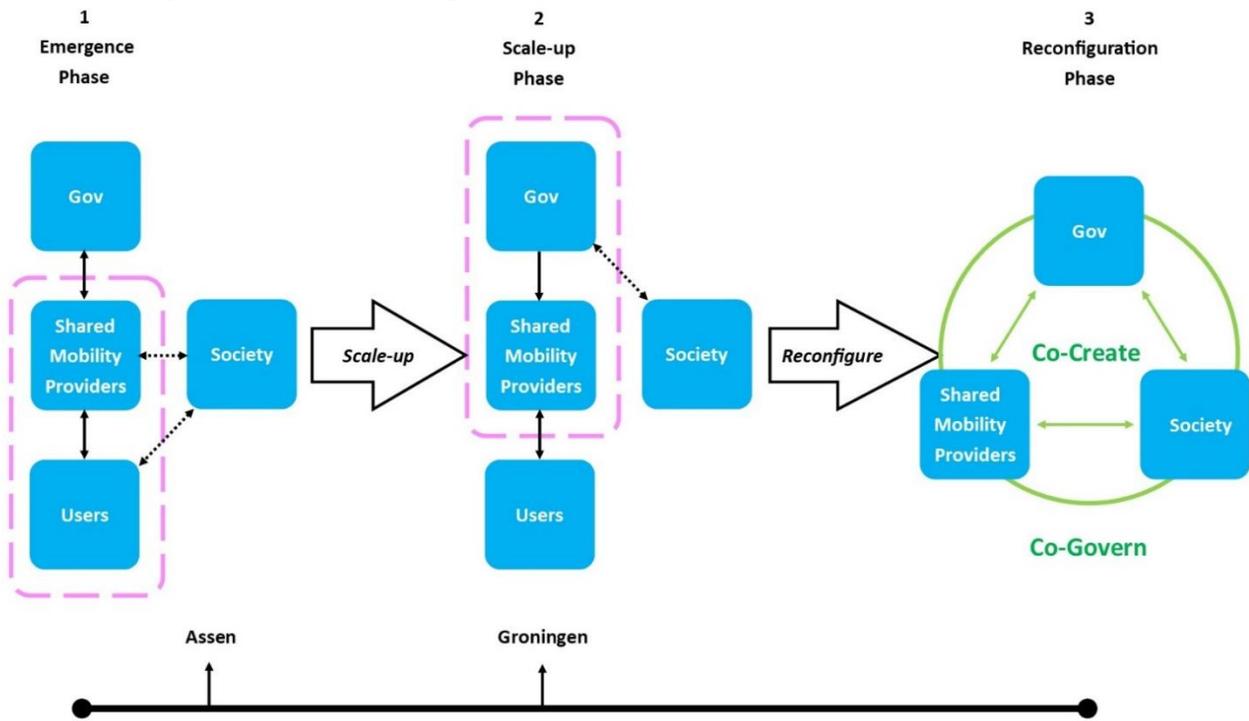


Figure 11 Three phases of dynamics in the sharing economy (Ma et al., 2018). Note: the arrow indicate collaborative actions. (Edited)

- 1. Emergence phase:** consists of the rollout of the vehicles. The role of the municipality is limited because of the lack of policy. The users are introduced to the new vehicles and learn 'the rules of the game'.
- 2. Scale-up phase:** the use is increasing. Society submits its complaints to the municipality. The municipality is introducing new policy.
- 3. Reconfiguration phase:** Desired situation. Demand and growth have stagnated. A stable relationship is created between the municipality, the providers, and society. In which the three parties work closely together.

#### 4.2.3. Policy design

In response to the growth of the sharing economy, public authorities are, on the one hand, developing policies and changing legislation, in order to handle problematic practices of the sharing economy and on the other hand, facilitating sharing practices that are seen as beneficial for society (Karlsson et al., 2020).

The municipality of Groningen has had a facilitating car-sharing policy since 2018. By giving parking permits to carsharing providers, charging parking fees per car and not per user, and reserve spaces for shared cars for new parking locations (Gemeente Groningen, 2018). The municipality of Groningen is expanding its ambitions in the field of shared mobility enormously and is working on an implementation program for shared mobility (Gemeente Groningen, 2021):

*‘We focus on a number of experiments in order to stimulate shared mobility and to learn how interpretation actually contributes to the future in which sharing mobility is inextricably linked to the interpretation of mobility in everyday life.’*

In addition, the municipality of Groningen wants to strengthen its control over shared mobility.

*‘At the same time, we hold the key to minimize unwanted side effects, such as nuisance caused by parking shared bicycles or scooters in public spaces. The unbridled number of providers operating in our public space does not match the social added value that we strive for.’*

### 3.3. User usage and experience

In this section, the outcomes of the questionnaire will be discussed. All questions of the questionnaire can be found in Appendix 4.

#### *Questionnaire*

46 responses were recorded during the collection of the questionnaire. Two responses were unfinished, and five people indicated that they did not use shared mobility and were therefore removed. This leaves 39 valid cases. 21 respondents live in the municipality of Groningen and 18 people in the municipality of Assen. 56 percent of the respondents are employed. 21 percent are working students, 21 percent are students. 1 respondent is unemployed.

#### 3.3.1. Usage

Figure 12 shows how often people use a shared vehicle. The majority (56%) indicate that they only use shared vehicles once a month. 18 percent use a shared vehicle approximately once a week. Only one respondent indicated that he uses shared vehicles daily.

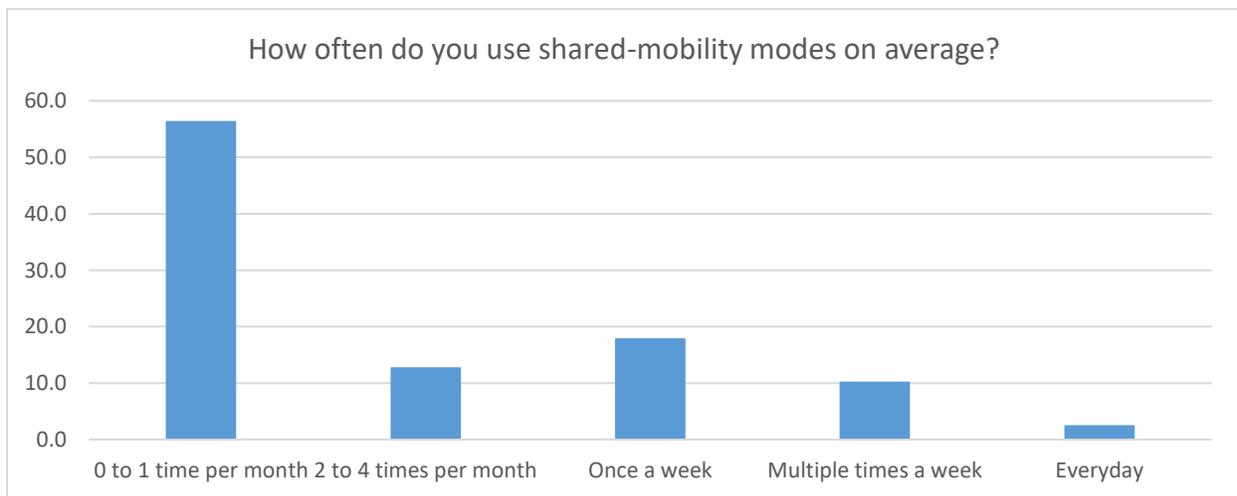


Figure 12 Average amount of use of shared modes

Figure 13 shows where people travel to with shared vehicles (Q5). The majority travel to friends or family. In addition, many other options have also been filled in. Respondents indicated here that they also travel to sports clubs, from the train station to work or the city-center, or use it for recreational purposes. No respondents indicated that they use a shared vehicle to travel to either carpool or P+R locations.

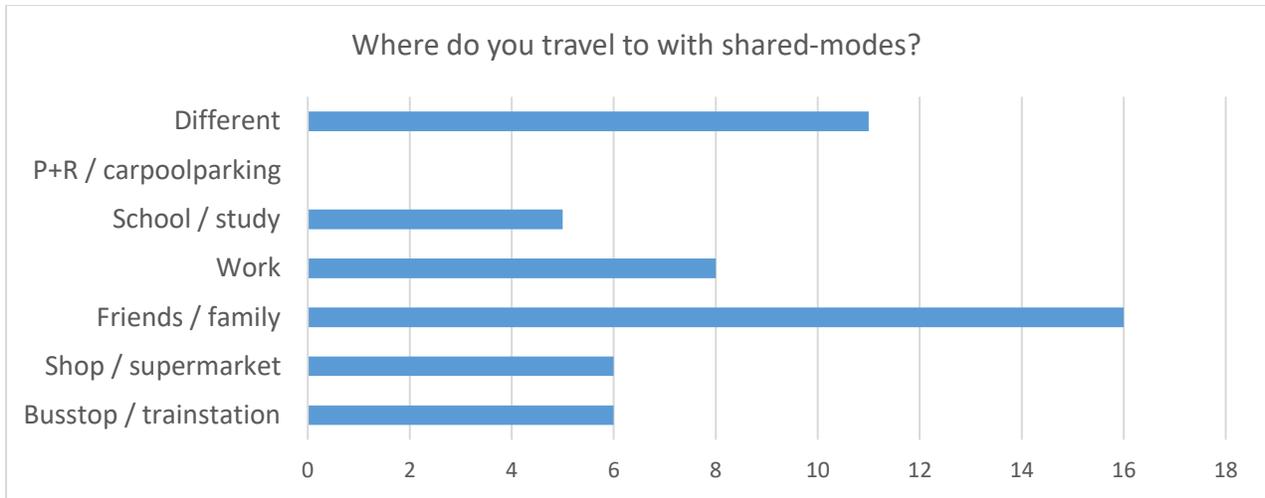


Figure 13 Answers to the question of where users travel to with shared modes (N=52)

The average travel time of the respondents (Q6) lies between 5 to 10 minutes (36%) or 10 to 15 minutes (39%), To question seven: ‘The use of shared modes replaces’: respondents indicate that shared modes replace: bicycle, car, walking or bus. The bicycle is replaced the most (31%). This contradicts with the ambitions of the municipality of Groningen, which strives for: ‘added value from shared vehicles as an alternative to the car without becoming a competitor for walking or cycling’ (Gemeente Groningen, 2021).

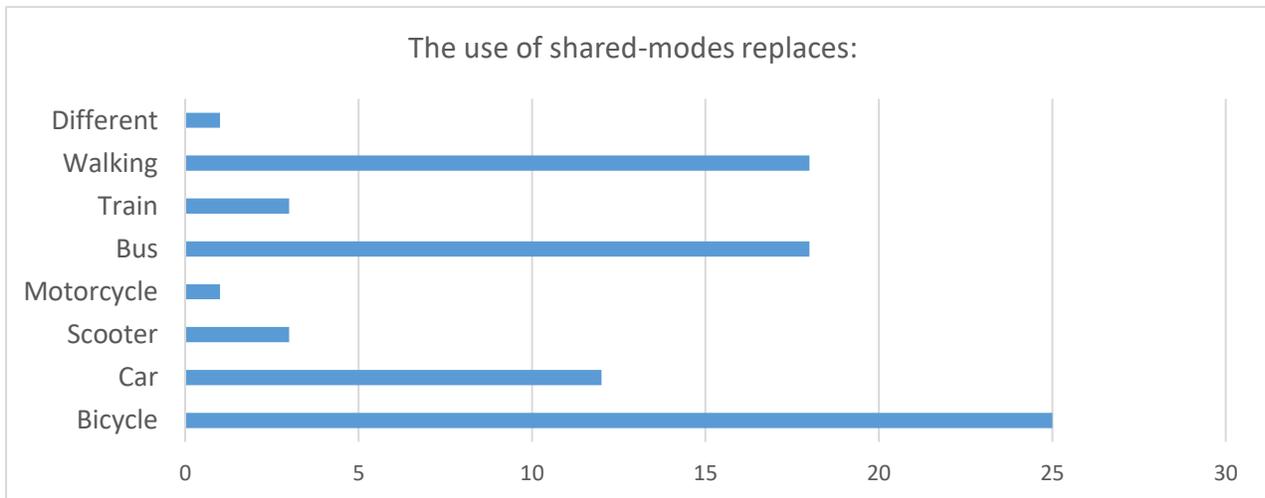
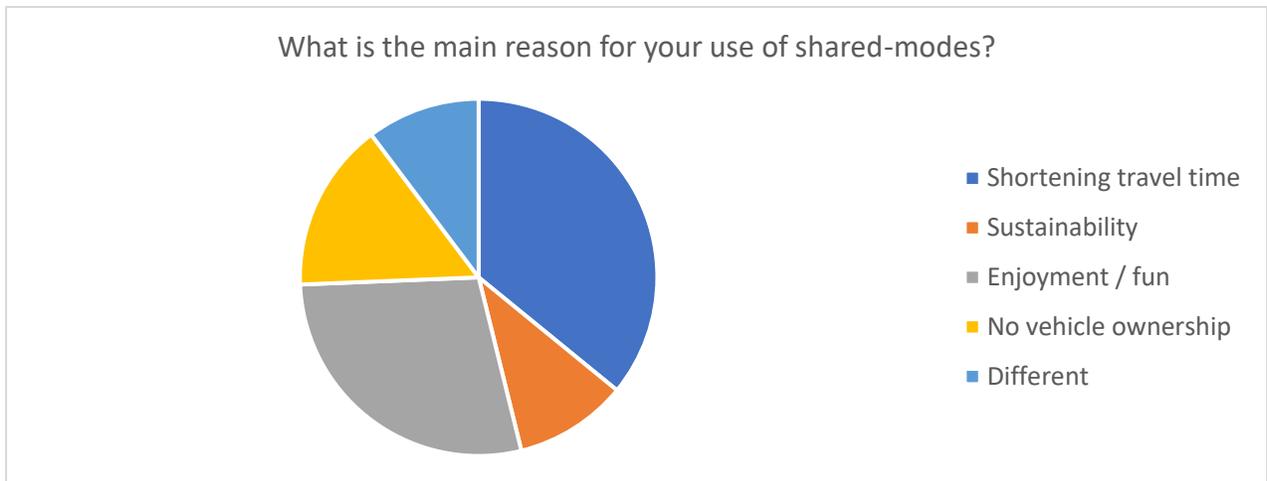


Figure 18 Answers to the question of what is replaced by shared vehicles (N=81)

On question 8: ‘What is the main reason for your use of shared modes?’, a majority indicated that they use shared modes to shorten their travel time, followed by the enjoyment of using a vehicle. Together with question seven, this hints that the bicycle is being replaced by shared scooters. Only 10 percent said they use shared modes for their sustainability, often used as a selling point of providers.



*Figure 15 Responses to the question what the main reason for using shared vehicles is*

The vast majority (62%) intend to use a shared vehicle equally frequently in the future (Q9). Question ten focuses on the possible consequences of COVID-19 on the use of shared vehicles. A majority indicate that the corona crisis does not influence the amount of use. A third indicated that they use shared modes less often. The respondents give working or studying from home, as a result of the corona measures, as the prime reason. 18 percent indicated that they make more use of shared vehicles.

### 3.3.2. User experiences

Question eleven asks respondents to indicate on a Likert-scale from completely disagree (1) to completely agree (5) how far they agree with the statement: ‘Shared mobility is a positive addition to the environment.’ The mean of this question is 4.13 and the mode is 5. The distribution is heavily negatively skewed (-1.233) and can be considered as not normal. The vast majority of the respondents, therefore, agree with the given statement and see mobility as a positive addition to the environment.

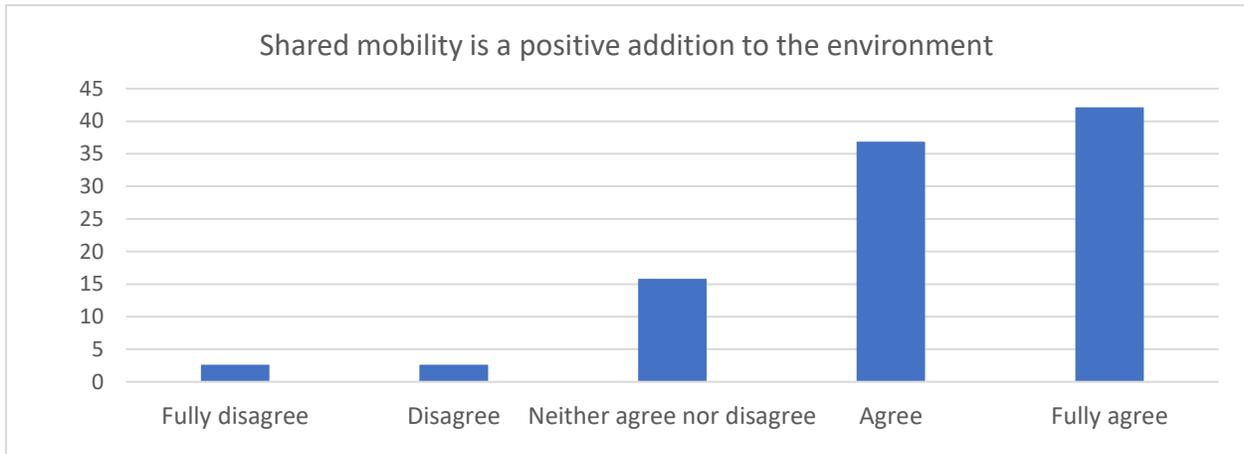


Figure 16 Responses to the statement: Shared mobility is a positive addition to the environment

Question twelve focuses on the role of shared vehicles within the accessibility of users with the statement: ‘Shared modes are important for my accessibility’. The mean of this question is 3.34 and the mode is 4. The distribution is negatively skewed (-0.322) and can be considered as not normal. The majority of respondents agree with the given statement, but this group is significantly smaller compared to question 10. 24 percent disagree with the given statement and another 5 percent fully disagree.

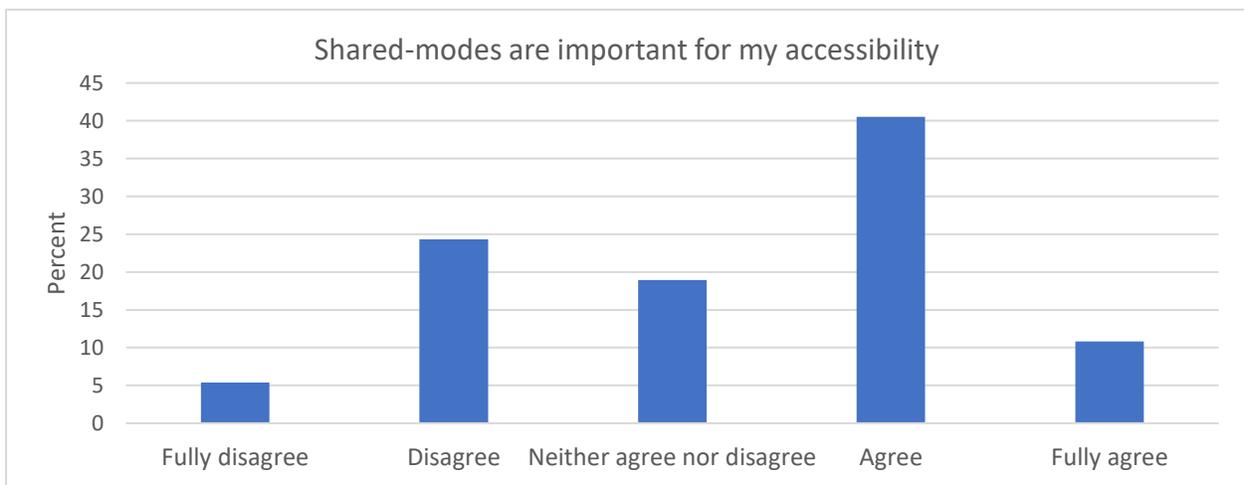


Figure 17 Responses to the statement: Shared modes are important for my accessibility

Question 8 showed that a limited number of respondents use shared vehicles because they do not own a vehicle themselves (16%). Shared vehicles are often used to enhance mobility, in the sense of shortening the travel time, comfort reasons, or because the user solely likes it. This is also reflected in question 13. 79 percent of the respondents indicate that they travel the same amount due to the availability of shared vehicles, merely 16 percent travels more because of the presence of the vehicles.

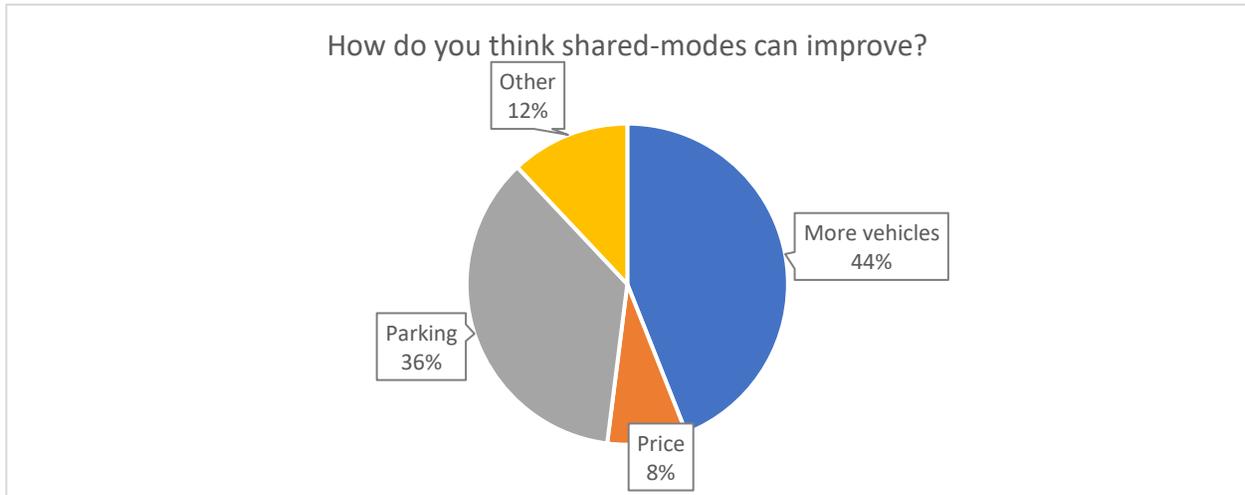


Figure 18 Coding of the open: How do you think shared modes can improve? (N=25)

In addition, the respondents indicate that they are satisfied with the availability of shared vehicles. The mean of question 14: 'How satisfied are you with the availability of shared mobility in your area?' is 3.76, on a scale of 1 to 5. Finally, the respondents were asked how shared mobility can improve. A large part of the respondents indicated that 'agreements must be made as to where shared scooters may be parked' and a majority of the respondents believe that more shared vehicles should be introduced.

## 4. Conclusion

It can be concluded that the availability of shared vehicles covers a complex and dynamic arena of providers, vehicles, and operating schemes. The availability of shared modes in Groningen has been growing in recent years, in particular, shared scooters and shared cars. Compared to Groningen, Assen lags in the availability of shared vehicles. Shared modes do not serve to strengthen mobility between the municipalities of Groningen and Assen, since the station based models make it not possible to park a shared vehicle outside the original pick-up location. Shared modes are often located around the city center. It cannot go unnoticed that the availability is not equally distributed across the municipalities. Citizens in neighborhoods on the outskirts of the municipalities have less or no availability to shared modes. This is in line with the concern made by Machado et al. (2018) who indicated that peripheral regions may face difficulties accessing shared modes.

Literature review has repeatedly shown that policy is lagging. This also emerged within the research area. Policymakers are responsible to define the 'rules of the game'. Clear policy is essential to avoid confusion among policymakers and the public. Particularly share-scooters were rolled out on a large scale in the municipalities before there was any policy. This resulted in complications, for which the municipality of Groningen has established regulation and will implement extensive policy frameworks. Assen is a phase behind, in the model of Ma et al. (2018), and has not yet developed policy. Command-and-control policy is used to keep shared vehicles out of designated areas. As a result of facilitating policy, the municipality of Groningen has a considerably larger availability of shared vehicles compared to Assen.

The questionnaire revealed that users often use shared modes as a replacement for biking, walking, and public transit. The main reason for use is to shorten the travel time and respondents use the vehicles because they simply enjoy it. The vast majority of the residents experience the vehicles as a good addition to the environment, but find it to a lesser extent important as part of their accessibility. This is in line with Rode et al. (2017) who stated that shared modes are used to complement existing options.

To answer the main research question: 'How does the availability of shared mobility opportunities influence the accessibility of citizens of the municipalities Groningen and Assen?'; The research clearly shows that shared mobility is growing in both Groningen and Assen. The municipality of Assen is leaving opportunities unused due to the low availability and lack of policy. In terms of large-scale implementation, both municipalities are still at an early but developing stage. Residents indicate that they do not travel more often due to the availability of the vehicles, compared to no availability. The availability of shared modes predominantly enhances the mobility of users, mainly in terms of shortening travel times and the comfort of the vehicles. It is often regarded as an addition to existing options, but not as an option that causes people to travel more often.

## 5. Reflection

This research contributes to the scientific knowledge about the influence of share vehicles on accessibility. Yet, besides corroborating, this study adds to existing literature by offering insight into concrete policy processes of local governments of two Dutch cities where shared vehicles have only been available for a relatively short time. Plus, investigating habits and experiences of the users of shared vehicles.

### *Reflection on the research process*

The questionnaire was a suitable method to investigate citizens' insights. An additional question about what kind of vehicle people used would have improved the questionnaire. As a result of the corona measures, letterbox invitations have been sent out. The response rate of these invitations was very low. More than 300 surveys have been delivered, of which only ten have been completed. It must be taken into account that responses may still be received late. If circumstances regarding COVID had been different, collecting a higher number of respondents would have been possible by handing out invitations in person. The literature review consisted of a combination of scientific articles, news articles, and policy plans and documents. Applied scientific articles describe cases from abroad. The articles used different definitions and interpretations of shared mobility. Moreover, the articles are based on foreign cities. It can be questioned to what extent these articles are suitable for the relatively small cities of Groningen and Assen. The maps with available shared vehicles were made on two reference dates, both on a Monday morning. The locations of shared vehicles and thus the availability is a snapshot. The locations of shared vehicles change over time. Vehicles that were in use or under maintenance were not visible on the map. The visualizations can be distorted because of this.

Looking back, it can be said the research process has been successful. The theoretical framework served as a successful guide for the research questions. The research must be viewed through the lens of the corona crisis. A crisis that affects society as a whole and the way citizens travel. As a result, people travel less to work and school. In addition, large-scale vehicle sharing systems have only been active for a short time and introduced within the 'corona-era'. It cannot be unmentioned that the shared mobility arena is very active. Providers are replaced or discontinued, and policies are changing.

### *Recommendations further research*

It is recommended to conduct a similar investigation after the corona measures have been lifted. In this way, it can be investigated whether shared vehicles are systematically part of the accessibility of people. It is recommended to conduct a similar follow-up study to identify differences over time, as shared mobility is still at a relatively early stage. Additionally, a larger sample size and different types of questions could result in a more significant and representative result for the research group. Finally, the shared mobility market is still at a relatively early stage. A future study in a later period is therefore advised.

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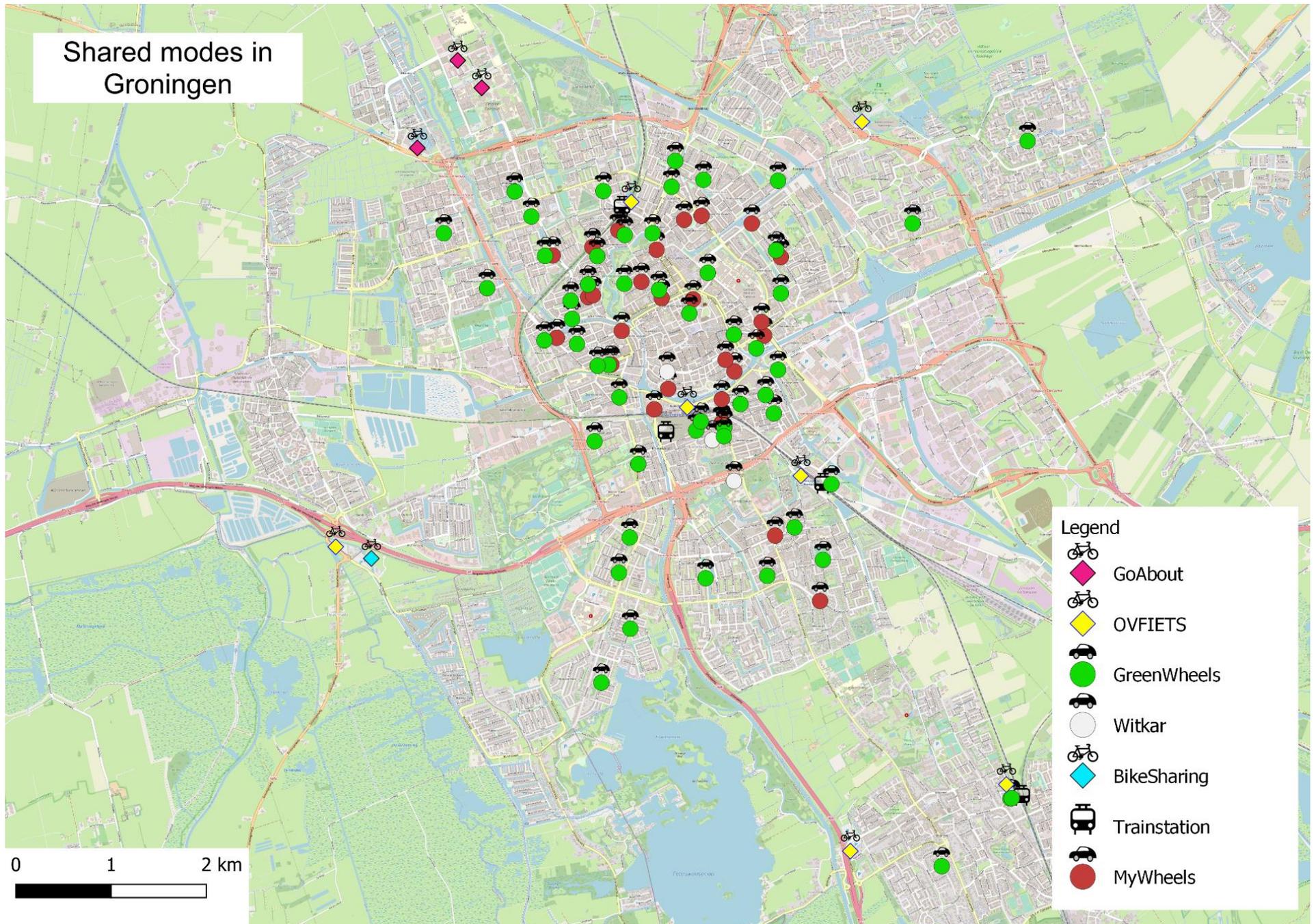
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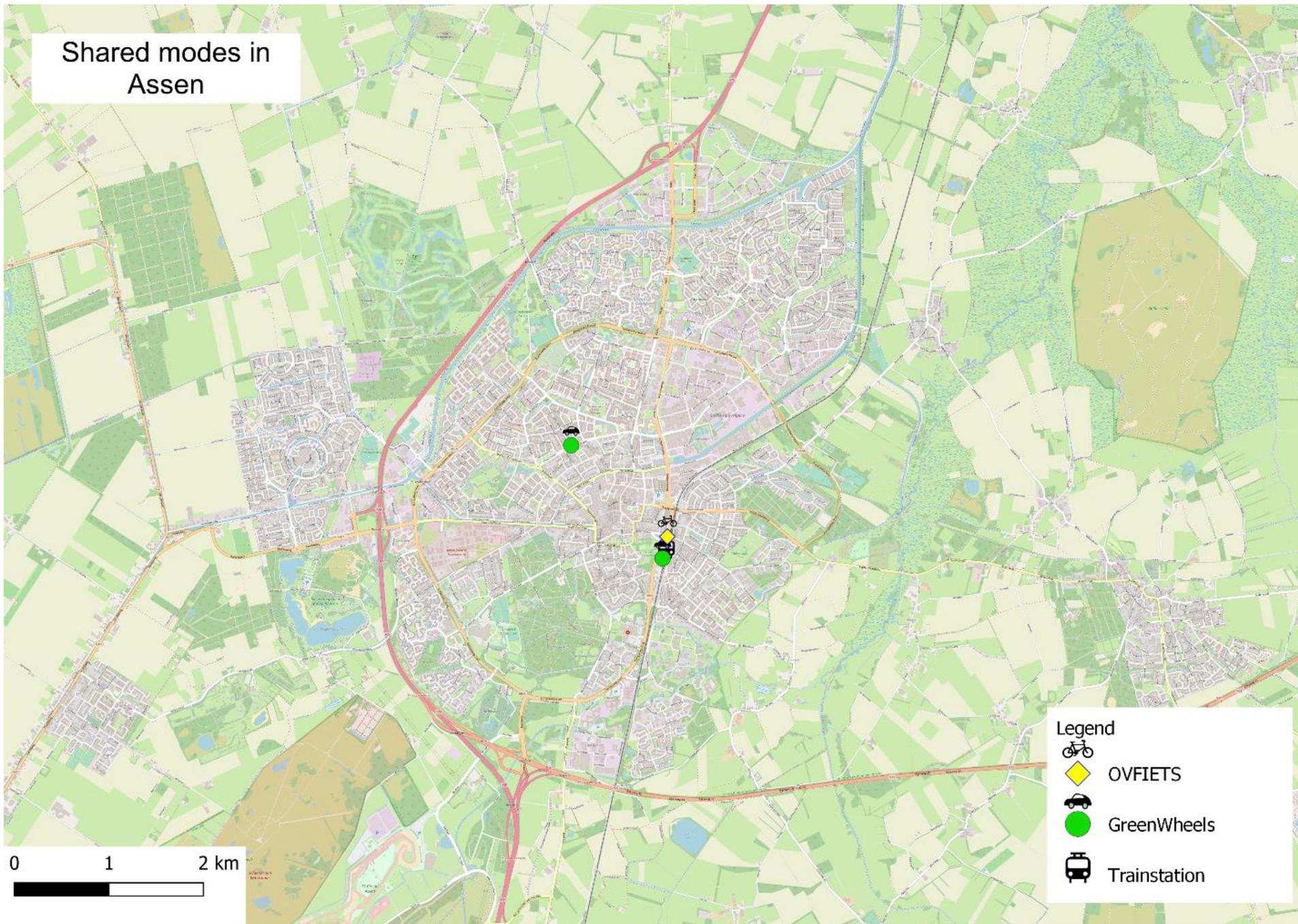
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## Appendices

## Appendix 1 Overview Shared modes

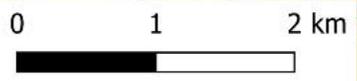


# Shared modes in Assen



Legend

-  OVFIETS
-  GreenWheels
-  Trainstation



## Appendix 2 Share-scooter per neighborhood

### Groningen

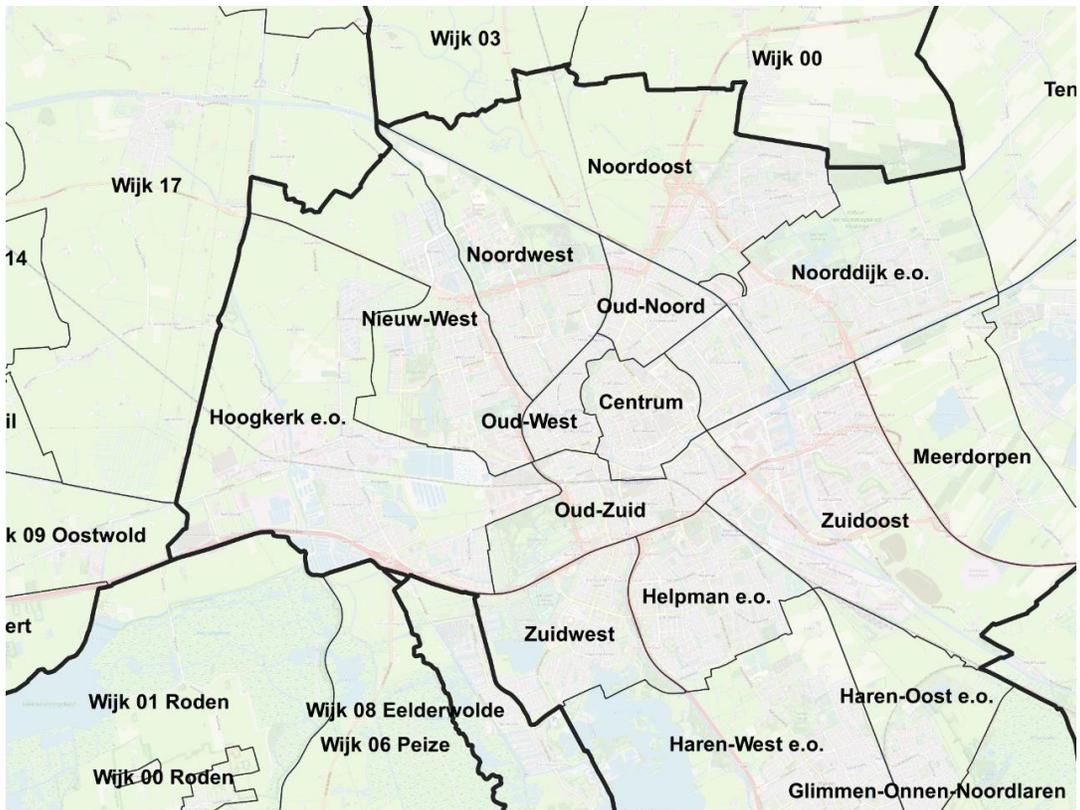
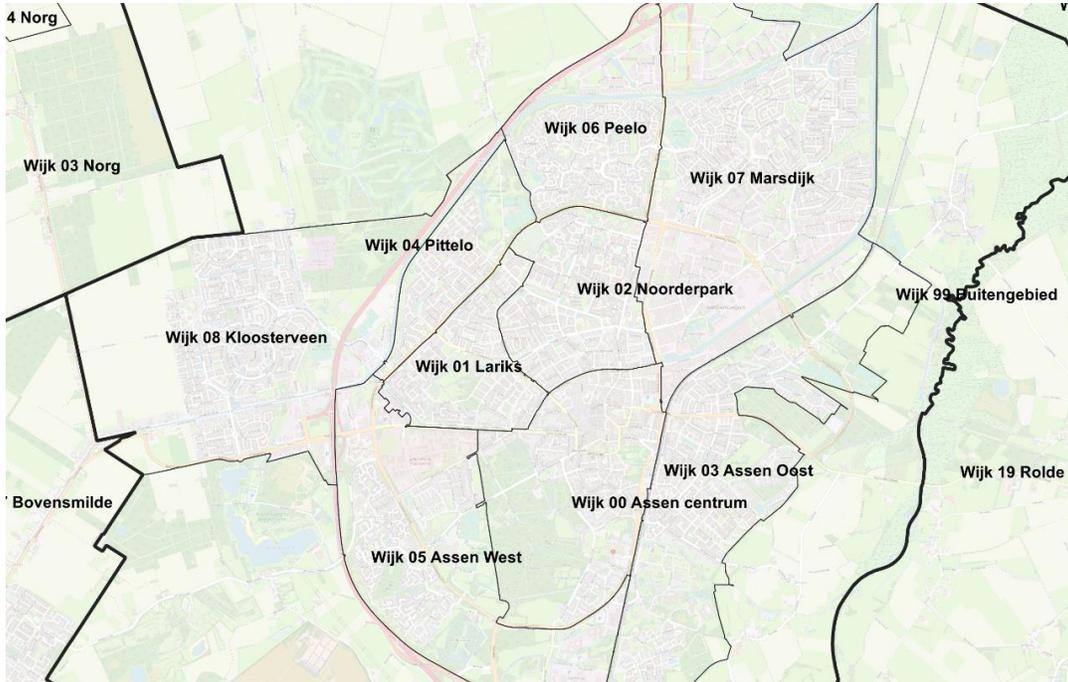
Neighborhood	GoSharing	Felyx
Haren	21	13
Zuidwest	6	14
Helpman	7	10
Oud-Zuid	18	6
Hoogkerk	5	2
Zuid-Oost	8	9
Oosterpark	4	3
Center	17	8
Oud-West	2	8
Oud-Noord	2	4
Meerstad	2	0
Noorddijk	5	1
Ten Boer	2	0
Ten Post	0	0
Noord-Oost	1	9
Noordwest (incl. Zernike Campus)	16	15
Nieuw-west	8	6
<b>Total</b>	<b>124</b>	<b>108</b>

### Assen

Neighborhood	GoSharing
De Lariks	15
Noorderpark	7
Center	8
Centrum-Zuid	9
Oost	11
Pittelo	12
West	5
Peelo	6
McDonalds	6
Marsdijk	40
Kloosterveen	12
Other (incl. Loon)	-
<b>Total</b>	<b>131</b>

## Appendix 3 Neighborhood map

(PDOK, 2021)



## Appendix 4 Questionnaire

Question	Theme	Measurement level (nominal, ordinal, interval, ratio)	Answer
Have you used a shared-vehicle in the past?	Introduction		
			Ja / Yes
			Nee, ga dan niet door met de enquête / No, please don't go on with the survey
Q1 In welke gemeente woont u? / In which municipality do you live?	Basic information	Nominal	
			Assen
			Groningen
Q2 Wat is uw huidige werksituatie? / What is your current work situation?	Basic information	Nominal	
			Werkend / Working
			Werkloos / Unemployed
			Student
			Werkende student / Working student
			Gepensioneerd / Retired
			Anders / Different
Q3 In welke wijk woont u? / In which neighborhood do you live?	Basic information	Nominal	
			(...)
Q4 Hoe vaak maakt u gemiddeld gebruik van deelvervoer? / How often do you use shared-mobility modes on average? (GoSharing / Felyx deelscooters, deelfietsen, deelauto)	User usage	Ordinal	
			0 tot 1 keer per maand / 0 to 1 time per month
			2 tot 4 keer per maand / 2 to 4 times a month
			1 keer per week / Once a week
			Meerdere keren per week / Multiple times a week

			Elke dag / Every day
Q 5	Waar reist u naar toe met een deelvoertuig? (Meerdere antwoorden mogelijk) / Where do you travel to with shared-modes? (Multiple answers possible)	User usage	Nominal
			School of studie / School or study
			Werk / Work
			Vrienden of familie / Friends or family
			Bushalte of treinstation / Busstop or trainstation
			Winkel of supermarkt / Shop or supermarket
			P+R of carpoolplaatsen / P+R or carpoolparking
			Anders (...) / Different (...)
Q 6	Hoe lang duurt uw reis met een deelvoertuig gemiddeld? / How long does your trip with a shared-mode take on average?	User usage	Ordinal
			Minder dan 5 minuten / Less than 5 minutes
			5 tot 10 minuten /5 to 10 minutes
			10 tot 15 minuten /10 to 15 minutes
			15 tot 20 minuten / 15 to 20 minutes
			Meer dan 20 minuten /More than 20 minutes
Q 7	Het gebruik van deelvervoer vervangt: (meerdere antwoorden mogelijk) / The use of shared-modes replaces: (multiple answers possible)	User usage	Nominal
			Fiets / Bicycle
			Auto / Car
			Scooter of brommer / Scooter

			Motor / Motorcycle
			Bus
			Trein / Train
			Lopen / Walking
			Anders (...) / Different
Q 8	Wat is de voornaamste reden voor u gebruik deelvervoer? / What is the main reason for your use of shared- modes?	User usage / experience	Nominal
			Om mijn reistijd te verkorten / To shorten my travel time
			Omdat het duurzaam is / Because it is sustainable
			Omdat ik het leuk vind om de voertuigen te gebruiken / Because I enjoy using the vehicles
			Omdat ik geen eigen voertuig bezit /Because I don't own my own vehicle
			Anders (...) / Different (...)
Q 9	In welke mate bent u van plan om in de toekomst gedeeld vervoer te blijven gebruiken? / To what extent do you intent to continue using shared-modes in the future?	User usage	Ordinal
			Ik wil stoppen met het gebruik / I want to stop using it
			Minder gebruik / Less frequent use
			Gelijk gebruik / Equal use
			Vaker gebruik / More frequent use
			Dagelijks / Daily
Q 10	Maakt u door de coronacrisis meer of minder gebruik van deelvervoer? / Are you making more or less use of shared mobility due to the corona crisis?	User usage	
			Minder gebruik / Less use
			Evenveel / Equal use
			Vaker gebruik / More frequent use
			Weet ik niet / I don't know

Q 10 . A/ B	Waarom maakt u meer / minder gebruik van deelvervoer door corona? / Why do you make more / less use of shared mobility due to corona?	User usage	Nominal	
				(...)
Q 11	In hoeverre bent u het met deze stelling eens? 'Deelvervoer is een positieve toevoeging aan de omgeving' / To what extent do you agree with this statement? "Shared transport is a positive addition to the environment"	User experience	Ratio	
				Volledig oneens / Fully disagree
				Oneens / Disagree
				Niet eens, niet oneens / Neither agree nor disagree
				Eens / Agree
				Volledig eens / Fully agree
				Geen mening / No opinion
Q 12	In hoeverre bent u het met deze stelling eens? 'Deelvervoer is belangrijk voor mijn bereikbaarheid' / To what extent do you agree with this statement? 'Shared-modes are important for my accessibility. '	User experience	Ratio	
				Volledig oneens / Fully disagree
				Oneens / Disagree
				Niet eens, niet oneens / Neither agree nor disagree
				Eens / Agree
				Volledig eens / Fully agree
				Geen mening / No opinion
Q 13	Hoe tevreden bent u met de beschikbaarheid van deelvervoer in uw omgeving? / How satisfied are you with the availability of shared mobility in your area?	User experience	Ratio	
				Zeer ontevreden / Very dissatisfied

			Ontevreden / Dissatisfied
			Neutraal / Neutral
			Tevreden / Satisfied
			Volledig tevreden / Very satisfied
			Geen mening / No opinion
Q 14	Op welke manier kan deelvervoer volgens u zich verbeteren? / How do you think shared-modes can improve?	User experience	Nominal
			(...)
	Do you have any questions or comments about the research?	End	Ja (...) / Yes (...) No