

Mobility in lower liveability level urban areas

How to make the Nijmegen Hatert residential area more liveable by increasing demand for public transport



Information

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Preface

In front of you is the end result of my master's thesis for the study Spatial Planning, Urban and Regional Mobility at the Radboud University in Nijmegen. After a bit more than a year, this research serves as the conclusion of my master's degree and my time as a student at the Radboud University overall. During my time in Nijmegen, I have most definitely learned a lot. I am not just talking about the things I learned during my studies, but I have also made some very big steps on a personal level. Starting over in a new and unknown city, moving out of my parental home, joining the study association and so forth. Even though my time as a student has been an amazing experience, it is now time for a new challenge: finding my way into the “real world”. It can be said that my master's thesis is the closing of the door of my student time, but as Alexander Graham Bell said: when one door closes, another door opens.

When diving further into the main research topic *“accessibility, equity, and policymaking”* which I had been assigned to, I discovered an interesting publication by the Dutch national statistics bureau CBS. The article stated that Dutch citizens with relatively lower education levels or citizens that have a migration background have the lowest levels of broad prosperity in the Netherlands. Since broad prosperity is such a comprehensive phenomenon, I thought of possibilities to find a place for my master's speciality Urban and Regional Mobility within this notion of broad prosperity. These possibilities, in combination with a brainstorm with my thesis supervisor and fellow students, formed the basis of my research proposal. This topic became therefore also the main subject of the document that you are now currently reading.

I could not have carried out this research without my supervisor. I would therefore like to thank Sander Lenferink for the guidance I received while preparing for & writing my master thesis. In addition to my thesis supervisor, I would also like to thank all the residents of the Nijmegen Hatert residential area who took the time to fill in my questionnaire. Without these 108 inhabitants, I would never have been able to carry out this research. Finally, I would like to thank my friends and family. Especially my parents for helping me distribute the survey invitations, because otherwise that would have taken even more time than it already did. My friends and family not only helped me when I was once again tangled up with SPSS or dealt with a writer's block, but above all they have been my mental support during the rollercoaster that is my master's thesis process for which I am eternally grateful.

I wish you a lot of fun reading my master's thesis,

Eline Leeneman

Zutphen, October 2023

Summary

Prosperity is often solely based on the gross domestic product (Majid, 2023). Recently, the prosperity debate has changed. This led to the introduction of “broad prosperity”. Central is the thought that, in addition to having an income, health, education, social connections, personal development, leisure activities, and the quality & safety of the environment in which people live are important to determine the prosperity (Raspe et al., 2019).

There are many indicators that influence broad prosperity. In this master’s thesis, the focus is on how encouraging inhabitants of areas with lower levels of broad prosperity to use more sustainable forms of transport, instead of the car of instance, could improve their broad prosperity. A reason for this is that the car is a relatively sustainable unfriendly mode of transport, negatively impacts the quality of the living area, but also the health of residents (Tobollik et al., 2016). When it comes to forming an alternative for car use, public transport proves to be the most important modal choice (Saif et al., 2019). Shifting from private motorized vehicles to public transportation can significantly increase the sustainability of transportation and improve the environment, economics, and public health in cities (Elias & Shiftan, 2012).

Such a switch will not happen all by itself. Travellers will have to be encouraged to make the switch to public transport. This switch can be caused by implementing measures that focus on creating a change in behaviour to make people use a different travel mode (Meyer, 1999). Therefore, in this thesis the focus is on which travel demand management measures could increase demand in public transport with the main goal to improve the levels of broad prosperity in neighbourhoods with relatively lower liveability levels.

This study used 108 completed online surveys and existing literature on the topics of mobility, specifically on public transport, travel demand management and broad prosperity to answer the research questions. To measure the effect of travel demand management measures on the levels of broad prosperity, the Nijmegen Hatert residential area was used as a research case. Located in the southern parts of the city of Nijmegen, with a population of about 10.000 people (AlleCijfers, 2023), the Nijmegen Hatert residential area was appointed as one of the Vogelaarwijken, a list of 40 areas that were seen as the most deprived urban areas in the Netherlands (van Essen, 2007). Furthermore, the number of cars per square kilometre in the neighbourhood is about ten times higher than the Dutch national average (AlleCijfers, 2023).

The results of the surveys show that there are a few travel demand management measures that can be taken to increase the demand for public transport in the Nijmegen Hatert residential area. Examples are expanding the working hours and frequencies of the buses and trains, but also improving the connection to the nearby Nijmegen Goffert train station. If these measures were to be implemented, the respondents, among them car users, would have the intention to use to public transport more often. In that case, the implementation of travel demand management measures could have a positive effect on the broad prosperity in the neighbourhood because using public transportation can significantly increase the sustainability of transportation and make a positive contribution to indicators of broad prosperity such as the environmental quality, finance, and public health in urban areas (Elias & Shiftan, 2012). Therefore, it can be said that implementing travel demand management measures that really target the issues that inhabitants currently have with the public transportation system could have a positive influence on the levels of broad prosperity of the people living in that neighbourhood.

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1. Introduction

This chapter aims at explaining the research problem that will form the basis of this thesis. Furthermore, the research questions and societal and scientific relevance will be explained. Finally, the structure of the thesis will be further elaborated.

1.1 Research problem

Most of the time, prosperity is solely based on the gross domestic product in an area (Majid, 2023). Recently however, the debate on how to measure the prosperity levels in an area has changed. When including different aspects to determine the welfare in an area a completely different picture was created. Regions that used to be seen as areas that have a greater level of welfare, the best example being the Groot-Rijnmond region (this area includes the Dutch city of Rotterdam and its surrounding municipalities), suddenly scored much lower on the prosperity scale in comparison to regions that have a lower gross domestic product such as the Northern province of Friesland (Majid, 2023). This is because in the broad prosperity calculation, several indicators such as the public health and the environmental quality of an area are also included. Not only are there differences between regions in the Netherlands, but there are also differences between urban and rural areas. These differences are not necessarily positive or negative, but they do exist (Majid, 2023).

When zooming in on the Eastern province of Gelderland, the province itself has broad prosperity levels that are higher than the Dutch national average, whereas the more urban Arnhem-Nijmegen region has lower levels than the national average (Provincie Gelderland, n.d.). This is mostly due to their relatively lower scores on health, the environmental quality, financial situations, and contentment on the living situation (Lifeport et al., 2022). According to recently published research by the Dutch national statistics bureau Centraal Bureau voor de Statistiek (in short: CBS), Dutch citizens with relatively lower education levels and citizens with a migration background have the lowest levels of broad prosperity in the entire country of the Netherlands (Centraal Bureau voor de Statistiek, 2022).

As mentioned, broad prosperity is measured by multiple indicators, one example is income, but the many indicators also include health, housing, and environmental quality, for example (Centraal Bureau voor de Statistiek, 2022). There are multiple factors that affect the indicators for broad prosperity and because of that, there are also many possible steps that can be taken to improve the levels of broad prosperity in an area. In this thesis the focus will be on mobility as a factor that could improve the levels of broad prosperity in a region. For instance, car use is, more often than not, not spread out evenly throughout a city or a country (Kuttler & Moraglio, 2020).; the physical, infrastructural, and socioeconomic properties of a certain location can all contribute to car use in a city (Wiersma et al, 2015). The spatial context shapes car use in the Netherlands. Besides the expected discrepancy between urban and rural areas, there are multiple relations between spatial properties and car dependency within cities all over the world (Kuttler & Moraglio, 2020). Wiersma et al. (2015) expect that a relationship exists between one's occupation and their car use; white collar- or knowledge jobs are more frequently situated in the city centres, where a large competitiveness between different modes of transport exists, whereas most industrial jobs are situated in more remote locations and therefore are often only accessible by car. This relation can also have societal implications, as a large part of these jobs require lower education levels, thus being lower paid and attracting more residents that hail from relatively lower income areas (Wiersma et al., 2015).

If these blue-collar workers are not able to afford taking the car anymore, for instance because of the rising gas and insurance prices, their daily life may encounter significant constraints that can lead to social issues, such as social exclusion and segregation (Tao et al., 2020). Due to the relatively disadvantaged socio-economic conditions, lack of needed resources and other factors these households might find it increasingly difficult to remain mobile and to actively participate in society (Tao et al., 2020). Therefore, these households could experience a phenomenon called mobility poverty, which entails *“the inability or difficulty of reaching activity locations due to inadequate transport options (both objective and perceived), in combination with socio-economic and spatial conditions in which individuals find themselves. As a result, individuals are hindered in participating in social life, which negatively affects the quality of life”* (Jorritsma et al., 2018). There are three factors that determine the accessibility of locations and therefore the (chance of) mobility poverty. These three factors are the following: social disadvantage, transport options and (in)competences (Jorritsma et al., 2018). To make sure that the households living in areas that have a relatively lower level of liveability in the Netherlands do not experience mobility poverty these three dimensions will have to be tackled. It is therefore important that in the areas where there are relatively many inhabitants who travel by car, measures are taken to enable the inhabitants to make the choice to use other forms of transport, such as public transport. These actions, or set of actions, aimed at influencing people's travel behaviour so that alternative mobility options are presented are better known as forms of travel demand management (Meyer, 1999).

In short, the inhabitants of lower liveability level areas in the Netherlands experience a lower level of broad prosperity. This can be partially related to the relatively higher car use in their neighbourhoods. One reason for this is that the car is relatively sustainable unfriendly mode of transport, which due to its emissions, negatively impacts the quality of the living area, but also the health of residents (Tobollik et al., 2016). Furthermore, owning a car is relatively expensive (Demary & Hüther, 2022). In some cases, however, travelling by car is the only viable travel mode and removing the car could cause serious social and financial problems. Therefore, by altering the modal choices that are available to include more sustainable and affordable forms of transport which form a good alternative to the car, some of the many indicators of broad prosperity (think of: health, financial situation, environmental quality), and therefore the level of broad prosperity itself, could be improved.

There are many shapes and forms of sustainable modal choices possible, but when it comes to forming an alternative to the car, public transport proves to be the most effective modal choice (Saif et al., 2019). Because the transport sector is a major contributor to the production of emissions in urban areas (Elias & Shiftan, 2012), investing more in efficient public transport networks is important to create well-operative and sustainable cities (Kujala et al., 2018). Shifting from private motorized vehicles to public transportation can significantly increase the sustainability of transportation and improve the environment, economics, and the public health in urban areas (Elias & Shiftan, 2012) and therefore cause a relative increase in the levels of broad prosperity of the inhabitants of these urban areas.

However, it does need to be mentioned that such a modal switch will not happen all by itself. Travellers will have to be encouraged to make the switch from their preferred mode of transport to public transport. This switch can be caused by implementing measures that focus on creating a change in behaviour to make people use a different travel mode (Meyer, 1999). Improving public transport by implementing such travel demand management measures, could lead to public transport becoming a viable alternative to the car in the lower liveability level areas of cities all over the world. Therefore, in this master's thesis the focus

will be on which travel demand management measures could effectively increase the demand for public transport in Dutch urban areas with relatively lower levels of liveability in order to improve the levels of broad prosperity in these areas.

1.2 Research aim

As mentioned in paragraph 1.1, finding ways to make lower liveability level areas in cities more connected to different and more sustainable forms of transport, could improve the level of broad prosperity of the inhabitants of these areas as measured by the indicators of the Dutch statistics bureau CBS. Housing and employment in the vicinity of a public transport network has shown to reduce car use and increase the use of public transport, or at least, the intention to make more use of public transport (Burns & Cracknell, 2019). Existing research has already shown that people are willing to switch to another transport mode if investments in viable alternatives for using the car are made (Puiu, 2016). Therefore, determining the effect of possible measures aimed at increasing the use of public transport by those living in lower liveability level areas, with the goal to improve their level of broad prosperity, forms an interesting subject for this research. According to existing research, the strategies that could enhance public transport include the accessibility of public transport stops, the connectivity of modes of public transport and the concept that system mobility should be considered to provide a user-friendly system of public transport (Cheng & Chen, 2015). This thesis will therefore include the topics of accessibility, connectivity, and user-friendliness as the basis for introducing travel demand management measures to the public.

In short, the research aim of this thesis is to determine which travel demand management measures could be introduced in lower liveability level neighbourhoods to increase the demand for public transport. This increase in demand will in turn contribute to creating well-operating and sustainable cities (Kujala et al., 2018).and therefore improve the levels of broad prosperity of the inhabitants of urban areas.

1.3 Research questions

To reach the presented research aim the following research question is used: *How can travel demand management measures in public transport improve the broad prosperity of the inhabitants of lower liveability level urban areas?* To answer the main question, the following sub questions will be used in this thesis:

- What are the preferred modal choices of the inhabitants of lower liveability level urban areas?
- What is the current opinion of the inhabitants of lower liveability level urban areas regarding public transport?
- What are the needs of the inhabitants of lower liveability level urban areas regarding public transport?
- Which measures could effectively be implemented to make public transport more popular in lower liveability level urban areas?

1.4 Scientific relevance of the research

The scientific relevance explains the value of the research for the world of science (Vennix, 2016). The study of mobility poverty and mobility inequality is closely linked to understanding uneven spatial developments (Kuttler & Moraglio, 2020). The spatial context shapes mobility poverty and car dependence in the Netherlands. Besides the expected discrepancy between urban and rural areas, there are multiple relations between spatial properties and car usage

in the Dutch cities (Wiersma et al., 2015). In the case of access to different forms of mobility and mobility poverty research is, however, more often conducted in rural areas instead of urban areas which means that mobility poverty research in urban areas is relatively lacking. Kuttler and Moraglio (2020) suggest conducting more research in certain fields that require urgent intervention to prevent the social exclusion and reduce the unequal treatment of vulnerable parts of the population. Focussing on lower liveability level and peripheral urban areas is named among these possible fields of research (Kuttler & Moraglio, 2020). This research could therefore provide more information about what can be done to create more extensive transport networks, for instance by increasing the frequency and accessibility of the existing transport networks, and combat mobility poverty in the relatively more underdeveloped neighbourhoods of cities in the Netherlands.

The ways most people travel are still relatively unsustainable, but households and companies have become very dependent on these travel methods. For instance, they base their location choices, such as where to live or where to work, on how accessible they are with the way they prefer to travel (Bertolini, 2020). The search for a balance between the two sides of this dilemma, however, goes very slowly. Bertolini (2020) therefore believes that there is need to do more research on the links between human prosperity and mobility growth. This research could help by statistically analysing the possible relationship between mobility and broad prosperity and introducing measures that can be taken to improve both the accessibility of mobility and broad prosperity at the same time.

1.5 Societal relevance of the research

The societal relevance explains the value of the research for practice and/or the society (Vennix, 2016). In this research there are two central themes, namely the concepts of mobility and broad prosperity. Approximately a quarter of energy-related emissions can be traced back to the mobility sector (United Nations, 2015). Finding ways to encourage people to use their car less often, and to travel by different means of transport could help combat climate change. Climate change is one of the biggest challenges for society and the world to date and therefore urgently needs us to step up and create more sustainable travel systems.

Next to this, the emissions produced by the mobility sector can have a relatively large impact on health and well-being of people (Tobollik et al., 2016). This not only causes a decrease in the levels of broad prosperity of the residents of urban areas, but also has other negative side effects. In the Netherlands, the healthcare sector is currently relatively short-staffed, which leads to long waiting lists and mental problems among healthcare staff members (NOS, 2021). If the emissions produced by the mobility sector are lowered, less people will have healthcare implications, increasing the level of broad prosperity and furthermore lowering a bit of the pressure on the Dutch healthcare system.

The last reason why this research could be socially relevant has to do with the current economic situation. Due to the current inflation, the gas prices are relatively high, which is especially bad news for the lower income households who are believed to experience a higher vulnerability to inflation than average (Albanesi, 2007). Introducing affordable alternatives to the car could therefore help lower income households when it comes to their finances and help improve the levels of broad prosperity of the lower income households.

In short, public health, financial situation and the environmental quality of the neighbourhood are important indicators to measure the broad prosperity of citizens. This research could help show measures that can be taken to make the transport networks in lower liveability level neighbourhoods more sustainable to combat environmental and health issues

and thus increase the levels of broad prosperity and create space to make the area more liveable.

1.6 Structure of this thesis

In the first chapter of this thesis an introduction was made, and the research questions were introduced. The second chapter, the theoretical framework, will dive further into existing literature and already conducted research regarding the problems, phenomena, and theories that were mentioned in chapter one. This literature forms the basis for the methodological choices that will be introduced and explained in chapter three, methodology. In chapter four, the research area that was introduced in chapter three will be further explained. Chapters five and six focus on analysing the data gathered from the survey that was conducted in the research area. This is done in a way consistent with the research sub questions that were mentioned in paragraph 1.3. Finally, chapter seven tries to answer the main & the sub questions and form a final conclusion and chapter eight will reflect on the conducted research and tries to make some recommendations for further research on this topic.

2. Theoretical framework

In order to make an inventory of which measures could effectively be implemented to increase the demand for public transport in the Nijmegen Hatert residential area, some insights and theories related to this topic have been described in this chapter. Based on the research aim and the research questions, concepts such as broad prosperity, public transport and travel demand management have been identified as key concepts and will be further explained below.

2.1 Critical review of the academic literature and of the policy context

In this paragraph a few central topics of this research will be described. The focus will be on existing literature and operationalising these topics.

2.1.1 Broad prosperity

The study of prosperity has traditionally been a subject of economic science (Theeuwes, 2008). It has led to unique and consistent theoretical results (Theeuwes, 2008). The Gross Domestic Product (GDP) has been given a central place in this, it is an indicator of the total value added of all goods and services and the balance of taxes and subsidies on products, and thus above all an indicator that reflects the material values produced in each country in a given period of time (Verbiest et al., 2019). The GDP per capita is a widely used measure to measure and compare the level of economic development of countries all around the world. Above all, it is an indicator that is important for policy, to relate the impact of its measures and investments: many policy efforts are made to improve prosperity in a country. The GDP is, therefore, often used as a general indicator of prosperity and well-being (Raspe et al., 2019).

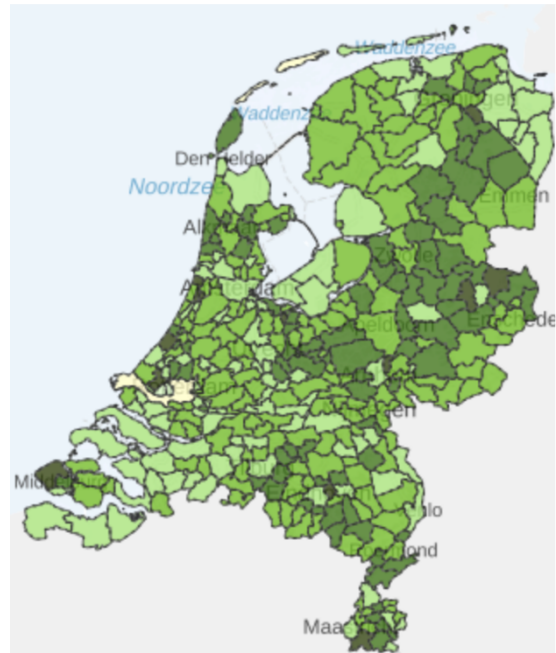
In recent years, however, an important debate has come into the spotlight: the debate about how to measure prosperity, and whether national statistics provide sufficient insight into this (Canoy & Lerais, 2008). We call this the debate on '*beyond and beneath GDP*' (Raspe et al., 2019). This discussion led to the introduction of the "*broad prosperity*" principle. Central in the broad prosperity principle is the thought that, in addition to having an income and being able to consume with it, health, the enjoyment of education, social connections, personal development, leisure activities, and the quality and safety of the environment overall and the environment in which people live are important factors to determine the prosperity (Raspe et al., 2019). Prosperity is now believed to not only be about the effects of human action in the 'here and now' but also about the effects 'elsewhere' (abroad) and 'later' (future generations) (CPB, PBL & SCP 2018). The broad prosperity principle places a strong emphasis on households and individuals, rather than the more traditional focus on aggregated economic values such as the GDP (Stiglitz et al., 2009). Interpreting prosperity is also about the geographical specification of the scale at which people experience prosperity, otherwise known as the daily living environment. It is the quality of the living and working environment of people that determine, to a relatively large extent, the possibility that people can actually realise and experience prosperity (Raspe et al., 2019). Therefore, improving the quality of the living environment of people could improve the possibility for people to realise and experience prosperity, which, in turn, increases the level of broad prosperity of these people (Raspe et al., 2019).

The quality of the living environment is, however, rather a broad phenomenon and because it is a relatively new area of research there is not one concrete definition (Leidelmeijer & van Kamp, 2003). One way to describe the quality of the living environment is '*the extent to which the living environment meets the needs and conditions that people place on the living*

environment in terms of housing stock, public space, facilities, population composition, life structure and cohesion of the population and safety.’ (Mul, 2010). The quality of the living environment can therefore be seen as something rather individualistic and subjective because people all have different needs and conditions, making it difficult to objectively rate the quality of the living environment in different areas (De Straat, 1998).

Quantifying the quality of the daily living environment

The fact that some factors that have an effect on this daily living environment are often described to be of a subjective nature can make it more difficult to quantify the living environment in an area (De Straat, 1998). The quality of the daily living environment is therefore measured in many different ways in several studies (van der Wouw, 2011). One way to quantify the quality of the living environment in areas all around the Netherlands is presented by the Ministry of the Interior and Kingdom Relations (in Dutch: *Ministerie van Binnenlandse Zaken en Koninkrijksrelaties*, or BZK for short). This Ministry is trying to quantify the quality of the living environment by means of the *Leefbaarometer*. This meter provides information about the quality of the living environment in Dutch municipalities, cities, districts and neighbourhoods. The Ministry defines liveability as the extent to which the living environment meets the conditions and needs set by humans (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019).



Map 2.1: The quality of the living environment for all Dutch municipalities (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2021)

The more the conditions and needs of people are met, the higher the quality of the living environment and therefore the higher the possibility that people can experience prosperity (Raspe et al., 2019).

The *Leefbaarometer* shows the current situation in an area and since it is updated every two years, it also shows the developments and history of the liveability in an area. To map the quality of the living environment, The Ministry uses approximately one hundred indicators, which are divided into five dimensions. This means that the *Leefbaarometer* provides an estimate of the quality of the living environment on the basis of one hundred, often objective, indicators. For each sub-area, the results of these indicators are compared to the national average, in order to arrive at an appreciation of the quality of the living environment (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2021).

The Dutch government is not the only one who is active in the research regarding the quality of the living environment. Van der Wouw (2011) has tried to create a method to measure the quality of the living environment as well. In contrast to the objectification of the quality the living environment that is used by the Ministry. This system is mainly focused on the residents' opinions about their environment (van der Wouw, 2011).

Van der Wouw (2011) divides quality of life into presumed and experienced quality of the living environment. By making a distinction between the presumed and the perceived quality, it is possible to separate the residents' perception of quality of life from a discussion

about the preservation or addition of facilities. In addition, it can be demonstrated that a facility in one village may have a completely different effect on the quality of the living environment than the same facility in a different village. Moreover, this method allows for a more dynamic and multi-scale view of the relationship between humans and the environment (van der Wouw, 2011).

According to van der Wouw, the presumed quality the living environment is the objectively measurable part (van der Wouw et al., 2009). The presumed quality refers to the package of facilities in an area that is considered conditional for the quality of the living environment in that area. In terms of policy, this package of facilities is better known as the basic facilities, a minimum package that an area must meet in order to make it liveable (van der Wouw, 2011). There is room for debate about what exactly is included in the minimum package. According to van der Wouw et al. (2009), in most cases the presence of a pharmacy, bank, primary school, library, village hall, general practitioner, public transport, post office, sports facilities and supermarket are seen as basic facilities. However, research by van der Wouw (2009) shows that residents of areas that do not have all of these facilities can still be very positive about the quality of the living environment in their neighbourhood or village. When certain facilities disappear, it does not necessarily mean that the soul of the area disappears. In other words, neighbourhoods, or villages where many facilities have disappeared over the years have often succeeded in preserving the heart of the area. The heart in question is not so much in the building of a facility, but more in what the residents do together and want to do for each other. In these residential areas, social connections are therefore much more important than the possible presence of facilities (van der Wouw, 2011).

As mentioned before, in some cases the disappearance of basic facilities has had no effect on the quality of life according to residents, while this should have been the case according to the presumed quality of the living environment indicator. This perception of the residents has to do with the different form of quality of life that van der Wouw uses. The perceived quality of the living environment is relatively more subjective. This form of quality is based on the opinions of the residents (van der Wouw et al., 2009). Residents can have very different opinions about their living environment. According to Van der Wouw (2011), the main reason for this is that residents may each have a different reason for living in the place where they live, but the different stages of life can also greatly change a resident's perspective. At first glance, the opinions of residents seem to be very individual, but it should be noted that there are also plenty of similarities between the residents. This creates some form of a shared image of the quality of the living environment as it is experienced by the residents (van der Wouw, 2011).

While van der Wouw focuses more clearly on the opinions of residents, another factor that might be of interest to residents of lower liveability level neighbourhoods is missing from his work. This factor is dealt with in Groot's (1972) liveability index. This factor focuses on the administrative climate. According to Groot, the involvement of the residents in local decision-making is examined in this indicator (Groot, 1972). When there is a high degree of involvement by the residents and the local administrators also facilitate this involvement when there is a demand for it, it benefits the quality of the living environment in the area.

In this master's thesis, the Leefbaarometer created by the Dutch national government will be used to help determine which neighbourhoods in cities in the Netherlands experience a relatively lower quality of the living environment and therefore broad prosperity. Using the information given by the Leefbaarometer will help in deciding which Dutch neighbourhoods

could prove to be areas that could be fruitful research areas. The indicators that will be used in the determination of the research areas are the following:

1. Housing

This dimension includes an inventory of the housing supply in an area. Think of the share of homes from certain decades. For example, modern houses, or pre-war houses, are positive for the living environment, while post-war homes negatively affect the quality of life (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019). Other indicators are the share per type of house (large, detached house, two-hairdressers, terraced houses, etc.), but the share of social rent or owner-occupied homes also has an effect on the quality of life, according to the Ministry.

2. Residents

This dimension mainly focuses on the population structure. For example, a distinction is made between the share of young people and the elderly, families with and without children, but the number of disabled and welfare recipients are also part of the indicators (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019).

3. Facilities

The amenities dimension is one of the larger dimensions. Here, the accessibility of the area is looked at (distance to station, presence of bus stops, distance to highways, etc.), but also the proximity of restaurants, shops and day recreation is treated at facilities. In addition to the presence of these facilities, the *Leefbaarometer* also considering the disappearance of facilities. For example, the share of vacant shops or the disappearance of supermarkets has a negative effect on the quality of life (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019).

4. Security

The relatively small dimension of security focuses on the crime rates of an area. Among other things, it looks at the number of reported violent crimes, burglaries, and vandalism (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019). These numbers are compared to the national average to value objective safety in an area.

5. Physical environment

The physical environmental dimension includes everything that relates to the (natural) location and accessibility of an area. Think of the proximity of the North Sea or the share of greenery in an area, but also the location on the railway and the amount of wind turbines and high-voltage pylons. Furthermore, the flood and earthquake risk are also included in this dimension (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019).

When looking at the combination of broad prosperity and mobility it shows that access and fair distribution of transport means, can give people the opportunity to participate in society and to improve their position and therefore, indicators of their broad prosperity level (Snellen et al., 2021). Access to mobility is also part of the *Leefbaarometer*, as the Dutch government believes that the accessibility of an area is an important factor to the quality of the living environment. Thus, it is believed that alterations in mobility, specifically encouraging the use of sustainable mobility, could make positive changes in the facilities and the physical

environment indicators, improving the quality of the living environment and therefore the possibility for prosperity. The *Leefbaarometer* is important for this thesis, because it shows which neighbourhoods of the Netherlands experience a lower quality of the living environment and could therefore function as a good research case for this thesis.

2.1.2 Public transport

Public transport is important for the mobility of people living in the Netherlands. In this country, public transport involves journeys taken by bus, train, the underground, and the tram. The national government still plays an important role in public transport in the Netherlands, despite the decentralisation that took place in 2001 (Veeneman, 2016).

In addition to someone's mobility, public transport also plays an important role in someone's accessibility. Accessibility is a very important concept of transport related research and transport policy and therefore plays one of the most important roles in the policy documents drafted by the Dutch national government. In general, accessibility refers to the possibilities that people have to travel to destinations to participate in many different forms of activities (Dijst et al., 2002). For individual travellers, the possibilities of public transport are important to determine their modal choice. In addition, when deciding which way to travel, it is important for someone to know how fast they would get somewhere by public transport in comparison to other forms of transport (Bakker & Zwaneveld, 2009).

Public transport in urban areas has gained a greater attention in recent years when it comes to improving sustainability and the quality of urban life (Saif et al., 2019). Research shows that urban areas are major contributors to current environmental problems, as they are emitting more than seventy percent of all greenhouse gas emissions and the energy consumption globally (Cohen and Muñoz, 2016). The transport sector is a big contributor to the production of the CO₂ emissions in urban areas (Elias & Shiftan, 2012). Investing in efficient public transport networks is important to create well-operative and sustainable cities (Kujala et al., 2018). Shifting from private motorized vehicles, such as cars, to public transportation, walking and cycling can increase the sustainability of transportation and improve the environment, economics, and public health in cities (Elias & Shiftan, 2012). This shift will happen in the condition that the public transportation is widely available and accessible to the public. Public transportation provides an opportunity to decrease negative effects of car usage on environmental conditions and public health (Yatskiv et al., 2017).

Public health is not only affected by greenhouse gas emissions. Increasing the access to public transport could cause a big opportunity to attain a minimum level of daily physical activity, for instance by walking to the bus stops (Besser and Dannenberg, 2005). Active lifestyle can directly be affected by providing the opportunity of accessible means of public transport to the public, especially to the lower income and minority parts of the population (Besser and Dannenberg, 2005).

To combat greenhouse gas emissions and low levels of daily physical activity, the public transport networks require improvements. Public transport could be made more attractive by providing "Door to door mobility" and the development of transportation services as an important factor of social quality (Yatskiv et al., 2017). Public transport in cities around the world could be improved by providing a well-organised transportation system. Therefore, the accessibility of public transport stops, connectivity of modes of public transport and system mobility should be considered to provide a user-friendly system of public transport (Cheng & Chen, 2015).

2.1.3 Travel Demand Management (TDM)

At the moment, the car is still a very popular mode of transportation. Compared to other travel modes, the car is fast, comfortable, and convenient (Gärling & Schuitema, 2007). Cars provide carrying capacity and privacy. Furthermore, for many people their car is a status symbol and a way to express themselves (Gärling & Schuitema, 2007). However, massive car use is known to cause some relatively serious problems such as a decrease in the quality of life in urban areas. Moreover, private car use is considered to be relatively unsustainable, due to the amount of space it requires and the emissions it produces (Gemeente Groningen, 2022).

Despite recent innovations in car technology, technical solutions do not yet solve all the problems car use creates (OECD, 1997). It is for this reason that scientists try to create models to combat car use and encourage the use of alternative transport modes (Goodwin, 1995). Travel demand management (or TDM for short) is such a model. Travel demand management involves *“any action, or set of actions, aimed at influencing people’s travel behaviour in such a way that alternative mobility options are presented and/or congestion is reduced”* (Meyer, 1999). In other words, travel demand management involves the development of a set of mechanisms that try to encourage a change in behaviour to make people use a different travel mode, -time, -cost, or -route. A reason to focus on travel demand management is the limited amount of space and means that are available, but another reason to use travel demand management is to promote several sustainable modes of transport (Ison & Rye, 2008).

Travel demand management can be divided in two forms of actions, namely carrots and sticks. The carrots are enablers or incentives to promote the desired travel behaviour, whereas sticks form deterrents or disincentives to discourage travel behaviour that is deemed undesirable (Farahmand et al, 2021). Strategies that try to combine the carrots and sticks are believed to provide more effective results than strategies which focus solely on one of them (Piatkowski et al, 2019). Travel demand management could help in increasing the freedom of modal choice. People are limited by the availability of infrastructure & means and the freedom of modal choice suggests that infrastructure and distribution of means influence human behaviour (Knoflacher, 2007). Therefore, implementing measures to improve the accessibility of other modes of transport (mobility enhancing measures) could influence human behaviour to make a modal switch to different mobility options instead of using the car. There are many shapes and forms of travel demand management measures, but not every measure is successful in each situation and target group. It is important to firstly monitor an area or target group to determine what the most effective measures could be (Berman & Radow, 1997).

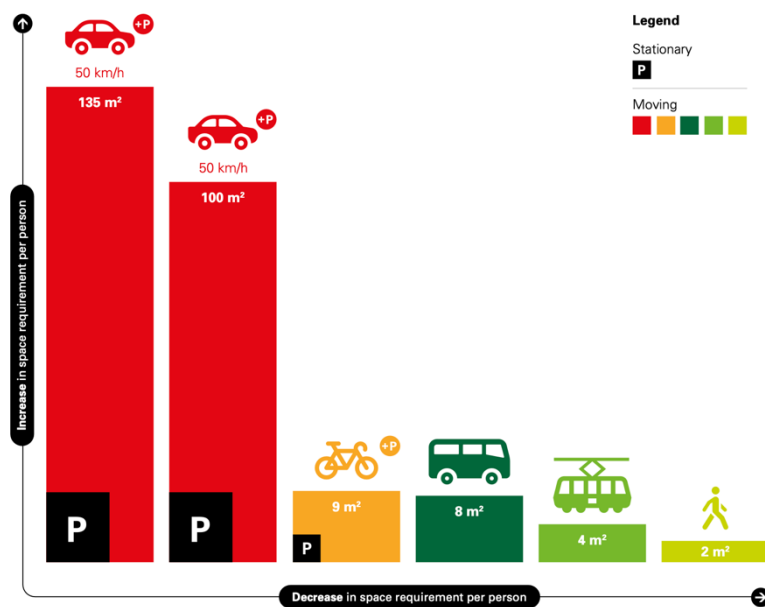
According to Ferguson (1998) there are eight categories of travel demand management measures that can be distinguished. He believes that the physical characteristics of an area are just as important to trigger a behaviour change as social constructs such as the attitudes, beliefs values and perceptions that travellers hold (Ferguson, 1998). Within these categories Ferguson believes that reliability, comfort, and convenience of transportation are often as important, or even more important, than either out-of-pocket costs or travel time savings (Ferguson, 1998). Steg (2003), however, distinguishes only four different forms of travel demand management measures. These forms include physical change measures, legal policies, economic policies, and information & education measures. In this research, the focus will mostly be on implementing physical change measures to improve public transport in the neighbourhood. Physical changes aim at increasing the relative attractiveness of alternative travel modes, for instance, by improving infrastructure for public transport, walking & cycling or by removing parking places and constructing speed ramps (Gärling & Schuitema, 2007).

2.1.4 Car dependency

In the last decades of the twentieth century, the car has played an increasingly important role in spatial policy in the Netherlands. These transportation planning decisions can have large and diverse equity impacts (Litman, 2023). The role of car use in spatial policy in the Netherlands has led to changing locations for employment, education, health care, and recreation, among other things (Social Exclusion Unit, 2003). For the people that depend on any means of transport other than the car, the focus on the car has led to a "mismatch" between where they need to go and whether or not they can achieve reaching this destination, or whether or not the destination is reachable within a relatively reasonable timeframe (Social Exclusion Unit, 2003). In that case, people who do not own a car or a driving license often have more time and difficulty reaching a destination than someone who does own or has the possibility to drive a car (Department of the Environment, Transport, and the Regions, 2000). In short, a non-car-owning person often has relatively limited possibilities of movement and therefore also limited opportunities to participate in social activities. Because some people are not able to travel to their destinations by any other means of transport than a car, they are forced to look for a way to have access to a car and have become dependent of them (Harms, 2003). This is phenomenon is called car dependency.

Car dependency can be defined as “relatively higher levels of car travel per capita, car-oriented land use patterns, and reduced transport alternatives” (Jeekel, 2016). Being car dependent has several negative side effects on the individual a scale, but also for society and the environment.

The first negative side effect of higher levels of car use is based on land-use. Public space is relatively scarce in urban areas in the Netherlands (Gemeente Groningen, 2022). As graph 2.1 shows private cars take up relatively a lot of the public space in urban areas in comparison with other modes of transport, both literally and figuratively, whether moving or standing stationary (Gemeente Groningen, 2022). The space that the cars now take up



Graph 2.1: The amount of space required by different means of transport (Gemeente Groningen, 2022)

comes at the relative expense of the public space that could be used to create a more pleasant and healthy living environment in the city (Gemeente Groningen, 2022).

Second, there are several studies that address the impact of transport and transport policies on health and well-being of people (Tobollik et al., 2016). Research states that the production of greenhouse gases has serious health implications for human beings (Haines et al., 2009). About a quarter of energy-related global greenhouse gas emissions can be traced back to transport and these emissions are projected to grow substantially in the years to come (United Nations, 2015). To improve public health and to reduce climate impact, transport

systems should be (re)designed. For this to be possible, a greater portion of future travel must be done by bicycle, by foot or by public transport instead of by car (Holmgren & Ivehammar, 2015). Transforming neighbourhoods to use less cars might have both direct and indirect health benefits (Nieuwenhuijsen & Khreis, 2016).

The last side effect of car dependency has to do with the current crises that are going on in the world. The relatively rapid recovery of the economy after the COVID-19 pandemic led to rising prices, which was already very evident in the oil and gas markets (Demary & Hüther, 2022). There were already indications that the inflation will remain higher for a longer period (Demary & Hüther, 2022). The inflation is rising even faster due to the sharp increase in, among other things, oil, and natural gas prices since the Russian invasion of Ukraine in early 2022 (Mbah & Wasum, 2022). The inflation is especially bad news for the lower income households who are believed to experience a higher vulnerability to inflation than average (Albanesi, 2007). If using the car gets too expensive and there is no real alternative to the car, it might lead to financial problems or people being unable to travel anymore. The lack of real means of transport can cause transport related-social exclusion. Transport-related social exclusion is a process when people are prevented from participating in the economic, political, and social life of the community because of a reduced accessibility to opportunities, services, and social networks (Kenyon et al., 2002). This is partially in whole due to insufficient motility (paragraph 2.2.2), and problems with the transformation of motility into mobility, in a society and environment built around the assumption of high mobility (Kenyon et al., 2002). Or in short, a person has become limited in the ability to move and therefore can no longer participate fully in social life (Meert, 2003). Transport-related social exclusion, or mobility poverty, is still a rather broad concept, but it can be divided into three different parts.

The first part states that transport-related social exclusion can lead to obstacles in finding a job due to limited travel opportunities (Hine, 2009; Hine & Mitchell, 2003). The possibilities on the labour market are severely restricted by poor access to transport (Cebollada, 2008). People that depend on public transport can often reach fewer work locations than people who can use a car within a decent travel time. If someone can't find a job due to limited transport options, there is a risk of social exclusion (Cebollada, 2008). When unemployed a person experiences less participation in society. In addition, no job means a lower income, which increases the likelihood that this person will have even less access has to transport due to a financial constraint and therefore ends up in a vicious circle.

The second part believes that in the exclusion of facilities, particular attention should be paid to important facilities such as healthcare and education. Such provisions are very decisive for the social inclusion and exclusion of a person within society (Cebollada, 2008). The lack of sufficient 'motility' can lead to problems with accessing these locations and as a result, increases the risk of social exclusion.

The last part is focused on the relationship between accessibility and social networks. This includes maintaining the networks with family and friends (Cass et al., 2005). If one is unable to maintain regular contact with people from their social networks, due to a lack of accessibility to travel modes, this can lead to exclusion of this network. The exclusion to social networks can have major consequences for a person's life. The reason for this is that a majority of people identify social obligations and activities as one of the crucial necessities in their lives (Cass et al., 2005).

Up until now, most literature has mostly focused on the consequences of a lack of transport possibilities on the labour market opportunities and access to different facilities

(Social Exclusion Unit, 2003). It is, however, important to also include social networks in the narrative surrounding mobility poverty and social exclusion.

2.2 Brief introduction to relevant theoretical frameworks

In this paragraph some theoretical frameworks will be introduced. Furthermore, there will be an explanation as to why these frameworks could be useful for this research.

2.2.1 Theory of planned behaviour

According to various policymakers, many societal problems, and challenges in the field of mobility are solved by means of nudging (John, Smith & Stoker, 2009). However, policymakers must consider that not everyone wants to be approached the same and that some strategies do not work for certain types of people. Previous research conducted by Anagnostopoulou et al. (2020) shows that some people need more and clearer interventions than others. This differs per situation; In one situation, a small intervention is enough, whereas in another situation a large one is needed (Anagnostopoulou et al., 2020).

Bovens (2009) and Alemanno (2012) have classified five conditions which an intervention must meet to classify as nudging. The first condition is that the intervention must not limit the individual choice. Also, the intervention must be in the interest of the person being nudged'. Thirdly, the environment must be changed. Furthermore, the interventions must involve strategic use of the 'cognitive biases'. The last condition implies that the final choice and the behaviour resulting from the intervention is not an autonomous choice.

A theory that fits well within the concept of nudging is the theory of planned behaviour (Ajzen, 1991). The theory of planned behaviour is a theory used to understand and to predict people's behaviour. The theory assumes that behaviour is determined by intentions and perceived behavioural control. These behavioural intentions lead to certain behavioural choices (Ajzen, 1991). This model of Ajzen can also be used to analyse people's choice when it comes to their modal choices. The theory of planned behaviour focuses solely on voluntary behaviour of people. An individual can therefore choose whether they behave in a certain way or perform a certain action or not. In practice, the individual choices that are made in certain situations are responded to and interventions are made on this basis. The theory of planned behaviour is shown in figure 2.1.

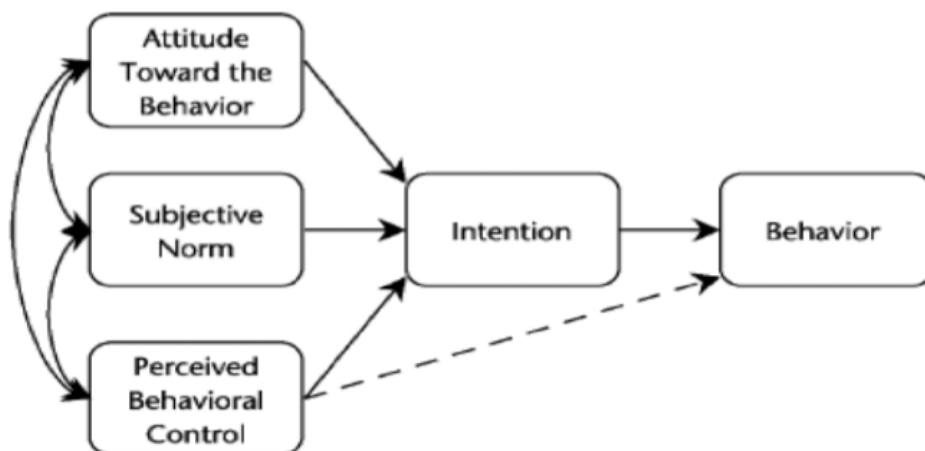


Figure 2.1: the theory of planned behaviour (Ajzen, 2005)

According to Ajzen (1991; 2005), there are multiple different processes that precede a decision or certain behaviour. These processes are the following: attitude toward the behaviour, subjective norm, perceived behavioural control, and intention (Ajzen, 2005).

The first element of the framework is the **attitude toward the behaviour**, this element describes a person's feeling about a certain behaviour (Shaw, 2013). If the feeling to change a certain behaviour is greater in an individual it is also more likely that this change will happen.

The second element is the **subjective norm**. This element describes how an individual can experience pressure to apply behavioural change (Shaw, 2013). One example could be the changing social norms with regards to smoking. If it is less socially accepted to smoke, less people will start smoking.

The third element is the **perceived behaviour control**. This element describes the power of an individual to carry out the behavioural change (Shaw, 2013). It includes the belief of an individual in carrying out the changes and the obstacles to the process which they may have to deal with (Shaw, 2013).

The fourth element is the **intention**: This element is a means of determining whether or not the individual will actually perform the required behaviour. The only way to determine if the behaviour is assumed, is by following it. In terms of research, this is not always entirely possible, so it is best to ask the individual if he intends to implement the required behavioural change (Shaw, 2013). This requires research, because only by asking people why they choose a certain behavioural choice, you can find out what their intention is.

Ajzen's model can be applied to various studies in which behavioural intentions are important. Think of studies that focus on advertising, healthcare, sports management, and durability for instance. There are also studies that implement the model created by Ajzen on someone's modal choice. One example is a study carried out by research bureau TNO (2010) which focusses on a policy advice in which the stimulation of cycling to work is the central aim.

In the case of this research, people are often used to taking the car, solely adding more travel options could possibly not be enough for people to alter their behaviour. It could therefore, with the aim of this research in mind, be interesting to look at how a change in mindset or behaviour could be achieved. For instance, which measures could actually trigger the individual to travel more by public transport instead of the way they travel now.

2.2.2 Motility

There are multiple reasons why people decide on which form of transport they use, think of income and physical fitness but also 'choice'. The background of this choice differs per person. For instance, a person living in the centre of a big city could consciously choose to not to buy a car, because public transport is faster and easier (Lucas et al., 2001). Consciously choosing not to take a car does not necessarily mean that someone no longer has disadvantages with regard to possibilities of movement. However, it can often be an indication that someone prefers uses public transport or accepts less accessibility to lower their costs of living (Lucas et al., 2001). If not having a car is not a conscious choice, the negative consequences of not having a car become relatively bigger (Lucas et al., 2001). When it comes to research on mobility it is all about the potential for movement of a person and not the actual movement (Martens, 2009).

To deal with the increasing number of travel methods, growing diversity in travel behaviour among a population and the greater variety in the behaviour of single individuals themselves, there was a need to develop a new conceptual tool to understand spatial mobility, starting with the individual's mobility potential and how the individual transforms

this potential into travel (Kaufmann, 2002). Analysing individual mobility potential requires the observation of how actors organise their travel with the use of technological networks. To describe and then analyse the mobility potential of an individual, the concept of motility is introduced (Flamm & Kaufmann, 2006).

Motility can be defined as “*how an individual or group takes possession of the realm of possibilities for mobility and builds on it to develop personal projects*” or in short “*the capacity to be mobile*”. The principle of motility is made up of three factors, namely:

- Access (the conditions under which available options can be used): this is related to the concept of service. This includes the range of conditions regulating price, schedules, etc., under which available options may be used.
- Skills (required to use these options): this factor refers to an actor’s know-how. Two things are central here: acquired knowledge and organisational capacity to plan activities.
- Cognitive appropriation (the evaluation of the available options vis-a-vis one’s projects): Cognitive appropriation is what actors do with their access and skills. It is therefore linked with strategies, values, representations, and habits.

Motility may or may not be transformed into travel. Particularly, one’s motility potential can be transformed into travel in different ways combining different forms of mobility (Flamm & Kaufmann, 2006). The concept of motility can show the already existing potential for mobility in lower liveability level areas, and it could possibly show the change in capacity when mobility enhancing measures are taken. Assuming that using more sustainable forms of transport has a positive effect on some of the indicators that determine broad prosperity, researching the potential for these forms of mobility could prove to be useful in this research.

2.3 The conceptual framework

The combination of the literature which was presented in the theoretical framework has resulted in the construction of a conceptual framework. The conceptual framework that will be used during this research is shown in figure 2.2.

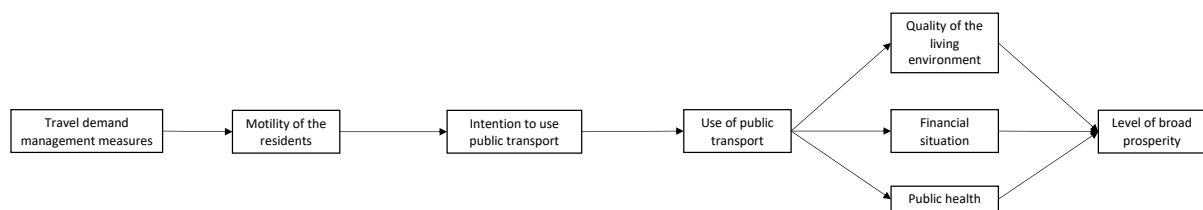


Figure 2.2 the conceptual framework

The presented conceptual framework consists of eight different aspects. The conceptual framework assumes that the implementation of effective travel demand management measures will increase the accessibility of public transport. In this case, the motility, also known as the capacity to be mobile (Flamm & Kaufmann, 2006), will improve. The residents will have access to other means of travel instead of just the car. This, in turn, can trigger an increase in the demand for public transport in the lower liveability level neighbourhoods. The reason for this is that when obstacles that could stop people from using public transport, the perceived behavioural control will alter, which in turn positively influences the intention of people to carry out certain behaviour (Ajzen, 2005).

In order to remove the possible obstacles, the proposed travel demand management measures must have a positive impact on the accessibility of the public transport stops,

connectivity of modes of public transport and system mobility (Cheng & Chen, 2015). This way, a user-friendly system of public transport will be provided. If the residents were to travel more by public transport instead of taking the car, this will have a positive effect on at least three indicators of broad prosperity as presented by the Dutch central statistics bureau (2022). These three indicators are included in the conceptual framework.

The first of these indicators is the quality of the living environment. The transport sector is a major contributor to the production of emissions in urban areas, which is relatively bad for the biodiversity (Elias & Shiftan, 2012). Furthermore, cars take up relatively a lot of the scarce public space. This space could also be used to create a more pleasant and healthy living environment (Gemeente Groningen, 2022). Therefore, investing in efficient public transport networks is important to create well-operative, sustainable, and liveable cities (Kujala et al., 2018).

The second indicator of broad prosperity that could benefit from a user-friendly system of public transport is the financial situation of inhabitants of lower liveability level areas. Owning a car is relatively expensive and the prices are only increasing (Demary & Hüther, 2022). If it becomes impossible for a person to pay for their car, this person has become limited in the ability to move and therefore can no longer participate fully in social life (Meert, 2003), which could lead to many different problems such as difficulty to find or keep a job. When public transport becomes financially more attractive, someone's potential for movement could increase. That way, social exclusion could be prevented, and the financial situation improved.

The last indicator that is included in the conceptual model is the public health indicator. The car is sustainable unfriendly mode of transport, which due to its emissions, has a significant impact on the health of the residents in urban areas (Tobollik et al., 2016). To improve public health, it is assumed that transport systems should be (re)designed. For this to be possible, a greater portion of future travel must be done by bicycle, by foot or by public transport instead of by car (Holmgren & Ivehammar, 2015). Transforming neighbourhoods to become less cars dependent could have both direct and indirect health benefits for the residents of these neighbourhoods (Nieuwenhuijsen & Khreis, 2016).

Switching from driving private motorized vehicles to using public transportation can significantly increase the sustainability of transportation and improve the environment, finance, and public health in urban areas (Elias & Shiftan, 2012). Therefore, in this research it is assumed that implementing measures that increase the demand for public transport will have a positive effect on the environmental situation, the financial situation, and the public health. As these three indicators are relatively important determine the broad prosperity of people, increasing the scores of these indicators will also increase the level of broad prosperity of the inhabitants of the lower liveability level urban areas in the Netherlands.

3. Methodology

The methodology chapter describes the research strategy used to investigate the relationship between the implementation of travel demand management measures and the levels of broad prosperity in the Nijmegen Hatert residential area. Furthermore, the approach of this research is further elaborated, and the data collection method is explained. Finally, this chapter will discuss the reliability and validity of the research that was carried out.

3.1 Research strategy

Before starting one's research, it is important to envision a well thought through research strategy. The aim of this research strategy is to be able to formulate valid answers to the main question by collecting data and processing and analysing this data (Verschuren & Doorewaard, 2007). For this thesis, the data collection was done by conducting a broad study. The main reason for this is that during a broad study, there is a large-scale approach with a higher degree of generalizability. Therefore, there is less focus in this research on in-depth and detailed substantiations.

Existing literature shows that car usage comes at the expense of the living environment and the public health (Tobollik et al., 2016; Haines et al., 2009). To create a better inventory of the data from one of these lower liveability level neighbourhoods, it is significantly better to conduct research into the field and not just carry out literature research. The collected data was used to assess the current mobility situation in the neighbourhood and what travel demand management measures can be taken to encourage the residents to use other, and more sustainable forms of mobility, especially public transport. This research involved a quantitative approach in which a conceptual model was drawn up based on a literature study that was tested by means of quantitative research (Vennix, 2016).

There are multiple forms of research that can be used to conduct research and each of these forms has their own advantages and disadvantages (Vennix, 2016). Although an experiment is very suitable for conducting causal research, it is not a suitable research strategy for this research. To demonstrate causality through an experiment, there must be a time sequence (Vennix, 2016). A baseline measurement must be done for the change, to demonstrate the causality in a second measurement after the change. In this study there is a baseline measurement, namely the current situation, but there is no question of a second measurement that must measure the change. The reason for this is that the situation has not yet changed at the time of writing, and it is not possible to implement the measures mentioned in the survey in real life for it would require long term alterations which are not able to implement by the writer of this thesis but need intervention of the local and/or national government.

The aim of the case study is to gain in-depth insights into a time-spatially limited process (Verschuren & Doorewaard, 2007). Although time-spatial processes are very relevant to this research, since performing mobility-based adjustments is a spatial process, a case study is not the best research strategy for this research. The main reason for this is that a case study mainly produces in-depth results, which forms a stark contrast to the purpose of this research that is to create a broader overview of travel demand management measures that can successfully be taken to encourage the use of public transport in order to improve the levels of broad prosperity in lower liveability level neighbourhoods in the Netherlands.

By choosing a broad study, a survey proved to be the most suitable research method for this thesis. According to Albinski (1978), a survey is *"an empirical study that relates to a multitude of objects and when their data is collected and statistically processed in real*

situations.". The survey mainly concerns making an inventory of the different opinions surrounding a topic (Vennix, 2016). In a survey, the focus is mostly on the generalisability (Verschuren & Doorewaard, 2007). This fits relatively well with the research because the goal is to make an inventory of what measures could be taken to successfully encourage the residents of lower liveability level areas to make the switch to public transport or to use public transport more often. Improving the accessibility to more sustainable forms of transport could in turn improve the environment and health of the residents. This is closely related to the main goal of this thesis, which is to present possibilities to improve the level of broad prosperity of the residents of lower liveability level areas.

3.1.1 Selecting a research area

To determine the effect of public transport on the broad prosperity in these lower liveability level neighbourhoods, fieldwork must be done in a lower liveability level neighbourhood in which the majority of the residents are not already vivid user of public transport, for instance a region with a relatively higher number of cars present. Car dependency can be defined as high levels of car travel per capita, car-oriented land use patterns, and reduced transport alternatives (Jeekel, 2016). Therefore, a possible case needs to meet two requirements: it can be classified as a lower liveability level area and there has to be a relatively big number of cars present in the area.

For the first requirement, selections were made based on the *Leefbaarometer*, which is a more actual tool to discover the quality of the living environment, in combination with the list of *Vogelaarwijken*, which shows which neighbourhoods in the Netherlands already have a history of lower liveability levels. Combining this list with statistics regarding the number of cars per square kilometre in Dutch neighbourhoods shows the possibility of the Nijmegen Hatert residential area as a case for this research. The neighbourhood knows a relatively lower quality of the living environment (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2021), but a total number of cars per square kilometre that is about ten times higher than the Dutch national average (AlleCijfers, 2023). More information on the Nijmegen Hatert residential area will be provided in chapter 4.

3.1.2 Population

The population of this research consists of the residents of the Nijmegen Hatert Residential area. Many of the residents of this neighbourhood have been given a chance to participate in this research via an invitation they received in their letterbox. The chance that each resident who has received an invitation actually fills in the survey is relatively slim. In order to be able to generalise the results from the survey on the entirety of the Nijmegen Hatert residential area, a minimum number of residents need to fill in the survey. This is the reason why the required sample size, or the number of respondents who must participate in the survey to give good reliability (Vennix, 2016), has been calculated. To achieve a low margin of error, it is important to gather a relatively large group of respondents. With a population of about 10,000 people, as is the case in the Hatert residential area, and a margin of error of five percent, this would require 370 inhabitants to fill in the survey (Checkmarket, 2023). With a margin of error of ten percent, 100 respondents would prove to be sufficient (SurveyMonkey, 2023). The aim was to achieve at least 100 respondents. In the end 108 residents filled in the survey. Therefore, the analysing of the data gathered for this research was conducted with a ten percent margin of error. The number of respondents initially seemed to be a bit higher,

but after checking the list of data, the survey appeared to be opened in several cases, but not (fully) completed. These cases were deleted from the list of respondents.

3.2 Research Philosophy

This research was conducted in a deductive manner. This entails that existing and already proven theories were applied to the research, with the aim to test if these proven theories are also significant in the context of this respective research (van Thiel, 2014). In this research, the theories that were presented in chapter two will be tested and applied to the data that was gathered by conducting surveys in the Nijmegen Hatert residential area.

This research focused more on whether or not there is a relationship between taking measures to improve public transport and the demand for public transport in the neighbourhood and not really on understanding the reasons behind this relationship. Therefore, the positivist or postpositivist paradigm was the most suitable paradigm for this research (Guba & Lincoln, 1994). Furthermore, the postpositivist paradigm assumes that the gathered data and the possible outcome of this research should be interpreted in the exact same way that they are presented. The reason for this is that postpositive thinkers believe that there only exists one single reality (Guba & Lincoln, 1994). In short, the research focus and the way the data is interpreted in this research form the best match with the postpositive paradigm. Therefore, this paradigm has been chosen for this research.

3.3 Data collection

To reach the amount of at least a hundred respondents, many houses that lay east of the Hatertseweg main road in the Nijmegen Hatert residential area have received an invitation to fill in the survey (Appendix A). This invitation included a short explanation of the survey, a QR code and a link to the list of questions (Appendix B) that were used in this research. These invitations were distributed door to door on multiple days. To respect the wishes of the residents of the Nijmegen Hatert residential area, most houses that had a “no-no” sticker on their mailbox, indicating that they did not want to receive anything other than their own letters and packages, were left out of the survey distribution.

The survey has been prepared in Qualtrics. An online survey was chosen because in this way the data of the respondents is stored directly online which saves a lot of time when it comes to administering the answers. Furthermore, there is no risk that a completely filled in survey could get lost in, for example, the mail. In addition, the non-response is often lower because respondents can quickly fill in the questionnaire online and do not have to send it by mail afterwards (Vennix, 2016). Another reason to choose for an online survey instead of asking respondents to send their filled in surveys by mail is the amount of money that this would require. Every envelope with questions that would be distributed to the address of a possible respondent would have to include a stamp. The reason for this is that you do not want to discourage respondents to send their answers because they have to pay for the stamps themselves. Considering that one single stamp already costs over one euro and the number of stamps it would require to get to the minimal amount of 100 respondents is relatively a lot of money for one single student, it was decided that this was not the most viable option to gather the required data.

Finally, it was preferable to put the research invitations through the letterbox instead of approaching people on the street. This allows people to complete the questionnaire at home in their own time. In addition, there were not very many people on the street, because

the invitations were distributed on working days, so it was more effective to put the invitations in the letterboxes instead.

3.4 Data analysis

The data collected through the survey questions was analysed via the SPSS program. Through the SPSS program, the relations between variables that were presented in the survey were investigated. As a result, the collected data could be checked for significance. Since the aim of the research is to investigate whether or not there is a link between taking specific travel demand management measures and the demand for public transport in the chosen research area, with the main goal to improve the broad prosperity, correlation tests were used in addition to analysing the descriptive statistics around the variables. These correlation tests investigated whether or not there is a clear positive or negative relation between the mobility-enhancing measures presented in the survey and the interest in using public transport.

Furthermore, these correlation tests can be used to investigate how strong the possible significant relationship between the variables is (Field, 2018). Field (2018) states in his book that there can be positive and negative correlation, where an outcome of -1 means an absolute negative correlation and +1 means an absolute positive correlation. Given that the probability of an absolute result is relatively small, Pearson's correlation coefficient can be used to calculate how strong the degree of coherence is (Field, 2018). According to Pearson, in addition to 1 and -1, there are some measures of correlation. For example, there is a weak correlation between 0.1 and 0.3, a moderate correlation between 0.3 and 0.5 and a strong correlation from 0.5 (Field, 2018).

The Pearson's correlation tests form a good addition to this research, because through these tests the appreciation of the inhabitants of the Nijmegen Hatert residential area for each possible mobility enhancing measure that was introduced in the survey could be analysed. Through the correlation tests, it was analysed which of the measures presented in the survey could have a significant positive or negative influence on the interest in using public transport in the Nijmegen Hatert residential area. Furthermore, through the Pearson's correlation tests it was possible to see if there were measures included in the survey that would target a specific group of people, think of different age groups for example.

3.5 Validity

The validity relates to the legitimacy of the study. In addition to the legitimacy, there is a focus on the extent to which there are systematic errors. The truthfulness of the research is the focus point in the assessment of validity (Vennix, 2016). To achieve a relatively high validity in this research it is important to look at three important factors when it comes to gathering data. These points are specifically related to the surveys that was used in this master's thesis.

The first point focused on the way these surveys were distributed. To have a high validity it is important that a different range of people fill in the survey. Distributing the survey via social media could leave out elderly people or those that simply do not use social media that often. It is therefore perhaps better to distribute the surveys via a QR code and link on paper. The papers were distributed from door to door. Some people found it difficult to fill in the surveys by themselves, so they received some help from me when filling in the survey.

A second remark has to do with the diversity of the Hatert residential area. It cannot be assumed that everyone in the area speaks Dutch (well). Therefore, it was decided to make the survey available in multiple languages. The choice for these languages is based on the languages in which the local newspaper *Wijkkrant Hatert* is translated, namely: Dutch, English,

Turkish, Arabic, Persian, Somali, and Ukrainian (Wijkkrant Hatert, 2023). Some of these translations had to be done by Google translate, others were checked by colleagues who were fluent in this language.

The third remark focuses on the target group of this research. Not all areas of Hatert experience a relatively lower level of liveability. Parts of the neighbourhood have gone through extensive gentrification. Because this research is focused on the parts that experience a lower liveability, conducting surveys in the richer areas of Hatert could hurt the truthfulness of the study. The '*Leefbaarometer*' of the Dutch national government shows the quality of the living environment. The greener an area is, the better the living conditions are (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2020). The survey invitations were distributed in the areas of the Nijmegen Hatert residential area which have a relatively worse score on the '*Leefbaarometer*'.

3.6 Reliability

The reliability of the research relates to the extent to which the research is free of accidental errors (Vennix, 2016). To obtain a relatively high reliability, it is important that the research is repeatable and that this repetition will lead to the same results as the previously conducted research (Vennix, 2016). To increase the reliability of this research, the triangulation method was used. By collecting information via two different forms of research, namely by using existing literature & data and conducting field research the data obtained from the surveys could be compared with other sources.

By drawing up the questionnaire partly on the basis of the existing literature, the repeatability of this research, and therefore the reliability, has been increased. The survey asked the same question a number of times, but always in a slightly different way. This was done with the aim of checking whether respondents were consistent with filling in their answers. During the analysis, it turned out that this was indeed the case. Therefore, it can be concluded that the answers of the respondents can be seen as reliable.

By including the results of some personal observations in the Nijmegen Hatert residential area in the preparation of the surveys, the reliability decreases somewhat. This has to do with the fact that the observations are no factual information, but observations of the researcher about the situation in the area as it is at that very specific moment (Vennix, 2016). Another researcher could have made relatively different observations at a different or even the same time. In view of the fact that the personal observations only functioned as a support tool for the preparation of the survey and did not serve so much as a collection method for the most important information, the influence that the observations have on the reliability of the study is not very large.

1. Housing

The Hatert residential area is one of the most populous residential areas in the entirety of the city of Nijmegen with about 10.000 residents (Gemeente Nijmegen, 2007). More than sixty percent of the houses built in the Nijmegen Hatert residential area are owned by housing corporations (CBS, 2012; Gemeente Nijmegen, 2023; AlleCijfers, 2023). The average value of a house in the neighbourhood is about €182.000, which is relatively lower than the €235.000 average price in the entirety of the municipality of Nijmegen (Gemeente Nijmegen, 2023). Furthermore, 48 percent of the buildings can be seen as high-rise buildings. Many of the houses that can be found in the neighbourhood are built during the housing shortage crisis after the second World War and are therefore of a relatively lower quality (Gemeente Nijmegen, 2007; AlleCijfers, 2023).

2. Residents

In addition to being the most populous residential area of Nijmegen, the Hatert residential area is also the district with the lowest disposable income per person (Gemeente Nijmegen, 2007). This is one of the reasons that relatively many households have difficulty finding for themselves, they are dependent on the state or need to receive extra healthcare (Gemeente Nijmegen, 2023). Approximately 23.1 percent of households have an income up to 110 percent of the social minimum, whereas the average for the city of Nijmegen is 15.5 percent. The residential area has a fairly high share of benefits: almost 12 percent of those in the working ages, which is about double the amount of the average of the entire city of Nijmegen. About 12 percent of households are considered to be the lowest affluent class here, which is three times the amount of the local average of 4 percent (Gemeente Nijmegen, 2023). The demand for healthcare in the Nijmegen Hatert residential area is also higher than average due to the increasing number of (almost) retired inhabitants (Gemeente Nijmegen, 2023). Moreover, there are relatively many low-educated people, 37 percent in 2019 versus 22 percent in the entire city of Nijmegen. This difference has decreased in recent years, which could be related to the gentrification in the neighbourhood.

Furthermore, the Nijmegen Hatert residential area is a very diverse neighbourhood. It is seen as multicultural and is the living place of many different ethnicities (Gemeente Nijmegen, 2023). The neighbourhood knows a relatively higher percentage of non-western immigrants than the Nijmegen average (Gemeente Nijmegen, 2007; AlleCijfers, 2023). This number is expected to grow due to the relatively large number of refugees that are appointed to the cheaper social housing in the area (Gemeente Nijmegen, 2023). Some people view this diversity as difficult, because these many different lifestyles can cause arguments between neighbours. Only 31 percent of the inhabitants of the area are content about how living together with all the different kinds of people goes (Gemeente Nijmegen, 2023). The residents are, however, very happy with the local engagement. There are many local activities, which they view as pleasant for their living experience (Gemeente Nijmegen, 2023).

3. Facilities

One relatively positive feature of the Nijmegen Hatert residential area are its facilities. There is an extensive range of supermarkets in different sizes, centrally located in the area. In addition, there are some shops with daily offerings, including drugstore items and external care. With several catering establishments and a centrally located district accommodation, the Nijmegen Hatert residential area has various meeting opportunities. There is a spread-out

range of general practitioners, dentists, or physiotherapy in the neighbourhood (Gemeente Nijmegen, 2023).

Furthermore, for sports and exercise there is a spread out offer in the area: an exercise route, some sport clubs, and fitness centres. In the public space there are various sports and play areas, which are relatively spread out over the area. Next to this, there is also a Cruyff Court present (Gemeente Nijmegen, 2023). The sport and play areas in the public space are accessible to everyone and do not require a financial contribution to enter.

The residents of the area are relatively content with the quality of facilities, because they believe that the number of facilities is sufficient, and they see the current facilities as good places to meet up with people they know (Gemeente Nijmegen, 2023).

4. Security

The Nijmegen Hatert residential has not been in held in a very high regard in the city of Nijmegen and the surrounding areas for a long time (Gemeente Nijmegen, 2023). The presence of many low-income families, a low level of education and 'problems behind the front door' characterise the neighbourhood (Gemeente Nijmegen, 2007). Due to the ongoing problems, the residential area was appointed as one of the *Vogelaarwijken*, a list of 40 areas that were seen as the most deprived areas in the Netherlands (van Essen, 2007). Even though the Hatert residential area made the list about 15 years ago, there are still a lot of difficulties in the neighbourhood. Think of loitering youths around the mall who seem intimidating to young women, drugs on the streets, unemployment, and housing shortages for instance (Barendregt, 2021).

When asked by the municipality of Nijmegen, many of the residents said that they believed that their neighbourhood has become less safe over time. Some reasons they gave were the fact that many cars drive far over the speed limits and that there are a lot of nuisances on the school grounds. Furthermore, drugs criminalities and vandalism of (personal) properties are no rare occurrences in the neighbourhood (Gemeente Nijmegen, 2023).

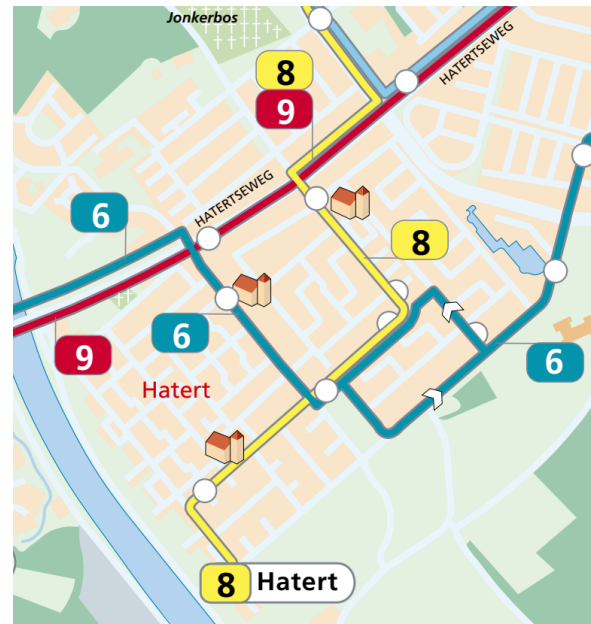
5. Physical environment

The Nijmegen Hatert residential area has a spacious lay-out and is located next to the Maas-Waal canal, which could offer interesting chances for the area (Gemeente Nijmegen, 2023). Moreover, Hatert has a relatively large amount of greenery, which is mostly located on the edges of the residential area. In other parts of the neighbourhood, the environment is mostly made out of stone (Gemeente Nijmegen, 2007). The residents experience that there are improvements on greenery, renovations, and maintenance, which they see as positives. This matches with the vision of the municipality to make the Nijmegen Hatert residential area more green and future proof (Gemeente Nijmegen, 2020). The residents do, however, not hold entirely positive views on their physical living environment. About 44 percent of the respondents of the survey conducted by the municipality of Nijmegen (2023) believe that the Nijmegen Hatert residential area is not clean enough and would like this to improve.

4.2 Mobility

When looking at the infrastructure in and surrounding the Nijmegen Hatert residential area, there seems to be a good connection to the S100 and to the A73 highways via the bridge. This means that the residential area has a relatively good car accessibility.

The residential area is situated on the edges of the city of Nijmegen. With a distance of 6.5 kilometres, it takes about 25 minutes to cycle to the city centre of the main train station of Nijmegen. The Nijmegen Goffert train station, which is only a stop for sprinter trains, is the nearest train station to the Nijmegen Hatert residential area. The train station is a bit further away and takes at least 20 minutes to reach by public transport (9292, n.d.). Next to this public transport is relatively expensive and sometimes even unreliable making it a less popular alternative to the car (Hunter et al., 2021).



Map 4.2: An overview of bus stops in the Nijmegen Hatert residential area (Breng, 2023)

There are however, three bus lines that cross the Nijmegen Hatert residential area. These bus lines are depicted in map 4.2. All of these bus lines can take residents to the main Nijmegen train station, which takes about 20 minutes. None of the buses will take the residents to the nearer Nijmegen Goffert train station. Only one of these lines, namely line 6, will take residents near the Radboud University campus, stopping at the Radboud University Medical Centre. The buses often run four times per hour on weekdays, starting at about six o'clock in the morning and ending at about twelve o'clock at night (Breng, 2023). The frequency of the buses is lowered by half after half past six o'clock in the evening. This is also the case in the weekends, during which the operating hours are from half past eight o'clock in the morning to twelve o'clock at night (Breng, 2023). This means that taking the bus is impossible if you have to work really early or get back rather late.

The relative lack of adequate alternative means of long-distance travel can mean that there are serious consequences when not owning a car, such as a loss in mobility and (mental) health issues (Sustainable Development Commission, 2011). When looking back at the presented case of the Hatert residential area, the lack of good modal choices results in a larger than average amount of cars in the area. Namely, in the Nijmegen Hatert residential area there are 2420 cars per square kilometre, whereas the average in the Netherlands is 258 per square kilometre (AlleCijfers, 2023). So, the number of cars per square kilometre in the neighbourhood is about ten times higher than the Dutch national average, which is a significant amount.

When it comes to the environmental vision that has been laid out by the municipality of Nijmegen in 2020, the number of cars in the Nijmegen Hatert residential area could prove to be a problem. The municipality aims at reducing car use in the city and creating more space for public transport, walking, and cycling (Gemeente Nijmegen, 2020). In their mobility vision document, the municipality pays special attention to the lower liveability level areas such as Nijmegen Hatert, because they have concluded that public transport in these neighbourhoods

is still of a relatively low quality compared to other neighbourhoods (Gemeente Nijmegen, 2019). Furthermore, the municipality wants to make all different working jobs accessible with public transport (Gemeente Nijmegen, 2019). This could also be of use for the residents of Nijmegen Hatert, for many of the residents work in sectors that are less accessible with other forms of transport than the car.

One last important alteration that the municipality of Nijmegen wants to make to the current public transportation system is the accessibility for the elderly and/or disabled population (Gemeente Nijmegen, 2019). Because the Nijmegen Hatert residential area has a relatively big number of retired inhabitants, making the public transportation systems more accessible for these parts of the population could greatly benefit the demand for public transport in the Nijmegen Hatert residential area.

In short, the Nijmegen Hatert residential area has a presence of public transport, but it is still relatively lacking in comparison to other neighbourhoods within the city of Nijmegen (Gemeente Nijmegen, 2020). To improve the public transportation systems in the neighbourhood, the municipality has placed extra emphasis on the lower liveability neighbourhoods and has named a few indicators that they want to focus on to make these improvements happen. This thesis could show some practical measures that can be taken within the indicators that are already mentioned in the policy documents to improve the mobility of the residents of the Nijmegen Hatert residential area.

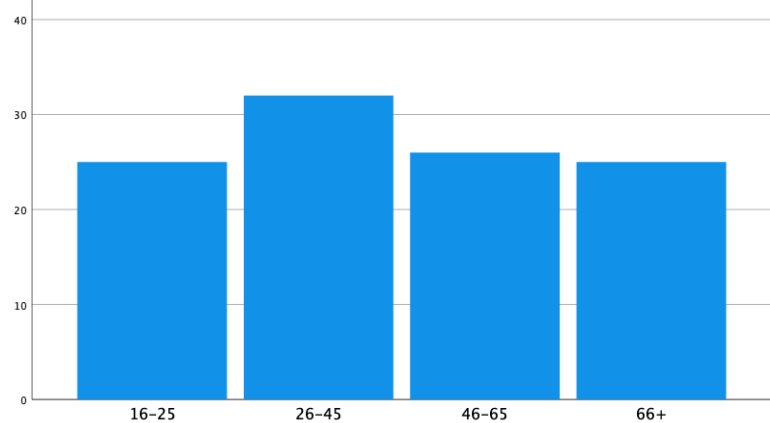
5. General description of the respondents

The survey was eventually completed by 108 residents. This section will first provide some general information on the respondents before proceeding to the analyses related to the research itself in chapter 6. Comparing the general information of the respondents to the national or local averages shows how representative this group of inhabitants will be for the entirety of the Nijmegen Hatert residential area.

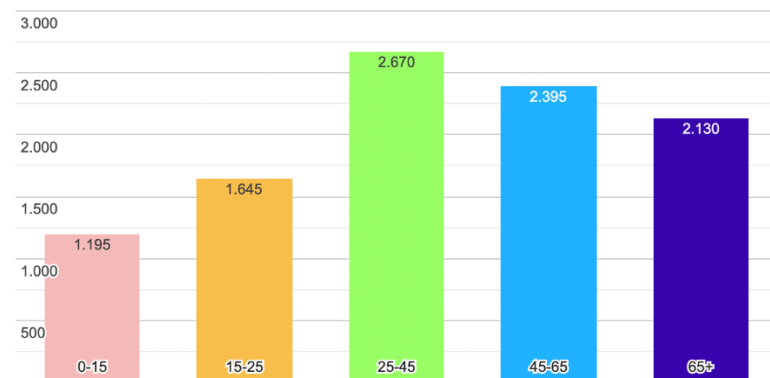
5.1 Age

Graph 5.1 shows the measured ages of the respondents, divided into the same age categories that are used by the website AlleCijfers. There are no participants that fall into the first age categories, namely 0-15. One reason for this is that the invitations were distributed door-to-door instead of face to face. This way the ones who are more probable to fill in the survey will be their parents. It is, however, not a big issue that the survey has not been filled in by this age group. Those under 16 are often still attending primary or secondary schools, thus tend to travel shorter distances and do, more often than, not require public transport yet.

When comparing the ages of the respondents to the numbers provided by the website AlleCijfers, depicted in graph 5.2, one can see that the distribution of the ages is relatively equal to the age frequencies of the entirety of the Nijmegen Hatert residential area. In both cases, the 25-45 category is the largest, followed by 45-65, 65+ and then 15-25. In the numbers provided by AlleCijfers the gap between 15-25 and 45-65 is relatively bigger than in the survey but considering that 15-25 is still a smaller group it is not a big issue. Because the counted ages in the survey are relatively equal to the entirety of Nijmegen Hatert the respondents form a relatively good representation of the entire population.



Graph 5.1: The ages of respondents

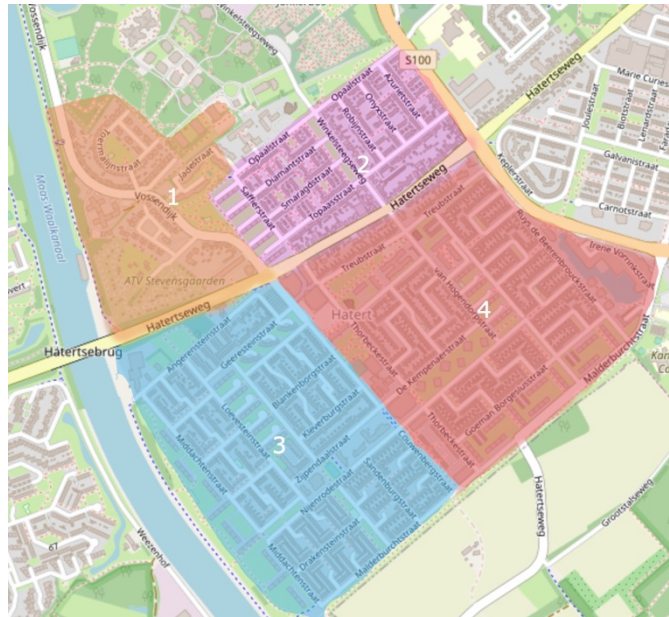


Graph 5.2: The ages of the inhabitants of the Nijmegen Hatert residential area (AlleCijfers, 2023).

5.2 Living area

Map 4.1 in paragraph 4.1 showed the current liveability levels in the Nijmegen Hatert residential area. To determine the effects of measures aimed at improving public transport in lower liveability level areas it is important that most of the respondents come from areas that

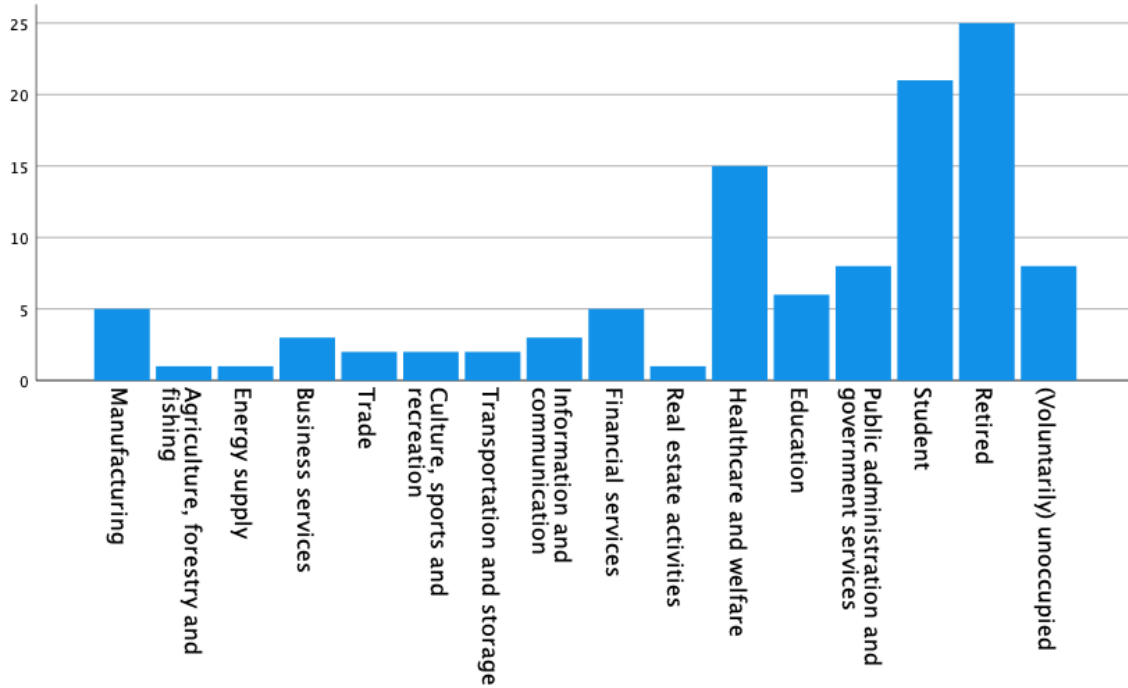
fall within that category. Therefore, the distribution of the invitational letters to the survey was mostly done in the areas south of the *Hatertseweg* main road. To double check whether or not the right people were reached the survey included a question to give a rough indication of the living areas of the respondents. Map 5.1 shows how the neighbourhood was divided and presented in the survey. It was important that a vast majority of the participating respondents lived in areas three and four, because those are deemed to score the lowest in the *Leefbaarometer* created by the Dutch national government. In the end, approximately ninety-five percent of the respondents to the survey filled in that they lived in these two areas, with 42.6 percent living in area 3 and 50.9 percent living in area 4. These numbers form a relatively big majority of the respondents.



Map 5.1: the Nijmegen Hatert residential area divided into four sections.

5.3 Work profile

When looking at the current occupation of the respondents, the relatively large number of respondents who are not, or no longer, working is particularly striking. This is partly due to the relatively large group of respondents who fall into the retirement age category as shown in graph 5.1. There is also a relatively big group of students represented in this survey. This can be due to the relatively lower housing prizes in the neighbourhood (Gemeente Nijmegen, 2023), which makes it more affordable for parents or investors to buy houses with the interest to use them for student housing. The last group that really stands out is the Healthcare and welfare occupation group. A reason for this could be that the city of Nijmegen has multiple hospitals and one of them, namely the Canisius Wilhelmina Hospital (or in short: CWZ) is located near the Nijmegen Hatert residential area.

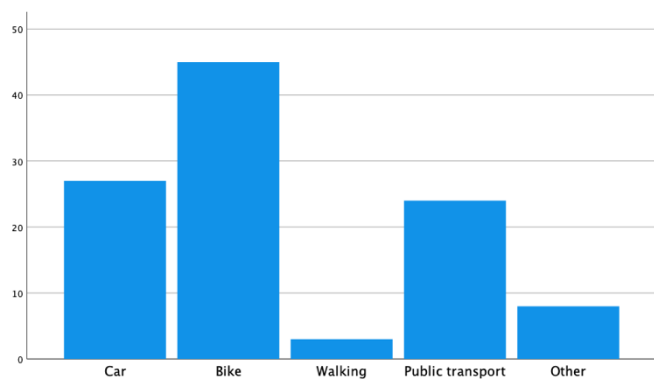


Graph 5.3: The occupations of the respondents

When asked if their occupation took place within the Nijmegen Hatert residential area only 3,7 percent of the respondents answered with yes. This percentage rose to 35,2 percent when to scope increased to the entirety of the city of Nijmegen. Furthermore, 37 percent of the respondents has a job outside of Nijmegen whereas 28,8% of the inhabitants who filled in the survey does not have a working job at all.

5.4 Mobility profile

To answer the first sub question as proposed in paragraph 1.3, *What are the current preferred modal choices of the inhabitants of lower liveability level urban areas?* The survey included several questions to determine the current mobility patterns of the respondents. The results a question aimed at finding the most popular form of transport are depicted in graph 5.4. Many respondents tend to travel the most by bike, but the car and public transport are also popular options. The other option includes mostly scooters and scoot mobiles.



Graph 5.4: The most used forms of transport

When asked to name to one reason the respondents found to be the most important reason why the travel, the respondents were allowed to pick out of four options (work, school, shopping, and recreation) or name a different reason to travel themselves. The results of this question can be found in table 5.1.

Reason to travel	Frequency	Percentage
Work	46	42.6%
School	19	17.6%
(Grocery) shopping	16	14.8%
Recreation	14	13.0%
Other	13	12.0%

Table 5.1: Reasons why the respondents travel.

As expected, about 42 percent of the respondents answered that the most important reason they travel is to get to, and back from work. Furthermore, graph 5.3 already showed that there were a relatively large number of students who participated in the survey, which explains that travelling for school is the second most popular option. Respondents who used the “other” option often mentioned visiting family as the most important reason they travelled.

About 45 percent of respondents believe that their current mobility choice is the easiest way to travel to their destination, followed by approximately 20 percent who view their modal choice as the fastest way to travel. Only 8 percent of respondents said that the way they travel now is the cheapest possible option. This might mean that many respondents would prefer a relatively shorter travel time or ease over the travel cost.

6. Results

This chapter presents the results that have been obtained after analysing the data in the SPSS program. First, paragraph 6.1 shows how respondents experience the current mobility situation, especially focused on public transport. This is followed by the second paragraph, paragraph 6.2, which delves into the wishes of respondents with regard to improving public transport in their neighbourhood. The last paragraph analyses which of the proposed measures would actually contribute to a growth in demand for public transport in the Nijmegen Hatert residential area.

6.1 Opinion on public transport

In the survey multiple questions with regard to the current mobility situation in the Nijmegen Hatert residential area were included. This was done to get a better picture on how the inhabitants of the neighbourhood experienced the presence of public transport. Therefore, the data drawn from these questions can help with formulating an answer to the second sub question, namely: *What is the current opinion of the inhabitants of lower liveability level urban areas regarding public transport?*

When asked how they would rate the accessibility and presence of public transport in their neighbourhood 46 percent of respondents believed the accessibility and presence to be good, followed by 23 percent of the respondents who believe the accessibility to be sufficient. The respondents were also given a question to determine the frequency they travel by public transport. Solely 7 percent of respondents answered that they never use public transport, whereas most of the respondents sometimes use public transport. The reasons why respondents use or don't use public transport differ. The survey included some questions to determine a few of these reasons. Tables 6.1 and 6.2 show how often some preselected reasons were chosen by respondents.

Reason to use public transport	Percentage of respondents
Public transport is a fast way to get to my destination	12,0%
I do not have access to a car	24,1%
I am worried about climate change	8,3%
Public transport is easy to access	22,2%
I can work when travelling	4,6%

Table 6.1: Reasons to use public transport.

When looking at reasons why the inhabitants of the Nijmegen Hatert residential area use public transport, there seem to be two important factors. The first being that 24,1 percent of people who use public transport sometimes do not have access to a car and are therefore unable to use a different method of travel when travelling relatively longer distances. In these cases, their destination might take too long to cycle to, or the respondents do not own a bike. Taking public transport when do you not own a car could also be weather related. Cycling 25 minutes to the city centre, for instance, is not preferable when it rains, or when it is very hot outside. In those cases, the bus forms a solid alternative to cycling.

Another reason why respondents use public transport is that approximately 22 percent of the respondents who are familiar with public transport use this travel mode because they believe it is easy access.

Other than the options presented in the survey, many respondents also mention the high parking costs and the difficulty to reach the Nijmegen city centre by car as reasons why they use public transport instead of taking the car. It is interesting to note that at about 30 percent of respondents did not name one or more reasons as to why they like to use public transport. A reason for this could be that these respondents do not want to use public transport at all, and therefore have no opinion as to why they would use this mode of transport.

Reasons not to use public transport	Percentage of respondents
Public transport is a slow way to get to my destination	32,4%
Public transport is not easy to access	3,7%
Public transport is difficult for me due to a disability	1,9%
I prefer using the car	12,0%
Public transport is not reliable enough	8,3%
Public transport is too expensive	15,7%

Table 6.2: Reasons not to use public transport.

The respondents were also asked to provide some reasons as to why they would not use public transport. By far the most chosen option was that public transport is a slower way to people's destinations. Therefore, it could prove to be fruitful to not only invest in improving public transport in the Nijmegen Hatert residential area itself, but also in areas that are barely connected to public transport such as industrial areas or smaller towns.

The survey not only included questions on the individual mobility choices of the inhabitants of the Nijmegen Hatert residential area. There are also questions which specify on the presence and accessibility of public transport in the area itself. The aspects of public transport that were presented in the survey are based on the article written by Cheng and Chen (2015) which states that the accessibility of public transport stops, connectivity of modes of public transport and system mobility should be considered to provide a user-friendly system of public transport. The aspects of public transport that form the basis of the survey are presented in table 6.3. This table also shows the respondents' opinions regarding the presence of these aspects in their neighbourhood.

Aspects of public transport	Completely disagree	Disagree	Neutral	Agree	Completely agree
There are enough bus stops	0,9%	1,9%	14,8%	47,2%	35,2%
There is a good bus frequency	1,9%	9,3%	22,2%	41,7%	25%
Bus stops are easily accessible	2,8%	0,9%	11,1%	53,7%	31,5%
There is a good connection with Nijmegen Goffert train station	15,7%	25,9%	42,6%	13%	2,8%

There is a good connection with Nijmegen train station	2,8%	6,5%	14,8%	44,4%	31,5%
Public transport is affordable	11,1%	25%	37%	20,4%	6,5%
There is enough seating space in public transport	3,7%	12,0%	23,1%	58,3%	2,8%
Public transport is reliable	5,6%	13,0%	25,0%	51,9%	4,6%
Public transport is accessible for people with disabilities	5,6%	7,4%	35,2%	46,3%	5,6%
The buses run late into the night	9,3%	29,6%	44,4%	13,9%	2,8%
The trains run late into the night	6,5%	27,8%	47,2%	15,7%	2,8%
The facilities are easily accessible by public transport	2,8%	6,5%	19,4%	50,9%	20,4%

Table 6.3: The opinion of respondents regarding the current public transport system.

Table 6.3 shows that the respondents are relatively positive about the presence and accessibility of public transport in their neighbourhood. For instance, when it comes to aspects such as the number of bus stops and how accessible they are, but also the connection to the Nijmegen main train station, more than seventy percent of the respondents share a positive view. There are, however, also aspects which show more divided opinions. Examples of this are the connection to the nearby Nijmegen Goffert train station, the affordability of public transport, but also the lack of presence of public transport later at night. In short, there are many factors of public transport that seem to be well organised, but there are also aspects that could use some improvement according to the residents of the Nijmegen Hatert residential area.

6.2 Needs for public transport

In order to answer the third sub question, namely: *what are the needs of the inhabitants of lower liveability level urban areas regarding public transport?* The respondents were asked whether or not they believed that altering certain aspects of public transport could improve the public transport system in the Nijmegen Hatert residential area. To keep the survey coherent, the aspects of public transport that were used for paragraph 6.1 were reused in paragraphs 6.2 and 6.3. The results of the statements included in the survey are depicted in table 6.4.

Public transport could be improved by:	Completely disagree	Disagree	Neutral	Agree	Completely agree
Placing more bus stops in my neighbourhood	13,9%	44,4%	30,6%	9,3%	1,9%

Running buses more often in my neighbourhood	11,1%	22,2%	25,9%	36,1%	4,6%
Making bus stops better accessible	10,2%	41,7%	32,4%	13%	2,8%
Making a better connection with Nijmegen Goffert station	3,7%	8,3%	32,4%	40,7%	14,8%
Making a better connection with Nijmegen station	13,9%	27,8%	35,2%	15,7%	7,4%
Making public transport cheaper	1,9%	4,6%	13,9%	35,2%	44,4%
Creating more seating space in public transport	3,7%	17,6%	41,7%	30,6%	6,5%
Making public transport more reliable	2,8%	11,1%	28,7%	42,6%	14,8%
Making public transport more accessible for people with disabilities	1,9%	12,0%	31,5%	42,6%	12%
Keep buses running until later in the night	2,8%	9,3%	31,5%	30,6%	25,9%
Let trains run until later in the night	1,9%	7,4%	41,7%	28,7%	20,4%
Making the facilities more accessible	4,6%	21,3%	47,2%	19,4%	7,4%

Table 6.4: The opinion of the respondents on how public transport could be improved.

Even though table 6.3 showed that the respondents were already relatively content with the presence and accessibility of public transport in their neighbourhood, there are still steps that can be taken to make public transport more popular. For instance, the inhabitants of the Nijmegen Hatert residential area believe that public transport could be improved by making it more affordable and accessible for people with disabilities. Moreover, the frequency and reliability of the buses seem to be measures that the respondents have a positive view on. There are also a lot of measures which, at first glance, seem to trigger a relatively neutral response, for neutral was the most frequent given answer in their case. However, when looking closer at the percentages, measures such as keeping buses running until later in the night have a majority of positive responses and could therefore also help with increasing the demand for public transport in the neighbourhood. The factor of the operating hours of trains and buses in the area seem to be more important for the younger generations in the area. A reason for this is that the younger generations often stay out longer, for instance because they go to the city centre at night, than the elderly generations who prefer to stay at home when it's dark.

6.3 Effectiveness of the proposed measures

The last part of the survey focused on which of the proposed measures could really have an effect on the demand for public transport. The respondents were asked to determine the last sub question, namely: *which measures could effectively be implemented to make public transport more popular in lower liveability level urban areas?* The answers given by the respondents are shown in graph 6.5.

I would use public transport more often if:	Much less	Less	Just as often	More	Much more
There are more bus stops in my area	0,9%	0%	84,3%	11,1%	3,7%
The buses run more often in my area	0%	1,9%	65,7%	27,8%	4,6%
The bus stops are easily accessible	0,9%	0,9%	76,9%	18,5%	2,8%
There is a better connection with Nijmegen Goffert station	0%	0%	61,1%	27,8%	11,1%
There is a better connection with Nijmegen station	0%	0%	70,4%	22,2%	7,4%
Public transport is cheaper	0,9%	0%	38,9%	38,0%	22,2%
There is more seating space in public transport	0%	0%	64,8%	21,3%	13,9%
Public transport is more reliable	0%	0%	57,4%	31,5%	11,1%
Public transport is more accessible to people with disabilities	0%	0%	85,2%	8,3%	6,5%
The buses continue until later in the night	0,9%	0,9%	51,9%	37,0%	9,3%
The trains will run until later in the night	0,9%	1,9%	59,3%	28,7%	9,3%
The facilities are easily accessible by public transport	0%	0%	83,3%	11,1%	5,6%

Graph 6.5: The opinion of the respondents on whether or not they would use public transport more often.

The table shows that in many of the proposed measures, most respondents would not alter their choice of transport. The only measure that can be taken that would increase the interest of the majority of the respondents would be to lower the prices of public transport. Exactly

sixty percent of the respondents would travel more or much more by public transport if it were more affordable.

There are, however, some aspects of public transport that, when improved, could draw about half of the respondents to use public transport more often. One example of this is that over about forty percent of the inhabitants of the Nijmegen Hatert residential area who filled in this survey would travel more often by public transport if the trains and busses would continue driving until later in the night. The same goes for the reliability of public transport and the accessibility of the Nijmegen Goffert train station. Therefore, it can be said that even though there is only one measure that has a majority of respondents drawn to public transport, there are a few that could increase the demand for public transport under forty percent of the respondents, which is already a significant extent.

It is possible to calculate if there is a relationship between the answers given by respondents in table 6.5 and their general information as described in chapter 5. This is done by conducting Pearson's correlation tests. This way we can see which proposed measures would be most effective per general variable. Next to this, the Pearson's correlation tests show how effective these measures will be with 1 or -1 being the highest possible score and 0 the lowest. The higher the score, the bigger the impact of the proposed measure will be. Because a score of 1 or -1 is almost impossible to achieve, Field (2018) distinguishes three forms of correlation. There is a weak correlation between 0.1 and 0.3, a moderate correlation between 0.3 and 0.5 and lastly a strong correlation from 0.5 up to 1. The results of the correlation tests are shown in table 6.6.

I would use public transport more often if:	Age	Occupation	Modal choice	Opinion on public transport	Living area
There are more bus stops in my area	0.041 Sig. 0.672	-0.126 Sig. 0.194	0.072 Sig. 0.460	-0.329** Sig. <0.001	0.039 Sig. 0.692
The buses run more often in my area	-0.185 Sig. 0.055	0.049 Sig. 0.617	-0.031 Sig. 0.754	-0.295** Sig. 0.002	-0.219* Sig. 0.023
The bus stops are easily accessible	0.034 Sig. 0.731	0.014 Sig. 0.887	-0.066 Sig. 0.496	-0.430** Sig. <0.001	-0.065 Sig. 0.517
There is a better connection with Nijmegen Goffert station	-0.305** Sig. 0.001	-0.282** Sig. 0.003	-0.152 Sig. 0.116	-0.307** Sig. 0.001	-0.126 Sig. 0.194
There is a better connection with Nijmegen station	-0.234* Sig. 0.015	0.009 Sig. 0.925	-0.121 Sig. 0.211	-0.318** Sig. <0.001	-0.144 Sig. 0.138
Public transport is cheaper	-0.296** Sig. 0.002	0.043 Sig. 0.655	-0.070 Sig. 0.472	-0.158 0.104	-0.152 Sig. 0.116
There is more seating space in public transport	-0.153 Sig. 0.113	-0.013 Sig. 0.891	0.019 Sig. 0.844	-0.257** Sig. 0.104	-0.185 Sig. 0.056
Public transport is more reliable	-0.192* Sig. 0.047	-0.064 Sig. 0.891	-0.003 0.979	-0.271** Sig. 0.005	-0.120 Sig. 0.217
Public transport is more accessible to	0.222* Sig. 0.021	0.110 Sig. 0.256	0.317**	-0.345** Sig. <0.001	0.083 Sig. 0.391

people with disabilities			Sig. <0.001		
The buses continue until later in the night	-0.334** Sig. <0.001	-0.049 Sig. 0.612	-0.180 Sig. 0.063	-0.071 Sig. 0.468	-0.033 Sig. 0.737
The trains will run until later in the night	-0.356** Sig. <0.001	-0.099 Sig. 0.308	-0.124 Sig. 0.201	-0.118 Sig. 0.225	-0.084 Sig. 0.386
The facilities are easily accessible by public transport	0.075 Sig. 0.442	0.191* Sig. 0.047	0.143 Sig. 0.141	-0.251** Sig. 0.009	-0.025 Sig. 0.797

**Correlation is significant at the 0.01 level

*Correlation is significant at the 0.05 level

Table 6.6: The results of the Pearson's correlation tests.

There are relatively many significant correlations that can be found in table 6.6. It is notable that most of these correlations are found in the age and opinion of public transport columns. This means that there are relatively many measures that can be taken to target specific groups of the Nijmegen Hatert community. When it comes to the age categories, table 6.6 shows that almost all of the significant correlations mostly impact the younger groups of society, whereas the aspect "public transport is more accessible to people with disabilities" would help attract more elderly people to public transport. The connection to the Nijmegen Goffert train station and the operating hours of public transport are significantly more important to younger inhabitants of the Nijmegen Hatert residential area. These aspects all have a score higher than 0.3 and therefore form a moderate correlation.

That the connection to the train stations in the city of Nijmegen is relatively more important to the younger population can also be seen in the significant correlation between occupation and this aspect of public transport. In that case, it shows that the inhabitants who currently have a working job would use public transport more often if the connection between their living area and the Nijmegen Goffert train station were to improve. This connection is relatively less important for the inhabitants who have already retired and therefore do not need to travel out of town as often or those are still students, for whom a good connection to the education district Nijmegen Heyendaal is more important than a connection to the Nijmegen Goffert train station. The retired inhabitants of the Nijmegen Hatert residential area and those working in the healthcare sector do find it more important than the others that the (medical) facilities are easily accessible by public transport.

As mentioned before, another interesting column is the "opinion on public transport" one. This column depicted in table 6.6 shows that many respondents who hold a relatively more negative opinion on the current public transport system in their neighbourhood could be made more enthusiastic when adjusting public transport with measures that they deem to be important. Many of these significant correlations are over 0.3 and therefore form a moderate correlation. The biggest number is the aspect "the bus stops are easily accessible" with a correlation score of 0.430, with seems to match up with the aspect "public transport is more accessible to people with disabilities" which has a score of 0.345 out of one. Therefore, it could be concluded that a portion of those who are relatively negative about public transport experience difficulty when it comes to travelling by public transport. This could be, for example, because of a disability or age-related issues.

Furthermore, it is interesting to note that there is just one significant correlation between proposed measures and modal choices. This correlation is that people who often use more active forms of mobility, such as cycling, walking or use a scoot mobile, would use public transport more often if this form of transport would be more accessible for people who experience a disability. There are, however, no measures that can be taken that attract only people that travel by car, for instance, to use public transport more often.

In short, many of measures that were proposed in the survey could have a significant impact in increasing demand for public transport in the Nijmegen Hatert residential area. This impact does differ, for instance per age category. But as table 6.6 shows many of them could attract people who currently hold a relatively more negative stance on the presence and accessibility of public transport in their neighbourhood.

7. Conclusions

The levels of broad prosperity in the Netherlands are not evenly spread out. One example can be found in the province of Gelderland, where the province itself has broad prosperity levels that are higher than the Dutch national average, whereas the more urban Arnhem-Nijmegen region has lower levels of broad prosperity than the national average (Provincie Gelderland, n.d.). This is mostly due to their relatively lower scores on health, the environmental quality, financial situations, and contentment on the living situation (Lifeport et al., 2022). The worst scores, however, are given to Dutch citizens with relatively lower education levels and citizens with a migration background (CBS, 2022). Broad prosperity consists of many different indicators such as income, but also health, housing, and environmental quality of their environment (CBS, 2022).

One way to possibly improve the levels of broad prosperity is to make the travel patterns in a neighbourhood relatively more sustainable. The main reason for this is that the transport sector is a major contributor to the production of environmental unfriendly emissions in urban areas (Elias & Shiftan, 2012). Creating a modal shift from driving private motorized vehicles to using public transportation can significantly increase the sustainability of transportation and improve the environment, economics, and public health in urban areas (Elias & Shiftan, 2012). This modal shift will only happen on the condition that the public transportation is widely available and accessible to the residents of an area. Public transportation provides a unique opportunity to decrease negative effects of car usage on environmental conditions and public health (Yatskiv et al., 2017). In this thesis it was decided to specifically focus on public transport, and no other forms of sustainable mobility, because when it comes to forming an adequate alternative for car use, public transport proves to be the most important modal choice (Saif et al., 2019).

The aim of this research is to find out which travel demand management measures can effectively (meaning measures that will truly encourage inhabitants to travel by a different mode of transport) be taken to increase the demand for public transport in lower liveability level areas in the Netherlands. The focus was on the case of the Hatert residential area in the southern parts of the Dutch city of Nijmegen. In chapters five and six, the results from the survey were analysed and further explained. This chapter will focus on summarising the data in order to formulate good answers to the sub questions and then give a final answer to the main question that was introduced in the first chapter of this thesis.

7.1 What are the current preferred modal choices of the inhabitants of lower liveability level urban areas?

Chapter four dove further into the personal characteristics of the respondents. This was done for two reasons. The first one was to see whether or not the respondents would form a good representation of the entire community of the Nijmegen Hatert residential area, and specifically the parts of the neighbourhood that have a relatively lower liveability. The other reason to include these questions was to determine which modes of transport are already relatively popular in the neighbourhood and to hear people's reasoning behind using these forms of transport. This way it was possible to create a broad overview of mobility patterns in the Nijmegen Hatert residential area. The answers provided by the 108 respondents showed that all age categories, except for the age category 0-15, were represented accordingly with the frequencies that were published on the website AlleCijfers (2023). This meant that, at least based on age, the respondents formed a good representation of the entire community of the

neighbourhood. This means that it was possible to draw universal conclusion out of the data that was gathered.

When looking at the answers that were given to the questions in the survey related to the personal mobility of the residents many different means of transport were filled in. Considering that when it comes to research on mobility it is all about the potential for movement of a person and not the actual movement (Martens, 2009), the fact that relatively many different forms of transport were seen as viable transport options by the respondents shows a relatively good access to mobility options. This is relatively positive signs for the motility (Kaufmann, 2022) of the residents of the Nijmegen Hatert residential area.

It shows that the bike is the most popular mode of transport in the Nijmegen Hatert residential area. An explanation for this is that many residents are already retired and therefore do not need to travel relatively long distances to go to work. The same can be said for the relatively large student population in the Nijmegen Hatert residential area. Furthermore, A relatively big part of the working population in the neighbourhood works in the healthcare sector, because the Canisius Wilhelmina Hospital, and also the Radboud University Medical Centre, are located nearby, these residents do not really require cars or public transport to reach their destination.

The data showed that for other people with working jobs the car, and in some cases public transport, is a relatively more popular means of transport. 37 percent of the respondents answered that they have a job that is situated outside of Nijmegen and for these respondents it is relatively unlikely that they will take the bike to get to work. The Pearson's correlation test confirmed a positive correlation of 0.2 between the modal choices and occupations. This means that people with working jobs more often took the car, whereas students or residents that are retired or unoccupied travelled more by bike.

About 45 percent of respondents believe that their current mobility choice is the easiest way to travel to their destination, followed by approximately 20 percent who view their modal choice as the fastest way to travel. Only 8 percent of respondents said that they believe that the way they travel now is the cheapest possible option for them.

7.2 What is the current opinion of the inhabitants of lower liveability level urban areas regarding public transport?

In order to know the opinions that the residents of the Nijmegen Hatert residential area have already formed on the presence and accessibility of public transport in their neighbourhood, some statements on this topic were included in the survey. This was done with the goal to answer the second sub question, namely: *What is the current opinion of the inhabitants of lower liveability level urban areas regarding public transport?*

When asked how they would rate the accessibility and presence of public transport in in general in their neighbourhood, 46 percent of the respondents believed the accessibility and presence of public transport to be good, followed by 23 percent who believe the accessibility to be sufficient. These are relatively positive opinions on public transport in the Nijmegen Hatert residential area. Which also resonates in the fact that over ninety percent of the respondents have answered that they use or have used public transport to travel to their destinations. Solely seven percent of the respondents answered that they never use public transport. As chapter six showed, the reasons why respondents use or don't use public transport differ. The most important reason to use public transport was because the respondent did not own a car and therefore were dependent on public transport to make relatively longer distance trips. Another big part of respondents answered that they believed

that public transport is easy to access. Furthermore, many respondents mentioned the high parking costs and the difficulty to reach the Nijmegen city centre by car as reasons why they use public transport instead of taking the car. These high parking costs and the car free zone in the city centre are travel demand measures taken by the municipality of Nijmegen to make transport in the city more sustainable.

Some respondents also hold a more negative view regarding public transport. The most often mentioned reason not to use public transport was that this form of transport is a slower way to get to people's destinations. This means that for some people only improving public transport in the Nijmegen Hatert residential area itself is not enough because their destination is not, or barely, connected to public transport. The reason for this is that in the last decades of the twentieth century, the car has played a relatively important role in spatial policy in the Netherlands. This has led to changing locations for employment, education, health care, and recreation (Social Exclusion Unit, 2003). This has caused a situation in which people are dependent on the car, because otherwise they are unable to reach their destination.

The survey not only included more subjective aspects of public transport. To determine possible measures that can be taken to increase the demand for public transport, some physical aspects of public transport were introduced. This was done because this thesis mainly focused on physical travel demand management measures that aim at improving the relative attractiveness of alternative travel modes (Gärling & Schuitema). The aspects of public transport that were presented as statements in the survey were based on the article written by Cheng and Chen (2015). This article states that the accessibility of public transport stops, connectivity of modes of public transport and system mobility should be considered to provide a user-friendly system of public transport (Cheng & Chen, 2015).

The municipality of Nijmegen had already concluded that public transport in the Nijmegen Hatert residential area is still of a relatively low quality compared to other neighbourhoods within the city (Gemeente Nijmegen, 2020). In their mobility vision document, the municipality pays special attention to the lower liveability level areas such as Nijmegen Hatert, especially when it comes to making public transport more accessible to the elderly and/or disabled groups of the population. Furthermore, the municipality wants to make all job locations better accessible with public transport. With these policies in mind, several statements with regard to public transport in the Nijmegen Hatert residential area were presented to the respondents.

Table 6.3 in chapter six showed the results of these statements. The respondents are relatively positive about the presence and accessibility of public transport in the Nijmegen Hatert residential area. For instance, when it comes to aspects such as the number of bus stops and how accessible they are, but also the connection to the Nijmegen main train station, more than seventy percent of the respondents have a relatively positive opinion. There are, however, also aspects which show that the respondents are relatively more divided. Examples of this are the connection to the nearby Nijmegen Goffert train station, the affordability of public transport, but also the lack of presence of public transport later at night.

In short, the residents of the Nijmegen Hatert residential area are relatively positive when it comes to public transport in their neighbourhood. There are many factors of public transport that seem to be well organised, but there are also aspects that could use some improvement according to the results of the survey.

7.3 What are the needs of the inhabitants of lower liveability level urban areas regarding public transport?

The aspects of public transport that were introduced for the second sub question have been reused for the other sub questions. This was done to keep constituency in the survey. In order to answer the third sub question, namely: *what are the needs of the inhabitants of lower liveability level urban areas regarding public transport?* The respondents were asked whether or not they believed that altering these aspects of public transport could improve the public transport system in the Nijmegen Hatert residential area.

Table 6.3 showed that the respondents have already formed relatively positive opinions on the presence and accessibility of public transport in their neighbourhood. There are, however, still steps that can be taken to make public transport more popular. These measures were depicted in table 6.4. For instance, the inhabitants of the Nijmegen Hatert residential area believe that public transport could be improved by making it more affordable and accessible for people with disabilities. Moreover, the frequency and reliability of the buses seem to be measures that the respondents have a positive view on. There are also a lot of measures which, at first glance, seem to trigger a relatively neutral response, for neutral was the most frequent given answer in their case. However, when looking closer at the percentages, measures such as keeping buses running until later in the night have a majority of positive responses and could therefore also help with increasing the demand for public transport in the neighbourhood.

In short, even though the respondents were already relatively positive when it comes to the presence of public transport in their neighbourhood, the respondents do believe that there are still some changes that can be made to improve public transport in the Nijmegen Hatert residential area. Examples are the frequency and reliability of the buses and the accessibility of public transport for residents with a disability.

7.4 Which measures could effectively be implemented to make public transport more popular in lower liveability level urban areas?

The last sub question was focused on which of the proposed travel demand management measures could really have an effect on the demand for public transport. The only way to determine if people have the intention to travel more by public transport is by following it (Shaw, 2013). In terms of research, it is best option to ask the individual if he intends to implement the required behavioural change (Shaw, 2013). This requires research, because only by asking people why they choose a certain behavioural choice, you can find out what their intention is. For this reason, the respondents were asked whether or not they would have the intention to travel more by public transport if a certain measure was implemented. The answers given by the respondents were shown graph 6.5 in chapter six. The table showed that in many of the proposed measures, most respondents would not alter their choice of transport. The only measure that can be taken that would increase the interest in public transport of the majority of the respondents would be to lower the prices of public transport. Exactly sixty percent of the respondents would travel more or much more by public transport if it were to become more affordable for people with relatively lower incomes.

There are, however, some suggested aspects of public transport that, when significantly improved, could encourage approximately half of the respondents to use public transport more often. One of these measures is that if the trains and busses would continue driving until later in the night, more people would travel by public transport. The same goes for the reliability of public transport and the accessibility of the nearby Nijmegen Goffert train

station. Therefore, it can be said that even though there is solely one measure that has a majority of respondents drawn more to public transport, there are a few measures that could be taken to increase the demand for public transport for about forty percent of the respondents, which is already a significant amount of people.

To see if there are measures that can be taken to draw certain categories of people to use public transport more often, Pearson's correlation tests were conducted. After conducting these tests table 6.6 showed that there are relatively many significant correlations that can be found. It is notable that most of these correlations were found in the age and opinion of public transport columns. This means that there are relatively many measures that can be taken to target age specific groups of the Nijmegen Hatert community for instance.

When it comes to the age categories, table 6.6 showed that almost all of the significant correlations mostly impact the relatively younger working groups of society, whereas the aspect "public transport is more accessible to people with disabilities" would help attract more elderly people to public transport. The connection to the Nijmegen Goffert train station and the operating hours of public transport are significantly more important to younger inhabitants of the Nijmegen Hatert residential area.

The second column with relatively many significant correlation scores is the "opinion on public transport" one. This column depicted in table 6.6 shows that many respondents who hold a relatively more negative opinion on the current public transport system in their neighbourhood could be encouraged to use public transport more often when adjusting public transport with travel demand management measures that they themselves deem to be important. The strongest significant relation is the aspect "the bus stops are easily accessible" with seems to match up with the aspect "public transport is more accessible to people with disabilities". Therefore, it can be said that a relatively big portion of those who tend to be a bit more negative towards public transport, experience some form of difficulty when it comes to travelling by public transport. This could be, for example, because of a disability or age-related issues that make it more difficult for them to travel.

Furthermore, it is interesting to note that there is just one significant correlation between proposed measures and modal choices. This correlation is that people who often use more active forms of mobility, such as cycling, walking or use a scoot mobile, would use public transport more often if this form of transport would be more accessible for people who experience a disability. There are, however, no measures that can be taken that attract only people that travel by car to use public transport more often. This is not necessarily an issue, because measures that have a significant result in the other columns, apply to people who use all sorts of transport and not just the car. Therefore, there are no measures that only target the car users, but there are measures where car users are included in the list of people that would use public transport more often if it were implemented.

In short, many of measures that were proposed in the survey could have a significant impact in increasing demand for public transport in the Nijmegen Hatert residential area. This impact does differ, for instance per age category. But as table 6.6 shows many of the proposed measures could attract people who currently hold a relatively more negative stance on the presence and accessibility of public transport in their neighbourhood to use this form of transport more often. This means that many of these measures could change the intention, or whether or not the individual will actually perform the required behaviour (Shaw, 2013).

7.5 How can travel demand management improve the broad prosperity of the inhabitants of lower liveability level urban areas?

In recent years the debate about how to measure prosperity, and whether national statistics provide sufficient insight into this has become relatively more important (Canoy & Lerais, 2008). This discussion led to the introduction of the “broad prosperity” principle. Central in this principle is the thought that, in addition to having an income and being able to consume with it, health, the enjoyment of education, social connections, personal development, leisure activities, and the quality and safety of the environment and living environment in which people live are important to determine prosperity (Raspe et al., 2019). It is the quality of the living and working environment of people that determine the possibility that people can realise and experience prosperity (Raspe et al., 2019). Therefore, improving the quality of the living environment of people could improve the possibility for people to realise and experience prosperity, which increases broad prosperity (Raspe et al., 2019).

There are many things that influence the quality of the living environment. Several studies address the impact of transport and transport policies on the health and well-being of people (Tobollik et al., 2016). These scientists write that the production of greenhouse gases has serious health implications (Haines et al., 2009). Because approximately a quarter of energy-related global greenhouse gas emissions can be traced back to transport (United Nations, 2015), these systems should be (re)designed with the goal to improve public health and to reduce climate impact. For this to be possible, a relatively bigger part of future travel must be done by more sustainable forms of transport instead of by car (Holmgren & Ivehammar, 2015). Furthermore, increasing the access to public transport could cause a big opportunity to reach a minimum level of daily physical activity (Besser and Dannenberg, 2005). Therefore, the public health can directly be affected by providing the opportunity of accessible means of public transport to the public, especially to the lower income and minority parts of the population (Besser and Dannenberg, 2005). In short, if efficient and affordable public transport networks are created and a modal shift is encouraged this will have a positive effect on the environmental situation, financial situation and public health of people living in urban areas (Elias & Shiftan, 2012). Because these factors are all indicators of broad prosperity (Centraal Bureau voor de Statistiek, 2022) it can be concluded that making public transport more popular will cause positive developments in the broad prosperity of people living in urban areas, such as the Nijmegen Hatert residential area.

A growth in the demand for public transport will not happen all by itself. It is important to invest in efficient public transport networks to create well-operative and sustainable cities (Kujala et al., 2018). Public transportation needs to be widely available and accessible to the public (Yatskiv et al., 2017). Thus, to make public transport more popular in urban areas measures need to be implemented that encourage people to travel a different way than they used to do. These measures are called travel demand management measures. Travel demand management involves *“any action, or set of actions, aimed at influencing people's travel behaviour in such a way that alternative mobility options are presented and/or congestion is reduced”* (Meyer, 1999).

In the case of the Nijmegen Hatert residential area, public transport was already present in the neighbourhood. Therefore, the focus was on which travel demand management measures could be implemented to improve the already existing system. The tables in chapter six showed that there are many measures that can be taken to increase the demand for public transport in the neighbourhood. Think of the working hours and frequencies of the busses and the trains or a fast connection to the train stations of Nijmegen Goffert & Nijmegen. There are

no measures that can be taken to only draw car users to public transport, but many of the measures that have a significant score would draw relatively many people to public transport, car users among them.

Therefore, it can be concluded that the implementation of effective travel demand management measures will increase the accessibility of public transport in the Nijmegen Hatert residential area. When the presence and accessibility of public transport is improved, the motility, or the capacity to be mobile (Flamm & Kaufmann, 2006), will grow. Some of the obstacles that could stop people from using public transport will have been removed, meaning that the perceived behavioural control will alter, which in turn positively influences the intention of people to carry out certain behaviour (Ajzen, 2005) and thus trigger an increase in the demand for public transport in the lower liveability level neighbourhoods.

In short, it can be said that when effective travel demand management measures are implemented to improve the presence and accessibility of public transport in the Nijmegen Hatert residential area this could also improve indicators such as the environmental quality and the public health and thus contribute to better broad prosperity levels in the neighbourhood.

8. Discussion and recommendations

In the final written chapter of thesis some recommendations for further research will be provided. Furthermore, there will be a reflection on the research that has been conducted and what could be improved on a personal level.

8.1 Recommendations

The conclusion of this research leaves some room for possible future research. Even though it is now relatively known what the effect of travel demand management could be on the broad prosperity of people living in the lower liveability neighbourhood of Nijmegen Hatert, the Nijmegen Hatert residential area is only one case from the many possible research locations the Netherlands. In this thesis, this specific case was chosen because it met the requirements that were mentioned, namely having a lower liveability level, and having a relatively bigger number of cars present in the area, but this specific case was also chosen because the neighbourhood is relatively nearby and therefore easy to reach. For further research it could be interesting to look at a neighbourhood whose liveability levels are even lower than those in the Nijmegen Hatert residential area. There is a list that consists of about forty *Vogelaarwijken* that could be used to test the results of this specific research. Many of these neighbourhoods are situated in the Western parts of the country of the Netherlands, seven of them are situated in the city of Rotterdam for instance (van Essen, 2007). I decided not to use these cases because it takes relatively long to reach these neighbourhoods when you depend on public transport. Another possibility is to start research in a neighbourhood that barely has access to public transport. In the Nijmegen Hatert residential area public transport is already present, the residents have access to a few bus stops, but travelling to the train stations takes a bit longer. When conducting research in a neighbourhood that does not or barely have access to public transport a baseline measurement can actually take place and the opinions that residents could have already formed on public transport would not have an impact on their answers with regard to public transport. In short, conducting the same research in these areas could prove to give a completely different picture, because the liveability levels or the car dependency could be much worse in these neighbourhoods than they are in the Nijmegen Hatert residential area.

Next to the selection of the case, there are also two things more related to the research itself that could be different in future research. In the theoretical chapter the concept of travel demand management was discussed. It was mentioned that travel demand management could be divided in two forms of actions, namely carrots and sticks. The carrots were the enablers or incentives to promote the desired travel behaviour, whereas sticks formed deterrents or disincentives to discourage travel behaviour that is deemed undesirable (Farahmand et al, 2021). In this research the focus was on the carrots, the aim was to see which measures promote the use of public transport in the Nijmegen Hatert residential area. In future research, it could prove interesting to include survey questions on measures that would discourage other forms of transport, such as the car, to make public transport a better alternative. It was decided to only focus on carrots in this thesis, because including many different forms of travel demand management measures would make this research much more extensive and therefore take up relatively more time for the researcher and the respondents who filled in the survey. Nevertheless, it could be an idea to focus on sticks or the combination of sticks and carrots in future research.

The last recommendation that could be made has to do with the travel mode that was focused on. Scientists focused on mobility and climate change believe that to combat the

production of emissions a greater portion of future travel must be done by bicycle, by foot or by public transport instead of by car (Holmgren & Ivehammar, 2015). In this research the focus was on improving the demand for public transport, whereas other sustainable or active forms of transport, such as cycling or shared mobility were left out. The most important reason for this choice is the argument that when it comes to forming an alternative for car use, public transport has proven to be the most important modal choice (Saif et al., 2019). Another reason for this choice was that focusing on the relatively many different forms of transport that could prove to be an alternative to the car would make this research very broad and extensive. Furthermore, asking many questions with regard to multiple forms of transport could discourage respondents to fill in the entire survey because it takes up a lot of time. Repeating this research with the focus on a different mode of transport, for example focusing on encouraging people to cycle to their destinations could also prove to be viable research. In the case of the Nijmegen Hatert residential area approximately forty percent of the respondents answered that their job is located outside of the city of Nijmegen, therefore the most important destinations of about sixty percent of respondents are situated within the city limits. Because public transport is often more useful for longer distance trips (Saif et al., 2019), the possibility of doing research on how you can encourage the use of sustainable mobility forms other than public transport in lower liveability level areas could also be explored.

8.2 Discussion

Despite the thorough preparations that were done before gathering the data, no research goes flawless, including this one. It was decided to collect the necessary data by means of an online survey, this choice has already been explained in the methodology chapter. Although enough people eventually participated in the survey, the number of respondents increased relatively slowly. This may be because people had little to say about their experiences with public transport, but the way in which the invitational letters were distributed may also have played a role. The distribution of the QR codes and links has mainly been done through the letterboxes. It is possible that people fill in the questionnaire more quickly when they have an idea who the person behind the survey is. This way they can be sure that they will not fall victim to phishing or other illegal activities. In order for the invitation to appear reliable, some personal information has been put on the note, but another possibility for a next time could be to start a short conversation with someone and hand over the invitation during that conversation. This gives people an idea of who is behind the invitations and these conversations can also provide more information about the experiences of a possible respondent. Since it takes a lot of time to talk to each resident, it is probably more efficient to talk to a few residents, so that at least some people know who is behind the invitations.

Furthermore, some feedback was received that a respondent thought that they had been asked the same question a few times in a row. They believed that this would perhaps stop people from filling in the entire survey because the question looked the same as the one before. Even though the questions indeed included the same aspects of transportation I wanted to use them for different sub questions and to make sure my analysis was consistent. It could be an idea for next time to find a way to keep the survey a bit shorter, so people do not feel discouraged to fill in the entire list of questions.

9. References

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10. Appendices

A. Invitational letter

Beste bewoner,

Voor mijn masterscriptie doe ik onderzoek naar het gebruik van, en de tevredenheid over, het openbaar vervoer in Nijmegen Hatert. Via de QR-code op deze flyer kunt u deelnemen aan een korte vragenlijst die u anoniem invult. Het onderzoek, onder supervisie van dr. Sander Lenferink, richt zich op de aanwezigheid van het openbaar vervoer in Nijmegen Hatert met als doel om het openbaar vervoer aantrekkelijker te maken voor alle bewoners. De vragenlijst kan daarom ook ingevuld worden als u nog geen gebruik maakt van het openbaar vervoer. **De vragenlijst is beschikbaar in meerdere talen.** Mocht u naar aanleiding van dit briefje of de vragenlijst nog vragen hebben, stuur mij dan gerust een mail naar eline.leeneman@ru.nl



Eline Leeneman
Student Urban & Regional Mobility aan de
Radboud Universiteit Nijmegen

Mocht het scannen van de QR-code niet lukken is de vragenlijst ook bereikbaar via deze link:
https://fmru.az1.qualtrics.com/jfe/form/SV_5jcM6patmQG3OLk

Dear resident,

For my master's thesis I am researching the use of, and satisfaction with, public transport in Nijmegen Hatert. Via the QR code on this flyer you can participate in a short questionnaire that you fill in anonymously. The research, supervised by Dr Sander Lenferink, focuses on the presence of public transport in Nijmegen Hatert with the aim of making public transport more attractive for all residents. The questionnaire can therefore also be completed if you do not yet use public transport. **The questionnaire is available in several languages.** If you have any questions regarding this note or the questionnaire, please feel free to send an email to eline.leeneman@ru.nl



Eline Leeneman
Student Urban & Regional Mobility at Radboud
University Nijmegen

If scanning the QR code does not work, the survey is also accessible via this link:
https://fmru.az1.qualtrics.com/jfe/form/SV_5jcM6patmQG3OLk

B. Survey questions

B.1 Dutch survey list

Start of Block: Introductie

Introductie Geachte heer, mevrouw,

Dank voor uw interesse in dit onderzoek. Het onderzoek richt zich op het gebruik van het openbaar vervoer in Nijmegen Hatert. Graag hoor ik wat uw ervaringen zijn en wat er verbeterd kan worden om het openbaar vervoer tot een hoger niveau te tillen. De enquête duurt hoogstens tien minuten en uw antwoorden zijn volledig anoniem. Mocht u vragen hebben over de enquête kunt u een e-mail sturen naar eline.leeneman@ru.nl.

Met vriendelijke groet,

Eline Leeneman

Masterstudent Urban & Regional Mobility aan de Radboud Universiteit Nijmegen

End of Block: Introductie

Start of Block: Algemene informatie

Q1 Wat is uw leeftijd?

- 0-15 (1)
- 16-25 (2)
- 26-45 (3)
- 46-65 (4)
- 66+ (5)

Q2 In welk deel van Hatert bent u woonachtig?

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

Q3 In welke sector bent u actief?

- Industrie (1)
- Bouwnijverheid (2)
- Landbouw, bosbouw en visserij (3)
- Waterbedrijven en afvalbeheer (4)
- Energievoorziening (5)
- Delfstoffenwinning (6)
- Zakelijke dienstverlening (7)
- Handel (8)
- Horeca (9)
- Cultuur, sport en recreatie (10)
- Vervoer en opslag (11)
- Informatie en communicatie (12)
- Financiële dienstverlening (13)
- Verhuur en handel van onroerend goed (14)
- Gezondheids- en welzijnszorg (15)
- Onderwijs (16)
- Openbaar bestuur en overheidsdiensten (17)
- Student (18)
- Gepensioneerd (19)
- (Vrijwillig) werkloos (20)

Q4 Werkt u in Hatert?

- Ja (1)
- Nee (2)
- Niet van toepassing (3)

Q5 Werkt u in Nijmegen?

- Ja (1)

- Nee (2)
- Niet van toepassing (3)

End of Block: Algemene informatie

Start of Block: Huidige mobiliteit

Q6 Wat is uw meest gebruikte vorm van transport

- Auto (1)
- Fiets (2)
- Lopen (3)
- Openbaar vervoer (4)
- Anders, namelijk: (5) _____

Q7 Waarom gebruikt u deze vorm van transport?

- Goedkoopste manier van reizen (1)
- Makkelijkste manier van reizen (2)
- Snelste manier van reizen (3)
- Geen andere optie (4)
- Anders, namelijk: (5) _____

Q8 Wat is de belangrijkste reden dat u reist?

- Werk (1)
- School (2)
- Boodschappen (3)
- Recreatie (4)
- Anders, namelijk: (5) _____

Q9 Het aanbod van vervoersmiddelen (auto, openbaar vervoer, etc.) in mijn wijk is:

- Zwaar onvoldoende (1)

- Matig (2)
- Voldoende (3)
- Goed (4)
- Uitstekend (5)

Q10 De toegang tot het openbaar vervoer in mijn wijk is:

- Zwaar onvoldoende (1)
- Matig (2)
- Voldoende (3)
- Goed (4)
- Uitstekend (5)

End of Block: Huidige mobiliteit

Start of Block: Nieuw mobiliteit

Q11 Hoe vaak maakt u gebruik van het openbaar vervoer?

- Nooit (1)
- Af en toe (2)
- Vaak (3)
- Altijd (4)

Q12 Wat is de belangrijkste reden dat u gebruik maakt van het openbaar vervoer?

- Het openbaar vervoer is een snellere manier om op mijn bestemming te komen (1)
- Ik heb geen toegang tot een auto (2)
- Ik maak me zorgen om het klimaat (3)
- Ik vind het openbaar vervoer makkelijk te bereiken (4)
- In het openbaar vervoer kan ik werk blijven doen (5)
- Anders, namelijk (6) _____

Q13 Wat is de belangrijkste reden dat u geen gebruik maakt van het openbaar vervoer?

- Het openbaar vervoer is een langzamere manier om op mijn bestemming te komen (1)
- Het openbaar vervoer is niet makkelijk te bereiken (2)
- Het openbaar vervoer is voor mij niet goed toegankelijk (bijv. door een beperking) (3)
- Ik geef de voorkeur aan de auto (4)
- Ik vind het openbaar vervoer niet betrouwbaar genoeg (5)
- Ik vind het openbaar vervoer te duur (6)
- Anders, namelijk: (7) _____

Q14 In mijn omgeving

	Helemaal oneens (1)	Oneens (2)	Neutraal (3)	Eens (4)	Helemaal eens (5)
Zijn genoeg bushaltes (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rijden genoeg bussen (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zijn de bushaltes goed te bereiken (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is er een goede verbinding met station Nijmegen Goffert (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is er een goede verbinding met station Nijmegen (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is het openbaar vervoer goed te betalen (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is er genoeg
zitruimte in
het openbaar
vervoer (7)

Is het
openbaar
vervoer
betrouwbaar
(8)

Is het
openbaar
vervoer
toegankelijk
voor mensen
met een
beperking (9)

Rijden de
bussen tot
laat in de
nacht (10)

Rijden de
treinen tot
laat in de
nacht (11)

Zijn de
(medische)
voorzieningen
goed
bereikbaar
met het
openbaar
vervoer (12)

Q15 Het openbaar vervoer kan verbeterd worden door:

	Helemaal oneens (1)	Oneens (2)	Neutraal (3)	Eens (4)	Helemaal eens (5)
Meer bushaltes in mijn omgeving te plaatsen (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Vaker bussen te laten rijden in mijn omgeving (2)

De bushaltes beter bereikbaar te maken (3)

Een betere verbinding met station Nijmegen Goffert te maken (4)

Een betere verbinding met station Nijmegen te maken (5)

Het openbaar vervoer goedkoper te maken (6)

Meer zitruimte in het openbaar vervoer te creëren (7)

Het openbaar vervoer betrouwbaarder te maken (8)

Het openbaar vervoer toegankelijker te maken voor mensen met een beperking (9)

Bussen tot later in de nacht door

te laten rijden
(10)

Treinen tot later
in de nacht door
laten rijden (11)

De (medische)
voorzieningen
beter
bereikbaar te
maken (12)

Q16 Ik zou vaker gebruik maken van het openbaar vervoer als:

Veel minder (1) Minder (2) Evenveel (3) Vaker (4) Veel vaker (5)

Er meer
bushaltes zijn in
mijn omgeving
(1)

De bussen vaker
rijden in mijn
omgeving (2)

De bushaltes
goed bereikbaar
zijn (3)

Er een betere
verbinding met
station
Nijmegen
Goffert is (4)

Er een betere
verbinding met
station
Nijmegen is (5)

Het openbaar
vervoer
goedkoper is (6)

Er meer
zitruimte in het

openbaar
vervoer is (7)

Het openbaar
vervoer

betrouwbaarder
is (8)

Het openbaar
vervoer

toegankelijker
voor mensen
met een
beperking is (9)

De bussen tot
later in de nacht
doorrijden (10)

De treinen tot
later in de nacht
doorrijden (11)

De (medische)
voorzieningen
goed bereikbaar
zijn met het
openbaar
vervoer (12)

End of Block: Nieuw mobiliteit

Start of Block: Afsluitende vragen

Q17 Zijn er nog verdere opmerkingen die u wilt maken?

Q18 Wilt u het resultaat van dit onderzoek ontvangen? Laat dan hier uw e-mailadres achter

End of Block: Afsluitende vragen

B.2 English survey list

Start of Block: Introduction

Dear Sir, Madam,

Thank you for your interest in this research. The research focuses on the use of public transport in Nijmegen Hatert. I would like to hear about your experiences and what can be improved to raise public transport to a higher level. The survey takes no more than ten minutes, and your answers are completely anonymous. If you have any questions about the survey, please send an e-mail to eline.leeneman@ru.nl.

Yours sincerely,

Eline Leeneman
Master student Urban & Regional Mobility at Radboud University Nijmegen

End of Block: Introduction

Start of Block: General information

Q1 What is your age?

- 0-15 (1)
- 16-25 (2)
- 26-45 (3)
- 46-65 (4)
- 66+ (5)

Q2 In which area of Hatert do you live?

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)

Q3 In which sector do you work?

- Manufacturing (1)
- Construction (2)
- Agriculture, forestry, and fishing (3)

- Water companies and waste management (4)
- Energy supply (5)
- Mining and quarrying (6)
- Business services (7)
- Trade (8)
- Accommodation and food services (9)
- Culture, sports, and recreation (10)
- Transportation and storage (11)
- Information and communication (12)
- Financial services (13)
- Real estate activities (14)
- Healthcare and welfare (15)
- Education (16)
- Public administration and government services (17)
- Student (18)
- Retired (19)
- (Voluntarily) unoccupied (20)

Q4, Do you work in Hatert?

- Yes (1)
- No (2)
- Not applicable (3)

Q5, Do you work in Nijmegen?

- Yes (1)
- No (2)
- Not applicable (3)

End of Block: General information

Start of Block: Current mobility

Q6 What is your most used form of transport.

- Car (1)
- Bike (2)
- Walking (3)
- Public transport (4)
- Other; (5) _____

Q7 Why do you use this form of transport?

- Cheapest way to travel (1)
- Easiest way to travel (2)
- Fastest way to travel (3)
- I don't have another option (4)
- Other: (5) _____

Q8 What is the most important reason you travel?

- Work (1)
- School (2)
- Groceries (3)
- Recreation (4)
- Other: (5) _____

Q9 The possibility to choose between forms of transport (car, public transport etc.) in my neighbourhood is:

- Highly insufficient (1)
- Insufficient (2)
- Sufficient (3)
- Good (4)

Excellent (5)

Q10 The access to public transport in my neighbourhood is:

Highly insufficient (1)

Insufficient (2)

Sufficient (3)

Good (4)

Excellent (5)

End of Block: Current mobility

Start of Block: New mobility

Q11 How often do you use public transport?

Never (1)

Sometimes (2)

Often (3)

Always (4)

Q12 What is the most important reason for you to use public transport?

Public transport is a fast way to get to my destination (1)

I do not have access to a car (2)

I am worried about climate change (3)

Public transport is easy to access (4)

I can work when travelling (5)

Other (6) _____

Q13 What is the most important reason for you **not** to use public transport.

Public transport is a slow way to get to my destination (1)

Public transport is not easy to access (2)

Public transport is difficult for me due to a disability (3)

- I prefer using the car (4)
- Public transport is not reliable enough (5)
- Public transport is too expensive (6)
- Other: (7) _____

Q14 In my neighbourhood

	Completely disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Completely agree (5)
There are enough bus stops (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a good bus frequency (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bus stops are easily accessible (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a good connection with Nijmegen Goffert train station (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a good connection with Nijmegen train station (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transport is affordable (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is enough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

seating space
in public
transport (7)

Public
transport is
reliable (8)

Public
transport is
accessible for
people with
disabilities
(9)

The buses
run late into
the night (10)

The trains
run late into
the night (11)

The (medical)
facilities are
easily
accessible by
public
transport
(12)

Q15 Public transport could be improved by:

Completely
disagree (1)

Disagree (2)

Neutral (3)

Agree (4)

Completely
agree (5)

Placing more
bus stops in
my
neighbourhood
(1)

Running buses
more often in
my
neighbourhood
(2)

Making bus stops better accessible (3)

Making a better connection with Nijmegen Goffert station (4)

Making a better connection with Nijmegen station (5)

Making public transport cheaper (6)

Creating more seating space in public transport (7)

Making public transport more reliable (8)

Making public transport more accessible for people with disabilities (9)

Keep buses running until later in the night (10)

Let trains run until later in the night (11)

Making the (medical)

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

facilities more
accessible (12)

Q16 I would use public transport more often if:

	Much less (1)	Less (2)	Just as often (3)	More (4)	Much more (5)
There are more bus stops in my area (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The buses run more often in my area (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The bus stops are easily accessible (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a better connection with Nijmegen Goffert station (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a better connection with Nijmegen station (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transport is cheaper (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is more seating space in public transport (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transport is	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

more reliable
(8)

Public
transport is
more
accessible to
people with
disabilities
(9)

The buses
continue
until later in
the night (10)

The trains
will run until
later in the
night (11)

The (medical)
facilities are
easily
accessible by
public
transport
(12)

End of Block: New mobility

Start of Block: Final questions

Q17 Are there any further comments you would like to make?

Q18, Would you like to receive the result of this research? Then leave your e-mail address here.

End of Block: Final questions
