Cars and the Village – a Study in Sharing

A mixed-methods case study into rural carsharing opportunities

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Abstract

This thesis examines opportunities for carsharing among rural Dutch households. Carsharing is one of various options to reduce cars, which is the main aim of Dutch sustainable mobility policies. Rural areas show higher car use and ownership, but also fall behind in access to carsharing services. Through a mixed method case study of two village communities, combining interviews with local households, interviews with municipal experts and Likert scale surveys for local drivers, insights have been gained into views and attitudes towards carsharing, the practicality of implementing different carsharing systems and households' car trip routines in rural communities. The results show that carsharing appeals to some rural demographics more than others, and that business-to-consumer carsharing is the most preferred and practical system to implement in villages.

Preface

Before you lies the thesis 'Cars and the Village – a Study in Sharing', written to fulfill the graduation requirements of the MSc Human Geography programme. As a farmer's son, I grew up with cars and bicycles, never using public transport until visiting university open days. From my experience, cars are inherently the most attractive mode in rural areas, and adapting their use is more practical than attempting full replacement by public transport, as is often posed in sustainable mobility discourse. This brought me to carsharing, a concept I had little knowledge about beforehand but easily found much theory on that interested and inspired me to conduct research.

The thesis was written for my thesis examiners, including my supervisor, and for everyone involved who is interested in the report. I want to thank my supervisor, Benjamin Cornejo Costas, for his guidance and support, as well as course coordinator Martijn Smit who helped me in the preparation phase and attended the mid-term presentation. I want to thank all interviewees and survey respondents for their participation in the research. Lastly, I want to thank my seeds, Rutten and Wolfheze's village interest organizations, my father and Wolfheze resident Annemiek Nijeboer, for sharing the survey links with villagers, starting the snowball sampling process.

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Inhoud

Introduction

Policymakers throughout the Netherlands have set sustainability targets to reduce greenhouse emissions in various areas. Within the field of mobility/transport, this usually manifests in aiming for less cars. While measures applied often include making car use and ownership less attractive and promoting alternative transport modes, most notably cycling and public transport, car ownership in the Netherlands has remained constant throughout the 2010s, and no trend towards less usage, less ownership or shifting views among young people can be observed (Kroesen & van Wee, 2021). Cycling, walking and public transport have long been common for young people in the Netherlands, especially in the cities, which are characterized by compactness, functional heterogeneity and high quality public transport (ibid).

Biking and public transport facilities are overall more available in urban than rural environments, making urbanites less likely to become car-oriented than rural residents (Olde Kalter, Puello & Geurs, 2020). Conversely, due to decreasing (young) populations, the use and provision of public transport in rural areas has been shrinking (Evers, 2017; Scheper, Everaars, Coffeng & Oranjewoud, 2005), as has the level of facilities, leading to more car use to facilities further away (Scheper et al., 2005). The newly-popularized e-bike thus far mostly functions as a replacement of the traditional bicycle, rather than replacing car trips (Mossel, 2018). According to Geels (2012), ' the automobility regime is still dominant and stable, although less so than fifteen years ago' (p. 479).

Differences between urban and rural attitudes towards cars seem to be low; car-minded travelers are only slightly overrepresented in rural areas, constituting 30% rurally, against 26% nationwide (Olde Kalter et al., 2020). This implies a strongly practical consideration for higher rural car use and ownership, rather than an emotional decision.

When shifting to different transport modes is impractical, adaptations in the mode can help to achieve emission targets. A major strategy in this regard is carsharing, a form of shared mobility whereby drivers can utilize cars from a fleet of a providing firm, by lending it from others or through sharing one car with multiple users. However, carsharing is currently mostly oriented towards high-income, high-educated urbanites that are already less likely to make use of cars due to environmentalist attitudes and their urban location (Koster, 2022), while carsharing access is low in areas with high mobilization rates (Meelen, Frenken & Hobrink, 2019). This thesis therefore aims to provide insights into the opportunities for carsharing among rural Dutch households. It does so within three research questions;

1. What are the views and attitudes of rural Dutch drivers towards carsharing?
2. To what extent are the different systems of carsharing fit for successful, efficient exploitation in rural Dutch areas?
3. What are the mobility routines, opportunities and constraints of rural Dutch households, and to what extend can these be adapted for and served by carsharing?

To answer these research questions, a mixed method case study has been conducted combining qualitative in-depth interviews and quantitative Likert scale surveys in two cases, Rutten and Wolfheze, Dutch villages that can provide much insight regarding rural mobility (see Methodology).

Relevance

Societal relevance

Carsharing is a highly topical concept in Dutch society that is rapidly growing in terms of numbers and publicity. The amount of shared cars has threefolded over the past few years in the Netherlands, from just above 30.000 in 2017 to almost 100.000 by 2022 (Gras, 2022). While carsharing is most

common in cities, certain middle-sized towns have also seen the start of carsharing projects, including Emmeloord near Rutten (PNP Redactie, 2020) and Oosterbeek near Wolfheze (Van der Poel & XON, 2022). However, overall rural areas fall behind, when in these places carsharing can benefit not just sustainability targets, even moreso with the larger car ownership level (CBS, 2022a), but also provide a more efficient alternative or complementary service to public transport (Shibayama, Lemmerer, Winder & Pfaffenbichler, 2013).

Scientific relevance

On top of the societal relevance, this research is also scientifically relevant and valuable in providing new insights into carsharing attitudes and opportunities. While Kroesen & Van Wee (2021) have held a survey on attitudes towards carsharing among a sample of 42 young Dutchmen, the research did not differentiate between rural and urban respondents. Olde Kalter et al. (2020) did look into attitudes towards (general) car use and their change over time with a variable distinguishing between urban, suburban and rural residential locations.

The research specifically investigated rural opportunities for carsharing, including the aforementioned attitude subject, which had been done in countries like Austria (Shibayama et al., 2013) and Germany (Wappelhorst, Sauer, Hinkeldein, Bocherding & Glaß, 2014; Silberer, Mrso, Bäumer & Müller, 2022), but not yet in the Netherlands. This includes linking carsharing as a transport mode to Hägerstrand's time geography, which has made many contributions to mobility and transport studies (Neutens, Schwanen & Witlox, 2011), but not much yet if any to the upcoming mobility concept of carsharing. Hopefully, this pioneer research will inspire further applications of time geography to carsharing research.

Theoretical framework

Carsharing

Definition

Carsharing has never had a standardized definition, which has caused regular confusion as to whether specific individual services count as 'carsharing'. Le Vine, Zolfaghari & Polak (2014) attribute the following general characteristics to mobility services referred to as carsharing (pp. 3-4);

- The user must go through an initial qualification process, after which he is permitted access cars from the service with no need for interaction with staff members
- The vehicle is driven as in traditional car hire (no paid chauffeur provided) by the end user, who may utilize the car on a personal basis or on behalf of an employer. Therefore, as with traditional rental cars, the cars in the carsharing service tend to be of uncomplicated models.
- The costs of usage are billed in time increments of minutes and hours, in some cases also on basis of the travelled distance. While daily rates usually end up being higher than traditional car rental, operators often provide discounts for usage over multiple days
- On top of the bills for usage based on time and/or distance travelled, operators might ask one-time sign-up fees and/or annual subscription fees.
- Usage can be spontaneous in some instances and or reserved in advance in others, this may depend on the service's specific system of carsharing
- Cars are usually available in locations throughout the service area, whereas traditional car rental is accessible from storefronts and airports.
- Servicing and cleaning is done by the staff occasionally, rather than after usage

According to the authors, an accurate description of carsharing would be 'sequential short-term car access'. Similar definitions have been coined by Shaheen, Belle, Cohen & Yelchuru (2017) and Machado, Machado, de Salles Hue, Berssaneti & Quintanilha (2018). What separates carsharing from traditional car rental, is that it lends cars for shorter periods of time, usually with the intent of conducting individual trips. Mindur, G Sierpiński and K Turoń (2018) concretely distinguish carsharing from 'car hire systems' as having the ability to hire cars for less than an hour.

History

The first carsharing experiment started in 1948 in Zurich, Switzerland, with the Sefage cooperative (Shaheen & Cohen, 2013; Mindur et al., 2018). Sefage was an abbreviation of *Selbstfahrergemeinschaft*, which in English means 'self-driver community'. Sefage offered short-term car rental for customers who were unable to afford car ownership, and operated for half a century until 1998. During the 1970s, various European cities saw carsharing projects emerge. This included Witkar in Amsterdam, which was established in the early 70s. The first carsharing services outside Europe were established in the United States in 1983 (Shaheen & Cohen, 2013; Mindur et al., 2018).

While the Witkar project stopped operating in 1988, the early 90s saw increased interest for carsharing in the Netherlands, promoted by the Ministry of Transport and Water Management (Jorritsma, Harms & Berveling, 2015). Back in 1993, expectations for carsharing were large; one research estimated that by 2010, carsharing could reduce 3.5 to 4 billion kilometers of travelled distance and that 40% of Dutch car drivers could be carsharing users (Jorritsma et al., 2015). While this turned out to be a large overestimation, the past few years have seen a rapid rise in carsharing activity in the Netherlands. The number of cars available for carsharing services has threefolded from 31.949 in 2017 to 98.906 in 2022 (Gras, 2022). The largest operator in the country is MyWheels, which has a fleet of 2.500, of which a majority electric (Van der Weerd, 2022). In 2022, MyWheels

saw a total of 350.000 customers, an increase of almost 60% compared to 2021 (Krijgsman, 2023). A three-quarter majority of shared cars (75.467) are however privately-owned, rather than part of a carsharing operator's fleet (Gras, 2022). Further elaboration on this distinction can be found under 'Carsharing systems'.

Rural mobility in the Netherlands

Statistics Netherlands or CBS (n.d.) measures urbanity, and thus rurality in reverse, through the 'omgevingsadressendichtheid' ('vicinity address density'). The omgevingsadressendichtheid (oad) is defined as the average number of addresses within a 1 kilometer radius circle around an address, divided by the circle's area, expressed in addresses per km^2. With data on address density, the CBS categorizes 5 levels of 'stedelijkheid' (urbanity);

- 'zeer sterk stedelijk' (very strongly urban); vicinity address density of 2.500/km^2 or higher
- 'sterk stedelijk' (strongly urban); vicinity address density of 1.500-2.500/km^2
- 'matig stedelijk' (moderately urban); vicinity address density of 1.000-1.500/km^2
- 'weinig stedelijk' (marginally urban); vicinity address density of 500-1.000/km^2
- 'niet stedelijk' (not urban); vicinity address density of below 500/km^2

Of these categories, marginally urban and not urban are considered the 'platteland' (rural are) by the Sociaal-Cultureel Planbureau (Steenbekkers, Simons & Veldheer, 2006). Both the villages in our study have vicinity address densities below 500, classifying them as not urban i.e. rural. In Rutten-woonkern (residential core) the density is a mere 153/km^2, and both boroughs of Wolfheze have densities below 200/km^2 too (CBS, 2022b).

For decades, the Dutch agricultural sector has seen a rapid scale increase and a decrease in number of firms, from 400.000 in the 1950s to below 100.000 by the mid-2000s (Scheper et al., 2005). Due to this, the size and capacity of agricultural vehicles has also increased, leading to a net decrease in agriculture-related trips.

The character of the Dutch countryside is shifting from being agriculture-oriented to serving the general populace, from providing recreational opportunities, which will increase urban-rural car trips, to allowing for more spacious, rural housing. Only between 1996 and 2001, 86.000 houses were built in rural areas, and due to the shrinking number of farms, many farm residences become detached from the agricultural sector and now house non-farmers. This has increased the population without daily facilities (primary school, supermarket and pharmacist) at walking distance (400 meter) to over 1/3rd. Trip distances have increased, further accentuated by the shrinking facility levels in villages, leading to a modal shift; less walking and cycling and more car use (Scheper et al., 2005).

Since the report by Scheper et al. came out (2005), the Dutch mobility field has seen the rise of the e-bike, electrically-assisted bicycles. In 2007, 7% of bikes sold were e-bikes; this share had increased to 29% by 2016 (Mossel, 2018). Compared to the traditional bicycle, an e-bike allows cyclists to travel more distance and faster, while demanding less personal energy. Research in an urban context (Brighton, UK) by Cairns, Behrendt, Raffo, Beaumont and Kiefer (2017) suggested that a proportion of e-bike use could substitute car trips, reducing car mileage by 20%. However, Mossel (2018) found that for a Dutch rural context (Eemsmond, Groningen), only a marginal share of e-bike trips replace car or public transport trips.

Data on a model shift show that the introduction of the e-bike mostly costs from the trip share of the traditional bicycle (-16.2%), with the car and public transport losing only 2,7% and 1,3% respectively of their share in total trips. The lack of substitution for car and public transport trips is mostly due to their length being too far for the e-bike; the average car trip was 19,7 kilometer and the average

public transport trip 48,7 kilometer. Most e-bike trips were recreational, and motivations for their use over the traditional bicycle are its comfort and speed, especially in the face of harsh winds in open fields (Mossel, 2018).

As far as carsharing goes, it's not very prominent in the rural Netherlands, which correlates with a higher level of overall car use and ownership (Meelen et al., 2019). Business-to-consumer carsharing is limited to the larger cities, and so is the adoption of peer-to-peer carsharing, though peer-to-peer carsharing is often available in rural areas. Elaboration on these various carsharing forms can be found under 'Carsharing systems'.

Klous, Smit, Borlée, Coutinho, Kretzschmar, Heederik and Huss (2017) have conducted a GPS study on a rural Dutch population. From the GPS data, it turned out the 870 participants spent an average of 0,3 hours per week walking, 1,1 hours per week cycling and 3 hours per week in motorized transport. The median distance from home was 2 kilometer for both walking and cycling and 7,4 kilometer for motorized transport.

The self-reported times spent in these three transport categories were overestimated; they were 13,7, 2,8 and 1,2 times higher than the GIS data, respectively. This implies that rural Dutchmen vastly overestimate their time spent walking and cycling, and marginally overestimate their time driving and in public transport (Klous et al., 2017).

Public transport facilities are scarce and have been shrinking in recent years due to a low demand and a lack of funding (Welzen, 2014; Delis, 2017; Evers, 2017). The low demand has various causes; on one hand, the population as a whole might be shrinking (Evers, 2017), but on the other hand, rural households tend to prefer car use, even when money is tight, due to the necessity to travel long distances without being constrained by the inflexibility of public transport (Welzen, 2014). Travel speed is less of a concern, though overlay time is, and the larger attachment to the car seems more pragmatical than emotional, due to the rural accessibility and flexibility of cars compared to other modes of transport (Welzen, 2014).

Inflexibility issues regard tight schedules (inflexibility 'when'), low frequencies (inflexibility 'as often') and fixed routes (inflexibility 'where'), leading to distances between the residence and destination with their nearest public transit stop having to be covered with other modes, increasing travel times. This phenomenon is known as the 'last mile problem' (Welzen, 2014). While there is a persisting public transport demand in rural areas, this demand is too low and too heterogenous to affordably retain a traditional public transport network, thus it would require more flexible alternatives to match the supply with the demand (Delis, 2017).

Views and attitudes towards cars and carsharing

Views and attitudes towards cars

Various research has observed a lack of a shift in attitudes towards cars among Dutch young adults compared to the previous generation (Jorritsma, Berveling & van der Waard, 2013; Kroesen & van Wee, 2021). Jorritsma et al. (2013) found that car mobility of young adults has decreased between 1995 and 2009, but attribute this to certain explanatory variables such as a shift to city (and shrinking young rural population) and a higher number of students (and lower number of working young adults). Kroesen & van Wee (2021) found that young adults' most common reasons for not owning a car are financial concerns, whereas opinions are divided regarding environmental concerns. While the car remains a status symbol, this is not and has never been a major driver of ownership. On the other hand, 3 in 4 young people find that cars enable freedom of movement and agree that the car provides many advantages compared to other transit modes (Kroesen & van Wee, 2021).

While rural areas have higher car use levels, this difference seems based on pragmatic considerations regarding the flexibility and accessibility of alternatives (i.e. public transport), rather than innate emotional differences (Welzen, 2014). While rural travelers are not very responsive to varying travel times, they are bothered by the lack of flexibility of public transport; the fixed schedules, routes with low frequencies, overlays that can be time-consuming and first and last mile to be travelled to and from the public transit stops with other modes (Welzen, 2014).

Olde Kalter et al. (2020) defines four 'latent classes' of Dutch travelers; the cost-sensitive, car-minded, environmentally aware and social-conscious. Only car-minded travelers were strongly optimistic about car use, due to experiencing pleasure from it and the flexibility. From their sample as a whole (N = 1640), 26% were rural dwellers, while from the car-minded class, 30% were, against a 27% share in cost-sensitive, 28% share in environmentally aware and 18% share in social-conscious participants. This indicates a slight overrepresentation of rural travelers in car-minded attitudes, but also a slightly smaller overrepresentation in the classes who would lower their car use for either costs or environmental concerns, while only in 'social-conscious' travelers, who are the least car-minded due to perceiving negative consequences for society as a whole, rural travelers are strongly underrepresented with 18% against 26% (Olde Kalter et al., 2020).

Interestingly, Kroesen, Handy & Chorus (2017) find that use of and attitudes towards travel modes have a bidirectional relationship, with behavior (mode use) having a larger influence on attitudes than vice versa. In other words; high car use prompts positive attitudes towards the car, high public transport use prompts positive attitudes towards public transport, etc. If car use is higher and public transport use is lower in rural areas, regardless of the cause, this will create more positive attitudes and attachment towards the car and more negative attitudes towards public transport, which will further accelerate car use and lower public transport demand.

Views and attitudes towards carsharing

Research into views and attitudes towards carsharing in the Netherlands has been limited. Kroesen & van Wee (2021) find that for young Dutchmen, carsharing is mostly seen as an addition to car ownership and/or public transportation. They define 6 perspectives/views on mobility modes when carsharing is included; weighing up traveler, car-dependent traveler, voluntary public transport user, involuntary public transport user, car lover and carsharing user. These perspectives have varying incentives that might incentivize them towards carsharing. For the weighing up traveller, environmental concerns and user comfort are the most important factors considered. While not that concerned by the environmental consequences, car lovers are also (and mainly) sensitive to user comfort levels. Car-dependent travelers are not motivated by these incentives at all and prefer to use their own car. They might consider carsharing however, if it comes with certain advantages, such as free parking in busy areas (Kroesen & van Wee, 2021).

For both voluntary and involuntary public transport users, carsharing would mostly function as an addition to their public transport-oriented lifestyle (Kroesen & van Wee, 2021). This aligns with earlier findings in Austria (Shibayama et al., 2013) and Switzerland (Becker, Loder, Schmid & Axhausen, 2017) that show carsharing trips mostly substituting public transport, often used in addition to a public transport-oriented lifestyle. According to Shibayama et al. (2013), carsharing can even substitute public transport entirely in areas where public transport is very scarcely demanded. For public transport user perspectives, carsharing would be more accessible if the supply increased, both at train stations and in their residential surroundings (Kroesen & van Wee, 2021).

Lastly, the carsharing user is already convinced of carsharing's advantages (Kroesen & van Wee, 2021). This is the only perspective for whom carsharing is a main mode of transport, able to not

merely complement but entirely substitute other modes. Interestingly, this group seems not all too environmentally conscious; while they are the most positively receptive towards electrification of shared cars, the environmental impacts of transport seems less of an incentive for carsharing than for weighing up travelers or for both public transport user perspectives, and not much stronger than for car-dependent travelers and car lovers. Rather, their main motivations for carsharing as a substitute for public transport and car ownership seem to be the costs of these traditional modes. Therefore, Kroesen and van Wee (2021) assume that this group can increase if car ownership becomes more expensive. Carsharing can also increase if parking spots in new residential projects become scarcer. Since only the carsharing user perspective considers carsharing a full mode and a substitute for ownership and public transport, Kroesen and van Wee (2021) conclude that it is not likely that car ownership among young adults will decrease as a result of carsharing anytime soon.

Research in Germany suggests that rural residents are open to (electric) carsharing (Wappelhorst et al., 2014; Silberer et al., 2022). However, Wappelhorst et al. (2014) see a major target group in tourists, and concede that their research has taken place in a strongly touristic municipality, whereas demand might be too low for carsharing services in other places of the same size; 'solutions have to be developed that can be established with considerably lower costs and therefore do not depend on a high demand' (p. 385).

Silberer et al. (2022) found that factors in carsharing being accepted in rural areas are performance expectancy, hedonic motivation and facilitating conditions. Trust and social norms were however only minor concerns. Performance expectancy strongly depended on an individual's perceived need for carsharing, as households tend to already own cars and feel no necessity for carsharing. As for hedonic motivation, most participants of the research didn't believe electric carsharing could be fun, but from the interviews it was revealed that their attitude could change after trying out the system, which seems to tie back into the bidirectional relationships between mode use and attitude (Kroesen et al., 2017). Regarding facilitating conditions, participants preferred a station-based model (see Carsharing systems) where a large number of stations are spread throughout the municipality, optimizing the amount of residents with a station in their direct vicinity. Additionally, participants suggested a ridesharing feature, empathizing a more social nature of rural carsharing as opposed to urban carsharing (Silberer et al., 2022).

Carsharing systems

Important in considering both profitability for businesses, which dominate the Dutch carsharing sector (Koster, 2022), and attractiveness for users is the specific system of carsharing. Sarasini & Langeland (2017) divide carsharing providers roughly into integrators and orchestrators. Integrators operate their own fleet (business-to-consumer or business-to-business), while orchestrators connect users to borrow each other's privately-owned vehicles (peer-to-peer), for which they receive provisional fees.

Shaheen, Chan, Bansal and Cohen (2015) define three main carsharing systems; roundtrip carsharing, one-way carsharing and Personal Vehicle Sharing (PVS). Roundtrip carsharing is the oldest, original system. Members access vehicles on a pick-up station, and have to return the vehicle to the station after use. In research among North American users, roundtrip carsharing led 25% to sell a private vehicle and another 25% to postpone purchasing one.

One-way carsharing is a newer, largely similar system to roundtrip carsharing, that saw a large increase in 2012. The difference with one-way carsharing is that members can pick up their car at one location and drop it off at another, rather than having to return the car to the pick-up location (Shaheen et al., 2015). This allows for more flexibility for users, but complicates operating the

network as it may create strong imbalances in vehicle supply between stations without proper management, potentially causing oversaturation and low utilization rates from some station pools while lacking the supply to match the demand in others (Machado et al., 2018). Nourinejad and Roorda (2015) show that the one-way system is more efficient than the roundtrip 'two-way' system regarding the fleet size, requiring less cars to serve the total demand, but requires more relocation time, time spend to re-position the vehicles. It also denies users the assurance of a return trip.

Referring back to the categorization by Sarasini and Lagerland (2017), roundtrip carsharing and one-way carsharing are both provided by 'integrators', as the shared cars are part of the operator's business fleet. Besides serving private individuals/households (business-to-consumer, B2C), many integrators also serve businesses (business-to-business, B2B) so they can offer their employees at-work shared cars. The third system defined by Shaheen et al. (2015), Personal Vehicle Sharing (PVS), includes the peer-to-peer (P2P) sub-system, which corresponds to 'orchestrator'-based carsharing from Sarasini and Lagerland (2017). With peer-to-peer carsharing, users lend privately-owned vehicles from other users on the platform (Shaheen et al., 2015). P2P carsharing is found to have a stronger geographical dispersion outside of urban areas, and also appeal more often to below average incomes. Besides P2P and its variants, PVS includes fractional ownership. This involves users subleasing or subscribing to a shared vehicle. In exchange for a portion of the expenses, subscribed users receive access to the vehicle they are subscribed to. In practice, this means a specific car, be it operator-owned, privately-owned or shared-owned, is available for use by a specific group of carsharing users (Shaheen et al., 2015). Fractional ownership seems to correspond to 'grass-root cooperative carsharing', the system Shibayama et al. (2013) researched in Austria.

Machado et al. (2018) largely replicate the categorization by Shaheen et al. (2015), but add a third integrator-operated system, Free-Floating One-Way Carsharing. Whereas roundtrip and one-way carsharing usually involve stations where cars are stored, picked up and dropped off, Free-Floating One-Way Carsharing allows for leaving a shared car anywhere within a designed operating area. It's allowed to drive outside the area, as long as the car is dropped off within its limits. Users are able to find the locations of shared cars dispersed through the operating area when booking reservations online. Cars can be locked and unlocked through smartphones, given the impracticality of physical keys when the cars are parked out in public between users (Machado et al., 2018). The Dutch carsharing operator MyWheels introduced 'zonefloating' in Amsterdam, a hybrid version where shared cars have to be parked within a small zone around electric car charging facilities (Mobiliteitsplatform, 2019)

Sarasini & Langeland (2017) consider integrators more suited for technological renewal, including electrification for sustainability/emission targets. Integrators concentrate in cities, maximizing their fleet's utilization rates due to density, while operators, unconcerned with utilization rates, also serve rural environments to maximize their user base (Sarasini & Langeland, 2017), as was found to be the case by Meelen et al. (2019).

However, Illgen & Höck (2020) show with a simulation model that urban business fleet carsharing networks can be extended to rural areas with profits and higher utilization rates under certain conditions, as long as individual networks don't exceed their capacity. When carsharing networks expand from cities into nearby rural areas, it might increase its attractiveness for urban consumers, compensating for the lower rural utilization rates. In the simulation model, the utilization rate after rural expansion even exceeded the pre-expansion utilization rate in the long run. The longer distances between destinations played a part in retaining and increasing the utilization rate; trips that take between 30 and 55 minutes provide for excellent results. Rural amenities that may attract urban residents, e.g. touristic locations, provide for additional long trips from urban to rural areas. If

organized as a one-way trip system, shared cars from rural pools can even support the urban pool by temporarily increasing its size during peak demand hours like the evening. Preceding the peak, many rural users travel to the city and drop off their cars at local drop-off points. The original sizes of the rural and urban pools would be restored after the peak, as rural users will take shared cars out of the urban pool to get home (Illgen & Höck, 2020).

Time-geographical constraints

Carsharing removes some of the freedom, independence and flexibility associated with car use, which is part of cars' appeal over public transport. To promote carsharing, actors need to change their behavior, which includes consumers' willingness to adapt their car use routines (Geels, 2012). However, users' flexibility to do so is limited. To explore these limitations, the research will be linked to Hägerstrand's time geography, which regards the spatial paths individuals take or can take over time, describing three types of constraints limiting one's mobility; capability, coupling and authority constraints (De Pater & van der Wusten, 1996).

Capability constraints include physical, mental and instrumental constraints, such as the need to sleep and eat regularly or the lack of availability of certain transport modes (De Pater & van der Wusten, 1996; Bastiaanssen, 2012). Hägerstrand considers the presence of humans inside bodies in a material world; our body has its needs that take up time, as does movement of the body through space (De Pater & van der Wusten, 1996). Therefore, the general limits of the body, (in)ability to be somewhere on time and personal constraints on our capacity to use certain modes of transport, such as not owning a driver's license, all count as capability constraints (De Pater & van der Wusten, 1996).

Coupling constraints regard obligations to be in certain locations at certain times (De Pater & van der Wusten, 1996). Employees are obligated to be at their assigned workplace during their assigned shift. Mothers might be required to be home when their children return after school. Coupling constraints can be ignored, unlike most capability constraints, but doing so may lead to consequences.

Lastly, authority constraints refer to the limited mobility to navigate certain demarcated areas, based on institutional rules and/or the need for permission by another individual or group, whether permanently or during certain periods (De Pater & van der Wusten, 1996; Bastiaanssen, 2012). Examples of authority constraints include opening times, exclusivity of certain events and pricing of access to amenities (Bastiaanssen, 2012).

Time geography concerns not just travel choices made, but also opportunities for alternatives, a negative freedom allowed by an absence of constraints (De Pater & van de Wusten, 1996; Neutens et al., 2011). Hägerstrand visualizes these opportunities, limited by their constraints, in figures known as 'space-time prisms' (De Pater & van de Wusten, 1996; Neutens et al., 2011; Bastiaanssen, 2012). These prisms reflect an individual's possible spatial paths within a certain timespan, which are limited by the capability, coupling and authority constraints (Neutens et al., 2011; Bastiaanssen, 2012). The prism is delineated by factors such as location of departure, time budget and speed of available transport modes (Neutens et al., 2011; Bastiaanssen, 2012). Projecting the prism onto a two-dimensional plane gives the potential path area (PPA), the physical space within a person's reach within the determined timespan (Neutens et al., 2011; Bastiaanssen, 2012). With every activity taken part in and distance travelled, the PPA for the remaining duration of the timespan changes (Bastiaanssen, 2012). Lastly, the daily PPA (DPPA) 'is derived by superimposing an individual's PPAs between all pairs of successive fixed activities during the day' (Weber & Kwan, 2002, in Neutens et al., 2011, p. 28).

Much time-geographic research has gone into transportation accessibility in relation to decarbonization (Neutens et al., 2011). However, as far as sources found through Google Scholar, time-geographical research has not yet been applied in the carsharing field.

Conceptual model

The interrelated concepts of the research and their linkages are summarized in the following conceptual model;

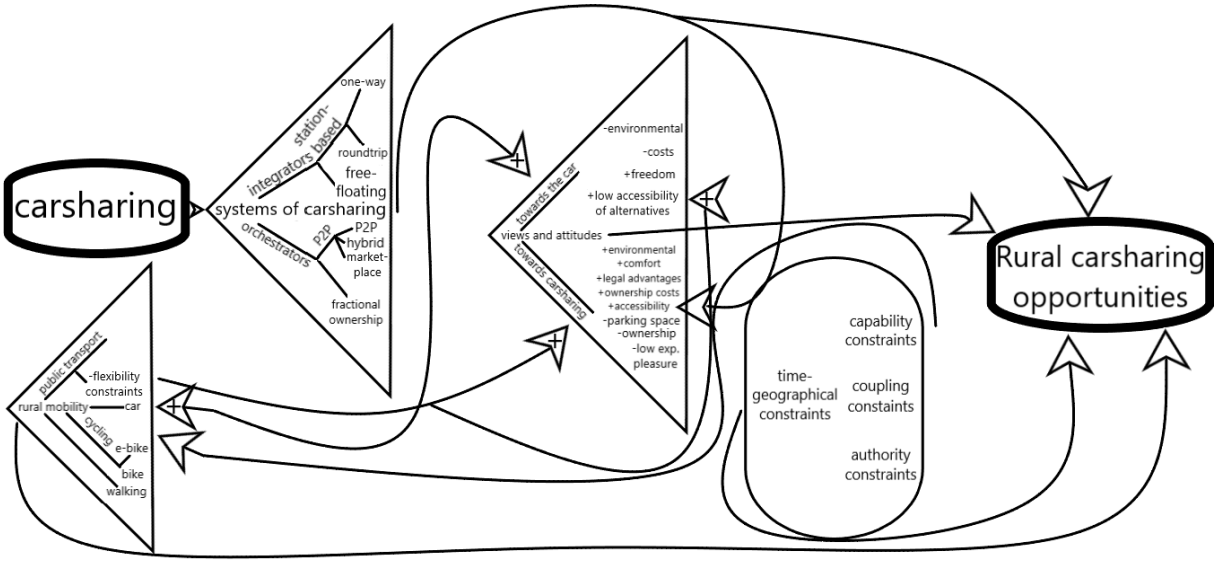

Figure 1 Conceptual model

To elaborate on the model and recap the theory; the choice between various systems of carsharing, rural views and attitudes towards cars and carsharing, time-geographical constraints of rural households and rural mobility situation all influence the extent of opportunities for carsharing to succeed in a rural context.

Furthermore, these concepts themselves influence each other in various ways. Views and attitudes towards a mode and use of the mode have a bidirectional relationship (Kroesen et al., 2017). Therefore, the car as a part of rural mobility, referring to its use and accessibility, has a positive relationship with views and attitudes towards the car and vice versa. Besides this, various variables that overlap with other concepts influence views and attitudes towards car use and carsharing.

A low flexibility of public transport makes it a less attractive mode of transport (Welzen, 2014), lowering the accessibility of alternatives to the car (over long distance) and thereby increasing car use and improving views and attitudes towards the car. It can therefore be expected to improve the relative attractiveness of carsharing, often considered supplementary to public transport by consumers (Shibayama et al., 2013; Becker et al., 2017; Kroesen & van Wee, 2021). The accessibility of carsharing is partially dependent on systemic choices as to where shared cars can be picked up and dropped off by consumers. Silberer et al. (2022) showed that one of the 'facilitating conditions' identified by rural residents was a station-based model with many stations spread throughout the town of research, highlighting the importance of vicinity of access.

Lastly, outside of the views and attitudes concept, there is a relation between capability constraints on rural mobility. Capability constraints are the 'constraints of the body' and our capacities, constraints that derive from our presence in a physical world (De Pater & van der Wusten, 1996; Bastiaanssen, 2012. This includes a lack of a driver's license (lack of capacity constraining car use),

and may also extend into disabilities constraining our physical ability to walk, cycle, access public transport or even use the car. Coupling constraints rather oblige a level of mobility.

Methodology

The research has been conducted as a case study. The case study design was attainable within the scope of the thesis, and is appropriate for researching current circumstances, provided that they are put in the context where they have been produced (Yin, 2009). Despite covering a small research population, and therefore often prejudiced against regarding their scientific value, case studies can provide major, sometimes generalizable contributions to scientific knowledge within a certain field (Flyvbjerg, 2006).

Data was collected with a 'mixed methods' approach, combining quantitative and qualitative data collection methods for comprehensive, integrated insights. Quantitative data was collected through two surveys with Likert scale statements based on Kroesen & van Wee's (2021) survey, one for Rutten and one for Wolfheze drivers. This allowed the study to reach a relatively large portion of both villages' population to investigate basic mobility preferences. Qualitative data has been collected through interviews, both with local households as with representatives of the villages' respective municipalities knowledgeable about the local mobility context. The surveys allowed for reaching a relatively large share of the village populations to investigate mobility preferences, while the interviews allowed for more in-depth explorations of the local mobility situation, carsharing opportunities and households' time geographies. The intent was to conduct 4 in-depth household interviews per village, an expert interview with a representative of each of the villages' municipalities and to get about 50 responses for the survey in both villages.

Research question 1 is answered through a combination of survey response data and in-depth insights from the household and expert interviews. Not just views and attitudes towards carsharing but also towards cars in general and public transport has been assessed, as the theory showed that these might be highly linked to carsharing. While the theoretical framework already discussed views and attitudes towards cars and public transport in the rural Netherlands, respondent-specific data could contextualize the various respondents'/interviewees' views and attitudes towards carsharing, which may diverge from each other and/or the general rural Dutch populace.

Research question 2 is answered through in-depth insights from the household and expert interviews, with some survey statements providing additional quantitative data into the locally preferred carsharing system and conditions. Research question 3 is mainly answered by the household interviews, where interviewees were asked to elaborate on their car trip routines and their opportunities/flexibility and constraints to adapt these. One survey statement related to this research question for additional quantitative data.

Interviews

All interviews were conducted semi-structured with a list of questions to be asked, yet allowing for the interviewees to answer freely and allow for a natural flow of conversation with follow-up questions. In total, I planned 10 interviews; 4 household interviews per village and 2 expert interviews, one each with a representative responsible for mobility from both villages' municipalities.

After conducting the interviews, I transcribed them in Word, then coded them using NVIVO. Working deductively, I wrote codebooks, with main categories based on the questions and themes discussed, with subcategories often anticipating possible answers under these. During the coding process, I labelled relevant text first under the main categories they regarded thematically, then redirected text under main codes under subcategories based on the specific answer given or sub-topic discussed. This sorted the text and gave a clear overview of the interviewees' (relevant) responses and their relations to each other across different interviews, enabling me to distinguish and summarize

relevant data in this report. Question list and codebook differ between household and municipality interviews.

Household interviews

The household interviews provided qualitative data into all three research questions for Rutten and Wolfheze households. Besides the car trip routines (RQ 3), the interviews also functioned to triangulate data with the surveys into views and attitudes towards cars, public transport and carsharing (RQ1) and with the expert interviews into the preferable system of carsharing (RQ2). It did so by adding broad questions that can substitute a large number of Likert scale statements from the survey. The semi-structured interview format allowed for qualitative, in-depth data, thereby requiring only a few people to cooperate (as interviewees) to substitute data-wise for a large number of survey responses.

The interviews could be conducted either one-on-one or with multiple members of the same household, but regarded the mobility of the entire household, as far as they covered mobility routines, opportunities and constraints (RQ 3), as individuals' trips often serve household-wide functions enforced on them by coupling constraints (De Pater & van der Wusten, 1996). Thus, the presence of other household members and their mobility routines was expected to strongly influence those of the interviewees. For this research question, I used interviews to explore the households' existing car trip routines, and the constraints and opportunities (negative freedom) to adapt these routines to include carsharing in it. For these, I expected mainly coupling constraints to appear, as they're strongly linked to routines themselves (obliged regular activities to drive for) and can lead to obliged mobility levels cars provide and other modes don't (e.g. long-distance commutes, unannounced/urgent trips). However, other constraints were also anticipated, for instance capability constraints when specific modes of transport aren't physically possible (e.g. no bus in the early morning to commute on time) or authority constraints (e.g. shop closed during weekends, thus routine to go on workday).

In this report, all interviewees are referred to by their surname's first letter and a dot, e.g. 'van 't Sant' would be 'S.' For the two interviews conducted with multiple household members (i.e. husband and wife), this letter refers to both, unless stated explicitly as 'husband/man' or 'wife/woman' before the letter. An overview of the interviewees and their households can be found in the Results under 'Overview of interviewees', after which the report will refer to these households by letter. For the list of prepared interview questions, see appendix A. For the codebook, see appendix J.

Municipality expert interviews

For both villages, an expert interview was conducted with a municipal representative. The people I had the privilege to interview can be found in the Results at the start of the 'Municipalities' interviews section. The intent with these interviews was to get more insight into the local mobility context in Rutten and Wolfheze, which is relevant to both RQs 1 and 2, and explicitly go in-depth on the choice between various carsharing systems within the local mobility context (RQ 2). For the list of prepared interview questions, see appendix B. For the codebook, see appendix K.

Surveys

The surveys mainly concerned drivers' views and attitudes towards cars, public transport and carsharing (RQ 1), with some questions tapping into system preferences (RQ 2) and one into opportunities and constraints to include carsharing in one's routines (RQ 3).

They were conducted through Microsoft Forms, allowing for people to submit their answers anonymously and over distance, while still recording full individual submissions and not just statistics

for each individual question and statement, allowing for correlations to be analyzed. One survey Form for each village was spread through the community with snowball sampling from the 'seeds' (Parker, Scott & Geddes, 2019), initial contacts into the local communities. Participants were encouraged to share the survey link further through social media. It was intended for all car drivers from Rutten and Wolfheze. Unlike the interviews, the survey was to be answered on an individual level, unless explicitly asked, as it mostly regards views and attitudes (RQ 1), something personal that household members might very well disagree on. This allowed controlling for possibly relevant demographic variables such as age and educational achievement that may differentiate between household members.

Snowball sampling is convenient when covering small populations (Parker et al., 2019). As a drawback, snowball sampling often leads to selection bias. For instance, women are more likely to cooperate with research, and conducting the survey online creates a bias against those who are less present online or digitally skilled (Parker et al., 2019). To partially control for biases, several demographic variables were inserted into the beginning of the survey in question form. The rest of the survey consists of statements to be responded to on a Likert scale, with values 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree. These statements were mostly derived from Kroesen & Van Wee (2021) in their survey for young adults into their perspectives towards carsharing.

The survey was structured as follows; there were 5 multiple-choice questions to obtain data on the controlled-for demographic variables. Then, there were 25 statements to be answered on a Likert scale. These were categorized under three different tables based on the specific sub-topic. The first table regarded car use in general and had 8 statements. The second table regarded public transport and had 4 statements. The third and last table regarded carsharing and had 13 statements. This last table also contains an 'elaboration' heading, defining the concept of carsharing for clarification, to ensure those unfamiliar with the topic had a basic idea of what carsharing encompasses when answering the statements.

In total, the survey had 30 answerable entries (5 questions and 25 statements). According to Steve Wigmore (2022), survey director at Kantar, a survey's length should be kept below 12 minutes, and ideally below 10, to keep engagement with respondents and minimize the dropout rate. On average, it takes 7.5 seconds to answer a simple online question (Wigmore, 2022). Therefore, a 10 minute maximum would allow for up to 80 entries, and a 30 entry survey would take a mere 3 minutes and 45 seconds on average. However, the exact time per question depends on the complexity; open questions take longer to answer than a simple yes or no (Wigmore, 2022).

The survey statements were often long sentences, and the last table contained statements about a topic many respondents would be uninformed about. Reading the introductory text and the elaboration heading on carsharing also takes time. This might have increased the time it takes to answer the statements. However, the statements were written to be understandable to laypeople and were all answerable on a standard Likert scale, easing their answerability compared to the in-depth interview subject matter. After going through the survey myself, as the researcher familiar with the questions, it took me about 4 minutes,. Therefore, I had estimated the survey to take from 4 to 6 minutes, depending on how quick one read the statements and text and how quickly one made up their mind to answer a question on a Likert scale.

The demographic variables that the survey controlled for are age, gender, educational achievement, household form and location of residence within the villages of the respondent households. These were largely based on background statistics (see 'The cases'), to compare the respondents to the

village population for representativeness. Since the survey was held at the individual level, multiple members of the same household might have answered the survey, biasing the shares towards household forms with more members. 'Residence within village' did not account for specific addresses or streets but was recorded with a binary question in both villages, corresponding to two-way divides of the villages' territories: for Rutten, the settlement and the countryside, for Wolfheze, the areas south and north of the railroad.

For all the survey questions and statements, see appendix C.

Data analysis

The data was analyzed in two ways; first, I analyzed the distribution of answers on all individual entries (full data in appendix D and E). These are summarized in the Results under 'Total numbers per individual statement'. In this summary, for concision, responses for 'agree' and strongly agree' were considered affirmative responses to the statements while responses for 'disagree' and 'strongly disagree' were considered denying responses.

Second, data analysis into response correlations has been conducted through Microsoft Excel. These can be found in the Results under 'Correlations between variables (Excel correlation matrix)' After exporting the results from both surveys into their own two Excel tables, Likert scale categories were converted to numeric values from 1-5 (see appendix C) to allow for data analysis through Excel's Analysis Toolpack.

The categories for the controlled-for demographic variables have also been converted to numeric values on a scale for this (see appendix C). For age and education these were straightforward, ascending with higher ages and education levels. Location of residence was binary in both villages, making the order inconsequential. I decided to put the 'Other' entries for gender and household form down as the highest value in their scale, as they are being the lowest-placed entries, intended for those who didn't find a fitting entry. Since nonbinary experiences tend to accord more with female than male experiences in socio-spatial research, male was put at the bottom, creating a scale for gender of 1=male, 2=female, 3=other (nonbinary).

Like age and education, household form was largely straightforward, as one-person households, couples without children and couples with children (unspecified how many) can be assumed on a linear scale of 1, 2 and 3+ members. However, besides the aforementioned 'Other' entry placed on top of the scale, there was also single-parent households. As these have 1 parent and an unspecified number of children, their total of 2+ members can be assumed to on average position them between couples without and couples with children. However, I put single-parent households above couples with children for two reasons. First, it is a less conventional/traditional household form than the other 3, which means it aligns somewhat with 'Other' on top of the scale; in fact, the background statistics don't count it as a separate category. Second, I considered the member/rider ratio, which can be assumed to asscend with the 3 linear categories; couples with children usually have more members who can't drive (children) than one-person households and couples without children, where all members are assumed to be of driving age. This puts a larger burden to drive non-driving members on the driver(s) and the car(s). Therefore, member/rider ratio might provide stronger correlations with views and attitudes than members totals. Using this ratio, single-parent households would be placed higher on the scale than couples with children, as there is only 1 parent (assumed driver), putting a larger burden of driving children on this parent than for couples with children households.

To get a clearer view of the data, survey statements that investigate the same topic (e.g. car-orientedness, public transport-orientedness, openness to carsharing) have been grouped into subsets. For this, certain statements needed to have their numeric values reversed. For instance, statement 5 on taking alternative modes to the car over short distances is relevant for analyzing car-orientedness, but due to how the statement is formulated, the more respondents agree, the more they use alternative forms of transport i.e. the less car-oriented they are. All subsets were given their own sheet, with a title indicating the subsets' topic.

The survey's main topic of interest, openness to carsharing, was measured with two subsets; the '(in a) vacuum' subset measures innate interest towards the mode through 6 of the 13 survey statements on carsharing, whereas the 'comparative' subset adds to this carsharing statements 2 and 11, 'I expect to prefer carsharing over public transport' and 'I would prefer carsharing over ownership if this becomes an accessible, less expensive option'. This assumes the respondents (all drivers) will have a stronger innate preference towards car ownership than towards public transport, hence the choice to add the costs factor for the latter. Due to these statements' framing, the comparative subset was expected to show lower correlations for the PT (public transport) subsets, but higher correlations for cost-sensitivity.

After grouping the subsets into their own Excel sheets, the average scores per respondent over the statements within one subset were calculated with a simple formula. The calculated averages were put into a new, slimmed down table sheet under a column with the sheet title (topic), together with the scores for the controlled-for demographic variables and the statements not grouped into a subset. The columns with separate statement data have been given titles to shortly describe their statements' topic, similar to the subsets. After first finishing two independent table sheets for both surveys, the data was combined into one larger table as well, with an added variable to indicate the village/survey of the respondent (1=Rutten, 2=Wolfheze) replacing the 'residence within village' controlled-for demographic variable, which differentiated between the two surveys in the two villages.

Using the combined table for both surveys, a correlation matrix for the data has been created. With this correlation matrix, it is possible to find correlations between the various statements and controlled-for demographic variables. The following describes the most important of these correlations. All of the following derives from the combined matrix, except for 'residence within village' whose data derives from matrixes from the two individual tables.

Method justification

Validity

This thesis regards 'rural Dutch households', researching their carsharing opportunities in a case study. As Flyvbjerg (2006) explains, the limited scope of the case study setup doesn't exclude the research from providing valid and generalizable data for the larger population it represents ('rural Dutch households').

In fact, strategic selection of 'atypical' or 'extreme' cases might be more useful for generalization than random representative samples; 'Atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied. In addition, from both an understanding-oriented and an action-oriented perspective, it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur. Random samples emphasizing representativeness will seldom be able to produce this kind of insight; it is more appropriate to select some few cases chosen for their validity' (Flyvbjerg, 2006, p. 13).

The cases Rutten and Wolfheze were specifically selected for their equal populations yet strongly diverging levels of public transport access (hourly bus vs half-hourly train, see 'The cases'), which is the mode for which carsharing is mainly considered as alternative by consumers besides private car ownership (Becker et al., 2017; Kroesen & van Wee, 2021; Shibayama et al., 2013) and was therefore expected to mediate carsharing opportunities, as well as existing car use. Similarities indicate a generalizable rural pattern, differences a relation to PT, overall measuring rural households' carsharing opportunities and how these might be affected by PT.

The survey statements were based on research by Kroesen and van Wee (2021), though often reformulated and/or combined from various statements to decrease survey length, increasing response. Using the controlled-for demographic variables and subsets for cars in general and PT, relations between carsharing attitudes with factors beyond the rural context were observable, as were selection biases. As there were only 8 household interviews, I could spot possible relations to other variables with the naked eye.

Reliability

The surveys, besides the village-dependent 'location within village' controlled-for demographic variable were the same for everyone and thus will lead to the same results if the same populations would be surveyed again, assuming persistent selection biases. The interviews were conducted semi-structured, as this allowed a natural conversation and focusing on what interviewees have more to say about. This meant that not for every interviewee, the same data would be collected to the same extensive degree, and not for every interviewee, the same follow-up questions were asked, decreasing reliability; there are various directions in which the conversations could have gone, producing different data.

Rutten has 1.660 and Wolfheze 1.745 inhabitants (AlleCijfers.nl, 2023c; AlleCijfers.nl, 2023d). With a 95% confidence interval and a 50% proportion, the aim of 50 survey responses each for all residents gave error margins of 13,653% and 13,663% in Rutten and Wolfheze respectively, based on the entire population. However, not all residents are drivers, the survey's research population. While exact driver numbers weren't available, at least the age group of 0-15 years old could be discounted entirely, as these people were not yet of driving age. This gave Rutten and Wolfheze maximum potential driving populations (MPDPs) of 1.370 and 1.580 respectively. Assuming all these people drive, this still lead to error margins of 13,609% and 13,643%, above the 10% threshold. With 100 responses, the error margins for the MPDPs would drop below the 10% threshold, but due to the research's scope I kept the aim at 50. This limits the reliability of the survey data.

Suitability

Research question 1 is assessed both in survey and household interview form. Likert scale survey data is quantifiable and concrete, a suitable method into assessing views for a relatively large number of people. Interview data can provide more in-depth insights into why people feel the way they do, letting them formulate arguments and elaborate on how they feel. Therefore, both methods were used.

Research question 2 regards more substantive matter within the carsharing field, that the average driver is not familiar with yet. Therefore, it was most appropriate to cover it in the interviews, both with households and municipalities. This allowed for discussion and explanation/elaboration on the different systems if interviewees don't understand them well. Interviewees can describe their preferred system in their own words, rather than having to pick between terms they just heard of, and could be asked for reformulations if these answers were not directly clear. Likewise, the few

survey statements that relate to RQ 2 don't use the systems' names, but rather describe what these entail.

Research question 3 was also mainly assessed by interview, specifically household interviews, due to the extensiveness of the data. People are less likely to finish surveys that take longer. Asking people to write down their car trips on say, a weekly basis, demands more time and effort than many might be willing to voluntarily give to a survey in their free time. Therefore, this was limited to the interviews, which again allowed interviewees to use their own words and the researcher to elaborate/reformulate or ask the interviewee to do so. Therefore, this in-depth data was also assessed mainly by interview, with just one survey statement regarding it, formulated as generally as possible; 'Carsharing to me seems incompatible with my agenda and/or obligations'.

The cases

Rutten, Flevoland and Wolfheze, Gelderland are two equally-sized villages, one with low and one with high public transport access. Rutten has one hourly bus line 77 between nearby trainless towns Emmeloord and Lemmer, and its municipality Noordoostpolder has the 13th largest distance to a train station nationwide (CBS, 2022a). Cars are used for almost all commutes in the Noordoostpolder, though no significant divergence from the national average has been observed for home-to-school trips (Boumans, 2018).

Wolfheze is one of the Netherlands' smallest villages served by train. The centrally-located station hosts a half-hourly NS Sprinter between the nearby cities of Ede and Arnhem, which are further well-connected to Utrecht and Amsterdam.

Figure 2 Location of villages within the Netherlands

For statistics, Rutten is divided into 3 neighborhoods; 'Rutten-landelijk gebied' (countryside), 'Rutten-bedrijventerrein' (business park) and 'Rutten-woonkern' (residential core) (AlleCijfers.nl, 2023b). The business park has only a handful of households and is part of the 'bebouwde kom' (settlement), located next to the residential core. These neighborhoods were therefore considered as one 'settlement' value in the 'residence within village' controlled-for demographic variable, opposite to

the countryside. Wolfheze is divided into 2 boroughs (AlleCijfers.nl, 2023a), which are cut off by the railroad; 'Wolfheze ten zuiden van het spoor' (south of the railroad) and 'Wolfheze ten noorden van het spoor' (north of the railroad), to which the 'residence within village' controlled-for demographic variable corresponded.

The following table provides an overview of background statistics for the case villages' demography and PT services. Demographic data is retrieved from online databases. Through personal communication with municipalities, I accessed PT data. For Rutten, I was referred to Antoine Uijttewaal, manager of the local PT concession. For Wolfheze, data was provided directly by the municipality's interviewee, alderwoman Daniëlle van Bentem.

Table 1 Village data

Village	***Rutten***	***Wolfheze***
Main demographics	**AlleCijfers.nl.,2023c**	**AlleCijfers.nl.,2023d**
Inhabitants	1.660	1.745
Gender divide	52% men, 48% women	52,3% men, 47,7% women
Households	670	685
Inhabitants/household	2,48	2,55
Age division	0-15 17,47% 15-25 12,65% 25-45 21,7% 45-65 29,217% 65+ 18,976%	0-15 9,4556% 15-25 5,73% 25-45 19,5% 45-65 36,1% 65+ 28,94%
Education level (ages 15-75)	Low 28,9% Mid-tier 48,4% High 22,7%	Low 24,8% Mid-tier 29,3% High 45,9%
Cars	915	820
Cars/household	1,3657	1,197
Advanced demographics	**CBS, 2022b**	**CBS, 2022b**
Household forms	One-person 25% Multi-person without children 37% Multi-person with children 38%	One-person 36% Multi-person without children 41% Multi-person with children 22%
Geographical population divide	Residential core 53,9% Countryside 45,18% Business park 0,9%	South of the railroad 55,6% North of the railroad 44,44%
Public transport	**Uijttewaal, A., personal communication, June 18th and 20th, 2023**	**Van Bentem, D., personal communication, June 15th, 2023 (except train passengers from NS, 2023)**
Connection	77 (bus)	NS Sprinter (train) 589/590 (Buurtbus, 2 mirrored lines)
Frequency	Hourly	Half-hourly (train) Hourly (Buurtbus)
Passengers (daily entrances and exits)	36 (settlement stop) 4,3 (countryside stops)	468 (train) 13,3 (Buurtbus, entrance only)

Results

Interviews

Households

Table 2 Overview of interviewees

Name	Village/location	Household makeup	Who interviewed?
Z.	Rutten (settlement)	Husband/man and wife/woman, 65+, both drivers, 1 car	Husband/man
B.		Husband/man and wife/woman, 25-45 (around 30), both drivers with car, son, -25 (baby), non-driver	Wife/woman
W.		Husband/man and wife/woman, 45-65 (50+), 2 sons, -25 (20+), all drivers, 3 cars (youngest son has student travel product)	Oldest son
V.	Rutten (countryside)	Husband/man and wife/woman, 45-65 (50+), both drivers with car, daughter, -25 (19), driver, son, -25 (16), non-driver	Wife/woman
K.	Wolfheze (north)	Husband/man and wife/woman, 45-65, both drivers with car, son, -25 (7), non-driver	Husband/man and wife/woman (referring to both, if not specified as husband/man or wife/woman K.)
D.		Husband/man and wife/woman, 45-65 (almost 60), both drivers, 1 car	Husband/man
O.	Wolfheze (south)	Husband/man and wife/woman, 45-65 (63), both drivers, 1 car	Husband/man
T.	Wolfheze (north)	Husband/man and wife/woman, 45-65 (66), both drivers	Husband/man and wife/woman (referring to both, if not specified as husband/man or wife/woman T.)

Views and attitudes towards the car

All interviewees except T. mention freedom (of movement) as a large factor for their car use. All except D. consider cars necessary in their lives, mainly for work-related trips. Rutten interviewees see

cars as practical and convenient; they're easily accessible and fast. W. for instance saves half the travel time since he switched from bus to car for his commute. Only Z. and the husband/man of household T. claims to find driving enjoyable, though neither drives for pleasure itself. User comfort and status are not mentioned once as a motivation.

As for downsides, Z., V., K., O. and T. mention the environmental impact of cars. K. are however skeptical of electric cars' environmental-friendliness. They also acknowledge doing away a car is environmentally efficient, but would not want to do so to then hire an electric (shared) car on occasion. Asides environmental pollution, O. also attributes other forms of pollution to the car; '*In hoofdzaak de vervuiling, voorlopig. En niet alleen de uitlaatgassen, maar ook de geluidsvervuiling. En het blikvervuilen…' 'Geluidsoverlast, en zicht, en overal staan die kleredingen, ze zijn gewoon lelijk.*' Translation: *'Primarily the pollution, as yet. And not just the exhaust gases, but also the sound pollution. And the visual polluting…' 'Sound pollution, and sight, and those *** things are everywhere, they're just ugly.*

Z. is also pessimistic about the number of cars in the Netherlands. When asked why, his answer was; '*Ik denk de gezondheid, omgeving, eh… noem maar op. Filevormingen, last, tijd nodig hebben om elders te komen.*' Translation: '*I think the health, environment, eh… you name it. Traffic jams, nuisance, requiring time to get somewhere else.*' However, he claims that congestion mostly concentrates in urban areas and less so near Rutten.

W. and V. also mention traffic jams as a drawback when travelling to the Randstad (urbanized west), and not near Rutten. Wife/woman T. (Wolfheze) also mentions traffic jams, primarily westwards.

Costs, especially fixed costs, are mentioned in various interviews. B. finds the fixed costs for car ownership to be quite accruing, while for W., these are acceptable due to higher public transport costs. V. considers the expenses a drawback too, but also mentions that driving was the more affordable option when visiting Amsterdam with her children, despite wanting them to experience the train. She considers driving cheaper when travelling with multiple people. This is echoed by O., who despite disliking cars drives to Amsterdam or Utrecht when travelling with his wife due to higher train costs when going together. D. finds cars costly, but says it has to become 'extremely' expensive for him to stop driving. Husband/man T. is bothered by fixed costs, while being fine with the (usage) costs for fuel; *'De vervuiler betaalt in dat geval*' (*'The polluter pays then*').

Interviewee B. thinks the car is too comfortable and accessible, making people lazy and physically inactive by replacing trips that could be cycled. Furthermore, if trains were locally accessible, she would take them over the car sometimes, allowing her to run errands instead of having to focus on driving.

For Z. and B., the best car trips are recreational, while for V. and husband/man T. it's tied between recreation and family visits. K. prefers work-related trips, whereas D., who commutes by train, prefers it for private, non-work trips, whether those are recreational, visits or doing groceries. W., O. and wife/woman T. have no preferred trip function.

Public transport

None of the Rutten interviewees uses public transport themselves, though W.'s brother and V.'s daughter do regularly as students with the *student travel product*, allowing free PT use. For all Rutten interviewees, the main issue with public transport is the low connection/accessibility from Rutten. Flexibility seems less of a concern. V. finds the frequency to be too low, while W. finds one bus an hour justifiable for the low use on line 77. He alongside Z. criticize the absence of any buses during evenings and weekends. Z. and W. find PT travel times (including overlays) too long. V. finds her

daughter has a decent travel time with the direct Lemmer-Leeuwarden bus line at 7.30 AM. At other times she needs to transfer onto the train, which takes longer. Z. also mentions travel times being far too high, though he does not mention overlays.

In Wolfheze, all but K. use public transport regularly, and D. even commutes by train (though his wife never uses PT). All interviewees are positive about Wolfheze's railway connection. K. have heard positive things from wife/woman K.'s clients and husband/man K.'s mother when visiting Wolfheze by train. Due to their work requiring both to drive a lot, they never use it themselves. PT users D., O. and T. all consider the half-hourly frequency and travel times sufficient. There are no complaints about reliability either. D. is fine with his daily commute's 5 minute overlay at Ede-Wageningen station, and O. finds one or two overlays acceptable up until 10 minutes. T. plan their train trips to have the best connection i.e. smallest overlay, sometimes leaving 15 to 30 minutes later for this.

Most household interviewees agree on PT costs being too high; this is mentioned by Z., W., V., D., O. and wife/woman T., despite Z., W., V. and D. all finding cars expensive too. For O., who is very cost-sensitive, driving is often cheaper, as he has a hybrid car powered by his own solar panels. Husband/man T. is not bothered by PT costs, due to many discount options. However, he does argue that free public transport would be *'een ultieme droom*' ('an ultimate dream') reducing car use, provided there will be improvements and extensions of the railways network.

Car trip routines

The three interviewees from Rutten-settlement Z., B. and W. all commute by car. Tuesday to Saturday, Z. drives his wife to and from her work so he can use the car in between, a short trip to Lemmer (5 km). Z. himself is largely retired, though he occasionally does work for which he visits a dozen of schools in Friesland province by car. B. works in Emmeloord (13 km), but has appointments for her work about three times a week to further places such as Ermelo or Almere (+- 75 km). Her husband works in Stroe, 125 km to the south. Both work and thus commute 4 full days a week.

W. lives with his parents and younger brother. Him and both parents have a car by which they commute to their jobs in neighbor regions. W. commutes to Kampen (36 km) 4 times a week and to Lelystad (49 km) once a week as a Provincial States member. His mother commutes to Heerenveen (30 km) 4 times a week, and his father to Vollenhove (27 km) 5-6 times a week. His brother only occasionally (2-3 times a month) borrows one of the cars to go to his Lemmer job.

V. (Rutten-countryside) and her husband both need the car for work. V. has appointments 3-4 times a week that can both be in Rutten or as far as IJsselstein (123 km). Her husband is a farmer who uses the car multiple times a day to travel to his plots or to appointments, needing direct car access to travel within the Rutten area at any time of day.

From Wolfheze, D.'s wife commutes to work by car in Doetinchem (46 km) twice a week (Tuesday and Thursday), whereas he commutes by train, working next to Utrecht CS. Husband/man and wife/woman T. have just retired; until a week before being interviewed, they owned a store in northern Arnhem (8,5 km) to which they commuted 5-6 times a week, usually with 1 car. Rather than commuting to a workplace, husband/man K. travels throughout 'all of central Netherlands' during weekdays for his job. His wife is self-employed, with both clients who visit her at home and clients that she visits by car throughout the country. O. and his wife are both retired and therefore do not have any work-related trips.

All interviewees drive for groceries, mostly on weekends. Now they're retiring, T. will mostly cycle for smaller groceries and only take the car once a week for major groceries. Rutten interviewees do groceries in Lemmer and/or Emmeloord, Wolfheze interviewees in Oosterbeek and/or Doorwerth,

except K., where husband/man picks up groceries after work depending on the direction he's driving home from, and the entire family does major groceries at the Odin in Ede on Friday evening.

Wife/woman K. occasionally takes the car with bad weather to get her son to school or swimming lessons, which they usually cycle to as both are within Wolfheze. No Rutten interviewees have young kids to drive to school, though V.'s daughter occasionally drives to college in Leeuwarden (56 km). As Wolfheze's church was recently closed, O. visits a church in Malburgen (southern Arnhem, 14 km) on Sundays. B. says that she 'really can't take the car', referring back to the laziness disadvantage she sees in cars, for a 150m trip to Rutten's church, but as church elder she does drive to meetings in the countryside.

Lastly, recreation and private visits are often done by car in both villages. Z. sports 3 times a week in Lemmer, for which he mostly uses the car. He however cycles on Friday evenings, when his wife visits her hobby in Urk (19 km). They both also regularly visit other people, which if it's outside Rutten's vicinity (e.g. Emmeloord) happens by car. B. does 'something fun' once a week, which can be as near home as Lemmer's beach or as far away as Groningen (85 km). W. uses the car recreationally 2-3 times a month, mostly for football or political activities. These trips can take from 50 up to 250 km retour (to + from). His brother also occasionally borrows the car for football, included in the 2-3 times a month. His mother (and often father), takes recreational trips 2-3 times a month, tours in the 50 km range. V. sports on the other side of Rutten's countryside on Thursday mornings, occasionally bringing her daughter along. Due to Rutten's large countryside area, she does this by car, as the distance is 8 km. On top of that, she says that she and her husband have an appointment each weekend, occasionally even 2, either a family visit or a recreational getaway.

D. goes on private visits about monthly, to places around the country. An example given is Vogelenzang, NH (119 km). About 4-5 times during summer, him and his wife take recreational trips to go cycling in another region. O. has 2 children in Amsterdam, and also frequents Utrecht. He makes visits about twice monthly, rotating between car and train based on whether he goes alone or with his wife. T. have many family members living in Drenthe and the western Netherlands. They haven't had much time for visits lately, but usually they make family visits 10-12 times annually. They also didn't have much time for recreation the past few years. Rather than long vacations, they would have 5-6 weekends a year with the caravan, to domestic destinations. This year, they have so far not had any getaway. As they are retiring, they plan to take long caravan vacations in the coming years.

Carsharing

W. and O. claim to be well-informed about carsharing, while B., V., D. and T. have heard of it but consider themselves not well-informed. Z. and K. weren't aware of carsharing at all. One of O.'s children is planning to lease a car from the business that he understood encourages lessees to offer their lease car for carsharing.

After being explained the carsharing concept, Rutten interviewees are split on whether it should be introduced locally. Z. doesn't believe in carsharing for a rural area like Rutten, though he's not against it in cities. B. and W. both coin a divide between residents working outside the area, and residents who don't. The former commute by car, making ownership necessary due to (near-)daily use, and carsharing for other trips redundant. This limits the potential carsharing pool to the latter, who use cars for not-so-frequent trips like groceries or visits. Despite this, W. would welcome a pilot with carsharing, as would V. Both believe carsharing can't be profitable in Rutten right now, eliminating market-led scenarios.

In Wolfheze, D., O. and T. support carsharing being introduced. For D., this is feasible in the short term, with enough carless households and households with 1 car like his. He believes carsharing

would be quicker than public transport and could even be used for urgent matters like hospital visits. O. thinks the village is too small, but mentions there will be new construction thus new residents, making for a larger user pool that would make it feasible. K. are sceptical due to the village's high car ownership level. However, husband/man K. thinks a share of the population would use it, as they have environmentalist ideologies; '*Er komen steeds meer mensen in het dorp wonen die de visie hebben, of die vanuit de Randstad komen en die heel erg milieubewust zijn.*' Translation: '*More and more are coming to the village that have the vision, or they're from the Randstad [urbanized west] and are very environmentally aware.*'

As for advantages, K., W., B., V., O. and husband/man T. mention costs being shared or reduced to usage costs as an advantage. For K., this would mostly apply to residents of the new aforementioned construction site, which includes many social housing units for whose residents car ownership is less affordable. Z., V. D., O. and T. also find carsharing more usage-efficient for if households occasionally need a (second) car. O. compares carsharing to farmer cooperatives to buy sparsely-used machines together, sharing the costs and making for more frequent use. Besides use- and cost-efficiency, V., O. and T. also attribute environmental benefits to carsharing.

All Rutten interviewees as well as O. and T. mention lower flexibility/freedom of movement as carsharing's main drawback. For O., this is only significant for urgent matters. He finds carsharing worth that drawback if it means he can switch away from ownership. W. personalizes his car to make himself comfortable and avoid back pains, a privilege that would be lost (or manually installed each time) with carsharing. Similarly, D. mentions some people feel uncomfortable driving strange cars, especially larger ones, though he has no issue with it. D. also doubts carsharing is practical for short trips such as doing groceries, due to the costs potentially being too high. T. instead finds carsharing inefficient for long trips, as the costs might increase for the car standing still while preventing others from using it, a disadvantage W. sees in carsharing for commutes.

V., O. and T. all mention car ownership-oriented attitudes as major obstacles for (local) carsharing. O. does however see a shift with people being more 'knowledge-sensitive' and environmentally aware. V. and T. also believe these trends will enable carsharing over time, with the latter comparing it to electric cars increasing.

Interviewees have different preferences in carsharing system, and some indicate personal preferences contradictory to what they find most feasible in their village. Z., W., D., O. and T. prefer professionally managed systems with standardized terms as to avoid conflicts between villagers/users. As W. puts it, '*dan heb je vooraf alles duidelijk en heb je achteraf nooit gezeik.*' ('then you have everything clear beforehand and no troubles afterwards'). This would likely be business-to-consumer (B2C) with fleets from the provider. This provider would likely not be a (major) commercial business due to unprofitability, but rather a local party such as the village interest organization, with management delegated to external professionals. W. and O. are also open to P2P carsharing, if it's top-down managed and standardized. Z. would only be interested in carsharing in a professional, commercial/corporate context ('*zakelijkheid*', '*bedrijfsmatig*').

K. prefer a more bottom-up peer-to-peer (P2P) system, exactly due to the flexibility to agree on terms together and an expected higher attachment to the cars. B. thinks a bottom-up provider, such as the village interest organization, would make carsharing feel more accessible and thus see higher utilization rates, regardless if the system is P2P or B2C with carsharing-specific cars from the provider. She however personally prefers B2C carsharing over P2P, as she feels this would cause less trouble in case of damage than if she lend a car from her neighbor.

Fractional ownerships seems 'irrelevant' to B. and K. in their small villages, while for V., fractional ownership with neighbors is the first preference, as she lives in the countryside and wouldn't want to go to the settlement to access a car. T. have it as their second preference after B2C, as their daughter has had experience on SnappCar (P2P) where she had to lend a car from a user outside Wolfheze. Similarly to V., distances to access cars is considered here. D. and O. reject fractional ownership as they find it too social and bottom-up, inciting conflicts.

In case of B2C carsharing, B., W. and T. prefer a roundtrip form to secure fleet sizes. The specific parking space within Rutten wouldn't matter for B., suggesting in-settlement floating, while T. finds Wolfheze too small for floating, and wants shared cars centrally located around the train station. D. and O. think one-way carsharing should be possible, if the village's fleet is manually restored afterwards. As O. says; '*Dan heb je gewoon mensjes nodig die de auto's terugbrengen op locatie. Dat is gewoon additionele kosten voor de gebruiker… Komt er een studentje hem weer terugbrengen, en die pakt de bus weer terug naar Arnhem. Dat kan.*' Translation: '*Then you just need people that return the cars on location. That's just additional costs for the user… A student comes to bring him back, then takes the bus back to Arnhem. That's possible.*' W. believes demand might be higher in weekends as the buses aren't running, and suggests a periodic fleet increase could be considered. Similarly, K. expect a peak during Friday evenings, when many families are expected to get groceries.

B. would favor an online system where she can find available shared cars in her vicinity on her phone. Similarly, D. and O. mention reservations should be made beforehand on an online platform, allowing users to then open the car with a card. W. suggests carpooling/ridesharing with shared cars between commuters going the same direction, a way for the commuter part of Rutten's population to incorporate carsharing into their lifestyle. Otherwise, commuters would occupy shared cars all day, burdening the carsharing network beyond its capacity.

As far as flexibility to adapt lifestyles for carsharing, Z. says he could cover for instance the occasional trips to various schools with carsharing, but without a car he would cycle to Lemmer for sports, as he does on Friday evenings. He however needs his own private car (he expects shared cars to be incapable for this) occasionally for deliveries for his wife's business on determined times, and for his part-time work visiting schools in Friesland. Instead of carsharing, he would also be able to borrow cars from family members nearby to for instance go to a wedding. Therefore, he considers carsharing redundant for him, even if he would not have a car.

If B. didn't need the car for work, she would be able and willing to cover her other trips (groceries, recreation) with shared cars. However, both her and her husband not only commute by car, but also have to be stand-by to be called up into work at any time, requiring both the flexibility to have direct access to a car.

W. says he doesn't have to drive to work, as work-from-home options have been enhanced since the pandemic. However, he prefers to be in the office, for the social interactions at work. He also has to drive for football. W. believes he could cover '100%' of his trips with carsharing, but believes this to be inefficient for commutes.

While V. will continue to drive, even to Lemmer for major groceries, all these trips can be covered with carsharing, including work-related appointments. For her husband, carsharing would not be practically possible, as he drives within the Rutten area multiple times a day. He needs the flexibility and freedom of movement of car ownership for his farm.

K. are tied to car ownership, both for husband/man K.'s work, for which he needs the car all day every day, and for wife/woman K.'s horses, as shared cars are usually too small to pull the trailer. Besides, they want their cars for urgencies (e.g. hospital visits, horse accidents).

D. needs the car to reach places less connected by public transport (e.g. Vogelenzang). He also needs a car for groceries, as he wouldn't want to take the Buurtbus with heavy bags. His wife could commute by train, but has an aversion to public transport. All obligatory car trips could be covered with carsharing, but D. doubts the price is worth this for a short trip to the supermarket and would rather delay groceries when his wife has the car.

O. claims all his car trips can be covered with carsharing or non-car modes, as he usually plans his (car trip) activities far ahead of time. In that case, he would use carsharing mostly during winter, and would cycle to intra-regional destinations like church during summer.

T. plan to travel a lot with their caravan for the next 5 years following their retirement. For this, they need their car to attach and drive. A shared car is not practical, efficient or affordable for this. At home they would only need to drive for the weekly major groceries and the occasional family visit. For these trips, carsharing could be practical. Therefore, they are interested in switching to carsharing after the next 5 years.

If they would engage in carsharing, it would have a supplementary function to all interviewees except O. and T. If he were to ever use carsharing, Z. would only use it for 'work-related' trips, referring back to his visits to schools. B. sees it the exact opposite; she could use carsharing for all car trips outside her work (her most frequent trips). For W., carsharing would be supplementary to public transport, as it would be used to drive to PT nodes for long trips, covering the 'first and last mile' within a broader, largely PT-based trip. As he would drop off the car picked up in Rutten at the PT node, he admits this would encompass one-way carsharing (whereas he earlier suggested mere roundtrips). It might also be used for short trips like football matches or groceries. For his brother, a non-car owner, this might be convenient. V. would be open to covering her own car trips with carsharing, if the car is available at or next to her countryside home, but her husband would still need his car for work. K. and D. would most likely use it for occasional cross-country visits. O. and T. would do away with their car and have carsharing, in combination with other modes, replace car ownership. As a car-hater, O. is interested in carsharing right now, whereas T. are interested in 5 years, after travelling a lot in their early retirement.

Municipalities

The interview with Rutten's municipality Noordoostpolder was conducted with a policy consultant for the physical environment. The interview with Wolfheze's municipality Renkum was conducted with alderwoman Daniëlle van Bentem, whose scope includes Mobility among other fields, and another interviewee, a mobility and traffic consultant.

Local mobility context

The Noordoostpolder sees traffic increase around its villages. Part of this is due to the villages still growing, but part also due to shrinking or already non-existing facilities. The E-bike so far has not had an observed influence on car trips; the car is still the 'go-to' in the municipality, a necessity in the villages. Due to a lack of local facilities and work opportunities, villagers tend to drive for many different purposes. For Rutten as northernmost village specifically, this travel is split between Emmeloord, the municipality's main town, and Lemmer, Noordoostpolder's northern neighbor, as Lemmer is closer to Rutten than Emmeloord (5 km against 13), whereas the other villages are largely Emmeloord-oriented, being located in a Christaller-inspired ring around Emmeloord as facilities

center. This could mitigate distances travelled, as (central) Emmeloord is further away from the other villages than (central) Lemmer is from Rutten. At the same time, it is the furthest away from Emmeloord, making for more car-dependency and longer distances when travelling there. As for interregional commuting, Noordoostpolder is an in-between area with commuters going in various directions; the Randstad (urbanized west), the north and the Zwolle region (southeast), with Zwolle recently increasing.

Despite its train station, Wolfheze is the most car-oriented village in Renkum municipality. Due to the many (semi-)detached houses, about 95% of the population has their own parking spot in front of their homes, a number higher than in the other villages. While some might be aware of the car's environmental downsides, they're more likely to switch to an electric car than to stop using/owning the car. Like in the Noordoostpolder, residents also travel for many different purposes, as there are few facilities or jobs in the village. This is expected to mostly take place by car. The E-bike so far has not had an observed influence on car trips, which might be partly attributed to the average age of Wolfheze residents being higher, making them less likely to cycle for groceries, for instance. For facilities such as the supermarket, Wolfheze residents rotate between the municipalities' various larger villages Oosterbeek, Doorwerth and to a lesser extent Renkum village, due to its central-northern position. One trend that has been noticed is that some PT users have bought a (second) car and switched to cars for their PT trips recently, due to the lower frequency and longer travel/overlay times during the pandemic.

While described as a *'nette bus*' (proper bus), the Noordoostpolder has received complaints from residents unhappy with line 77's low (hourly) frequency and bad connection to further lines (i.e. long overlays in Emmeloord and Lemmer). As for Wolfheze, residents have not complained about the municipally-organized Buurtbus, though alderwoman van Bentem expects that they would support a frequency increase from hourly to half-hourly if asked. Wolfheze sees high use of the Buurtbus due to the absence of larger bus lines and a necessity for residents of Het Schild (care center for blind people) and Pro Persona (metal health care center). While the larger bus lines are costly for the municipality, the Buurtbus does well financially.

Carsharing

Noordoostpolder's incumbent executive board refuse to include carsharing in their mobility policies in any capacity; they fully leave it to the market, to which carsharing is unappealing in the vast, low-density municipality. The interviewed consultant would have preferred municipal action on carsharing, as he expects carsharing in the villages to be unprofitable due to low utilization rates (e.g. one commuter who occupies the car all day), but environmentally efficient and feasible on government initiative, if well-communicated with residents. He believes that there are many opportunities for carsharing entirely dependent on the right communication approach, and even if poorly communicated, residents would at least not protest it. This would take the form of business-to-consumer (B2C) carsharing (with municipality-owned cars) with roundtrips to and from a village's mobility hub to be designated, so as to keep control of the system as municipality. For Rutten, the consultant prefers a mobility hub in the central village rather than the new multi-functional accommodation 'Het Klavier', so as to include bus stop Lemsterpoort, with new functions such as a package drop-off point. He believes peer-to-peer (P2P) and fractional carsharing should come from the residents themselves, and since Rutten residents haven't done so yet, he doesn't expect this in the future either.

So far, a few initiatives have developed in the municipality. In Emmeloord, the local entrepreneurial collective '*Pioniers van de Toekomst*' (Pioneers of the Future) have placed a few shared cars for (B2C) rent, which so far have not been running well yet. In Luttelgeest, a village closer in size to Rutten, the

village interest organization is researching options to lease a car to be provided for carsharing in the village. Lastly, there's plans for an apartment complex in southern Emmeloord with relatively little parking space, where residents are supposed to share the complex' cars.

In Renkum municipality, carsharing projects have started in the municipality's three larger villages Oosterbeek, Renkum and Doorwerth. All three are fractional in nature between neighbors and originate from the users themselves. The project in Renkum village was the first and regards a car fully bought, while those on Oosterbeek and Doorwerth started recently and have the car leased from a business they can call for accidents or maintenance issues. The municipality is willing to help facilitate these projects, e.g. providing a parking spot or electric charging point, but refuses to initiate projects or pay for the cars. Business initiatives have so far not appeared in Renkum municipality, though there are residents who lend GreenWheels B2C cars, presumably from Arnhem or Ede.

In Wolfheze, a large residential project is planned with 30% social housing and a total of 75% 'affordable' housing (below €355.000). This could attract many low-income and young starter households. As these groups have less financial means for (double) car ownership and the new generation is expected to be less car-oriented and more likely to use alternative transport modes, e.g. commute by train, this might create a sizeable pool for carsharing. Due to the residential project and other developments in Wolfheze, the municipality is making a new '*dorpsvisie*' (village vision) development plan with residents. During this procedure, villagers have posed shared mobility to be included in the document. While there were skeptic voices, leading to a discussion, ultimately the pro-sharing argument has prevailed into the document. Renkum's consultant believes that the system should be as comfortable as possible, to optimize the user pool and thereby the feasibility. This includes a flexibility 'similar to car ownership', meaning the system should be B2C with a one-way option. This would also allow for the easy linking of modes. It is acknowledged that this would complicate the business model with fluctuating fleet sizes at the station(s), thus this one-way option might be charged higher; '*maak even de vergelijking met een huurauto op vakantie. Als ik in Malaga kom en ik huur een auto, en ik lever hem weer in in Malaga, kost 'ie zoveel. Lever ik hem in in Sevilla, dan zegt de verhuurder ook van, oké Bart, dat is leuk, maar dan moet je 50 euro extra betalen. Da's een keuze.*' Translation: '*make the comparison with a rental car on holidays. When I come to Malaga and rent a car, and I return it in Malaga, it costs that much. If I return it in Sevilla, the renter says, fine Bart, but then you have to pay 50 euro's extra. That's a choice.*'

Surveys

Total numbers per individual statement

Representativeness of the responses (controlled-for demographic variables)

Compared to the total populations, women and high education levels are strongly overrepresented in both villages, while men, low and mid-tier education levels are underrepresented in both, with Wolfheze having 0 responses with low education level. No single response selected 'Other' for gender, turning the variable into a binary between male and female.

'Couples with children' households are overrepresented and one-person households are underrepresented in both villages. This is in line with the expected bias towards larger households due to multiple members of one household being able to respond. All 3 that have selected 'Others' in Rutten elaborate that they (still) live with their parents (i.e. 'couple with children' category), while all 3 under the 'Others' category in Wolfheze are couples whose children have left the house (i.e. couple, no children' category). Therefore, for the correlation analysis, their numeric values have been adjusted to 3 and 2 respectively (see appendix C for numeric values).

Data on age was skewed for measuring representativeness, as the background statistics include children and young adult ages that might not be driving (yet). Indeed, only 4% of Rutten and 3% of Wolfheze respondents are below 25. However, by comparing the three categories above 25, it can still be detected that ages 25-45 is strongly overrepresented in Rutten, while ages 45-65 are strongly overrepresented in Wolfheze. In both villages, the 65+ category is underrepresented. This might be attributed to lower online presence and/or digital skills, posing a selection bias (Parker et al., 2019), or to retirees driving and owning cars less. Other selection biases might explain the overrepresentation of women, who are more likely to cooperate with research, and of the highly educated, which too might be attributed to digital skills or comprehension ability of the statements (Parker et al., 2019).

Statements about the car in general

The car is considered a necessity to overwhelming majorities in both villages, though moreso in Rutten (91,1% in Rutten to 72,2% in Wolfheze). Smaller majorities (66,7% in Rutten to 58,3% in Wolfheze) enjoy driving the car, while 95% majorities in both agree the car offers them freedom of movement. Status seems less of a motivation, as only one-sixth in both villages think the car says a lot about someone's status.

Almost half of Rutten respondents find car ownership more expensive than they would be willing to pay if it wasn't a necessity, against less than one-fifth that does not. This statement is more divisive in Wolfheze, where one-third (strongly) agrees while a quarter (strongly) disagrees.

A quarter of Rutten respondents and half of Wolfheze respondents claim to be concerned about the impact cars have on the environment. None in Rutten and only 8,3% in Wolfheze choose the 'strongly agree' category. On the other hand, almost half in Rutten and about 30% in Wolfheze are not environmentally concerned. Furthermore, half of respondents in both villages claim that for short distances, they try to use other modes than the car as much as possible, while about 30% in Rutten and one-fifth in Wolfheze say not to do so.

Statements about public transport as an alternative

Only 6% of Rutten respondents use public transport regularly, against 83,6% who says not to do so. With Wolfheze respondents, the amount of regular users and non-(regular) users of public transport seems to be balanced with slightly more regular users (44,4% to 38,9%).

Rutten respondents are more negative on public transport services; the statements on public transport being too slow, having unfavorable schedules and having overlays as a huge drawback are all supported by a majority (resp. 58,2%, 58,2% and 52,3%), and disagreed upon by small minorities (resp. 13,5%, 10,5% and 15%). For Wolfheze, 44,4% (less than in Rutten) finds public transport too slow, 25% (more than twice less than Rutten) finds the schedules to be unfavorable, and a 57,1% majority considers overlays a huge drawback (slightly more than in Rutten).

Statements about carsharing

About one-third of respondents claim to be informed about carsharing and one-third claim to not be in both villages. 50,7% in Rutten and 40% in Wolfheze expect to prefer carsharing over public transport, against 18% in Rutten and 25,7% in Wolfheze who expect not to. 43,3% in Rutten and 25% in Wolfheze dislike the idea of using cars also used by others outside one's household, while 29,9% in Rutten and 41,7% in Wolfheze does not.

28,8% of respondents in Rutten and 13,9% in Wolfheze would prefer to lend a car from a private owner (P2P) over a business fleet (B2C), while over 40% wouldn't in both. 18,4% in Rutten and 16,7% in Wolfheze would give up the assurance of a retour trip if they didn't have to return the car to the pick-up location, while 43% in Rutten and 58,3% in Wolfheze wouldn't, implying a preference for roundtrips over one-way B2C trips.

A three-fourth majority in Rutten and four-fifth majority in Wolfheze considers user comfort would an important factor in their consideration for carsharing. Further, to 44% in Rutten and 58,3% in Wolfheze, sustainability would be a reason to consider (electric) carsharing services, while for 27,2% in Rutten and 27,8% in Wolfheze this would not be a factor.

About 50% of respondents in Rutten and 40% in Wolfheze believe carsharing to be incompatible with their agenda and/or obligations, while only a quarter in Rutten and one-third in Wolfheze does not expect this. Regardless, about 40% in Rutten and 50% in Wolfheze claim that they would 'probably' use shared cars if they became available in their direct surroundings of 500 meters, while 36,9% in Rutten and 30,5% in Wolfheze claims they would not.

While seeming open to carsharing services, respondents show a persistent attachment to car ownership. If they were to use carsharing services, only 19,7% and 30,5% of respondents in Rutten and Wolfheze respectively would consider selling their car; large majorities (resp. 65.1% and 61,2%) would not. About 30% of respondents in Rutten and 40% in Wolfheze claim that they would prefer carsharing over ownership if this becomes a less expensive option accessible to them, while about 40% in Rutten and 50% in Wolfheze wouldn't. To the last statement, 'Carsharing seems a good alternative to owning a car to me', 40,9% (strongly) agrees, while 28,8% (strongly) disagrees and 30,3% neither agrees or disagrees in Rutten, while in Wolfheze 44,4% (strongly) agrees, while 33,3% (strongly) disagrees and 22,2% neither agrees or disagrees.

Correlations between variables (Excel correlation matrix)

	Village	Age group	Gender	ucation lev	usehold fo	unction pre	itivity (car i	awareness	-orientedn	PT use	PT services	dness (use	Informed	B2C prefe	omfort sen	ing private	flexibility p	nness vacu	ess compa
Village	1																		
Age group	0,174093	1																	
Gender	0,082745	0,087965	1																
Education	0,316417	-0,243	-0,03537	1															
Household	-0,26718	-0,36146	-0,05837	0,113283	1														
Work func	-0,18859	-0,19474	-0,2253	0,050175	0,140859	1													
Cost-sensi	-0,12923	0,055817	0,085652	0,04001	-0,05272	0,105134	1												
Environme	0,187617	0,07229	0,274796	0,260427	-0,1601	0,023665	0,464334	1											
Car-orient	-0,26243	-0,28774	-0,24287	0,150531	0,179591	0,128798	-0,08588	-0,2537	1										
PT use	0,46977	0,030368	0,033514	0,089102	-0,0811	-0,07531	0,04325	0,060887	-0,28868	1									
PT services	0,159131	0,250505	0,058186	-0,19219	-0,25192	-0,18452	-0,00159	0,082467	-0,31487	0,157011	1								
PT-oriente	0,309863	0,230241	0,061382	-0,13754	-0,24951	-0,18664	0,015197	0,091657	-0,38633	0,507911	0,930083	1							
Informed	0,06228	-0,07611	0,032795	0,092831	0,096234	0,029997	0,165413	0,166755	-0,03797	0,118493	0,04286	0,076585	1						
P2P > B2C	-0,11653	0,152552	0,000366	-0,12592	0,028071	0,1293	0,134304	0,047204	0,008881	-0,17301	0,030142	-0,04367	-0,02678	1					
User comf	0,046644	-0,0593	-0,03484	0,244536	-0,02545	0,201009	0,411679	0,362807	0,167511	0,039901	-0,22104	-0,18089	0,06791	0,080609	1				
Selling priv	0,094064	0,10769	0,218629	0,099071	-0,19561	-0,06651	0,356953	0,491543	-0,36994	0,211064	0,080108	0,144562	0,095283	-0,00889	0,198448	1			
One-way f	-0,11236	0,097363	-0,00739	0,006309	-0,09781	-0,08823	0,135922	0,241007	-0,07698	-0,06597	0,03718	0,003906	0,056939	0,056534	0,138106	0,146649	1		
Openness	0,095843	0,070273	0,213253	-0,01945	-0,09626	-0,02475	0,380984	0,515095	-0,40648	0,263263	0,271158	0,328963	0,161239	0,168381	0,290172	0,589824	0,261908	1	
Openness	0,052579	0,024979	0,231596	0,038533	-0,06965	-0,03381	0,430806	0,547508	-0,37033	0,234107	0,183661	0,241507	0,171575	0,167541	0,327274	0,642887	0,299843	0,973561	1

Correlation
>0,5
0,25-0,5
0,1-0,25

Figure 3 Correlation matrix (combined table)

Differences between the two villages

Wolfheze respondents are far more likely to use public transport services, with a 0,47 correlation between village and PT use. The lower correlation for PT services (rating) at 0,16 balances the PT-orientedness (subset combining use and service rating) out to a 0,31. Rutten respondents are instead more car-oriented, with a correlation of -0,26. As for differences in controlled-for demographic variables, the village variable sees a 0,32 correlation with education level, 0,17 with age, 0,08 with gender and -0,27 with household form. Wolfheze respondents are thus generally higher educated, older, more often female and have smaller households.

Wolfheze respondents are more open to carsharing, with a 0,10 correlation to the subset 'openness in a vacuum'. The subset 'openness comparative', which adds in statements 2 and 11, comparing carsharing to public transport and car ownership if carsharing becomes more affordable, shows a smaller correlation at 0,05. This links back to Rutten respondents' lower PT-orientedness and higher cost-sensitivity (-0,13). Wolfheze respondents are slightly more informed about carsharing (0,06) and more sensitive to user comfort (0,05), whereas Rutten respondents have stronger preferences for P2P over B2C carsharing (-0,12) and one-way carsharing's flexibility over the (roundtrip) assurance of a retour ride (0,11).

Controlled-for demographic variables

Older age groups are noticeably less car-oriented (-0,29) and more PT-oriented (0,23), which mostly stems from a more positive rating of the services (0,25). Regarding carsharing, age correlates with a higher openness to carsharing, with a 0,07 correlation in a vacuum and a 0,02 correlation for 'openness comparative'. Here again, the gap closes when being compared to public transport and a scenario with more expensive car ownership. Age also correlates with being slightly less informed about carsharing (-0,08) or sensitive to user comfort (-0,06), and a stronger preference for P2P over B2C carsharing (0,15) and one-way carsharing's flexibility over the (roundtrip) assurance of a retour ride (0,10). Older respondents are more likely to consider selling their car in case they would engage in carsharing (0,11).

Women, the highest value in the gender variable due to the absence of 'Other' entries, are less car-oriented (-0,24), more environmentally aware about car use (0,27) and have less of a preference for work-related car trips (-0,23). They are more open to carsharing, which increases from the vacuum to the comparative subset (0,21 to 0,23). They're also more likely to consider selling their car if they were to engage in carsharing (0,22).

Higher education levels correlate with environmental awareness about car use (0,26), yet they also correlate with higher car-orientedness (0,15). PT use correlates positively to education level (0,09), but PT service ratings negatively (-0,19). Education level correlates slightly negatively to openness in a vacuum (-0,02), but slightly positively to openness comparative (0,04), which might be attributed to the judgement on PT services and slightly stronger cost-sensitivity (0,04). The higher educated are more informed about carsharing (0,09) and more likely to consider selling their car when carsharing (0,10), while they less often prefer P2P carsharing (-0,13).

Larger households are more car-oriented (0,18) and less environmentally aware about car use (-0,16). They have a stronger work-related trip preference (0,14), are less likely PT users (-0,08) and rate PT services far lower (-0,25). While more informed about carsharing (0,10), they're less open to it (-0,10 in a vacuum, -0,07 comparatively). They're less likely to prefer one-way flexibility (-0,10) and even less likely to consider selling their car if they were carsharing (-0,20).

From the individual tables for both surveys, the correlations of residence within village has been investigated through two individual matrixes. For Rutten, there's a strong positive correlation with car-orientedness (0,37), implying the countryside, the higher value in the binary, is more car-oriented than the settlement. At the same time, environmental awareness about car use also correlates positively (0,14), as does a preference for work-related trips (0,14) and cost-sensitivity (0,07). PT use is lower in the countryside (-0,05), as is the rating of PT services (-0,08). Regarding carsharing, countryside respondents are less informed about it (-0,15) and less open to it, with both subsets having a -0,09 correlation. They are more sensitive to user comfort (0,11), less likely to sell their car when carsharing (-0,07) and less likely to prefer one-way carsharing (-0,07).

For Wolfheze, where 'south of the railroad' is the higher value, cost-sensitivity is positively correlated (0,14). Despite environmental awareness about the car being lower south of the railroad (-0,04), car-orientedness is lower as well (-0,03), while PT use is a lot higher (0,17). Respondents south of the railroad claim to be more informed about carsharing (0,14) and more open to it (0,16 in a vacuum, 0,18 comparatively). They are more likely to sell their car if they were carsharing (0,17). The preference for P2P carsharing seems higher north of the railroad (-0,09), as does the preference for one-way flexibility (-0,04).

Correlations between statements/subsets about the car in general and statements/subsets about carsharing

A preference for work-related trips correlates to larger sensitivity to user comfort (0,20), a smaller likeliness to consider selling one's car if they were carsharing (-0,07), a higher preference for P2P over B2C carsharing (0,13) and a lower preference for one-way carsharing's flexibility over the (roundtrip) assurance of a retour ride (-0,09). The correlation with openness is minor and negative (-0,02 in a vacuum, -0,03 comparative).

Cost-sensitivity shows a strong positive correlation to openness, especially comparatively (0,38 to 0,43). Furthermore, there are strong positive correlations to user comfort sensitivity (0,41) and considering selling one's car if they were carsharing (0,36). The level of being informed about carsharing shows a correlation of 0,17, while the preference for P2P carsharing and preference for one-way flexibility both positively correlate as well (resp. 0,13 and 0,14).

Const-sensitivity also strongly correlates (0,46) with the level of environmental awareness about car use. Environmental awareness then, shows a -0,25 negative correlation with car-orientedness and a very high correlation with openness to carsharing, 0,52 in a vacuum and 0,55 comparatively. Like cost-sensitivity, this subset has high correlations to likeliness to consider selling one's private car when carsharing and user comfort sensitivity (resp. 0,49 and 0,36). The correlation to being informed

about carsharing is 0,17. The preference for one-way flexibility correlates strongly at 0,24, while the preference for P2P carsharing is less strongly correlated at 0,05.

Car-orientedness shows a strongly negative correlation to openness to carsharing, with -0,41 in a vacuum and -0,37 comparatively. The correlation with likeliness to sell one's car is also strongly negative at -0,37. User comfort sensitivity is positively correlated at 0,17, while the preference for one-way flexibility is negatively correlated at -0,07.

Correlations between statements/subsets about public transport and statements/subsets about carsharing

Public transport users are more likely to be informed about carsharing (0,12) and more open to it (0,26 in a vacuum, 0,23 comparative). They are more likely to sell their private car if they were carsharing (0,21) and less likely to prefer P2P over B2C carsharing (-0,17) or one-way carsharing's flexibility over the (roundtrip) assurance of a retour ride (-0,07).

The rating of PT services shows a strongly positive correlation with openness to carsharing, although this decreases when comparative statements are taken into account (0,26 to 0,18). User comfort sensitivity shows a strong negative correlation at -0,22, while the likeliness to sell away one's own car correlates positively at 0,08.

Discussion

Research question 1 What are the views and attitudes of rural Dutch drivers towards carsharing?

In line with Kroesen & van Wee's 2021 survey among young Dutchmen, carsharing is mostly seen as additional to ownership, rather than a full, independent mode replacing it. Over 60% of respondents in both villages wouldn't consider selling their car if they engaged in carsharing. Similar results were shown from the interviews, where only retiree households O. and T. would sell their private car. While Kroesen and van Wee's 'carsharing user' perspective had a stronger financial than environmental incentive, this research shows a stronger correlation of openness to carsharing with environmental awareness than with cost-sensitivity, though both correlations are sizeable. As expected, openness comparative shows lower correlations than openness in a vacuum for the PT subsets, but higher correlations for cost-sensitivity.

The survey and the household interviews showed that respectively car-orientedness and ownership diminishes interest. Car-orientedness had a -0,41 correlation with openness to carsharing in a vacuum and -0,37 with openness to carsharing comparatively to other modes. Interviewees B. and W. mentioned carsharing being redundant for Rutten's commute-drivers, and K. explicitly brought up the high ownership levels in Wolfheze. This links back to the 'performance expectancy' (Silberer et al, 2022) being lower for car owners. Furthermore, 3 interviewees mentioned car-oriented attitudes as an obstacle for carsharing (in their village) themselves.

The suggested social element to rural carsharing from Silberer et al. (2022) has not been observed. A majority of household interviewees want a carsharing network to have professional management and standardized terms, to prevent conflicts between villagers/users. Interviewee W. does suggest a ridesharing option, but for practical purposes with commutes rather than social.

The survey showed that residents in both villages vary in awareness of and attitudes towards carsharing. Consistently, Wolfheze gave higher levels of openness than Rutten. Wolfheze residents also requested shared mobility themselves when discussing the new village vision with the municipality. This might be attributed to Rutten's generally stronger car-orientedness; the car is considered a necessity more often and sees more respondents enjoy driving. Considering the bidirectional relationship between use and positive attitudes towards a transport mode (Kroesen et al., 2017), the significantly lower use of public transport in Rutten compared to Wolfheze (6% against 44,4%) might explain this stronger car-orientedness. However, Noordoostpolder's consultant poses that communication and information can make a major difference in carsharing opportunities for car-oriented villages like Rutten.

Besides Wolfheze's higher PT access through its station, higher PT use also derives from Wolfheze's higher average age and presence of two care centers, as mentioned in the municipality interview; age group showed a negative correlation with car-orientedness and positive correlation with PT-orientedness. Many elderly sell their car, increasing (rural) demand for public transport that could also be partially covered by carsharing services. This showed when discussing Wolfheze's Buurtbus with the municipality or talking to local retirees O. and T., who frequent the train and would like to in time trade their private car for carsharing. It follows that older age groups and PT users are more open to carsharing due to lower ownership.

As for other controlled-for demographic variables, women too are more open to carsharing, which can be explained by lower car-orientedness and higher environmental awareness. Larger households correspond to higher car-orientedness and lower environmental awareness, making them less open

to carsharing. These households tend to have more (non-driving) members, making cars more of a practical necessity, and as mentioned by V. and O., more affordable compared to public transport than for those who live i.e. travel by themselves or as a mere couple. The higher educated are more car-oriented (0,15), yet at the same time more environmentally aware of it (0,27) and more informed about carsharing (0,09). As a result, education levels show little correlation with openness to carsharing either way, being negative -0,02 in a vacuum and positive 0,04 comparative to other modes.

In Rutten, the 'location within residence' variable measured the difference between the medium-density settlement (the village in a narrow sense), and the low-density 'countryside' (farmlands). Countryside residents are more car-oriented than settlement residents, despite being more environmentally aware of it. Living in a vast farmland, often kilometers from Rutten-settlement, they are tied to owning and driving cars as they have to be self-reliant in their mobility. With residents often being self-employed farmers leasing plots around the Rutten area, their job tie them to car ownership as well, as is the case for V.'s husband. V., the only countryside interviewee, was the most open to covering her trips with carsharing of all Rutten interviewees, whereas she knew her husband will always need his own car.

Household interviewees were more likely to recognize cost-efficiency and linked general usage-efficiency as carsharing advantages than environmental targets, though these were brought up to a lesser degree. As for the disadvantages, decreasing freedom of movement and flexibility were mainly mentioned, which tie back into the motivations for rural households' high car use and low PT use. Direct, flexible car access is valued highly, as 6 of the 8 household interviewees brought this up. User comfort as a disadvantage was also brought up by W. and D.

Research question 2 To what extent are the different systems of carsharing fit for successful, efficient exploitation in rural Dutch areas?

While most literature pointed at peer-to-peer (P2P) carsharing being more feasible in rural contexts and business-to-consumer (B2C) carsharing being more contained to cities, there hasn't been any observed preference for P2P carsharing over B2C carsharing. The survey had 28,8% of Rutten and 13,9% of Wolfheze respondents preferring P2P carsharing over B2C carsharing, while over 40% explicitly disagreed to having this preference. From the interviews, most would rather gravitate towards B2C than P2P carsharing. 5 out of 8 household interviewees believed a local carsharing network to be most feasible with professional management and standardized terms, of which 3 explicitly want (business) fleet cars, with two others open to standardized, professionally managed P2P platforms. Household interviewees consider the social elements of many P2P and fractional ownership networks as conflict catalysts that should be avoided. Only K. explicitly preferred to base the system on personal relations and agreements, whereas for V., fractional ownership between neighbors was the only way to make carsharing feasible due to living on a farm. While B. believed top-down organization to be more appealing to Rutten residents, she herself also preferred B2C carsharing.

Interviewees acknowledged the lack of profitability for businesses to serve the villages. K., O. and Renkum municipality all saw market opportunities in Wolfheze's proposed new construction site, which will include many social and affordable housing units, expected to attract low-income residents and train-commuting starters that might be less car-oriented than previous generations. Furthermore, interviewees suggested for the system to be initiated locally (e.g. the village interest organization buying cars and hiring third-party managers) or municipally. Noordoostpolder municipality's consultant believes in a municipally-operated B2C system to cover for the lack of

commercial operators, and another Noordoostpolder village's interest organization is trying to lease their own shared car to lend out to villagers.

Within B2C carsharing, roundtrip forms seem preferred. Only 18,4% of Rutten and 16,7% of Wolfheze survey respondents would 'give up the assurance of a retour trip' for the flexibility to not have to return the car to the pick-up location, against 43% and 58,3% respectively who would not. 3 household interviewees explicitly preferred roundtrip carsharing to ensure fleet sizes, while D. and O. believe one-way carsharing is possible, provided that the cars are returned by someone else to fill the village's fleet. Of expert interviewees, Noordoostpolder's consultant supports roundtrip carsharing to keep control over the system, while Renkum's consultant supports a one-way option to increase carsharing's appeal. Both the consultant and O. explicitly mention this option to charge the user for the extra operational expenses.

Pro-roundtrip interviewee W. pointed out that (roundtrip) carsharing is inefficient for commutes. Commuters can't drop off their car during their workday, increasing their costs and making the cars unavailable for other users. W.'s solution is a carsharing-ridesharing hybrid model for commuter trips. The commuter issue could also be alleviated with one-way carsharing. Referring back to Illgen & Höck (2020), one-way B2C carsharing with rural-urban trips can increase utilization rates i.e. efficiency by increasing urban fleet sizes temporarily. Furthermore, it requires lower fleet sizes (Nourinejad and Roorda, 2015). Interestingly, W. himself mentioned later in the interview to prefer carsharing to cover the first and last miles to and from PT nodes for longer trips, suggesting one-way trips for modal links as Renkum's consultant proposed. However, to temporarily increase urban fleet sizes and allow commuters to drive home after work, the operator shouldn't return every car to the village directly as proposed by pro-one-way interviewees, but rather connect the village station to stations in the city, ensuring a minimum capacity at the village's station rather than direct compensation to full capacity. This might integrate the network with a larger commercial urban network.

Besides commuting's claim on the fleet, W. and K. mentioned the possibility of demand peaks at respectively the weekends, as Rutten has no bus then, and Friday evening, as many families might do groceries. This might suggest a periodically fluctuating (minimum) fleet size.

As for fractional ownership, only V. preferred this measure, so that the shared car could be exclusively shared with and thus available at her neighbors' homes. Providing carsharing in one's direct surroundings, as suggested in Kroesen and van Wee's (2021) survey (translated into the survey used in this thesis) and Silberer et al.'s (2022) preferred 'facilitating conditions', would be unfeasible in Rutten-countryside and similar agricultural areas through other systems, as even the settlement is out of walking distance for most residences and densities are too low for stations or a P2P supply. Furthermore with P2P, the provider can't ensure a set number of nearby cars in settlements either, leading to situations like T.'s daughter being sent to non-Wolfheze users. The lower geographical embeddedness that enables rural carsharing access currently (Meelen et al., 2019) becomes a downside once the services are used.

This implies a population (density) threshold above which (non-profit) B2C is the most preferrable and practical system and below which fractional ownership is the only practical possibility, with P2P never being the most preferrable or practical in rural contexts. While in Rutten the divide is between settlement and countryside, fractional ownership might also be more attractive for smaller villages than Rutten and Wolfheze; the fractional-esque 'grass-root cooperative carsharing' projects researched by Shibayama et al. (2013) served 3 villages in the 600-1.000 inhabitants range.

Research question 3 What are the mobility routines, opportunities and constraints of rural Dutch households, and to what extend can these be adapted for and served by carsharing?

With half of Rutten and 40% of Wolfheze survey respondents believing carsharing to be incompatible with their agenda and/or obligations, it shows mobility routines and constraints to their flexibility are very relevant to rural carsharing opportunities.

From the household interviews, driving is required for three main groups of functions; work-related (commutes and trips for/during work), groceries and private trips (e.g. visits, recreation). Due to the latter being the least frequent and often having a variety of interregional destinations, interviewees seemed most open to using carsharing for these private, occasional trips like visiting family members or having a day trip to a recreational location, for which driving is often more convenient than public transport. D. had his doubts on carsharing's cost-efficiency for groceries as a short trip, but most other interviewees were open to covering this function too.

Work-related trips are the most car-dependent and the most complicated to cover with carsharing. Due to their generally larger distances than groceries, covering commutes with other modes is (near) impossible, besides for D., who works next to Utrecht Central Station. The same is true for K. and V.'s work-related trips. V.'s husband also needs the car as a farmer within the Rutten area. Due to their high frequency, both commutes and other work-related trips are less practical to cover with carsharing. Many interviewees were unwilling, if not entirely unable to cover their work-related trips with carsharing. In fact, the two households willing to replace ownership with carsharing, O. and T., are retirees.

From a time-geographical perspective, as expected, coupling constraints (obligations to travel to specific locations at specific times) were mainly found. Besides the routines i.e. set (compulsory) trips assessed, one might also consider the need for flexible freedom of movement as a coupling constraint. B., her husband and V.'s husband all need direct, flexible car access at any time for work. Besides, car ownership's flexibility is valued for urgent matters, like a horse accident for wife/woman K. Only D. considered carsharing useful for urgent matters, assuming customers don't have private cars available and comparing it to public transport.

Authority constraints have not been found at all, but some capability constraints have emerged from household interviewees' comments, showing households' awareness of them. T. and V. hint that minor groceries can be done by bike, but major groceries require a car. This implies a constraint to the body to carry heavy bags on a bike or in the bus as mentioned by D. Z. too mentioned he needs his car for deliveries for his wife's business. He expected shared cars to not have enough capacity for this. Similarly, wife/woman K. mentioned that shared cars are too small to pull her horse trailer. The capability constraint here is extended from the body's carrying capacity to that of shared cars.

As capability constraints also include inability to be somewhere on time (with the available modes), complaints about (public transport) travel times are also capability constraints. These are also assessed in the surveys, where 58,2% of Rutten and 44,4% of Wolfheze respondents found them too slow. Furthermore, the absence of public transport in Rutten on weekends and evenings is a capability constraint, denying an option for movement through space. In case of local carsharing, the absence of shared cars to lend at certain times might also pose capability constraints.

Conclusion

This thesis employed interviews and surveys to provide insights into the opportunities for carsharing among rural Dutch households, using Rutten and Wolfheze villages as cases. Insights were delivered for three research questions;

1. What are the views and attitudes of rural Dutch drivers towards carsharing?

Rural Dutchmen vary widely in level of openness towards and awareness about carsharing. To most rural households, having a car is necessary to achieve a satisfying mobility level due to the speed and freedom of movement, making carsharing, if considered, additional to ownership. More car-oriented and car-owning rural drivers are generally less open to carsharing. Elderly and female drivers are more open to carsharing, whereas openness declines with household size. No significant relation to education level has been observed. Rural drivers recognize carsharing as usage- and cost-efficient, deterring households from buying a second or third car, and to a lesser degree as environmentally advantageous, but also perceive carsharing as less free and flexible, qualities that motivate rural drivers to car ownership. Communication and information is key to achieve efficient utilization rates.

2. To what extent are the different systems of carsharing fit for successful, efficient exploitation in rural Dutch areas?

Most rural drivers believe a local carsharing network should be professional and standardized, rather than social and bottom-up from within the community, to avoid conflicts between locals. Therefore, while carsharing businesses refrain from serving rural areas due to a perceived unprofitability, the business-to-consumer model seems the preferred (i.e. highest utilization rates) and practical system in villages. This could be provided by local non-profit entities substituting for 'business', most likely municipalities or village interest organizations. For drivers outside of village settlements however, this station will not be sufficiently nearby, making fractional ownership with neighbors the only practical carsharing option. Peer-to-peer carsharing is the least preferred, as this removes the provider's ability to ensure a standard capacity (fleet size) at a strategically-chosen central location (station), instead relying on undetermined levels of supply within undetermined vicinities from users. While B2C preferences gravitate towards roundtrips, a one-way option could be included, provided that cars be returned to the village to ensure a basic available fleet size. This one-way option optimizes flexibility increasing its appeal to car-oriented residents, enables links with other modes and enables commuters to drop cars off so they don't occupy them during the workday.

3. What are the mobility routines, opportunities and constraints of rural Dutch households, and to what extend can these be adapted for and served by carsharing?

Rural car trips largely cover 5 purposes; commutes, trips for/during work, groceries, (family) visits and recreation. Visits and recreation are private, infrequent and often interregional trips, able to be served by carsharing without major modifications. Due to grocery trips' short distances, they can be covered by bike. Cars may however be needed to carry larger grocery loads. Grocery car trips are also able to be served by carsharing. Commutes, the most regular trips, have long workdays in-between the initial trip and the return. Carsharing commutes would only be practical and usage-efficient with either one-way drop-offs near work or a ridesharing hybrid. Trips for/during work are frequent, have no set schedule and can vary widely in destination, urgency and distance, making carsharing impractical for these trips. The constraints identified are mostly coupling constraints (obligation to 'be somewhere' like work), with some capability constraints have been detected that oblige car use, such as the aforementioned burden to carry heavy (grocery) loads.

Implications

There are opportunities for carsharing among rural households, if provided in their nearby surroundings and with decent communication and information provided. Paradoxically, local social ties put villagers off from bottom-up carsharing, and peer-to-peer carsharing's lower geographical embeddedness becomes a downside when using the network. Referring back to Sarasini and Lagerland (2017), peer-to-peer carsharing also loses out to B2C in options for technological renewal i.e. electrification to achieve sustainability targets, making it an inefficient system policy-wise. The business-to-consumer model, which can ensure capacities and locations with provider-owned fleets (thus fully electrifiable), is preferred by villagers, whereas farmlands would practically require neighbor-based fractional ownership.

Like Kroesen and van Wee (2021) found for young Dutchmen, most rural residents would only opt for carsharing as an additional mode, often for occasional trips, and only few residents, usually retired, are willing to fully substitute car ownership with carsharing. Carsharing's weaker points, lower flexibility and freedom, regard the very attributes households value in cars. While the research's time-geographical dimension remains limited (see below), it did identify routines, coupling constraints obliging households to flexible and direct car access not ensured by carsharing, as well as some capability constraints for which they don't trust carsharing to alleviate them.

Households thus are unlikely to give up ownership entirely, and efforts to lower ownership (through carsharing) will only show limited results, deterring some households from getting a second or third car. Especially for work-related trips, car ownership is considered more practical than carsharing. Therefore, carsharing appeals less to those with long car commutes and other frequent work-related car trips, including farmers, and appeals more to demographics like retirees, starters and housewives/-husbands, whose lower car use and often frequent PT use shows relatively high resemblances to the urban pool that the current market gravitates towards.

Reflection on methodological approach, execution and limitations

This thesis has researched carsharing opportunities for rural Dutch households through a mixed methods approach. Both surveys and interviews saw a successful conduction and a smooth data analysis, providing diverse and useful data, but also met their fair share of limitations. The mixed methods approach was ambitious and broad for the research's scope, which led to suboptimal data collection, whereas data analysis went generally well.

The semi-structured interviews were not very concrete, with broadly formulated questions. This led to asymmetric data collection from question (mis)interpretations and the semi-structured approach to ask further on topics interviewees have more to say about. With the duration and depth of the interviews I ultimately got sufficient data for all interviewees on all prepared questions, albeit some with more elaboration than others. I had time to reframe the prepared questions if interviewees misunderstood, so a basic level of data for each question/code was ensured. Coding and analyzing went well and smoothly afterwards, with thematic hierarchy in the codebook leading to a clear data overview per RQ. Regardless, the semi-structured setup makes the findings' reliability suboptimal.

All interviews were conducted, transcribed and coded in quick succession within three weeks in June. Interviewees were willing participants, who were satisfied with the 30-40 minute interview length. Finding interviewees beforehand proved difficult however, stalling and accelerating the execution. I intended to interview various experts, approaching municipalities for local perspectives and carsharing firms for sector perspectives. As neither MyWheels nor SnappCar (respectively largest Dutch B2C and P2P firm) responded to my e-mails, I limited expert interviews to municipalities. Therefore, a commercial and in-sector perspective is missing, though both theory and muncipality

interviews imply a lack of profitability and some household interviewees told second-hand consumer experiences.

The surveys, as anticipated, suffered from error margins above the 10% threshold, but rather than both having 50 responses, Rutten has twice as many as Wolfheze (67 to 36), giving MPDP-based error margins of respectively 11,68% and 16,151%. This limits the survey's reliability, especially for Wolfheze. Surveys were spread through both villages' interest organizations' socials in May, but Wolfheze's took it off after a week with 12 responses for undisclosed reasons. I therefore gave more prominence to RQ 1 in the interviews, to compensate in case Wolfheze wouldn't provide enough survey responses. During the June interview phase, a local (non-interviewee) was willing to share the link in a 300-member village WhatsApp group, threefolding the response within 2 days. While selection biases were anticipated and the controlled-for demographic variables indeed spotted demographic disproportionalities, especially for education, no measures to correct other data for these biases were taken. Despite all setbacks, data analysis itself went well. Survey responses were transparently provided by Microsoft Forms, and directly exportable to Excel. In Excel, the correlation matrix was very straightforward to make and useful in identifying relevant correlations. The subsets have helped greatly in creating a more easily comprehensible overview.

In hindsight, I would have rather conducted a qualitative interview-based research than a mixed methods research. This would give me more time to focus on the interviews, allowing me to make them clearer and more structured, so as to collect more reliable and concrete data. Due to the villages' small populations, achieving responses high enough for error margins below 10% was found unrealistic early on, and accentuating on merely in-depth qualitative data might have led to a higher validity, and ironically, higher comprehensiveness.

Recommendations

Policy

Municipalities should initiate or encourage village interest organizations to initiate business-to-consumer carsharing services in villages. Informing and communicating with residents about carsharing is key to achieving sufficient utilization rates. The carsharing network should include one-way carsharing, allowing users to drop the car off at nearby PT hubs and in cities they commute to, possibly as a part of urban commercial networks, with a minimum number of cars ensured at the village station. Alternatively, a carsharing network could include ridesharing features to combine commutes. If the village interest organization functions as the provider 'business', a professional external party should be employed for management, so as to separate carsharing from local relations.

In agricultural countryside areas, carsharing is only feasible under neighbors-based fractional ownership. Even then, farmers need direct, flexible car access at all times, as do certain non-agricultural workers. Like public transport, carsharing will appeal to some rural demographics more than others, and is one of many tools to achieve sustainable mobility. Its enhancement in rural communities therefore requires integration and alternation with other options such as car electrification, ridesharing and public transportation.

Further research

This research's limitations to identify households' car trip routines have limited the depth of the findings. Further pioneer time-geographic carsharing research should prepare interviewees to identify their car trip routines beforehand so they can answer concretely, and anticipate a balance between different types of constraints, enabling visualizations like space-time prisms to create a

comprehensive overview of people's routines and constraints and relate it to carsharing opportunities.

Further carsharing research should also include insights from the carsharing sector and non-profit initiators such as the Luttelgeest village interest organization and the fractional ownership initiatives in Renkum municipality. By including communities of varying sizes and densities, the threshold for non-profit B2C being practically possible could be investigated. Research into optimal fleet sizes and how to determine these would be useful in determining efficiency. Lastly, research into the impact of communication and information about carsharing on rural communities' attitudes towards and use of the mode should be assessed.

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Appendix A Questions household interviews

1. How many household members do you have, and how many of them drive? What ages and gender are they?
2. What motivations do you have for driving?
3. What downsides do you find in car use and ownership?
4. What function do car trips preferably have for you?
5. Do any of you use public transport? How do you feel about its service in terms of travel times, overlays, reliability, schedules' flexibility, frequencies and connections and the costs?
6. Would you please tell me map your household's car trip routines on a recurring basis? For which activities do you take the car at what frequencies, and on which times of day?
7. To what extent are you informed about carsharing?

Explanation of carsharing mode

8. Do you believe carsharing should be introduced in your village?
9. What advantages and disadvantages do you see in carsharing?
10. Under which system (P2P, fractional or B2C) with what conditions would carsharing be compatible with your household's car routines and needs?
11. What activities and socialization obligations do you and your household have that constrain or force your household to car ownership? Which of these are flexible to change, specifically to allow for carsharing use?
12. If you were to use carsharing services, to what extent (supplementary or substituting) and for which activities would you use carsharing?

Appendix B Questions expert interviews with municipality representatives

1. Do shrinking levels and vicinities of facilities affect the amount, distances and/or nature of car trips of Rutten/Wolfheze residents?
2. Has the rise of e-bikes affected the amount, distances and/or nature of car trips of Rutten/Wolfheze residents?
3. What other factors and trends have you observed that affect the amount, distances and/or nature of car trips of Rutten/Wolfheze residents?
4. What functions do car trips serve for Rutten/Wolfheze residents (work, school, recreation, etc.)
5. How large is the demand for public transport? How does the municipality feel about the public transport facilities in Rutten/Wolfheze in terms of travel times, overlays, reliability, schedules' flexibility, frequencies and connections and the costs?
6. What are the attitudes of Rutten/Wolfheze residents to car use and ownership? What perks and drawbacks do they see in cars?

Explanation of carsharing mode

7. What experiences do you have with carsharing, and specifically carsharing projects in your municipality?
8. Do you believe carsharing is feasible in Rutten/Wolfheze?
9. Do you believe carsharing can be efficient in the transition to sustainable mobility with lower car use and ownership in your municipality and in Rutten/Wolfheze specifically?
10. How do you think introducing carsharing will be received by the residents in Rutten/Wolfheze?
11. Under which system (P2P, fractional or B2C) with what conditions (station-based or floating, one-way or two way, social element through e.g. ridesharing?) would carsharing be the most feasible and efficient in and fitting and compatible with the local mobility context in Rutten/Wolfheze?

Appendix C Survey questions & statements

Controlled-for demographic variables				
Variable	**Question**	**Answers**		**Values**
Age	Please indicate your age	Younger than 25		1
		25-45		2
		45-65		3
		65+		4
Gender	Please indicate your gender	Male		1
		Female		2
		Other		3
Educational achievement	What is the highest level of education you have followed?	Primary education, lbo, vglo, lavo, mavo, mulo or vmbo		1
		MBO, HAVO or VWO		2
		HBO or university		3
Household form	What kind of household do you live in?	One-person household		1
		Couple, no children		2
		Couple with children		3
		Single parent with children		4
		Other (***field to elaborate***)		5, unless the description fits one of the defined values
Residence within village	Where do you live in the village?	*Rutten*	In the settlement	1
			In the countryside	2
		Wolfheze	North of the railroad	1
			South of the railroad	2

Further survey entries were statements to be answered on a Likert scale with values 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree.

Variable	**Statements**	**Corresponding statement(s) Kroesen & Van Wee (2021)**
Statements about the car in general		
Necessity	The car is a necessity for me	1
Pleasure	I enjoy driving the car	2
Freedom	The car allows me the freedom to go and be where I want to be	3
Status	The car says a lot about someone's status	6
Use of alternatives	For short distances, I try to use other transport modes than the car as much as possible	4
Function	I prefer to use the car for work-related trips	7
Costs of ownership	I find car ownership more expensive than I would be willing to pay if it wasn't necessary	28/30

Environmental concerns	I am concerned about the environmental impacts of cars	40
Statements about public transport as an alternative		
PT use	I regularly use public transport	-
PT travel time	Travelling with public transport goes too slow (for my travel routine)	22/27/30
PT flexibility	Public transport schedules are unfavorable to me	24/25
Overlays	Overlays are a large drawback to public transport	-
Statements about carsharing		
Awareness	I am aware of and informed about carsharing	10
Carsharing vs PT	I expect to prefer carsharing over public transport	9
Sharing as an issue	I dislike the idea of using cars that are also used by others outside my household	33
Sharing with peers	I would accept sharing a car with an established group of peers	-
P2P vs B2C	I would prefer to lend a shared car from a private owner over a fleet	-
Comfort	User comfort would be an important factor in my consideration regarding shared car use	31/35
Sustainability consideration	Sustainability would make me consider using a (electric) shared car, if available	32/36/39/40
Compatible agenda	Carsharing to me seems incompatible with my agenda and/or obligations	19/35
Potential use	I would probably use shared cars if they become available within my surroundings (500 meters)	8
Carsharing substituting ownership	If I were to use shared cars, I would consider selling my privately-owned car	20
Costs consideration	I would prefer carsharing over ownership if this becomes an accessible, less expensive option	29
One-way vs roundtrip	I would give up the assurance of a retour trip if I would not be obligated to return a shared car to the pick-up location	-
Carsharing as alternative	Carsharing seems a good alternative to owning a car to me	19

Appendix D Table on total distribution of answers for the Rutten survey

Controlled-for demographic variables						
Age		**-25**	**25-45**	**45-65**	**65+**	
Please indicate your age	***Total***	3	30	24	10	
	%	4	45	36	15	
Gender		**Male**	**Female**	**Other**		
Please indicate your gender	***Total***	28	39	0		
	%	42	58	0		
Educational achievement		**Primary education, lbo, vglo, lavo, mavo, mulo or vmbo**	**MBO, HAVO or VWO**	**HBO or university**		
What is the highest level of education you have followed?	***Total***	4	24	39		
	%	6	36	58		
Household form		**One-person household**	**Couple, no children**	**Couple with children**	**Single parent with children**	**Other**
What kind of household do you live in?	***Total***	6	16	38*	4	3*
	%	9	24	57*	6	4*
Residence within village		**In the settlement**	**In the countryside**			
Where do you live in the village?	***Total***	38	29			
	%	57	43			

Likert scale statements						
		Strongly disagree	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
Statements about the car in general						
The car is a necessity for me	***%***	1.5	3	4.5	25.4	65.7
I enjoy driving the car	***%***	0	9.1	24.2	39.4	27.3
The car allows me the freedom to go and be where I want to be	***%***	0	1.5	3	24.2	71.2
The car says a lot about someone's status	***%***	13.4	32.8	37.3	13.4	3
For short distances, I try to use other transport modes than the car as much as possible	***%***	10.4	19.4	23.9	34.3	11.9
I prefer to use the car for work-related trips	***%***	9.1	22.7	25.8	28.8	13.6
I find car ownership more expensive than I would be	***%***	4.5	15.2	34.8	36.4	9.1

willing to pay if it wasn't necessary						
I am concerned about the environmental impacts of cars	*%*	19.7	27.3	27.3	25.8	0
Statements about public transport as an alternative						
I regularly use public transport	*%*	62.7	20.9	10.4	1.5	4.5
Travelling with public transport goes too slow (for my travel routine)	*%*	9	4.5	28.4	23.9	34.3
Public transport schedules are unfavorable to me	*%*	9	1.5	31.3	19.4	38.8
Overlays are a large drawback to public transport	*%*	7.5	7.5	32.8	28.4	23.9
Statements about carsharing						
I am aware of and informed about carsharing	*%*	7.5	28.4	29.9	28.4	6
I expect to prefer carsharing over public transport	*%*	9	9	31.3	34.3	16.4
I dislike the idea of using cars that are also used by others outside my household	*%*	3	26.9	26.9	28.4	14.9
I would accept sharing a car with an established group of peers	*%*	9	26.9	16.4	40.3	7.5
I would prefer to lend a shared car from a private owner over a fleet	*%*	12.1	28.8	30.3	22.7	6.1
User comfort would be an important factor in my consideration regarding shared car use	*%*	4.5	4.5	15.2	53	22.7
Sustainability would make me consider using a (electric) shared car, if available	*%*	13.6	13.6	28.8	37.9	6.1
Carsharing to me seems incompatible with my agenda and/or obligations	*%*	9.1	15.2	24.2	30.3	21.2
I would probably use shared cars if they become available within my surroundings (500 meters)	*%*	15.4	21.5	23.1	36.9	3.1
If I were to use shared cars, I would consider selling my privately-owned car	*%*	34.8	30.3	15.2	16.7	3

I would prefer carsharing over ownership if this becomes an accessible, less expensive option	*%*	27.3	13.6	28.8	25.8	4.5
I would give up the assurance of a retour trip if I would not be obligated to return a shared car to the pick-up location	*%*	21.5	21.5	38.5	16.9	1.5
Carsharing seems a good alternative to owning a car to me	*%*	16.7	12.1	30.3	37.9	3

***All 3 responses in the 'Other' value elaborate that they live with their parents, thus they would fit in the 'Couple with children' value, which would make for a total of 41 (61%) in the latter value**

Appendix E Table on total distribution of answers for the Wolfheze survey

Controlled-for demographic variables						
Age		**-25**	**25-45**	**45-65**	**65+**	
Please indicate your age	***Total***	1	7	23	5	
	%	3	19	64	14	
Gender		**Male**	**Female**	**Other**		
Please indicate your gender	***Total***	12	24	0		
	%	33	67	0		
Educational achievement		**Primary education, lbo, vglo, lavo, mavo, mulo or vmbo**	**MBO, HAVO or VWO**	**HBO or university**		
What is the highest level of education you have followed?	***Total***	0	4	32		
	%	0	11	89		
Household form		**One-person household**	**Couple, no children**	**Couple with children**	**Single parent with children**	**Other**
What kind of household do you live in?	***Total***	5	16*	11	1	3*
	%	14	44*	31	3	8*
Residence within village		**North of the railroad**	**South of the railroad**			
Where do you live in the village?	***Total***	17	19			
	%	47	53			

Likert scale statements						
		Strongly disagree	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
Statements about the car in general						
The car is a necessity for me	***%***	5.6	11.1	11.1	33.3	38.9
I enjoy driving the car	***%***	2.8	11.1	27.8	36.1	22.2
The car allows me the freedom to go and be where I want to be	***%***	2.8	0	2.8	41.7	52.8
The car says a lot about someone's status	***%***	27.8	25	30.6	13.9	2.8
For short distances, I try to use other transport modes than the car as much as possible	***%***	8.3	11.1	27.8	30.6	22.2
I prefer to use the car for work-related trips	***%***	19.4	30.6	25	13.9	11.1
I find car ownership more expensive than I would be	***%***	8.8	17.6	41.2	26.5	5.9

willing to pay if it wasn't necessary						
I am concerned about the environmental impacts of cars	*%*	22.2	8.3	19.4	41.7	8.3
Statements about public transport as an alternative						
I regularly use public transport	*%*	19.4	27.8	8.3	25	19.4
Travelling with public transport goes too slow (for my travel routine)	*%*	11.1	27.8	16.7	25	19.4
Public transport schedules are unfavorable to me	*%*	8.3	16.7	25	25	25
Overlays are a large drawback to public transport	*%*	5.7	17.1	20	40	17.1
Statements about carsharing						
I am aware of and informed about carsharing	*%*	5.6	27.8	30.6	22.2	13.9
I expect to prefer carsharing over public transport	*%*	14.3	11.4	34.3	37.1	2.9
I dislike the idea of using cars that are also used by others outside my household	*%*	13.9	27.8	33.3	11.1	13.9
I would accept sharing a car with an established group of peers	*%*	22.2	11.1	19.4	38.9	8.3
I would prefer to lend a shared car from a private owner over a fleet	*%*	19.4	22.2	44.4	11.1	2.8
User comfort would be an important factor in my consideration regarding shared car use	*%*	5.6	2.8	11.1	52.8	27.8
Sustainability would make me consider using a (electric) shared car, if available	*%*	16.7	11.1	13.9	44.4	13.9
Carsharing to me seems incompatible with my agenda and/or obligations	*%*	16.7	16.7	27.8	22.2	16.7
I would probably use shared cars if they become available within my surroundings (500 meters)	*%*	22.2	8.3	16.7	44.4	8.3
If I were to use shared cars, I would consider selling my privately-owned car	*%*	30.6	30.6	8.3	22.2	8.3

I would prefer carsharing over ownership if this becomes an accessible, less expensive option	*%*	22.2	27.8	8.3	33.3	8.3
I would give up the assurance of a retour trip if I would not be obligated to return a shared car to the pick-up location	*%*	27.8	30.6	25	16.7	0
Carsharing seems a good alternative to owning a car to me	*%*	25	8.3	22.2	33.3	11.1

***All 3 responses in the 'Other' value elaborate that they are a couple with children who have left the house, thus they would fit in the 'Couple, no children' value, which would make for a total of 19 (53%) in the latter value**

Appendix F Survey subsets

Title	Statements	reversed values
Statements about the car in general		
Work function preference	6	
Cost-sensitivity	7	
Environmental awareness (car in general)		
Car-orientedness	1-5	5
Statements about public transport as an alternative		
PT use	1	
PT services	2-4	2-4
PT-orientedness	1-4	2-4
Statements about carsharing		
Informed	1	
P2P > B2C	5	
User comfort sensitivity	6	
Selling private car	10	
One-way flexibility preference	12	
Openness vacuum	3, 4, 7-9, 13	3, 8
Openness comparative	2-4, 7-9, 11, 13	3, 8

Appendix G Combined correlation matrix for the surveys

Correlation
>0,5
0,25-0,5
0,1-0,25

	Village	*Age group*	*Gender*	*Education level*	*Household form*	*Work function preference*
Village	1					
Age group	0,174093	1				
Gender	0,082745	0,087965	1			
Education level	0,316417	-0,243	-0,03537	1		
Household form	-0,26718	-0,36146	-0,05837	0,113283	1	
Work function preference	-0,18859	-0,19474	-0,2253	0,050175	0,140859	1
Cost-sensitivity (car in general)	-0,12923	0,055817	0,085652	0,04001	-0,05272	0,105134
Environmental awareness (car in general)	0,187617	0,07229	0,274796	0,260427	-0,1601	0,023665
Car-orientedness	-0,26243	-0,28774	-0,24287	0,150531	0,179591	0,128798
PT use	0,46977	0,030368	0,033514	0,089102	-0,0811	-0,07531
PT services	0,159131	0,250505	0,058186	-0,19219	-0,25192	-0,18452
PT-orientedness (use+services)	0,309863	0,230241	0,061382	-0,13754	-0,24951	-0,18664
Informed	0,06228	-0,07611	0,032795	0,092831	0,096234	0,029997
P2P > B2C preference	-0,11653	0,152552	0,000366	-0,12592	0,028071	0,1293
User comfort sensitivity	0,046644	-0,0593	-0,03484	0,244536	-0,02545	0,201009
Selling private car	0,094064	0,10769	0,218629	0,099071	-0,19561	-0,06651
One-way flexibility preference	-0,11236	0,097363	-0,00739	0,006309	-0,09781	-0,08823
Openness vacuum	0,095843	0,070273	0,213253	-0,01945	-0,09626	-0,02475
Openness comparative	0,052579	0,024979	0,231596	0,038533	-0,06965	-0,03381

	Cost-sensitivity (car in general)	*Environmental awareness (car in general)*	*Car-orientedness*	*PT use*	*PT services*	*PT-orientedness (use+services)*
Village						
Age group						
Gender						
Education level						
Household form						
Work function preference						
Cost-sensitivity (car in general)	1					
Environmental awareness (car in general)	0,464334	1				
Car-orientedness	-0,08588	-0,2537	1			
PT use	0,04325	0,060887	-0,28868	1		
PT services	-0,00159	0,082467	-0,31487	0,157011	1	
PT-orientedness (use+services)	0,015197	0,091657	-0,38633	0,507911	0,930083	1
Informed	0,165413	0,166755	-0,03797	0,118493	0,04286	0,076585
P2P > B2C preference	0,134304	0,047204	0,008881	-0,17301	0,030142	-0,04367

User comfort sensitivity	0,411679	0,362807	0,167511	0,039901	-0,22104	-0,18089
Selling private car	0,356953	0,491543	-0,36994	0,211064	0,080108	0,144562
One-way flexibility preference	0,135922	0,241007	-0,07698	-0,06597	0,03718	0,003906
Openness vacuum	0,380984	0,515095	-0,40648	0,263263	0,271158	0,328963
Openness comparative	0,430806	0,547508	-0,37033	0,234107	0,183661	0,241507

	Informed	*P2P > B2C preference*	*User comfort sensitivity*	*Selling private car*	*One-way flexibility preference*	*Openness vacuum*	*Openness comparative*
Village							
Age group							
Gender							
Education level							
Household form							
Work function preference							
Cost-sensitivity (car in general)							
Environmental awareness (car in general)							
Car-orientedness							
PT use							
PT services							
PT-orientedness (use+services)							
Informed	1						
P2P > B2C preference	-0,02678	1					
User comfort sensitivity	0,06791	0,080609	1				
Selling private car	0,095283	-0,00889	0,198448	1			
One-way flexibility preference	0,056939	0,056534	0,138106	0,146649	1		
Openness vacuum	0,161239	0,168381	0,290172	0,589824	0,261908	1	
Openness comparative	0,171575	0,167541	0,327274	0,642887	0,299843	0,973561	1

Appendix H Correlation matrix for the Rutten survey's residence within village variable

	Residence within village
Age group	-0,06651
Gender	-0,05378
Education level	0,240582
Household form	0,016081
Residence within village	1
Work function preference	0,144575
Cost-sensitivity (car in general)	0,068611
Environmental awareness (car in general)	0,138406
Car-orientedness	0,370498
PT use	-0,04704
PT services	-0,08002
PT-orientedness (use+services)	-0,09155
Informed	-0,14723
P2P > B2C preference	0,007571
User comfort sensitivity	0,106485
Selling private car	-0,06714
One-way flexibility preference	-0,07399
Openness vacuum	-0,08889
Openness comparative	-0,08819

Appendix I Correlation matrix for the Wolfheze survey's residence within village variable

	Residence within village
Age group	0,178697
Gender	0,157378
Education level	-0,33443
Household form	-0,01738
Residence within village	1
Work function preference	0,014871
Cost-sensitivity (car in general)	0,142582
Environmental awareness (car in general)	-0,04479
Car-orientedness	-0,34734
PT use	0,174576
PT services	-0,11031
PT-orientedness (use+services)	-0,01508
Informed	0,142893
P2P > B2C preference	-0,0855
User comfort sensitivity	0,003096
Selling private car	0,166821
One-way flexibility preference	-0,04272
Openness vacuum	0,158178
Openness comparative	0,183852

Appendix J Codebook household interviews (in Dutch)

Name	Description
Auto-afhankelijkheid	
Auto-afhankelijkheid activiteiten en sociale verplichtingen	
bezoek visite	
boodschappen	
kerk	
kind naar school brengen	
onderwijs volgen	
recreationeel	
ritten voor werk	
urgente zaken	
woon-werkverkeer	
Auto-afhankelijkheid flexibiliteit	
met deelauto bereikbaar	
rit niet noodzakelijk	
zonder auto bereikbaar	
Geïnformeerd over deelauto	
beeld van deelauto	
ervaring mee	
niveau van geïnformeerd	
van gehoord of niet	

Name	Description
Mening introductie deelauto in dorp	
efficiëntie	
haalbaarheid	
ja	
nee	
rendabiliteit	
systeem en omstandigheden	
weet niet	
OV	
OV beoordeling	
aansluiting	
betrouwbaarheid	
flexibiliteit	
frequentie	
geluiden van anderen	
kosten	
overstappen	
reistijden	
OV gebruik	
gebruik door kinderen	
geen gebruik	
soms gebruik	
standaard gebruik	

Name	Description
studentenreisproduct	
Routines auto	
bezoek visite	
bestemmingen afstanden	
frequenties	
tijdstippen	
boodschappen	
bestemmingen afstanden	
frequenties	
tijdstippen	
kerk	
bestemmingen afstanden	
frequenties	
tijdstippen	
kind naar school brengen	
bestemmingen afstanden	
frequenties	
tijdstippen	
onderwijs volgen	
bestemmingen afstanden	
frequenties	
tijdstippen	

Name	Description
recreationeel	
bestemmingen afstanden	
frequenties	
tijdstippen	
ritten voor werk	
bestemmingen afstanden	
frequenties	
tijdstippen	
woon-werkverkeer	
bestemmingen afstanden	
frequenties	
tijdstippen	
Systeem en omstandigheden van voorkeur deelauto	
Omstandigheden van voorkeur deelauto	
door wie organisatie of eigendom	
flexibel afspreken of standaardiseren	
online systeem	
ophaalpunt	
overig	
sociaal aspect	

Name	Description
Systeem van voorkeur deelauto	
B2C	
Floating	
One-way	
Roundtrip	
Fractioneel	
Overig	
P2P	
Voor- en nadelen auto	
Motivaties voordelen auto	
gemak	
kosten	
noodzaak	
plezier	
praktisch	
status	
vrijheid flexibiliteit	
Nadelen auto	
files	
impact op klimaat	
kosten	
overig	
parkeerruimte	
Voor- en nadelen deelauto	

Name	Description
Nadelen deelauto	
beschikbaarheid vrijheidsbeperking	
hygiëne	
lager gebruiksgemak	
overig	
reserveringstijden	
Voordelen deelauto	
duurzaamheid	
efficiënt gebruik	
kosten	
minder parkeerruimte nodig	
Voorkeur functie autoritten	
bezoek visite	
boodschappen	
geen voorkeur	
kerk	
kind naar school brengen	
onderwijs volgen	
recreationeel	
werkgerelateerd	
Voorkeur functie deelauto	
activiteiten	
niveau	

Cases (correspond to controlled-for demographic variables)

Name	Description
Aantal leden	
1	
2	
3	
4	
5	
6+	
Aantal rijders	
1	
2	
3	
4	
5+	
meerdere rijders delen auto	
Geslacht	
Geslacht geïnterviewde(n)	
Geslachten in huishouden	
Leeftijden	
Locatie in dorp	
Rutten	
uit de woonkern	
van de buitenweg	
Wolfheze	

Name	Description
ten noorden van het spoor	
ten zuiden van het spoor	

Appendix K Codebook expert interviews with municipality representatives (in Dutch)

Name	Description
Autoritten bewoners	
Afstanden en bestemmingen autoritten	
Functies en aarden autoritten	
Hoeveelheid autoritten	
Ervaringen met deelauto	
Gemeentelijk beleid	
Gem. beleid deelauto	
Gem. beleid mobiliteit overig	
Gem. beleid overig	
Mening introductie deelauto in dorp	
Efficiëntie deelauto	
Haalbaarheid deelauto	
Verwachte ontvangst deelauto in dorp	
OV in dorp	
OV beoordeling	
OV gebruik	
Systeem en omstandigheden deelauto	
Omstandigheden deelauto	
Systeem deelauto	

Name	Description
Trends met invloed op autogebruik	
Trend E-bike	
Trend overig	
Trend voorzieningenpeil	
Voor- en nadelen auto volgens bewoners	
Motivaties voordelen auto bewoners	
Nadelen auto bewoners	

Cases

Name	Description
Titel functie in gemeente	