

Master's Thesis – Urban & Economic Geography

**Willingness to participate in carsharing: The
influence of cohousing and attitudes towards
shared facilities**



**Utrecht
University**

Author: Felix Zandanel (6460666)

Supervisor: Dea van Lierop

Second reader: Simon Scheider

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Abstract

This research investigates the willingness of both cohousing and non-cohousing residents to participate in carsharing programs, examining the effects of living in cohousing communities and attitudes towards shared facilities. Carsharing, as a sustainable transportation solution, reduces the need for private vehicle ownership, contributing to lower carbon emissions and space savings. The global trend indicates a significant increase in carsharing participation, particularly in metropolitan areas and countries like the Netherlands and Germany. Using survey data collected in the Netherlands, this research aims to determine whether living in cohousing environments, which are characterized by communal and ecological values, has a positive effect on the propensity to engage in carsharing. Additionally, it evaluates whether attitudes towards shared facilities significantly influence carsharing participation across both groups. Using ordinal logistic regression and descriptive analysis, the study analyses survey data to identify key determinants of carsharing adoption, encompassing various carsharing models such as Business-to-Consumer (B2C), Part Ownership, and Peer-to-Peer (P2P). The findings indicate that living in cohousing communities and positive attitudes towards shared facilities significantly increase the likelihood of carsharing participation. These insights can inform strategies to promote carsharing in diverse residential settings, enhancing sustainable transport behaviours and contributing to broader environmental goals.

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1. Introduction

Carsharing emerged as a new trend in the transportation sector, providing vehicle access through innovative sharing systems, gaining prominence in recent years (Prieto et al., 2017). This trend now has acquired immense popularity and rapid growth in metropolitan areas. Worldwide car-sharing members are estimated to grow from 123.4 million in 2022 to 269.4 million by 2027 (Berg Insight, 2023). Indeed, the number of vehicles in operation for car sharing is expected to increase from 575,000 in 2022 to just under one million by the end of 2027 (Berg Insight, 2023). Also, in the Netherlands, this trend is visible, with a noticeably increased number of shared cars in recent years. The number has grown from a modest 14,000 shared vehicles in 2015 to 87,825 shared vehicles by 2021, serving a user base of 971,000 individuals (Rijkswaterstaat Environment, 2022). This surge is most pronounced in densely populated urban areas, with cities like Utrecht and Amsterdam leading the charge (Rijkswaterstaat Environment, 2022). Not limited to the Netherlands, shared cars in Germany had reached some 5,000 units by 2012 and are projected to have increased to 33,930 by 2023 (CROW, 2023).

Moreover, several studies recognize car sharing as a sustainable transportation solution (Shaheen and Cohen, 2007, 2008; Firnkorn and Muller, 2011, 2012; Prieto et al., 2017). Car sharing goes beyond personal convenience, potentially replacing four to eight private vehicles per shared car (Rijkswaterstaat Environment, 2022). This not only reduces carbon emissions significantly—estimated at 175-265 kg CO₂ per year per car-sharing household—but also saves substantial space, with each shared car reclaiming 36-38 square metres (Rijkswaterstaat Environment, 2022).

Specific types of housing, like community-based living, may provide an ideal setting for the implementation of carsharing services. Namely, residents of community-based living concepts, such as cohousing, defined as "housing with common space and shared facilities" (Vestbro, 2010) may find car sharing especially attractive, as it aligns with their lifestyle preferences. Research conducted by Clark (2021) shows that shared values among cohousing residents are often centred around ecological living. Cohousing communities actively embrace sustainability through the adoption of eco-friendly technologies, thus promoting a greener lifestyle (Marckmann et al., 2012). Additionally, studies by Wang et al. (2020) further underscore the social and sustainable values inherent in cohousing, which tend to attract like-minded individuals. Furthermore, cohousing residents integrate renewable energy technologies and energy-saving designs, such as high levels of insulation (Clark, 2021). In addition, carsharing is already often strategically positioned nearby cohousing, either due to limited parking availability or to preserve green spaces and ensure safe play areas for children (Ruij, 2014).

The commonalities between carsharing and cohousing suggest a possible correlation between the two. While the aforementioned literature indicates a potential alignment between community-based living environments and carsharing models, a gap remains in understanding how attitudes towards shared facilities specifically influence

residents' willingness to participate in carsharing programs and whether residing in cohousing could also be a significant factor. Addressing this gap is crucial for developing targeted interventions to promote sustainable transport behaviours both within and outside of cohousing communities.

The current study endeavours to investigate the potential relationship between residents' attitudes towards shared facilities and their willingness to participate in carsharing programs. The primary objective is to investigate how attitudes towards shared facilities (including the borrowing of household items and tools), alongside the distinction between living in cohousing versus non-cohousing environments, influence residents' willingness to engage in carsharing. Additional to the main research question, we assess whether there are differences in residents' attitudes between the distinct types of car-sharing programs (i.e., P2P, part-ownership, B2C). Furthermore, this study also assesses the impact of residents' personal characteristics and travel behaviour on their propensity to participate in carsharing initiatives.

The remainder of this paper is organised as follows. The subsequent section reviews the literature pertaining to both community-based living and carsharing. This is followed by an explanation of the data collection and methods. Following these sections, the analysis and results are explored in detail. Finally, the concluding section presents a discussion, summarises the findings, and suggests avenues for future research.

2. Literature Review

This literature review examines established determinants of carsharing adoption, as well as cohousing demographics, and serves as the theoretical background for investigating whether similar factors apply to the use of other shared services within community-based living, more specifically cohousing. Additionally, it will explore and clarify the definitions of both carsharing and cohousing, providing a comprehensive understanding of these concepts as they are central to the research process.

2.1. Community-based Living

2.1.1 Defining Community-based living & Cohousing

Community-based living refers to a residential arrangement where individuals or households actively engage in shared spaces, resources, and collaborative activities within a community setting (Vestbro, 2010). Various forms of community-based living include cohousing, collaborative housing, collective housing, communal housing, or cooperative housing, each characterised by a commitment to communal values, shared responsibilities, and a collaborative approach to daily living (Vestbro, 2010).

Among the various housing models, 'co-housing' emerges as particularly relevant to the present research. It originated in the 60s in Denmark (Ruiu, 2014) and is defined as "Housing with common space and shared facilities" (Vestbro, 2010). Cohousing combines the autonomy of individual homes with the advantages of community living, providing residents with private residences alongside shared spaces both indoors and outdoors, as well as semi-private areas. Services commonly provided within cohousing residences include shared kitchens, dining rooms, libraries, laundries, gymnasiums, offices, and gardens (Ruiu, 2014). Cohousing communities are constructed at various densities, ranging from low to high, and can be found in diverse layouts and locations, resulting in a wide array of community types. However, McCamant and Durrett (2011) listed six foundational principles of cohousing: (1) participatory design process, (2) social contact design, (3) private homes supplemented by common facilities, (4) resident management, (5) non-hierarchical structure and decision-making, and (6) no shared community economy). The design and operational methods within cohousing promote a collaborative way of life and create and promote increased reliance on one another among residents, thus creating strong and lively communities (Williams, 2005; Boyer & Leland, 2018).

2.1.2 General Demographics of Cohousing

Boyer & Leland's (2018) study provides insight into the demographics of cohousing communities, contrasting them with the broader population captured in the 2010 U.S. Census. They found that cohousing residents tend to be older, disproportionately female, educated, financially stable, and predominantly white/Caucasian, with a significant proportion identifying as Democrats. This paints a picture of a relatively

homogenous demographic within cohousing communities, suggesting that cohousing may be perceived as inaccessible to certain demographic groups, such as younger individuals, males, and those with lower incomes within the United States. Additionally, gender differences contribute to this homogeneity in demographics in the US, with women showing a higher interest in cohousing, potentially reflecting broader societal and lifestyle aspirations (Vestbro & Horelli, 2012).

Reasons for the relatively homogenous demographic composition within cohousing communities may stem from exclusionary factors. Affordability poses a significant barrier to cohousing models, despite potential cost savings through shared resources and energy-efficient living. This holds especially for younger populations (McCamant & Leach, 2021; Czischke, 2018). Namely, cohousing often excludes less affluent groups due to the substantial capital required to enter the community, typically in the form of mortgages (Williams, 2008). Furthermore, cohousing homes typically cost more than other town homes, because they commonly offer more generous common facilities which other houses simply don't have. However, the most recent wave of cohousing has been aiming for environmentally friendly, socially inclusive and affordable housing (McCamant & Leach, 2021). Moreover, Szypulski (2016) emphasises the diversity within cohousing projects in Europe, with a wide range of organisational forms and project types catering to various needs and preferences. These projects encompass aspects such as ecological building, affordability, multigenerational housing, and inclusivity for different user groups, including those with disabilities (Ache & Fedrowitz et al., 2012).

2.1.3 Interest in Cohousing

While cohousing currently attracts a predominantly affluent and educated demographic, there is evidence to suggest that interest in cohousing is not limited to individuals fitting these characteristics. Boyer & Leland (2018) note that interest in cohousing in the US spans across genders, age groups, and racial/ethnic categories, with educational attainment showing no clear association with interest. Similarly, Szypulski (2016) highlights a shift in the appeal of cohousing in Europe as well, indicating that it is increasingly attractive to both older and younger demographics, as well as families and singles. This indicates an expansion in the appeal of cohousing beyond the demographic patterns observed in the US.

In agreement with Szypulski's claim of cohousing's broader appeal, Ruiu (2014) claims that residents of cohousing communities tend to be diverse in economic state and ideology, however there must exist a minimal ideological base among the residents. Clark (2021) agrees with this, acknowledging a shared ethos among cohousing residents, which is often linked to ecological living. Cohousing's sustainability advantage, marked by the adoption of eco-friendly technologies, contributes to environmental well-being and a greener lifestyle for residents (Marckmann et al., 2012). Elaborating on these benefits, Wang et al. (2020) underscore cohousing's social and sustainable values, emphasising its potential to attract like-minded individuals, foster a community-oriented lifestyle, and promote intergenerational living and community building.

As the review of community-based living literature explains the demographics and principles of cohousing, the next part of the review shifts focus to carsharing literature, providing the definition and determinants of carsharing.

2.2 Carsharing

2.2.1 Definition of carsharing & background

Carsharing minimises the need for personal vehicle ownership by offering shared access to cars. Carsharing has many different elements, such as ownership status, pricing structures, logistics, and liability regulations. The vehicles involved can be owned by businesses, individuals, or governmental entities, and may cater to diverse user demographics (Velez, 2023). Carsharing typically differs from traditional car rental services in its focus on short-term rentals, with fuel costs commonly incorporated into the rental fee (Nansubuga & Kowalkowski, 2021). Additionally, studies have highlighted the various benefits of carsharing, including reductions in car usage frequency (Liao et al., 2020), vehicle kilometres travelled (Firkorn and Shaheen, 2016; Nijland and van Meerkerk, 2017), and vehicle ownership (Millard-Ball et al., 2005; Nijland and van Meerkerk, 2017; Giesel and Nobis, 2016; Kolleck, 2021; Klinevicius et al., 2014; Liao et al., 2020; Martin and Shaheen, 2011). Moreover, it promotes public transport usage (Tarnovetckaia and Mostofi, 2022; Martin and Shaheen, 2011; Münzel et al., 2018) and mitigates air pollution (Nijland and van Meerkerk, 2017; Martin and Shaheen, 2011; Migliore et al., 2020; Firkorn and Müller, 2015), road congestion (Litman, 2023; Shaheen and Cohen, 2013; Ferrero et al., 2018) and parking shortage (Stasko et al., 2013; Firkorn and Müller, 2015).

Generally, carsharing is distinguished by three primary types: Business-to-Consumer (B2C), Part Ownership, and Peer-to-Peer (P2P) (Münzel et al., 2018). Business-to-Consumer carsharing is characterised by companies providing rental services of their own cars to individual consumers, offering flexibility and convenience without the commitment of ownership. This model can further be categorised into "one-way" and "two-way" or "roundtrip" services (Vaskelainen 2014; Shaheen et al. 2015). Initially, only two-way carsharing existed, in which members picked up the car at a specific location and were required to return it to the same location (Lempert et al., 2019). The introduction of B2C one-way carsharing operations in 2008 (Lindloff et al., 2014) marked a significant shift. These operations were primarily established in the largest cities of a country. Unlike the roundtrip model, the one-way model allowed cars to be dropped off anywhere within a designated city area (free-floating) or at a different station of the provider (station-based) (Münzel et al., 2018). Generally, one-way carsharing is motivated by greater convenience and two-way carsharing is motivated by efficiency and savings (Lempert, et al., 2019).

Part ownership car-sharing, involves multiple users or a community jointly owning or having fractional ownership of a vehicle, fostering a sense of shared responsibility and reducing individual financial burdens (Hampshire & Gaites, 2011).

P2P car-sharing, which emerged around 2010 (Shaheen et al., 2012), connects private car owners and individuals in need of short-term rentals, effectively transforming private consumers into both suppliers and consumers. Commonly, a third-party company serves as an intermediary, facilitating these transactions, claiming a percentage of the profit.

In contrast to roundtrip and one-way carsharing (B2C), P2P carsharing provides a wider array of pick-up and drop-off points, vehicle options, and pricing structures. Moreover, the P2P model has the potential to notably decrease operational expenses (Shaheen et al., 2019). Namely, roundtrip carsharing companies typically save nearly 70% of their total operating expenses by avoiding the cost of vehicle capital (Shaheen, Mallery, and Kingsley, 2012). Although there is potential for P2P carsharing to expand into less densely populated areas due to reduced costs, the initial focus has been on dense urban centres, where roundtrip carsharing companies are already established (Shaheen et al., 2019). However, a few years after its initial launch, P2P carsharing shifted its focus from short-term trips to longer durations. Now, P2P carsharing stands out for its emphasis on longer trips, diverging from the short-term usage patterns typically seen in roundtrip and one-way carsharing services (Shaheen et al., 2019).

2.2.2 Determinants of Carsharing

2.2.2.1 Demographic determinants

Studies indicate that carsharing users often share similar socio-demographic characteristics: they tend to be male (Velázquez Romera, 2019; Hjortset and Böcker, 2020; (Amirnazmiafshar and Diana, 2022), young (Martin and Shaheen, 2011; Costain et al., 2012; Dias et al., 2017), well-educated (Kopp et al., 2015; Clewlow, 2016; Becker et al., 2017; Dias et al., 2017; Hjortset and Böcker, 2020), high-income (Clewlow, 2016; Efthymiou and Antoniou, 2016; Dias et al., 2017; Le Vine and Polak, 2019; Hjortset and Böcker, 2020), working individuals (Dias et al., 2017), and primarily residing in higher-density areas (Dias et al., 2017; Aguilera-García et al., 2022; Hjortset & Böcker, 2020). This user profile is consistent across different car-sharing schemes, though specific preferences and usage patterns may vary. Lastly, the presence of children seems to decrease the usage of ride-sourcing and car-sharing services among low and middle-income households (Dias et al., 2017), possibly due to financial constraints and the increased complexity of travel needs associated with having children.

2.2.2.2 Personal Characteristics

Vehicle ownership is a key determinant, as the utilisation of carsharing services often results in a decrease in individual vehicle ownership, and research consistently reveals a greater adoption of carsharing in areas where personal vehicle ownership is lower (Jochem et al., 2020; Namazu and Dowlatabadi, 2018; Martin & Shaheen, 2011; Dias et al., 2017; Celsor and Millard-Ball, 2007).

Additionally, awareness of available carsharing services is crucial for individuals to participate, with higher education and personal income positively correlated with increased awareness (Loose et al., 2004). Moreover, familiarity with different carsharing models, such as free-floating and peer-to-peer platforms, enhances the likelihood of engaging with such services (Bulteau et al., 2019). Awareness of the associated costs of carsharing is highlighted in several studies as a major determinant of its usage (Bardhi & Eckhardt, 2012; Moeller & Wittkowski, 2010; Mohlmann, 2015). Those aiming to avoid the hassles and expenses linked to vehicle ownership, as well as individuals sensitive to transportation costs, tend to gravitate towards carsharing (Celsor and Millard-Ball, 2007). In contrast, Burlando et al. (2019) found no significant correlation between awareness of costs and car use, deviating from the findings of other studies.

Psychographic profiles also shape carsharing appeal, with social activists, environmental protectors, and practical travellers finding carsharing particularly attractive (Celsor and Millard-Ball, 2007). Environmental and social consciousness serve as powerful drivers of carsharing adoption, with individuals concerned about sustainability more likely to embrace carsharing as part of their lifestyle choices (Kuhn et al., 2021; Sajid et al., 2022; Efthymiou et al., 2013; Ferrero et al., 2018). However, practical considerations, such as convenience and cost savings, often play a more significant role in driving the adoption of carsharing. While environmental motivations are important, the attractiveness of carsharing lies in its ability to provide convenient and affordable transportation solutions, which appeals to a broader range of users (Hjorteset & Böcker, 2020; Lempert et al., 2019).

2.2.2.3 Geographical determinants

The ability of individuals to live without a personal vehicle is a critical determinant of the viability of carsharing in a neighbourhood. High parking costs and limited off-street parking (Hjorteset et al., 2020; Celsor and Millard-Ball, 2007) reduce the attractiveness of car ownership, leading to increased demand for alternative mobility solutions such as carsharing. Additionally, a high presence of shared vehicles within neighbourhoods (Hjorteset et al., 2020) lowers the barriers to participation and enhances the convenience of using carsharing as an alternative to personal vehicle ownership.

Commuter habits also play a role in carsharing adoption, with public transportation users showing a preference for shared mobility options. Furthermore, the accessibility of public transportation (Hjorteset et al., 2020) within a neighbourhood complements carsharing services (Efthymiou et al., 2013). A well-connected public transit network not only offers alternatives to car ownership but also facilitates seamless intermodal travel, strengthening the value proposition of carsharing for residents.

Neighbourhood walkability (Hjorteset et al., 2020) emerges as another crucial determinant. Pedestrian-friendly infrastructure not only promotes walking but also integrates carsharing into residents' daily mobility routines. This is particularly evident in historic neighbourhoods known for their walkability and a higher proportion of one-person households renting their homes (Celsor and Millard-Ball, 2007), as well as the propensity of dense neighbourhoods to exhibit lower rates of vehicle ownership and

travel (Celsor and Millard-Ball, 2007). Making them ideal locations for implementing carsharing initiatives. Similarly, the cyclability of a neighbourhood (Hjortset et al., 2020) complements walkability by providing additional active transportation options, enhancing the appeal of carsharing as part of a multimodal mobility strategy.

2.3 Conceptual Framework

Figure 1. Conceptual Model.

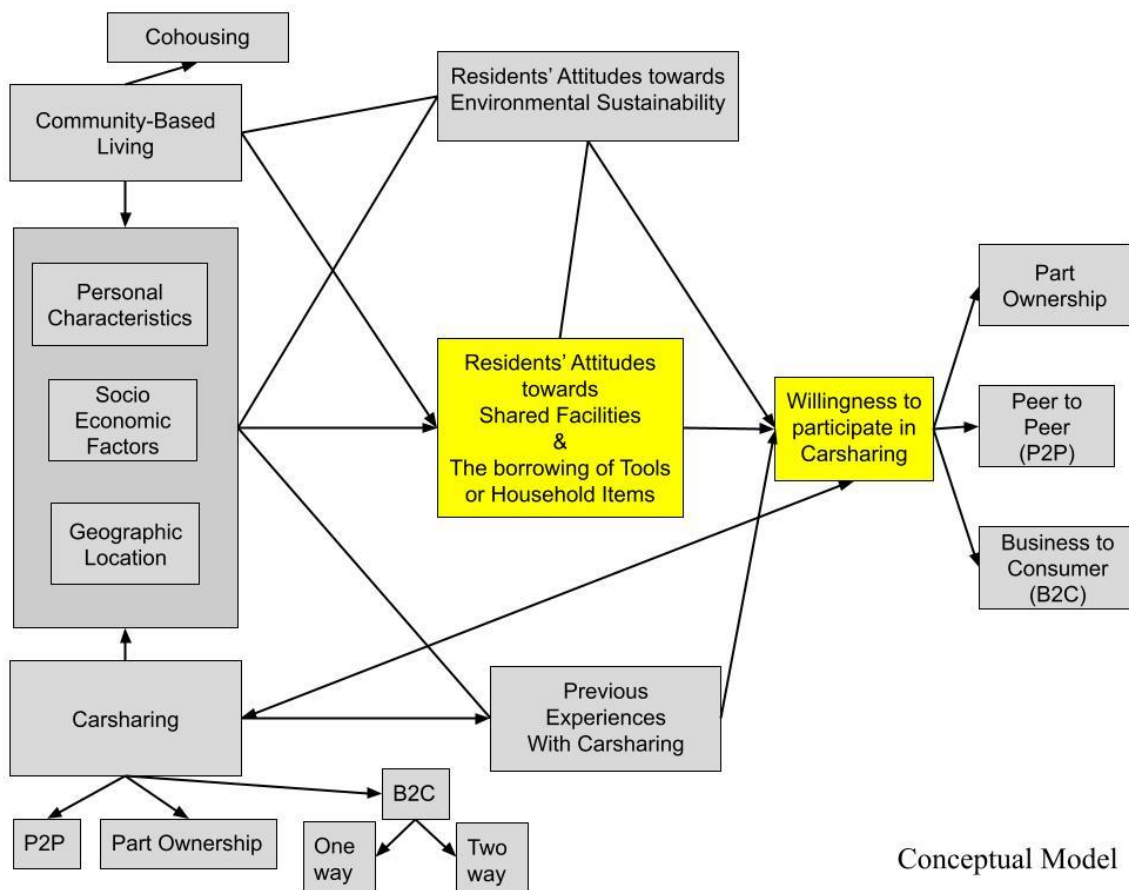


Figure 1 illustrates the relationships among the general themes from the literature. The yellow boxes highlight the two main research themes: (1) attitudes towards shared facilities and the borrowing of household items, and (2) willingness to participate in carsharing. The grey boxes represent the determinants of both community-based living, specifically cohousing, and car sharing adoption, including its various forms.

3. Data Collection & Methods

3.1 Data

The data for this study were collected through a survey conducted in the Netherlands during April and May 2024. Participants were required to be at least 18 years old. Additionally, efforts were made to ensure anonymity in responses, which encouraged participants to provide honest feedback without fear of identification or repercussion.

To compare the results of cohousing residents with the general population, the respondents were classified between these two groups. Cohousing respondents were recruited through flyers distributed to four cohousing locations in Utrecht, chosen for their nearby accessible car-sharing services. These locations were in the neighbourhoods of Wisselspoor, Tuindorp, Rotsoord, and Overvecht. The non-cohousing respondents were recruited through platforms such as Nextdoor, Facebook, another flyer, and word of mouth. The survey was available in both Dutch and English and included questions on individuals' sociodemographic characteristics, travel behaviour, attitudes towards and perceptions of shared facilities, carsharing attitudes, and environmental sustainability attitudes.

Using online platforms like Nextdoor and Facebook for participant recruitment may introduce bias towards individuals who are more active on social media. Such individuals may not represent the entire population of interest and could skew results towards certain demographics or behaviours, such as more frequent users of online platforms. To mitigate this bias, diverse recruitment channels were employed, including both flyers and digital invites. This approach aimed to reach a broader spectrum of the population, including those who may not be actively engaged online. Furthermore, the specific cohousing locations in Utrecht—Wisselspoor, Tuindorp, Rotsoord, and Overvecht—were chosen based on their accessibility to car-sharing services. While this selection was necessary for the focus of the study, it also introduces potential limitations and biases. By choosing only cohousing communities with accessible car-sharing services, the sample may not fully represent the broader population of Utrecht or other regions in the Netherlands, thus limiting the generalizability of the findings

A total of 104 responses were collected. During data cleaning, 20 responses were removed due to missing values and potential robotic answers. This left 84 valid responses, consisting of 50 cohousing and 34 non-cohousing respondents, as shown in [Table 1](#). In the survey, carsharing was defined as a transportation service where individuals can access vehicles on a short-term basis, typically by renting them by the hour or by the trip. The survey explained three types of carsharing: Peer-to-Peer (P2P), Business-to-Consumer (B2C), and Part Ownership. Furthermore, shared facilities were defined as communal amenities or resources accessible to residents within a community or living environment. These include communal gardens, recreational areas, laundry rooms, kitchens, and other common areas intended for collective use. To make it possible for non-cohousing respondents to fill in the survey, the definition also extends to the borrowing of household items and tools. The survey questions were mostly Likert scale questions, scaling from 1 to 5, with very few qualitative, open-ended questions.

Several variables were recoded to facilitate analysis. Age groups were consolidated into two categories: 18-44 years and 45-74 years. Income levels were categorized into low, middle, and high income based on respondents' reported earnings. Employment status was recoded into broader categories: full-time, part-time, student, and other. The

recoding simplified the data, making it more manageable for statistical analysis and ensuring clearer comparisons across different respondent groups.

[Table 1](#) provides a summary of the respondents' characteristics. The distribution of gender and income shows a relatively balanced representation. However, there is a noticeable skew towards younger respondents, with 94% falling between the ages of 18 and 44 years. Additionally, a significant portion of the respondents are highly educated, with 34% holding a master's degree. These demographics suggest a predominantly youthful and well-educated participant pool in the study.

Table 1. Summary Characteristics.

Variables	Definitions	Cohousing	Non-Cohousing	Total Data
		Data (N=50)	Data (N=34)	(N=84)
		N(%)	N(%)	N(%)
Gender	Male	21 (42.0)	15 (44.1)	36 (42.9)
	Female	26 (52.0)	19 (55.9)	45 (53.6)
	Other	3 (6.0)	0 (0.0)	3 (3.6)
Age	18-44	47 (94.0)	20 (68.8)	67 (79.8)
	45-74	3 (6.0)	14 (41.2)	17 (20.2)
Income	Low Income	23 (46.0)	13 (38.2)	36 (42.9)
	Middle Income	11 (22.0)	10 (29.4)	21 (25.0)
	High Income	15 (30.0)	11 (32.4)	26 (31.0)
	Missing Values	1 (2.0)	0 (0.0)	1 (1.2)
Education	Bachelor's Degree (University)	11 (22.0)	4 (11.8)	15 (17.9)
	Bachelor's Degree (HBO)	12 (24.0)	10 (29.4)	22 (26.2)
	Master's Degree (University)	17 (34.0)	12 (35.3)	29 (34.5)
	Other (VWO, VMBO, MBO, HAVO)	10 (20.0)	8 (23.5)	18 (21.4)
Nationality	Dutch	39 (78)	28 (82.4)	67 (79.8)
	Other	11 (22.0)	6 (17.6)	17 (20.2)
Employment Status	Full-Time	18 (36.0)	6 (17.6)	24 (28.6)
	Part-Time	11 (22.0)	12 (35.3)	23 (27.4)

		Cohousing Data (N=50)	Non-Cohousing Data (N=34)	Total Data (N=84)
Variables	Definitions	N(%)	N(%)	N(%)
Children	Student	15 (30.0)	12 (35.3)	27 (32.1)
	Other	6 (12.0)	4 (44.1)	10 (11.9)
	Children	4 (8.0)	11 (32.4)	15 (17.9)
	No Children	46 (92.0)	23 (67.6)	69 (82.1)
Household Size	1 person	19 (38.0)	8 (23.5)	27 (32.1)
	2 people	16 (32.0)	9 (26.5)	25 (29.8)
	3 or more	15 (30.0)	17 (50.0)	32 (38.1)
Housing Type	Private Housing (Rent)	16 (32.0)	9 (26.5)	25 (29.8)
	Social Housing	5 (10.0)	5 (14.7)	10 (11.9)
	Student Housing	24 (48.0)	2 (5.9)	26 (31.0)
	Owned (Mortgage)	5 (10.0)	9 (26.5)	14 (16.7)
Carsharing Member	Other	0 (0.0)	9 (26.5)	9 (10.7)
	Yes	4 (8.0)	5 (14.7)	9 (10.7)
Valid Driver's License	No	46 (92.0)	29 (85.3)	75 (89.3)
	Yes	41 (82.0)	29 (85.3)	70 (83.3)
Personal Vehicle	No	9 (18.0)	5 (14.7)	14 (16.7)
	Yes	21 (42.0)	13 (38.2)	34 (40.5)
Previous Car Sharing Usage	No	29 (58.0)	21 (61.8)	50 (59.5)
	Yes	16 (32.0)	12 (35.3)	28 (33.3)
Commuting Days per Week	No	34 (68.0)	22 (64.7)	56 (66.7)
	4 or 5	30 (60.0)	25 (73.6)	55 (65.5)
	Less than 4	20 (40.0)	9 (26.4)	29 (34.5)

		Cohousing Data (N=50)	Non-Cohousing Data (N=34)	Total Data (N=84)
Variables	Definitions	N(%)	N(%)	N(%)
Average Commuting Time	Less than 30 minutes	29 (58.0)	18 (52.9)	47 (56.0)
	More than 30 minutes	19 (38.0)	16 (47.1)	35 (41.7)
	Other (Remote working, unemployed)	2 (6.0)	0 (0.0)	2 (2.3)
City	Utrecht	32 (64.0)	11 (32.4)	43 (48.8)
	Other Cities	18 (36.0)	23 (67.7)	41 (51.2)
Residency Length	Less than a year	12 (26.1)	5 (16.1)	17 (22.1)
	1 to 5 years	30 (65.2)	7 (22.6)	37 (48.1)
	More than 5 years	4 (8.7)	19 (61.3)	23 (29.9)

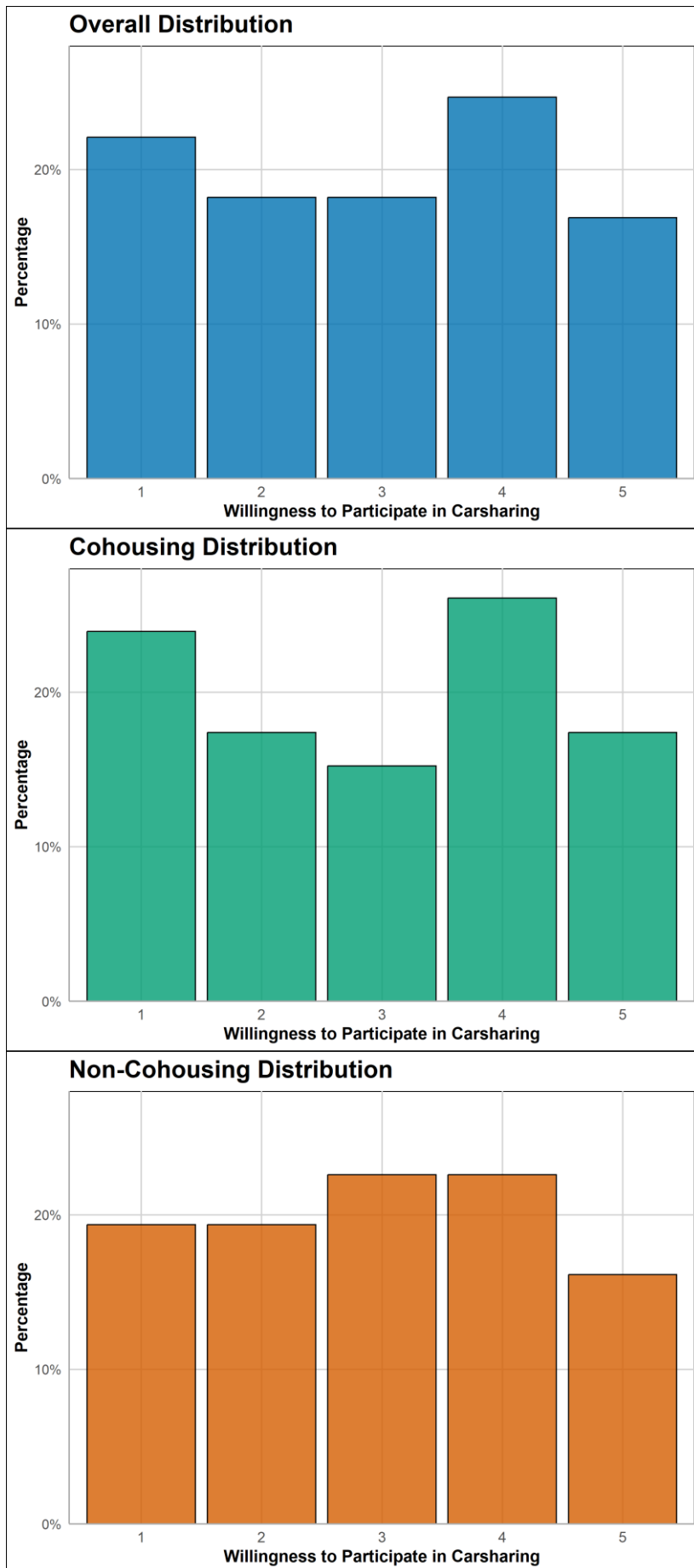
3.2 Methods

3.2.1. Ordinal Logistic Regression

To investigate whether there is a relationship between cohousing and non-cohousing residents' attitudes towards shared facilities, and their willingness to participate in carsharing, we assessed residents' willingness to participate in carsharing programs using a series of ordinal logistic regression models. The main model examined the willingness to participate in carsharing as the dependent variable, measured on a 5-point Likert scale (see [Figure 2](#)). Additionally, three supplementary models analysed the willingness to participate in specific types of carsharing: Business to Consumer (B2C), Peer to Peer (P2P), and Part Ownership. Using multiple models allowed us to explore potential variations in attitudes and preferences across different modes of carsharing among cohousing and non-cohousing residents.

Questions related to life satisfaction assessment and expectations are typically ordinal (Grilli & Rampichini, 2014). Similarly, our dependent variable, willingness to participate in carsharing, is measured on a scale from 1 to 5. While it is possible to analyse ordinal outcomes using a linear regression model by assuming equal distances between categories, this method has several well-documented drawbacks (Lu, 1999; Winship & Mare, 1984; Ananth et al., 1997). Therefore, when the response variable, such as willingness to participate in carsharing, is ordinal, it is more appropriate to use ordinal logistic regression (Grilli & Rampichini, 2014).

Figure 2. Distribution of respondents' willingness to participate in carsharing in (L) for the total population, (M) cohousing population, and (R) the non-cohousing population.



3.2.2. Factor Analysis

To further analyse these results, we tested the relationship between the dependent variable (willingness to participate in carsharing) and various independent variables, including personal characteristics and attitudes. Of particular interest was the attitude towards shared facilities (including the borrowing of household items and tools), the primary focus of this study. The analysis was conducted using R software.

A factor analysis was employed to reduce the number of observed variables and produce uncorrelated factors that adequately describe the data. [Table 2](#) presents the results of this factor analysis, which identified three significant factors from the initial 11 variables, based on respondents' ratings on a 5-point Likert scale ranging from "agree" to "disagree." These factors were labelled as: Attitude towards Shared Facilities, Attitude towards the Environment, and Efficiency Prioritization (see [Table 2](#)).

Table 2. Derived Factors.

Factors	Indicators	Loadings
Attitude towards Shared Facilities	Satisfaction of the quality of the available shared facilities	0.479
	Believe whether shared facilities contribute to environmental sustainability	0.569
	Value of the convenience of shared facilities	0.613
	Likelihood to actively use shared facilities	0.869
	I feel included in my community	0.541
Attitude towards Environment	More inclined to use shared facilities if good for the environment	0.557
	Environmental sustainability is important to me	0.779
	Carsharing is good for the environment	0.781
Efficiency Prioritization	I prioritise convenience in my transportation choices	0.776
	I prioritise saving time in my transportation choices	0.903
	I prioritise saving money in my transportation choices	0.468

4. Results

4.1. Descriptive Results

The data resulting from the survey (N = 84) shows that the respondents living in cohousing (N=50) have chosen “4” (26.1% > 22.6%) or “5” (17.4% > 16.1 %) more often than the respondents not living in cohousing ([Table 3](#)). This difference between cohousing and non-cohousing responses is statistically significant ($p < 0.1$).

Table 3: Frequencies dependent variable.

Variables	Definition	Cohousing	Non-	Total
		Data	Cohousing	Data
		N(%)	N(%)	N(%)
Willingness to participate in Carsharing	1= Not Willing	11 (23.9)	6 (19.4)	17 (22.1)
	2	8 (17.4)	6 (19.4)	14 (18.2)
	3	7 (15.2)	7 (22.6)	14 (18.2)
	4	12 (26.1)	7 (22.6)	19 (24.7)
	5 = Willing	8 (17.4)	5 (16.1)	13 (16.9)

Furthermore, [Table 4](#) shows the data for the dependent variables of business-to-consumer, peer-to-peer, and part ownership carsharing. Notably, the differences in responses between cohousing and non-cohousing groups for these dependent variables are not statistically significant ($p > 0.1$). Due to the minimal difference between the two groups for these variables, we analyzed the combined data instead. Interestingly, there is a remarkably high percentage of respondents indicating they are “Not Willing” to participate in both P2P (42.9%) and Part Ownership (45.5%), compared to those selecting “4” and “Willing” (13% for P2P, 7.8% for Part Ownership). These high “Not Willing rates to participate in P2P and Part Ownership” could be attributed to the less traditional nature of P2P and part ownership carsharing compared to business-to-consumer models (Shaheen et al., 2012). This unfamiliarity or lack of trust in sharing cars directly with peers or jointly owning a vehicle with others may explain the reluctance to participate in these carsharing options. Additionally, business-to-consumer carsharing, has a distribution of willingness responses relatively even, with no extreme reluctance or enthusiasm noted. This model appears more balanced in terms of acceptance among the respondents.

Table 4: Frequencies B2C, P2P & Part Ownership.

		Cohousing Data	Non- Cohousing Data	Total Data
Variables	Definition	N(%)	N(%)	N(%)
Willingness to participate in B2C Carsharing	1= Not Willing	13 (28.3)	7 (22.6)	20 (26.0)
	2	9 (19.6)	7 (22.6)	16 (20.8)
	3	7 (15.2)	6 (19.4)	13 (16.9)
	4	12 (26.1)	7 (22.6)	19 (24.7)
	5 = Willing	5 (10.9)	4 (12.9)	9 (11.7)
Willingness to participate in P2P Carsharing	1= Not Willing	22 (46.8)	11 (35.5)	33 (42.9)
	2	9 (19.6)	12 (38.7)	21 (27.3)
	3	8 (17.4)	5 (16.1)	13 (16.9)
	4	5 (10.9)	3 (9.7)	8 (10.4)
	5= Willing	2 (4.4)	0 (0.0)	2 (2.6)
Willingness to participate in Part Ownership	1= Not Willing	22 (47.8)	13 (41.9)	35 (45.5)
	2	12 (26.1)	11 (35.5)	23 (29.9)
	3	7 (15.2)	6 (19.4)	13 (16.9)
	4	3 (6.5)	0 (0.0)	3 (3.9)
	5= Willing	2 (4.4)	1 (3.2)	3 (3.9)

4.2 Factor Analysis Results

Figure 3 presents the attitudes and affinities towards various aspects of carsharing, comparing cohousing respondents, non-cohousing respondents, and the overall data pool. A notable finding is the stark contrast in attitudes towards environmental sustainability. Cohousing respondents display a significantly stronger appeal for environmental sustainability, likely influenced by their community values that emphasize collective well-being and sustainability (Clark, 2021; Vestbro, 2010; Marckmann et al., 2012; Wang et al., 2020). Their lifestyle choices, which often include eco-friendly practices, might make them more receptive to sustainable transportation options like carsharing (Kuhn et al., 2021; Sajid et al., 2022; Efthymiou et al., 2013; Ferrero et al., 2018). In contrast, non-cohousing respondents exhibit a comparatively negative affinity towards environmental sustainability.

Additionally, cohousing respondents demonstrate a positive inclination towards shared facilities, likely due to their familiarity with shared resources and communal living, viewing carsharing as an extension of their lifestyle (Kuhn et al., 2021; Sajid et al., 2022; Efthymiou et al., 2013; Ferrero et al., 2018). On the other hand, non-cohousing respondents show a negative attitude towards shared facilities, potentially due to a greater value placed on privacy and individual ownership.

Lastly, non-cohousing respondents place higher importance on efficiency prioritization compared to their cohousing counterparts. This difference might be attributed to practical considerations such as time management, convenience, and personal schedules. The higher score on efficiency prioritization among non-cohousing respondents could also reflect a more individualistic approach to transportation, focusing on personal benefits rather than communal or environmental advantages.

Figure 3. Factor Analysis cohousing and non-cohousing.



4.3 Ordinal Logistic Regression Model Results

Ordinal regression models were employed to examine individuals' willingness to participate in various forms of carsharing and its correlation with attitudes towards shared facilities, both within and outside of cohousing. [Table 5](#) presents the regression results for general willingness to participate in carsharing, business-to-consumer (B2C) carsharing, peer-to-peer (P2P) carsharing, and part ownership carsharing, alongside goodness-of-fit statistics. All models include attitudes towards shared facilities, other variables derived from factor analysis, and relevant personal characteristics. General personal characteristics were included in all models regardless of their statistical significance ($p > 0.1$), as identifying non-significant effects contributes significantly to model robustness. Additionally, variables that did not achieve significance at the 10% level in any model and did not improve model robustness were excluded from [Table 5](#) to enhance clarity and minimize multicollinearity. [Table 5](#) encompasses four models: one for general willingness to participate in carsharing, one for B2C carsharing, one for P2P carsharing, and one for part ownership carsharing.

The model for general willingness to participate in carsharing was statistically significant ($p(\text{Chi}) = 0.0000$) compared to the null model, indicating that the predictors collectively contributed significantly to explaining variability in willingness to participate in carsharing compared to an intercept-only model. This significance also holds for the B2C model ($p(\text{Chi}) = 0.0003$) and the P2P model ($p(\text{Chi}) = 0.0001$). In contrast, the Part Ownership model failed to reject the null hypothesis, indicating that the predictors in this model did not collectively contribute to explaining variability in willingness to participate in part ownership carsharing compared to an intercept-only model, rendering the model non-significant ($p(\text{Chi}) = 0.2586$).

4.3.1. General Willingness to participate in carsharing

The primary objective of this study was to examine the correlation between attitude towards shared facilities (including the borrowing of household items and tools) and willingness to participate in carsharing. The results indicate a highly significant positive effect ($p < 0.01$) of attitude towards shared facilities on willingness to participate in carsharing. Specifically, individuals who have a favourable attitude towards shared facilities are more likely to be willing to participate in carsharing programs. Additionally, living in cohousing communities is significantly associated with a higher willingness to participate in carsharing ($p < 0.1$). This finding suggests that the cohousing environment fosters a greater openness to carsharing. Furthermore, a favourable attitude towards the environment is positively correlated with willingness to participate in carsharing ($p < 0.1$), indicating that environmentally conscious individuals are more inclined to use carsharing services.

Possessing a driving license significantly increases the likelihood of higher willingness to participate in carsharing ($p < 0.01$). This implies that individuals who can drive are much more open to the idea of carsharing. Similarly, prioritizing efficiency is a significant positive predictor ($p < 0.01$) of willingness to participate in carsharing, suggesting that those who value efficiency are more likely to consider carsharing favourably. Regarding age, individuals in the 35-44 and 65-74 age groups are significantly less likely to be willing to participate in carsharing ($p < 0.01$). In contrast, the effects for other age groups (25-34, 45-54, 55-64) were not statistically significant. Lastly, gender, income, and confidence in carsharing did not show significant effects on willingness to participate in carsharing. These results indicate no clear differences in willingness to participate based on gender (male, female, or other), different income levels (low, middle, high), or varying levels of confidence in carsharing.

Table 5: Ordinal Logistic Regression Results.

	General		B2C		P2P		Part Ownership	
	B	Std.err.	B	Std.err.	B	Std.err.	B	Std.err.
Cohousing (ref = non-cohousing)	0.8473 *	0.4969	0.5414	0.4924	0.1345	0.5436	0.5564	0.5213
Shared Facilities	0.7607 ***	0.2651	0.5339 **	0.2521	0.9341 ***	0.2953	0.2352	0.2526
Attitude towards Environment	0.4675 *	0.2828	0.4481	0.2818	0.8091 **	0.3357	0.3180	0.2958
Confidence in Carsharing	-0.2156	0.1711	-0.2467	0.1724	-0.2111	0.1837	-0.2214	0.1759
Driving License (ref = No)	1.8042 ***	0.6975	1.1656 *	0.6731	1.6124 **	0.7686	0.2916	0.7058
Efficiency Prioritization	0.7495 ***	0.2687	0.6964 **	0.2737	0.7833 **	0.3147	0.3260	0.2718
Age (ref = 18-24 years)								
25-34 years	0.8616	0.5553	0.5565	0.5617	0.6944	0.6406	0.1686	0.6050
35-44 years	-15.9367 ***	0.00001	-15.0327 ***	0.00003	-14.7259 ***	0.00006	-15.8567 ***	0.0006
45-54 years	-0.1615	1.058	0.0298	1.031	-0.9267	0.9472	-0.8237	0.8982
55-64 years	-0.5493	0.9104	-0.9964	0.9628	-0.6813	1.1381	-0.6912	1.0596
65-74 years	-17.9365 ***	0.00001	-17.7171 ***	0.00001	-15.6485 ***	0.0002	-17.5579 ***	0.0004

Gender (ref = Male)								
Female	0.3515	0.4730	0.3949	0.4782	0.1168	0.5264	0.7581	0.5003
Other	1.1052	1.258	-0.1155	1.230	3.5647 **	1.5152	0.7728	1.2311
Income (ref = Middle Income)								
Low Income	-0.1863	0.6249	-0.6496	0.6389	0.0387	0.7364	0.5336	0.6903
High Income	0.2397	0.6402	0.0916	0.6568	0.1120	0.6753	0.4864	0.6613
Intercept 1 2	2.8817 **	1.3238	1.3307	1.2409	3.5552 **	1.4468	1.0675	1.2899
Intercept 2 3	4.2103 ***	1.3884	2.6090 **	1.2858	5.2309 ***	1.5156	2.5691 **	1.3240
Intercept 3 4	5.4406 ***	1.4549	3.6227 ***	1.3209	6.6647 ***	1.5652	4.0775 ***	1.3695
Intercept 4 5	7.1968 ***	1.5318	5.4714 ***	1.3704	8.9143 ***	1.8160	4.8579 ***	1.4273
Chi (p-value)	0.00002 ***		0.0003 ***		0.00006 ***		0.25863	
Log likelihood	-95.2998		-98.8889		-80.9583		-87.1503	
R-squared	0.2259978		0.190322		0.219957		0.11056	
Deviance	190.5997		196.1578		161.9167		174.3005	

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

4.3.2. B2C, P2P & Part Ownership Carsharing

The most remarkable finding across the three carsharing models (B2C, P2P, and Part Ownership) is the general insignificance of most independent variables for the Part Ownership model, except for specific age groups. Specifically, individuals aged 35-44 and 65-74 exhibited a significant negative effect on willingness to participate in carsharing across all models. Comparative analysis between the B2C and P2P models reveals that living in a cohousing community does not significantly impact the willingness to participate in any specific type of carsharing, although the effects were positive, they were not significant, which contrasts with the general model findings. A positive attitude towards shared facilities significantly increased the likelihood of participating in B2C and P2P carsharing models, with a more pronounced effect for P2P ($B = 0.9341$, $p < 0.01$) compared to B2C ($B = 0.5339$, $p < 0.05$). This suggests that individuals who value shared facilities are particularly inclined towards P2P carsharing. Environmental consciousness positively influenced the willingness to participate in P2P carsharing ($B = 0.8091$, $p < 0.05$), but not in B2C ($B = 0.4481$), indicating that environmentally conscious individuals are more likely to favour the community-driven P2P model. Possessing a driving license significantly increased the likelihood of participating in both B2C ($B = 1.1656$, $p < 0.1$) and P2P ($B = 1.6124$, $p < 0.05$) carsharing models, with a stronger effect observed for P2P, suggesting that individuals with driving licenses are more open to flexible carsharing options. Prioritizing efficiency was a significant positive predictor for both B2C ($B = 0.6964$, $p < 0.05$) and P2P ($B = 0.7833$, $p < 0.05$) carsharing models, but not for Part Ownership ($B = 0.3260$), highlighting that individuals who value efficiency are more likely to adopt carsharing models that emphasize ease of use and quick access. For these three models, income, gender, and confidence in carsharing had no significant effect, except for a unique preference for P2P carsharing among non-binary individuals.

5. Discussion & Conclusions

Using survey data collected among cohousing and non-cohousing residents in the Netherlands, this paper investigated the potential relationship between residents' attitudes towards shared facilities and their willingness to participate in carsharing programs. The primary objective was to investigate how attitudes towards shared facilities, alongside the distinction between living in cohousing versus non-cohousing environments, influence residents' willingness to engage in different forms of carsharing. Additionally, the study aimed to assess the impact of residents' personal characteristics and travel behaviour on their propensity to participate in carsharing initiatives. Based on the models presented, there is clear evidence that residents' attitude towards shared facilities, and the distinction between cohousing and non-cohousing, as well as personal characteristics and attitudes, play an important role in willingness to participate in carsharing. Additionally, the study aimed to assess residents' propensity to participate in different types of carsharing initiatives. The analysis results compared willingness to participate in business-to-consumer (B2C), peer-to-peer (P2P), and part ownership carsharing models revealing notable differences. However, the part ownership model did not give any relevant significant results.

5.1 Attitude towards shared facilities & Cohousing

The results of the analysis indicate that positive attitudes towards shared facilities (including the borrowing of household items and tools) significantly increase willingness to participate in carsharing. Which was also visible in both peer-to-peer (P2P) and business-to-consumer (B2C) models. This correlation is logical, as carsharing can be seen as a possible complementary of other shared amenities. Moreover, living in cohousing communities is associated with a higher likelihood of engaging in carsharing. This association can be attributed to the community environment in cohousing that supports shared resource use and shared values centred around ecological living and sustainability (Clark, 2021; Vestbro, 2010; Marckmann et al., 2012; Wang et al., 2020). Additionally, individuals with strong environmental concerns show greater inclination towards carsharing, particularly in the P2P model, which is consistent with the literature (Kuhn et al., 2021; Sajid et al., 2022; Efthymiou et al., 2013; Ferrero et al., 2018). This alignment of sustainability values likely contributes to the increased participation in carsharing within cohousing communities.

Given the study's findings linking cohousing and positive attitudes towards shared facilities with increased carsharing participation, several practical steps can be taken to support adoption. Policymakers should advocate for local policies such as

dedicated parking spaces, subsidies for carsharing companies, and integration into public transport plans within cohousing areas. Additionally, collaborating with cohousing developers to incorporate carsharing into new projects aligns with sustainability values and enhances the appeal of such programs. Lastly, prioritizing efficiency is a significant positive predictor of willingness to participate in carsharing, suggesting that those who value efficiency are more likely to consider carsharing favourably. This suggests that for many potential participants, the appeal of carsharing lies in its efficiency in providing a convenient and cost-effective solution, which is in line with findings by Celsor and Millard-Ball (2007), Hjortset & Böcker (2020), and Lempert et al. (2019).

5.2 Personal characteristics

The results revealed that possessing a driving license significantly increases the likelihood of a higher willingness to participate in carsharing, consistent with Xu et al. (2024). Regarding age, individuals in the 35-44 and 65-74 age groups are significantly less likely to be willing to participate in carsharing, aligning with previous studies (Martin and Shaheen, 2011b; Habib et al., 2012; Dias et al., 2017). In contrast, the effects for other age groups (25-34, 45-54, 55-64) were not statistically significant.

Gender, income, education level, and confidence in carsharing generally had no significant impact. This contrasts with existing literature, which suggests carsharing users tend to be male (Velázquez Romera, 2019; Hjortset and Böcker, 2020; Amirnazmiafshar and Diana, 2022), high-income (Clewlow, 2016; Efthymiou and Antoniou, 2016; Dias et al., 2017; Le Vine and Polak, 2019; Hjortset and Böcker, 2020), and well-educated (Kopp et al., 2015; Clewlow, 2016; Becker et al., 2017; Dias et al., 2017; Hjortset and Böcker, 2020).

5.3. Limitations

Despite significant findings on shared facilities attitudes and cohousing, the relatively small sample size might have limited the statistical power to detect significant effects for some variables, such as gender, income, and education level, as well as variables excluded from the regression. This limitation could explain the discrepancy with established literature on carsharing participation. Additionally, the study did not include geographical factors like neighbourhood walkability, density, or commuter habits, preventing an analysis of differences between cities or neighbourhoods.

Using online platforms like Nextdoor and Facebook for participant recruitment may have introduced a bias towards individuals more active on social media, potentially skewing results towards certain demographics or behaviours. To mitigate this, diverse recruitment channels, including flyers and digital invites, were employed to reach a

broader spectrum of the population. The specific cohousing locations in Utrecht were selected for their accessibility to carsharing services. This selection, while necessary for the study's focus, introduces potential biases and limits the generalizability of the findings to the broader population of Utrecht or other regions in the Netherlands.

Furthermore, the part ownership model did not yield any significant outcomes, which is a notable shortcoming. The intention was to use the same model for all three carsharing types to facilitate comparison of the outcomes. However, it became evident that the independent variables could not adequately explain the willingness to participate in part ownership carsharing. Given that most respondents showed very little interest in this type of carsharing compared to others, it might have been more appropriate to use a different model for this dependent variable. Nonetheless, finding no significant outcomes is also a result.

6. Future Research Directions

The present research revealed significant findings that pave the way for future research directions. While the study demonstrated notable results for both cohousing and shared facilities attitudes in relation to willingness to participate in carsharing, the sample size was relatively small. Future research should expand upon this study by including a more diverse set of cohousing locations, particularly involving a greater number of older participants and individuals from different regions and socioeconomic backgrounds, to enhance the generalizability of the results. Since cohousing is a very broad concept, a focus on very specific types of cohousing could additionally provide valuable insights for policy makers. Most importantly, a larger sample size is crucial, as it is anticipated that more variables will achieve significance and could be incorporated into the results. Additionally, investigating the effects of specific types of shared facilities and incorporating more qualitative measures could provide valuable insights. Exploring the dynamics within cohousing communities and providing in-depth understanding for residents' incentives to share facilities could also enrich the present research.

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