Moving towards a carless place of work

Qualitative research on hospital employees

Master thesis

E.L.T. Zadeits

TU Delft

Moving towards a carless place of work

Qualitative research on hospital employees

by

Emma Lena Tine Zadeits

to obtain the degree of Master of Science in Transport, Infrastructure and Logistics
at the Delft University of Technology,
to be defended publicly on Thursday February 15th, 2024 at 11:00 AM.

Student number: 4671880
Project duration: September 4, 2023 – February 15, 2024
Thesis committee:

Prof. dr. G. P. van Wee,	Faculty of TPM, chair
Dr. ir. N. van Oort,	Faculty of CEG, supervisor
Dr. E. J. E. Molin,	Faculty of TPM, supervisor
Ms. K. R. M. Maas,	Business Development Manager Pon
Mr. R. Gense,	Director of Pon Mobility

Cover: Image retrieved from https://nl.freepik.com.
Style: TU Delft Report Style, with modifications by Emma Zadeits

An electronic version of this thesis is available at http://repository.tudelft.nl/.

TU Delft

Preface

This report and research are the final products of my master Transport, Infrastructure and Logistics. During my master my affinity with sustainability has grown, giving me the inspiration to look for a graduation project which focuses on sustainable transport. The collaboration with Pon was a seamless fit regarding their wide variety of mobility solutions and options and their increasing focus on decarbonizing the transport sector. Together we started with the project for the academic medical center, with the goal to decrease the emissions related to their employees' commute trips. The initial plan was to conduct a large scale survey among the employee population with a choice experiment, to be able to analyze the mode related trade-offs. However, due to misalignment of schedules, the survey became in-depth one-on-one interviews with a selection of employees. This proved to be very insightful and valuable for Pon and academic medical center, since the employees expressed their ideal sustainable transport options and spoke about their preferred way of internal communication, which will help them in further pilot testing and implementation.

During my research I have received extensive help and guidance from various people I would like to express my gratitude for. First of all, my supervisors from Delft University of Technology, Eric Molin and Niels van Oort. They have helped me throughout the process with their expertise, on practical level but also on the organizational aspects of my thesis. When I had to change my method, they supported and guided me through my decisions and adapted planning. Second, my chair, Bert van Wee, who gave detailed and valuable feedback during our meetings, which allowed me to improve my report every time. Then I would like to thank the last two people of my graduation committee, Kim Maas and Raymond Gense, my Pon supervisors. They were always open to listen and help, no matter what the question was. I have learned a lot about how organizations work and how to improve my professional communication. Besides my graduation committee I have received support from many people in my personal life. I want to thank my family, for always being there for me, and giving me their endless support, pride and love. Last, I want to thank my friends who spent their time with me to keep my mind of graduating at night and in the weekends.

I have enjoyed the entire graduation process and started (almost) everyday with the energy to continue with my research and writing my report. By following my own motto ”Geen stress”, it have been five educational, enjoyable, and rewarding months.

E.L.T. Zadeits
Rotterdam, February 2024

Summary

Objective and research gap

The transport sector is a significant contributor to global carbon dioxide emissions, with nearly half of these emissions attributed to passenger road movements. This issue is particularly acute in the Netherlands, where the Dutch government has implemented policies requiring companies with more than 100 employees to report their carbon emissions, aiming to curb work-related mobility emissions. The health care sector, responsible for a substantial part of these emissions, is under scrutiny due to its large size, continuous growth, and the commuting habits of its employees, primarily involving single-occupancy vehicle use. One of the largest medical centers in the Netherlands with over 12,000 employees, is a case in point. The majority of academic medical center employees rely on cars for commuting, influenced by factors like the need for flexible transportation due to irregular working hours, insufficient public transport services during early morning and late night shifts, increased work pressure, and concerns about safety when using public transport or non-motorized modes.

Based on an extensive literature review and field research at the academic medical center, a research gap has been established. Namely, the knowledge on whether the new alternatives are effective and just for hospital employees, and how these alternatives should be implemented and communicated to increase the acceptation of the alternatives. The goal of this study is to fill this gap and to provide academic medical center and Pon, a leading mobility group in the Netherlands, with actionable advice on sustainable commuting alternatives. The study's goals include evaluating the adoption of alternatives such as leased electric bikes and a combination of train travel with a mobility hub, understanding the factors affecting employees' commuting choices, and assessing the perceived equity of these alternatives. The research also seeks to identify effective strategies for academic medical center to engage employees in adopting these alternatives and enhance the implementation process. The practical significance of this study lies in offering academic medical center a deeper understanding of their employees' needs and perceptions, thus aiding in the successful integration of sustainable commuting options. From a scientific standpoint, the research contributes to the broader discourse on sustainable travel alternatives in the health care sector, particularly in the context of the Netherlands' unique infrastructure and commitment to reducing carbon emissions.

The report is structured into two phases: the exploratory phase, which is the main focus of this report, and the test phase. The exploratory phase is centered on understanding the academic medical center employees' perceptions and experiences regarding proposed travel alternatives, their internal communication, and the equity related to these mobility options. The main research question that is drafted to reach the objective of the research is:

"What is the level of fit to personal needs and perceived equity of the proposed travel alternatives among hospital employees?"

This question is explored through sub-questions that delve into the factors influencing employees' commute mode choices, their views on the fairness of the proposed travel alternatives, and the policy strategies and communication approaches that academic medical center can utilize to boost the effectiveness of their implementation. The research methodology includes detailed interviews providing insights into employees' perceptions, supporting the optimization of survey questions for the test phase.

Methodology

The methodology of both phases combined encompasses a combination of qualitative and quantitative approaches, including a literature review, interviews, a survey, and discrete choice experiments. The framework used to structure the research, is based on the UTAUT2 framework (Venkatesh et al., 2003), the extended version of the unified theory of acceptance and use of technology. This framework is applicable to this research since the final output measure is the use, in this case of a travel

mode, which is affected by the intention to use and behavior, which is in turn affected by moderators - socio-demographics, experience, psychographics, and communication - and contextual variables - performance, effort, social influence, facilities, price value and habit. The focus of this report lies on the qualitative approach, which will focus on specific parts of the framework that are hard to capture in a survey. The exploratory phase's qualitative insights inform and optimize the test phase's survey design. This integrated approach ensures a comprehensive understanding of employee needs and preferences, facilitating the effective implementation of sustainable commuting options at academic medical center.

The exploratory phase of the research involves in-depth qualitative one-on-one interviews with employees of academic medical center. This phase is crucial for gaining insights into employee attitudes, beliefs, and perceived equity about commuting and mobility within the organization, which is instrumental in guiding the development of sustainable commuting options. Interviews were selected as the primary method in this phase due to their ability to capture nuanced perspectives, including non-verbal cues, in-depth responses, and the opportunity for follow-up questions. The type of interview used is semi-structured. This type is chosen for its flexibility, the possibility to probe and ask follow-up questions, and the opportunity for employees to extensively explain themselves.

Participants were carefully chosen to ensure a wide range of perspectives. The selection process involved direct contact by academic medical center's Project Team Sustainable Transport Pilot members, based on their past participation in a focus group about mobility. Additional interviewees were recruited when it was evident that there was a lack of car users and employees with irregular hours among the initially recruited participants. The interviews eventually targeted a broad representation of employees, ensuring a diversity of backgrounds, job roles, and commuting habits. This diversity was key to understanding the varied mobility needs and preferences across the organization. The interviews were conducted with a focus on ensuring privacy and consent, with each participant signing an informed consent form and agreeing to the recording of the interviews for research purposes. A total of 17 employees participated in the interviews over three weeks, providing a rich dataset for analysis. These interviews provided critical insights into employees' experiences with mobility challenges at academic medical center, going beyond the quantitative data that a survey might offer.

The data analysis followed a structured approach, including transcription of interviews and thematic coding using open, axial, and selective coding techniques. Saturation was reached relatively early in the interview process, indicating that the majority of relevant themes and perspectives were captured within the initial interviews. The analysis revealed key themes around commute comfort, safety concerns, and the perceived fit of proposed mobility alternatives with employee needs.

Results

The results are organized based on the three sub-questions, to give structure and to logically arrive at the answer to the main research question. The first sub-question focuses on the influential factors in mode choice, the second on the perception of the proposed travel alternatives, and the third and last sub-question covers the policy strategies and communication regarding mobility.

First, the influential factors in mode choice are discussed, as visualized in figure 1. The largest influential factor is the working schedule of the employee, since this factor causes the environmental constraints experienced by employees with irregular hours. Employees who work irregular hours are unable to use public transport due to insufficient service and female employees feel unsafe on the bike at night or early in the morning. The daytime workers on the other hand experience no environmental constraints because of their start and/or end time. Their mode choice behavior strongly depends on the distance they must commute, where under 25-30 kilometers the chances are high the employee will opt for the (e-)bike due to health, monetary, and travel time benefits. Employees who live outside of cycle range now dominantly travel by car since the alternative, public transport, is more expensive, takes more effort and is less comfortable and flexible. Few interviewees have indicated to be willing to travel more by public transport when complete reimbursement is established. The daytime employees experience extreme congestion at the Uithof at the end of their working day which stimulates them to choose another mode than the car when possible. Additionally, the parking costs increase during the daytime, to offer employees with irregular hours travel compensation with free parking. So, where the daytime employees are stimulated by external factors and push measures to opt for another mode than the car, the employees with irregular hours are not.

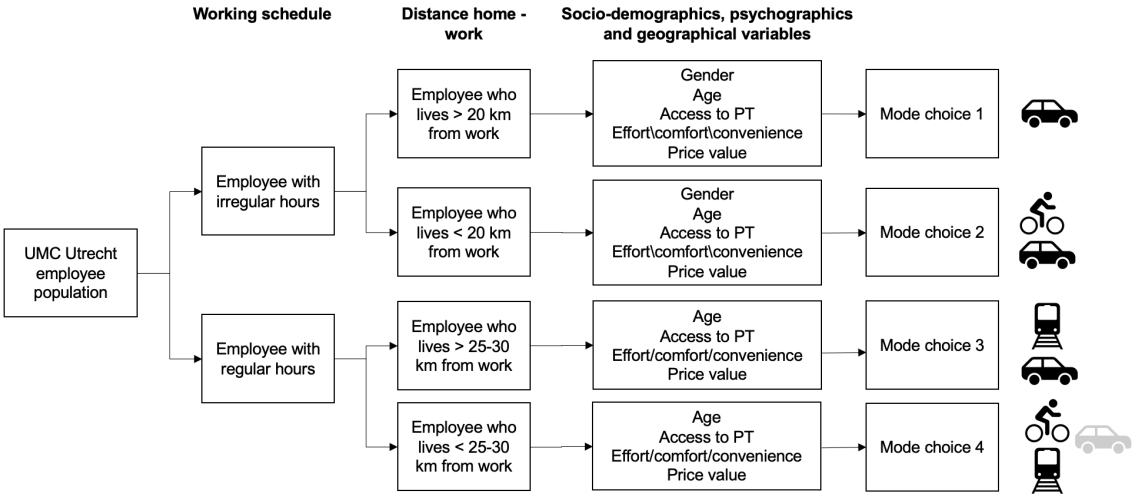


Figure 1: Chronological order of factors affecting mode choice of hospital employees (PT = public transport)

Then, the results present the perception of the two proposed alternatives and the perceived equity. The e-bike alternative is well-received, particularly for employees within cycling range. The benefits are perceived as high, including physical movement, cost-free, avoidance of congestion and parking close to home and work. On the other hand, the shared bike option at Utrecht Central station, is less favored due to its impracticality for employees. For employees who work irregular hours or who are poorly connected to the public transport network and live outside of cycling range, the alternative is not a travel option, excluding them from the mobility transition which leads to the feeling of unfairness. Employees explain that the problem does not lie with the last-mile trip from Utrecht Central to academic medical center, but with reaching Utrecht Central station overall. Furthermore, there is a fast and reliable tram connection between Central station and academic medical center, which is also reimbursed. Nevertheless, one interviewee explained to favor the shared bike over the tram, due to the crowds in the tram and the health benefits of the bike. A factor which negatively affects the acceptance of the shared bike alternative, is the perception of public transportation, since employees combine the shared bike with the train. This negative perception centers around high costs, inadequate scheduling for irregular shifts, many transfers, and long travel times compared to personal vehicles. However, the employees with irregular shifts and those who are poorly connected by public transport are willing to reduce their commute emissions and relieve the Uithof from parking actions. The alternative that they suggest that fits their travel needs, is the construction of various P+R facilities around the city of Utrecht where they can park their car and take an (e-)bike or bus for the last mile. This offers them door-to-door transport with one transfer and with the possibility to travel with private modes for the entire commute.

Last, the interview results shed light on what policy strategies and communication approach would increase acceptance of the alternatives. Arising from the interviews, were solutions and alternatives to optimize the travel options and create a better match with employees' travel needs. Interviewees suggest a permanent enhancement to the current e-bike plan, establishment of Park and Ride (P+R) facilities with shared (e-)bikes, and better integration of public transport with work schedules. Furthermore, additional services like charging stations for e-bikes and e-scooters, and improved facilities for cyclists are recommended. Regarding the communication, there is a need for more engaging, inclusive, and diverse communication strategies. Interviewed employees express a desire for more involvement in decision-making processes and clearer, more direct communication regarding mobility policies. Furthermore, the current communication relies on online notice, excluding employees who have little time and access to a computer. Therefore, employees suggest to expand the communication with physical means, such as posters or visiting day- and week-starts.

These findings highlight the complexity of commuting behaviors and preferences in the hospital sector. They underscore the necessity for tailored, inclusive, and well-communicated mobility solutions to meet the diverse needs of healthcare employees effectively.

Conclusion, discussion, and recommendations

The conclusion centers around the main research question: assessing the suitability and perceived equity of the travel alternatives among hospital employees. The findings reveal two distinct employee groups, each with unique mobility needs influenced by their work schedules. Daytime workers, unencumbered by the operational constraints of public transport or safety concerns associated with night travel, are more open to adopting (e-)bikes. This group sees cycling as a viable alternative, offering health benefits and ease of travel, particularly amidst the congestion at Uithof. For employees residing within a 25 to 30 kilometer radius, e-bikes are especially appealing. However, those living farther away and are poorly connected by public transport view the shared bike and public transport option less favorably. This sentiment is even more pronounced among employees with irregular shifts, who find these alternatives impractical and misaligned with their demanding work schedules. They perceive the e-bike as viable for employees who live close to the academic medical center, since the acceptable cycling range decreases when having to cycle through dark meadows and tree dense areas. The shared bike alternative is insufficient for employees with irregular shifts, since the public transport service schedule does not operate early or late enough for them. Therefore, the shared bike at Utrecht central as a solution for the commute is largely perceived as unfair. However, employees who live far away and are poorly connected by public transport or work irregular hours are willing to change their commute behavior and therefore suggest a solution that meets their travel needs: P+R facilities around Utrecht city where they can park their car and take a shared (e-)bike or bus to the academic medical center. This preserves the flexibility and comfort of their commute, by adding solely one transfer and offering private modes the for the entire trip.

Besides the importance of supplying the employees with viable and fair travel options, the way of implementing and communicating is also of influence on the acceptance and use behavior of the employees. Derived from the interviews, it is important to provide the employees with information on the decision-making process to make them feel engaged. Furthermore, it is advised to organize focus group sessions with a wide variety of employees and extend the communication to physical means like posters or visiting day- and week-starts.

Importantly, the study underscores that the employees' mode choice behavior is more profoundly influenced by the utility aspects of the travel options than by attitudes and perceived behavioral control.

The research's scientific relevance is highlighted through its focus on the health-care sector, a domain with specific commuting challenges due to irregular work hours and high-pressure environments. Comparing with existing literature, this study aligns with some findings while diverging in others, particularly in the emphasis on travel convenience and comfort as primary determinants of mode choice for healthcare workers.

From a practical standpoint, the study offers actionable insights for the stakeholders Pon, academic medical center, and the Municipality of Utrecht. For Pon, it suggests continuing pilot studies to gauge the real-world impact of their mobility solutions. academic medical center is advised to closely monitor employees' travel experiences to tailor their mobility policies effectively and to optimize their communication based on the suggestions derived from the interviews. The Municipality of Utrecht could enhance the safety and upkeep of cycling paths to promote sustainable commuting, which can be communicated through the academic medical center when they wish to partner together.

However, the study is not without its limitations. The selection of interview participants by the academic medical center's Project Team Sustainable Transport Pilot, potentially leading to bias, and the absence of intercoder reliability in analyzing interview data are notable constraints. To address these, future research should aim for a more random and unbiased selection of participants and consider a broader scope that includes other professions with similar work demands. Additionally, the report provides steps for conducting a survey among a larger share of the population, which consists of a choice experiment to be able to analyze quantitative trade-offs made by the employees regarding their commute mode.

In conclusion, the report acknowledges the importance of aligning mobility options with employees' specific needs, particularly in demanding sectors like healthcare. It highlights the critical role of employee engagement in the success of any mobility initiative and calls for the development of equitable, nuanced mobility solutions.

Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Definition
AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
BVR	Bivariate Residuals
DCE	Discrete Choice Experiment
E-bike	Electric bike
HREC	Human Research Ethics
ICR	Intercoder Reliability
LCCM	Latent Class Choice Model
MNL	Multinomial Logit Model
PBC	Perceived Behavioral Control
TDM	Travel Demand Management
RUM	Random Utility Maximization theory
UMC Utrecht	University Medical Center Utrecht
UTAUT	Unified Theory of Acceptance and Use of Technology

1

Introduction

One fifth of the global carbon dioxide emissions are due to the transport sector, of which almost half are caused by passenger road movements (Ritchie, 2020). The Dutch government has therefore implemented an obligation on reporting carbon emissions for companies with more than 100 employees, with the goal to reduce work-related mobility emission (Nederland, 2023).

The trips made between home and work, called commute trips, are of significant impact on the environment due to its regular pattern, relation to congestion problems, and people's choice behavior regarding place of living and work (van de Coevering & Schwanen, 2006). According to Miralles-Guasch (2011), commuting trips distinguish themselves from leisure trips by their relative long distance, time consuming nature, and dominance of motor vehicles. Furthermore, Garcia-Sierra and van den Bergh (2014) adds that people live and work more scattered now, making the use of public transport more difficult, and thus increasing the dominance of the private vehicle. Companies and organizations worldwide face the challenge to decarbonize the commute of their employees and/or visitors, to contribute to the goal of reducing the total amount of emitted green house gases. Universities, for example, generate a lot of travel movements throughout the day, made by their students and employees, and have therefore been the topic of various research (Romanowska et al., 2019; Appleyard et al., 2018). The study of Romanowska et al. (2019), a case study of a University in Poland, establishes that car availability, trip origin location, and accessibility are experienced as the most important factors influencing mode choice. Adding to this knowledge, the case study of San Diego State University by Appleyard et al. (2018), shows the financial impact that decarbonization has and what solutions could stimulate the use for more sustainable options. At the San Diego State University, when a zero-carbon transportation network is realized, annually 130 million dollars can be saved plus the 700 dollars per parking space that becomes redundant. In their case, this can be reached by increasing on-campus housing, improving the cycling, public transport, and walking access, and introducing shared mobility technology.

Another industry that generates many commuting trips, is the health care sector. The emissions from commuters in the health care sector are significant for four reasons. This sector is large, being responsible for almost 15% of the Dutch economy (CBS, 2022b). Furthermore, the number of employees in health-care are ever increasing (CBS, 2023). Third, a large share of the work has to be performed on location, demanding employees to make the commute. Last, most employees travel to work alone in their car (CBS, 2021). These factors contribute to the relatively large share the health care sector has in the greenhouse gas emissions within the Netherlands. With the aim to reduce emissions generated by home-work movements, the use of the petrol fueled car has to decrease. This automatically indicates that the use of sustainable alternatives has to increase, alternatives being: public transport, walking, cycling, or electric vehicles. Making this shift however, is relatively challenging for the health-care sector, due to the exceptional circumstances the employees operate under. Where University students and employees are most of the time expected to be on location no earlier than 8 a.m. and no later than 6 p.m., certain groups among hospital employees work irregular hours and even 24 hour shifts while performing physically demanding work with patients. These exceptional circumstances give the four main causes that make the car the dominant mode of transport. First, its flexibility and comfort when working irregular hours. Second, the insufficient service the public transport provides early in the morning and late at night. Third, the rising work pressure on health-care employees due to lack

of personnel which negatively influences the negotiating position of the employer (CBS, 2022a). Last, employees indicate to feel unsafe early in the morning and late at night when they travel with public transport or more vulnerable modes like the bike or going on foot (Plyushteva, 2021).

This research focuses on one of the largest academic medical centers in the Netherlands, with over 12,000 employees, who are looking at ways to decarbonize the commute to work for her employees. Currently, the majority of the academic medical center employees are traveling to work by car, explained by the reasons previously given.

The academic medical center has three goals they want to reach in 2030 regarding their mobility: the reduction of carbon dioxide emissions with 55%, the reduction in parking actions/movements of 55%, and to keep their employees satisfied and healthy. The reasons for these three goals are the governmental constraints regarding commute emissions, the aim to create space at the site to facilitate more organizations and housing, and to increase the employee satisfaction within the organization. To reach these goals, the academic medical center has consulted Pon for their expertise in the field of mobility and their variety in sustainable mobility options. Pon is the biggest mobility group in the Netherlands, who sell imported cars, supply millions of bikes annually and operate innovative mobility services. Together, these parties have found two alternatives that could help reach the mobility goals of the academic medical center. The two alternatives they are considering for implementation are the electric bike supplied by Lease-a-Bike (n.d.) and the combination of the train with a mobility hub at Utrecht Central. The mobility hub is operated by Hely (n.d.) which has reserved an area at Utrecht Central, stalling (electric) bikes solely for academic medical center employees. They have come to these alternatives based on the sustainability, feasibility to implement and stimulation of employees' health.

Besides offering attractive alternatives and stimulating employees to adapt these travel modes, the academic medical center should focus on their implementation process and approach in communication towards their employees. This step is crucial since over the last three years, the academic medical center has made several attempts to implement measures and alternative to stimulate or oblige the use of another mode than the car, without widespread success. The hypothesis for the repetitive misalignment is the feeling of obligation that the employee experiences and the fact that the biggest protesters are heard best in the organization. Individuals who benefit from certain privileges which are eliminated or cut back on, actively protest against implementation, possibly overruling the overall positive attitude of individuals who didn't benefit from the privileges in the first place. To distinguish different behaviors and attitudes among the academic medical center population, it is beneficial to create groups that overlap in their mode choice behavior. When the employees who prefer the same way of commuting are grouped together, these groups are analyzed on their personal characteristics and attitudes. This process of grouping the employees enables the analysis of the relation between personal characteristics and mode choice behavior. Establishing the heterogeneity among the employee population will give the academic medical center and Pon a clear overview of the different groups with their preferences and values within the population, to which they can adapt their alternatives, communication and implementation process. During previous implementations there were no distinctions made in employee groups based on their mobility needs or preferences, backgrounds, work shifts, and travel options. This led to a conflict between effectiveness and equity, since the offered sustainable travel options are not viable for all employees. Furthermore, the academic medical center primarily focused on push-measures rather than pull-measures. They used travel demand management to negatively impact the use of the private car, instead of stimulating sustainable alternatives. This made certain employees feel misunderstood, which currently leaves the mobility transition a sensitive topic within the organization.

Currently, there is a gap in knowledge on whether the new alternatives are effective and equal for hospital employees, and how these alternatives should be implemented and communicated to increase the acceptation of the alternatives. The goal of this study is to fill this gap. It attempts to analyze whether employees are willing to adopt the two alternatives, what factors influence their choices, whether the alternatives are perceived as righteous according to employees, and how they prefer to be approached. The practical relevance is the established insight into the needs and perceptions of the employees, to form a substantiated advice for academic medical center to improve their chances of success when implementing future alternatives. The scientific relevance this study aims to add to existing research, is the qualitative analysis of sustainable travel alternatives that could possibly decarbonize hospital commuting trips. There has only been one study that investigates the decarbonization options for

health-care commuters, at three hospitals in the United States (S. Kaplan et al., 2016). Since infrastructure is significantly different in the Netherlands compared to the United States, more bike and transit friendly infrastructure being available nation-wide, this study aims to be valuable for countries similar to the Netherlands. Another research, by Esztergár-Kiss and Zagabria (2021), has performed a mobility questionnaire to compute a list of sustainable mobility options which are feasible for a wide variety of employers who want to decarbonize the commuting trips. However, this research is applicable to many companies, lacking the special context variables of the hospital. Furthermore S. Kaplan et al. (2016) recommend to conduct a survey with a large sample size, which will be done when executing the test phase of the research.

1.1. Objective

The goal this research pursues is to be able to advise the academic medical center and Pon on whether the alternatives are deemed successful, what factors affect the take-up of the alternatives and what measures improve the adoption among the employees. Furthermore, the perceived equity of the employees regarding the presented alternatives is asked. The alternatives can then be adjusted or redesigned when inequity is experienced. This directly means that the research will focus solely on academic medical center employees. Also, the research will limit itself to the five selected alternatives: leased e-bike, train + shared (e-)bike at Utrecht Central, car, bus or tram and train + bus or tram. The reason for doing so is because the academic medical center and Pon wish to gather information on the uptake of their two considered alternatives and the other three are most feasible for academic medical center employees seen the available infrastructure in and around Utrecht. Last, the choice experiment only targets academic medical center employees who currently use the car for most of their commuting trips. The reasoning behind this scope is that the academic medical center is interested in stimulating employees to get out of the car, into or onto the new modes. Therefore, the experiment will focus on the current and perceived future behavior of car users, to be able to draw a conclusion targeting the group among the academic medical center employee population where most gains can be made seen the decarbonization.

Evident is that there are multiple parties that have an interest in or influence the decision process. Five parties are considered who are expected to be significant. The Dutch government has set a frame in which the academic medical center has to handle, namely obliging larger companies to document the emissions generated by their commuting employees. The government is powerful, yet have little to no interest in the case of the academic medical center. Then, the municipality of Utrecht is powerful, seen their influence on the infrastructure in the region of where the hospital is located. They have the power to change and expand the public transport network and create safe bike lanes to stimulate sustainable and safe traffic in the municipality. The academic medical center wants to drastically reduce their emissions, having set three goals to subject the alternatives to. They are the most powerful party with a high interest, since they ultimately decide which alternatives they want to implement to reach their goals. Then, Pon offered two of their mobility services to help the academic medical center during the mobility pilot. This makes them an interested party, since their services could be viable for the goals of the academic medical center. Last, the employees of the academic medical center are involved in the process. They are highly interested but less powerful. However, the academic medical center has one of their goals aimed at the health and satisfaction of her employees, making the opinion of the employees weighty in the final decision. The societal objectives of this research are directly aimed at the last three parties, and indirectly at the Dutch government, since the recommendations will fall within the frame of their emission reduction policy. The academic medical center can propose infrastructure enhancements to the municipality based on the experienced traffic situation in the region of the medical centers by the employees working on site. Issues experienced by the people traveling through the city of Utrecht might trigger the municipality to improve travel services. The academic medical center will benefit from this research since it will give a more detailed and thorough insight into the variation in mode choice behavior among the interviewed population and their feelings and perception of equity regarding the travel alternatives that they offer. This will help the academic medical center create a deeper understanding of their employees, to be able to integrate the alternatives and needs of the employees. The employees on the other hand benefit since their opinion and stated behavior is collected in more depth and detail, to enable a more seamless match between means and needs. This aims to provide a more relaxed atmosphere around the mobility topic within the organization and therefore create a more

willing attitude to adapt the travel alternatives by the employees. Last, Pon is helped by the research since they receive information on if and/or how their alternatives are able to satisfy the needs of the employees. This will help them during the trial period of the mobility alternatives, to experiment with altered designs based on the needs of the employees.

1.2. Research questions

This research has two parts: the exploratory phase and the test phase. Both phases are considered and elaborated, however only the exploratory phase is executed and concluded on in this report. The test phase is set up and the instructions on the methodology allow for further research right away. The focus in the exploratory phase lies on creating insight into the perception and experience of the academic medical center employees regarding the proposed alternatives, internal communication and equity related to the mobility options.

The reason for splitting the research into two phases was not voluntarily, but is ought to be of added value in hind sight. Due to external factors, the planning of the survey would extend to the first quarter of 2024, which would not fit the planning of the project. Therefore, the new research approach of conducting interviews is taken up, that will provide more detailed knowledge on the employees' perception and will support the optimization of the survey questions.

The main question drafted to answer in this research is the following:

"What is the perceived equity and opinion on the fit between the personal needs and the proposed travel alternatives among hospital employees?"

In order to answer the main research question, the following three sub questions are stated:

1. What factors play a significant role in commute mode choice according to hospital employees?
2. What is the perceived level of equity of the proposed travel alternatives?
3. Which policy strategies and communication approach do hospital employees experience as positive and motivational for travel alternative adoption?

Additional questions are drafted that build on the exploratory phase of the research and continue with the test phase, which includes the survey. Since these questions will not be answered in this report, they are stated separately and are recommended for further research.

4. What are the trade-offs made between the mode-related attributes and what is the impact of the attributes on the mode utility?
5. What is the perceived level of equity according to hospital employees regarding the alternatives, given the presented choice sets?
6. Which groups can be distinguished among the academic medical center employee population, based on the mode related trade-offs made, and what are their socio-demographic, psychographic and behavioral characteristics?
7. What is the effectiveness and perceived equity of the proposed travel alternatives among hospital employees?

The methods used to answer these questions will be elaborated upon in chapter 2.

This report is divided into seven chapters. The second chapter discusses and presents the methodology that is applied in this research and why they are chosen as most suitable. Chapter three through five elaborate further on the methodology and describe its application. Chapter 3 is the literature review performed, laying the basis for this research. Then, the exploratory phase is described in detail in chapter 4, together with the analysis of the interview participants. Chapter 5 explains the steps that need to be taken for the test phase, with a thorough explanation about how the survey is designed and validated. The results of the exploratory phase are presented and elaborated on in chapter 6, accompanied by quotes of the interviewees that emphasize the pain points in the mobility transition of the academic medical center. Last, the conclusions are drawn, the results and limitations are discussed, and further recommendations are given in chapter 7.

2

Methodology

This chapter discusses the methodology that will be used, including the necessary tools. The chapters 4 and 5 will describe the execution of the methods and how the results will be retrieved to be able to answer the research questions. This research consists of two phases, the exploratory phase and the test phase. The test phase partly relies on the output generated from the exploratory phase. In figure 2.1 the method split is shown, with the corresponding research questions answered per process step. The part of the research that will not be performed in this report, are the gray tinted parts in the figure. The survey, including the discrete choice experiment, is designed and ready for distribution. The test phase is documented up to the point where solely execution is required to answer the sub questions four through seven of the test phase.

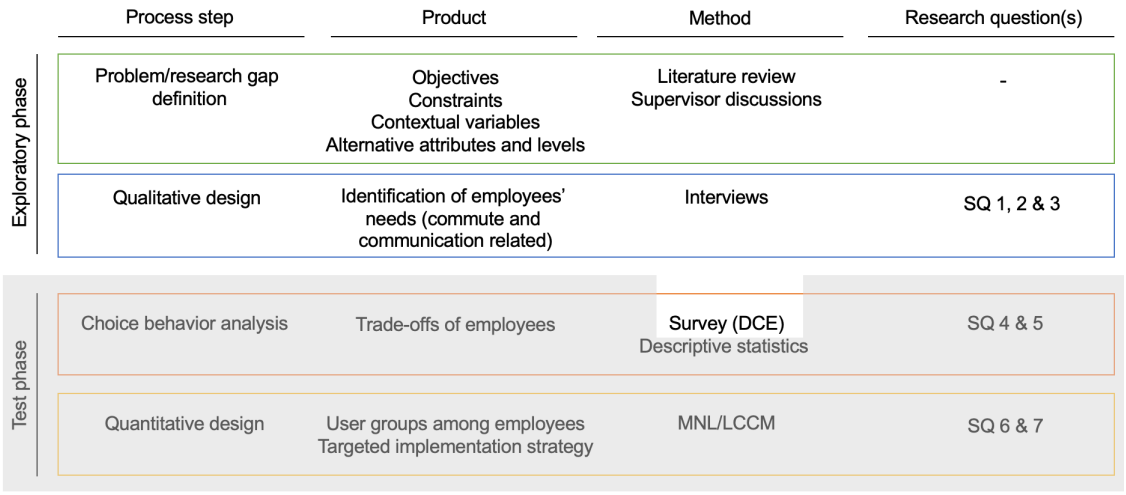


Figure 2.1: Flow of the research with applied methodology and research questions answered

The first process step is to identify the problem and research gap. This will give the objectives and constraints of the project. Furthermore, this step generates the contextual variables to consider when working towards the objective(s). Last, the alternatives and the attributes and levels corresponding to the alternatives will be established in this step. This is achieved by performing an extensive literature review and having discussions with the supervisors from Pon and academic medical center. The literature review approach is elaborated on in section 2.1. No research questions will be answered with this step. However, the information and knowledge gained from this step are crucial when proceeding with the qualitative design of the exploratory phase and the choice behavior analysis step of the test phase.

Then, the second and last process step of the exploratory phase is entered. The qualitative design consists of the advice for the academic medical center and Pon regarding the fit between employees' needs and the available means and an approach for their internal communication. Several factors are considered when advising the two most powerful stakeholders: available infrastructure (in region

Utrecht), employee needs and preferences, level of sustainability, cost of implementation, Pon and academic medical center their available means and safety and wellbeing of the employees. This is done based on explorative research among the employees, with the employer and regarding infrastructure possibilities in the region. The needs and preference of the employees regarding the commute and communication are retrieved by conducting in-depth one-on-one interviews. The interview method applied can be found in section 2.2. The research questions answered with this step are the three sub questions and the main question from the exploratory phase, found at the end of the introduction. Also, the fifth sub question from the test phase, focusing on the communication approach of the organization, is answered with this process step.

After having established the qualitative design in the qualitative part of the research, the test phase will start with the choice behavior analysis. This step will generate the trade-offs made by the employees and give an overview of the socio-demographic. The first method applied in this step of the research is the conduction of a discrete choice experiment among the academic medical center employee population, as part of a survey. After having collected sufficient survey responses, the output should be analyzed by means of descriptive statistics. A more extensive explanation of this part of the research is given in section 2.3. The research questions four and five, part of the test phase, as seen in the introduction, can be answered with this step.

The final step is the quantitative design, which consists of the distinguished user groups among the employee population based on their mode related trade-offs made and their socio-demographics and psychographics. This allows for a targeted implementation strategy for the academic medical center, where they are able to satisfy the needs of the different user groups to a greater extent than currently pursued. The methods applied in this final step, are the multinomial logit model (MNL) and the latent class choice model (LCCM). With this analysis, the answer to sub question six and seven, part of the test phase, will be found.

The chapter concludes by describing the link between the two research phases in section 2.6. Also, the desired link between the collected data and the purpose of the method is given, since this is found to be an essential step in research design of a case study (Yin, 2009).

2.1. Literature review

2.1.1. Approach

Sources used for the literature research are TU Delft repository, Brightspace, Scopus, Science Direct and Google Scholar. These five sources provide an extensive collection of scientific papers and articles. To be able to find literature that is of added value to this research, a specific combination of search words is used in Scopus:

- ALL (”travel behavior”) AND TITLE-ABS-KEY ((”commute” OR ”commuters”) AND (”mode” OR ”modal” OR ”transport” OR ”transportation”) AND (”choice” OR ”behavior” OR ”option” OR ”perception” OR ”adopt”))
- TITLE-ABS-KEY ((”commute” OR ”commuters” OR ”commuting”) AND ”shared mobility” AND (”hub” OR ”transport hub”))
- TITLE-ABS-KEY ((”commute” OR ”commuters” OR ”commuting”) AND (”electric bike” OR ”e-bike” OR ”electric bicycle”) AND (”replacement” OR ”substitute”) AND (”car” OR ”private car”))
- (”perceived equity” OR ”equity” OR ”equity perception” OR ”experienced equity”) AND ”in” AND (”mobility” OR ”transport” OR ”travel” OR ”commute”)

The criteria used for the selection of trustworthy and valuable information state, in chronological order, are:

- The study area of the publication, this research limits its scope to studies in Western countries. Since this study focuses on the Netherlands and literature that is most similar to this case study is selected.
- Check the field weighted citation impact in Scopus. This impact indicates how well the publication is cited compared to similar publications, taking the citation average of the year of publication and the three consecutive years. When the impact has a value greater than one, the publication is considered. Exceptions are made for TU Delft repository publications and lecture slides.

- Relevant abstract, title and keywords. These are scanned for information and wording that match the goal, hypothesis and method of this research.
- Read paper or relevant parts. When the literature captures relevant findings regarding travel behavior, mode choice, or the methodology applied, the source is included in this research.

For the literature on equity related to mobility, a different selection approach is used, since the papers found most valuable did not comply with desired the field weighted impact but were deemed to be valuable for this research. For example, the research of Esztergár-Kiss and Zagabria (2021) is only cited four times according to Scopus, but it is very similar to this research and contains valuable insights in Travel Demand Management, commuting behavior, and workplace approaches to decarbonize the commute. Furthermore, research by Savvides (2013) has zero citations, but has a clear and concise description of transportation equity that is used in this report. Both papers are based on literature with a high field weighted impact and sufficient citations on Scopus, and are therefore deemed as scientifically relevant and reliable.

Furthermore, the literature review is not limited to the sources found by using the search strings, since additional valuable knowledge was found through backward and forward snowballing, as seen in table 2.1. Also, due to the scarce information of health-care or hospital related commute, it was deemed necessary to do additional search attempts outside of the search strings listed above.

Table 2.1: Backward and forward snowballing applied

Initial source	Snowballed source	Forward/backward
Kuppam et al., 1999	Dobson and Tischer, 1977	Backward
Fu, 2021	Haustein et al., 2018	Backward
Abenoza et al., 2018	Shen, 2014; Greene and Hensher, 2003; Teichert et al., 2008	Backward
Washbrook et al., 2006	Louviere et al., 2000	Backward
Lancaster, 1966	Amaya-Amaya et al., 2008	Forward

2.1.2. Attributes and levels

In order to be able to perform an experiment in which alternatives are differently valued by respondents, attributes have to be allocated to the alternatives. These attributes are then varied in level per alternative, to be able to establish the weights individuals assign to attributes. The attributes are selected when they comply with the following two goals (Molin, 2020):

- They are expected to influence the opinion on mode choice;
- The attributes must target design characteristics of the transport mode. This way the operating actor, academic medical center, will be able to influence these characteristics to enable change in the modal choice behavior of its employees.

Using the approach of Hensher et al. (2005), a universal and finite list of attributes is computed, giving the researcher three options. First, to randomize all the attributes among the respondents, this approach leaves the researcher with a highly complex data set to analyze. The second way to extract valuable attributes is to eliminate 'insignificant attributes' as assumed by the researcher, to reduce the list of attributes used in the survey. This elimination process can be made more reliable by consulting experts in the research field. Last, the researcher can present the respondent with unlabeled or generic alternatives, by not naming the attributes. The second approach, to filter the list of attributes with an expert, is chosen, since the first and last approach are more time consuming for the researcher and more difficult to extract travel behavior information from. While Abiiro et al. (2014) agree to rely on a literature review to create an extensive list of attributes to the alternatives, it is advised to consult an expert in the field of research and conduct an in-depth interview to analyze the chosen attributes and possibly generate additional attributes.

The attributes and levels should be stated in such a manner that efficient extraction and examination of the behavior of respondents is possible (Louviere et al., 2000). Therefore the levels should be measurable, all-inclusive and non-infinite (Kjaer, 2005). To ensure efficient extraction, the attributes and its

levels must be unequivocal and correlation between attributes must be avoided (Gates et al., 2000). Furthermore, equidistance among the levels should be preserved and each level should occur an equal number of times (Molin, 2020). Last, it is recommended to use more than two levels per attribute, to enable the estimation of non-linear effects (Kløjgaard et al., 2012). Consulting an expert on these criteria and performing an additional test experiment are advised for an optimal output (Coast et al., 2012; Mangham et al., 2009).

Besides questions to retrieve subjective and objective information from respondents, statements can be used, to indicate how strong individuals feel about a certain topic. For this research, it is valuable to rate the level of equity per choice set given for example. Also, specific psychographic and behavioral characteristics can be obtained from the respondents by giving them statements that are relevant to this study and having the respondent answer on a five or seven point Likert scale. A Likert scale gives the respondent the possibility to express their intensity of approval/disapproval or likeliness/unlikeliness on varying topics (Schwanen and Mokhtarian, 2005; Joshi et al., 2015).

2.2. Interviews

In this research, qualitative semi-structured interviews will be conducted. The choice for interviews was made based on four reasons. The first reason is not voluntarily, but it did determine the choice for the new research approach. The interviews are the back-up plan for the survey, since the planning of the survey, part of the graduation thesis, did not align with the planning of the academic medical center regarding their mobility transition. However, even though it was not the original plan to conduct interviews, it is valuable to conduct interviews in this research, since the behavior and willingness of the employees is currently obstructing the implementation of more sustainable travel alternatives. However, the academic medical center is not completely informed on the hind lying thoughts of the employees and how they could amend their approach to increase success of implementation. So, the remaining three reasons to choose interviews are the main advantages interviews have over conducting an online survey. First, during an interview the researcher is able to see the respondent when a question is posed. Initial resistance or willingness can be deduced from observed physical or mimic reactions. A survey saves the answer given by the respondent, but not the tone of voice or posture when answering. The second advantage of interviewing is the possibility to probe or ask follow-up questions. This can be of added value when a respondent has a deviant opinion or feels very strong about a subject. Giving the interviewee the chance to elaborate on the answer will give more detailed insight into the motives of the employees when choosing a specific mode of transport and behaving a specific way. Last, opening the conversation between researcher and academic medical center employee will make it easier to capture the feelings and perceptions regarding commuting. Static survey questions make it difficult to give the employee the chance to express their feelings, while open-ended interview questions ask the employee to elaborate on their beliefs and behavior in detail. Since the mobility approach is a sensitive topic within the academic medical center, the interviews are conducted one-on-one rather than focus groups, to allow each participant to express their full range of emotions and to avoid out-of-control discussions.
Although interviews are not able to test the mode choice behavior of a large share of the academic medical center employee population, they do enable the analysis of the feelings and perception employees have regarding the alternatives, implementation approach of their employer and the way of communicating. These aspects will help the three main stakeholders that are involved in the problem:

- **academic medical center**, by being able to advise them on how to communicate the travel alternatives and how to approach the implementation to match the preferences of the employees.
- **Pon**, by informing them about the attitude people have towards the lease e-bike and shared bike at Utrecht Central. Follow-up questions can lead to a better understanding on how the alternatives would align with the needs of the employees.
- **academic medical center employees**, they are able to extensively elaborate on their opinions about the alternatives and also on how they experience the approach their employer uses. This will give them the feeling of being heard during the process of reaching the academic medical center mobility goals.

2.2.1. Interview design and conduction

Gall et al. (1996) find there are three types of interview to be distinguished: informal conversational interview, general interview guide approach, and the standardized open-ended interview. The informal conversational has no predetermined questions prepared and starts the interview more as a casual conversation. Furthermore, the general interview guide approach is on the other side of the spectrum, where all the questions are predetermined and no follow-up questions or casual conversation is possible during the interview. The standardized open-ended interview allows for rich and extensive answers from the respondent, and leaves room for the researcher to ask follow-up questions or to probe. The interviewees will be able to express their full viewpoint and opinion on the asked topics. The downside to this type of interview is the difficulty of coding the answers, since the interviewee is asked to answer in as much detail as possible when posed an open-ended question (Turner III and Hagstrom-Schmidt, 2022). Nevertheless, since all interviewees receive identical questions and they are able to give extensive answers, the bias of the researcher in the analysis decreases (Gall et al., 1996).

The target group for the interviews, consists of a wide variety of employees regarding their age, mode of choice, function group and gender. Interviewing such various employees will increase the chance of being able to generalize the findings to the entire employee population of the academic medical center at the end of the research. It is desirable that the majority of the interviewees are currently traveling to work by car, since these employees need to be targeted by the designed alternatives and implementation approach. The number of selected employees will be determined throughout the process, since the saturation is determined by interactive reflection of every step of the process (Seidman, 2006). Due to the sensitivity of the subject within the organization, the recruitment of participants is a careful process. First, one of the Project Team Sustainable Transport Pilot members of the academic medical center calls or emails potential participants, to ask them whether they are willing to and have the time to participate. Then, the credentials are forwarded to the researcher to plan the interview. A minimum of 20 interviewees is aimed for, considering both feasibility and sufficiency. Sufficiency is based on the variation in individuals and the variation in insights they provide. When the majority of the selected employees indicate the same behaviors and beliefs, so share the same views, less participants are required (Douglas, 1976). The interviews will be conducted on location at the academic medical center to make the participation as low-threshold as possible. Also, according to the theory of environmental psychology, people tend to feel more comfortable in familiar environments (Craik, 1973), this will benefit the open conversation. Besides environmental comfort, the interviewee should also feel comfortable around the researcher. To establish this feeling of comfort, a personal introduction is given at the start of the interview and an open posture is guarded to radiate an inviting atmosphere. Furthermore, the interviewee will be informed on the topic and will receive the interview questions in advance. To ensure that all answers and transcriptions are anonymized and protected for the interviewee and usable for the researcher, the interviewee has to sign a HREC form preceding to the interview. This form also states that the recording and transcription are deleted after the end of the study. Last, the researcher will ensure a safe environment by listing more than speaking, to generate follow-up questions that match the answers and add depth to the answer given.

As Kvale and Brinkmann (2009) state, it is good to gain basic knowledge from literature and to determine what interviews fit your research, but the practice of conducting interviews is learned from doing interviews and reflecting on the process. Therefore, the skill of conducting interviews is practiced a few times with a test group before being performed on the selected employees. It is important establish the feeling of mutual respect at the start of the interview, by showing that you take your research and their time seriously (Seidman, 2006).

Questions are drafted based on the goal of the interviews: gain deeper insight into the behavior and beliefs of the employees of the academic medical center regarding their commute, the proposed travel alternatives, and their preferred way of communication within the organization that will stimulate uptake of sustainable alternatives. Retrieving the motives and thoughts of the employees on these three topics will enable the advice for the academic medical center and Pon on how to design the alternatives to match needs and means and how to approach their internal communication to maximize the uptake of the alternatives. After drafting the questions, they are discussed with the two supervisors from Pon, as well as the Project Team Sustainable Transport Pilot of academic medical center, consisting of three people, who are responsible for sustainable mobility at academic medical center. The final set of questions that will be posed to all interviewees, can be found in appendix A.

2.2.2. Interview analysis

The analysis of interviews consists of four phases, of which phase one starts during the interview and the other three phases are consecutive to the interview.

1. **Record**: the first step is to start of strong by making a high quality recording of the interview and to make notes during the interview about the physical reactions and mimics that the recording does not catch.
2. **Transcribe**: the recording will be transcribed afterwards, which means that the literal conversation is typed out, word for word. This ensures that the interviewee is analyzed based on the exact statements they have made and there is no room for personal interpretation.
3. **Code**: the analysis of the answers starts by coding the transcription. Coding involves the categorization of the answers of all interviewees. First, all the answers that are stated are given labels that correspond with the subject of the answer. Then, the labels are placed under more overarching categories. This leaves the researcher with an overview of the categories found important among the interviewees.
4. **Analyze**: the last step is to analyze the codes from the previous step. Where some codes might return in multiple interviews, emphasizing its significance among the target group.

2.3. Survey

According to Groves et al. (2009) survey methodology consists of the steps: design, collection, processing, and analysis. During the design, the stated choice experiment needs to be considered, since this is part of the survey. According to the Ngene User Manual, there are three steps to be taken when drawing up a stated choice experiment (Metrics, 2018). First, the model needs to be specified, which includes the selection of attributes and the attribute levels. To be able to select valuable attributes and levels for the experiment, a thorough literature review is performed on previous research. The information retrieved from the review is then combined with the internal knowledge obtained from test interviews with a small number of academic medical center employees. This combination will create realistic alternatives with attributes and corresponding levels.

The second step is the generation of the experimental design, which will produce the choice sets that are considered in the experiment. This is done with the software Ngene, explained in more detail in section 5.3. These generated choice sets will be processed into the questionnaire and tested with a predetermined test group, consisting of experts, academic medical center employees and random individuals. The feedback received from the test group will then be incorporated, to arrive at the final step, the creation of the final survey design, which will be spread among academic medical center employees. So, the design of the survey is based on literature review, exploratory interviews with hospital employees, expert consultation and testing to optimize the pilot survey. After this, the collection, processing, and analysis steps mentioned by Groves et al. (2009) are proceeded.

The considerations and decisions about the target group, the content of the survey and the method applied for constructing the survey are elaborated on in section 2.3.5. Then, the approach for collecting the survey data is briefly elaborated on. Third, the way the data will be processed is discussed. Last, the methods selected for data analysis are explained.

2.3.1. Test interviews

To verify the questions, statements and specifically the attributes and levels, and explore the possibility of missing certain aspects, test interviews are conducted. The questions aim to gain insight into how the employees feel about the implementation of new travel options and their perception of the equity regarding the alternatives and the implementation process. This will benefit the design of the experiment, since interviews can shed light topics and questions that might be too sensitive or on which employees are very willing to comment, this influences the way the topics and questions will be posed in the survey. The attributes and levels found through literature review and expert consultation will be presented to the interviewees, to see whether employees find the options realistic and feasible. The interviews will be conducted with a small group of employees from different function-groups within the organization, aiming to represent a large share of the employees. The interviewees have to be selected by a member of the project team for mobility within the academic medical center, since the mobility transition is a sensitive topic and the team prefers to inform the interviewees thoroughly before exposing them to the interview questions.

2.3.2. Discrete choice modeling

The framework for discrete choice modeling of travel demand was initiated by McFadden in 1973, with the first focus of travel demand being the choice of travel mode (Bernasco and Block, 2013). The framework is widely applied with the goal to reveal underlying observed and unobserved factors regarding travel behavior (Train, 1986; Bhat, 1997). Individuals are regularly presented with a finite set of alternatives from which they have to choose under consideration (Bierlaire, 1998). Train (1986) explains that the Utility Maximization Theory, the most common decision rule, lies at the base of the modeling approach. This theory assumes that individuals choose the alternative(s) that will maximize their utility. The individuals make a trade-off between the alternatives to obtain their maximum utility gain, based on the attributes, with corresponding levels, of the alternatives. Discrete choice modeling is applied to reveal or predict these trade-offs made by individuals regarding their transportation demand. The relative importance assigned to attributes by individuals, is revealed by varying with the attribute levels between the choice sets. The trade-offs made, will then reveal attribute weights which are used to predict reliable choice probabilities. The choice options presented to the individuals are collected in a Discrete Choice Experiment (DCE), where the varying of alternatives is done based on experimental design. The data source used for this experimental design is stated preference, as applied in the econometric paradigm. This paradigm is the basis of this research, with a cross link with the mobility style paradigm. Stated choice means that the researcher computes hypothetical alternatives to present to the participant. This source of data is beneficial over its counterpart, revealed preference, when wanting to study the trade-offs made in a choice experiment (Bridges et al., 2003). Revealed preference data is harder to interpret due to covariance between choice attributes and little variance in attribute levels (Washbrook et al., 2006).

As explained, the attributes and their levels are varied among the choice experiments to obtain attribute weights and choice probabilities. The weights and probabilities on their own are interesting, however, they become more valuable for policymakers when combined with person-related characteristics of the respondents. For example, individuals' lifestyle, attitudes and preferences influence their choice behavior. The heterogeneity within the market is explained through different kinds of segmentation, elaborated upon in 3.4.2. The respondents of the experiment will be segmented based on their socio-demographic, psychographic and behavioral characteristics. The segmentation technique previously used in transport behavior modeling is the Latent Class Choice Model (LCCM) (Greene and Hensher, 2003; Teichert et al., 2008; Shen, 2014; Abenoza et al., 2018). The theory of LCCM states that travel behavior depends on attributes and latent heterogeneity affected by person-related characteristics which are mostly unobservable (Greene and Hensher, 2003). This heterogeneity is analyzed by dividing individuals into segments which then influence their probability of choosing a certain alternative. The created segments are labeled by the most common characteristics of the grouped individuals, which sketches traveler profiles. These profiles are valuable to create a better understanding of the existing segments to be able to target them more precisely during the implementation of the travel alternatives.

2.3.3. Discrete Choice Experiment

Discrete Choice Experiments (DCE) implement the finding of Lancaster (1966), that implies that goods are not homogeneous but are a sum of their attributes, and when these attributes change there might be a switch from one good to another. Second, DCE uses a finite and mutually exclusive set of alternatives, in contrast to the continuous number of goods in the consumer theory (Amaya-Amaya et al., 2008). Last, DCE assumes that consumer behavior is random or probabilistic instead of completely rational. This research applies an alternative-specific discrete choice experiment based on stated preference (Washbrook et al., 2006; Louviere et al., 2000), to be able to capture the randomness and probability of mode choice behavior. The experiment gives the respondent a set of two or more alternatives to choose from, repeating this multiple times for every respondent to reduce the number of respondents required. Besides the practical advantages the DCE has, the method is also beneficial to this research, seeing the ability to vary with selected travel and mode related attributes within one choice option (Washbrook et al., 2006). By varying with hypothetical levels of parking costs, travel time, comfort and level of service, the perceived value of these attributes will become clear (Westin and Gillen, 1978; Azari et al., 2011; Paulssen et al., 2014).

The choice sets are generated in a way that the attributes and levels are balanced among the alternatives. One of the alternatives will be the private car, since the goal of the research is to gain better

insight into the trade-offs between car and alternative modes of transport. This insight will help increase the success of travel alternative implementations, since the alternatives can be designed or chosen in a manner that closely suits the personal preferences of the employees. The experiment will be conducted among hospital employees who are asked to choose between multiple travel alternatives in an online template. The lay-out of the survey will be kept simple to avoid confusion, engage all age groups and limit the number of aborted survey responses. To be able to construct an experiment that generates valuable responses, a thorough literature research will be done on survey components and ultimately on the contents of the survey. The experimental design is made with the software Ngene. This software enables the balancing of attribute levels and evaluation of design characteristics. When the survey is constructed, evaluated by an expert and tested by a test group, it is spread among academic medical center employees. After receiving the responses, the analysis will start. The methods and tools applied are elaborated on in subsection subsection 2.3.8.

2.3.4. Experimental design

For the experimental design it is necessary to state what alternatives are used, labeled or unlabeled, and if sequential or simultaneous construction is applied. The alternatives that are part of the choice sets in the survey, vary in their attributes, therefore they are labeled (e.g. train, bike, car). The experimental design will be constructed with the software Ngene, with the simultaneous construction, which is common when using labeled alternatives.

2.3.5. Survey contents and sample size

Research finds that a survey should start with a welcome text and/or introduction that explain the goal of the survey and the destination of the data retrieved from the survey, all while ensuring the anonymity and data security of the respondents (Sue and Ritter, 2012). Accompanied by the contact details of the researcher in case respondents have additional questions. M. A. Smith and Leigh (1997) state that the response rate decreases when anonymity is not ensured or endangered. Furthermore, the introduction will explain how the survey is designed and what is expected from the respondents. Last, a brief introduction is given on the contents of the survey and the choice alternatives. It is proven that familiarity with the choice alternatives increases the reliability of the responses (Ben-Akiva et al., 2019). A neutral introduction is hard to achieve (McFadden, 2017), but crucial to ensure that the respondent is not (unconsciously) influenced by certain wording (Nelson and Oxley, 1999). Survey introductions that are found to be effective in literature, consulting professionals in the field of stated choice experiments and a test experiment will increase the chance of reaching a neutral introduction.

The sample size should be sufficient to be able to generalize findings to the population and to create clusters of travelers among the respondents (Kitchenham and Pfleeger, 2002). The general opinion is that a larger sample size is better (Cudeck and O'dell, 1994; Comrey and Lee, 1992; Velicer et al., 1982), although some research concludes differently (MacCallum et al., 1999). Gorsuch (1990) states that a sample size of 100 is sufficient. However, Comrey and Lee (1992) found that 100 is poor, 200 is fair, 300 is good, 500 is really good and 1.000 is excellent. According to Alreck and Settle (1995) it is sufficient to sample 10% of the total population targeted. In the case of the academic medical center with 12.000 employees, this would mean a sample of 1.200. Concluding, for this research the goal is to reach a minimum of 300 valid responses to the survey. Research has found that egotistic text appeal or monetary rewards attached to the survey response help to increase the response rate (Pedersen and Nielsen, 2016; J. Yu and Cooper, 1983). So, to incentivize the targeted employees, the respondents who fill in the complete survey will receive the chance of winning one of five gift cards.

The survey aims to retrieve four subjects of information from the respondents. First, it should be determined whether the respondent fits the target population and if so, what their current travel behavior is. These aspects are essential to determine whether they can continue with the survey and whether they should be given the choice experiment, since the choice experiment is determined to be interesting solely for employees who currently commute by car. Then, the respondent will be presented with multiple sets of choice alternatives with varying attributes such as price and travel time. Simultaneously, the respondent will receive the question to rate the perceived equity of the presented choice set. Then, the psychographic and behavioral questions and statements are asked, these include environmental engagement, norms and attitude. Last, the personal characteristics, such as age, gender, occupation and shift type will be retrieved. Since the personal characteristics tend to be a more sensitive topic, these questions are posed at the end of the survey (Nardi, 2018). So, the flow of the survey will be the

following:

- Introduction
- Part 1: Socio-demographics part one
- Part 2: Stated choice experiment and equity rating per choice set
- Part 3: Psychographic and behavior related questions/statements
- Part 4: Socio-demographics part two

The questions will be closed-ended combined with hybrid and contingency questions. Open-ended questions require more effort in analysis for the researcher and in answering for the respondent, and tend to be more prone to touching sensitive topics (Nardi, 2018). In addition to the importance of the type of question, the tone and design of the question are imperative to consider. The framing of the questions and choice sets can influence the choice behavior of the respondents (Tversky and Kahneman, 1981; Starmer, 2000; Molin, 2005). Emphasizing the negative side of a choice rather than the positive, such as 'lives lost' compared to 'lives saved', can lead to difference in attitude of the respondents. Therefore, a balance in questioning needs to be found based on literature and experience in stated choice experiments.

2.3.6. Survey testing and risks

The survey will be optimized by means of a test group. Individuals who are not familiar with transport and logistics, academic medical center employees, Pon employees and experts in the field of survey design will be part of the test group. This combination of participants generates the richest feedback to be able to filter out professional jargon, match the tone of voice of the target group and generate valuable data for analysis.

A risk that needs to be taken into account is the fact that respondents might be biased when answering the questions. This research has as goal to support the decision making process of the academic medical center and Pon when designing travel alternatives for the academic medical center employees. When this will be given as the reason for the conduct of the survey, the employees might adapt their answers thinking that it will nudge the decision making into the direction of their preferred travel alternative. A balance has to be found between being honest about the nature of the experiment and avoiding to trigger biased behavior.

2.3.7. Collection of data

The survey will be spread among academic medical center employees via online services. An online survey has the advantages that it is more time efficient, larger reach with less effort, anonymity and low costs, compared to physical interviews or pencil-paper approaches (Coomber, 1997; Van Selm and Jankowski, 2006). The survey will be active for two weeks, ten working days, due to the time frame and planning of the project. During the active period of the survey, it is recommended to analyze the socio-demographics of the responses to determine whether specific socio-demographics are under- or over-represented. This way, targeted approach can be applied to reach a wide variety of respondents.

2.3.8. Processing and analysis

Data preparation

Before analyzing the data received from the survey responses, the data needs to be 'cleaned'. The cleaning of data includes removing responses which are closed before finishing the survey and responses that indicate the respondent is not part of the target group. Furthermore, inconsistency is analyzed throughout the answers and inconsistent responses are removed from the sample. For instance, if individuals have stated that they don't own a car or don't have access to one, but later on have opted for the travel alternative with the car.

Descriptive statistics

A descriptive analysis prior to a more thorough analysis helps the researcher become familiar with the data set (Nardi, 2018). Analyzing these statistics gives insight into whether variables are statistically significant and what the representation of the different socio-demographics is within the response sample. The tool used for this analysis is the software SPSS, which enables a broad variety of information to be retrieved from the raw data.

2.4. Latent Class Choice Model

2.4.1. Random Utility Theory

The theoretical paradigm used to estimate the latent class choice model (LCCM) is the Random Utility Theory (RUM) since it is found to be the richest and most widely used (Cascetta and Cascetta, 2009). The theory is based on the assumption that every individual is a rational decision-maker who wants to maximize their utility output. Relying on the assumptions which underlie the theory, it is not possible to predict the decision-makers' choice with certainty. However, it is possible to predict the probability an individual will select alternative j subject to the choice set I.

$$p^i(j/I^i) = Pr[U^i_j > U^i_k \; \forall k \neq j, k \in I^i] \tag{2.1}$$

The perceived utility U^i_j is the sum of the mean utility, experienced by all decision-makers with the same attributes within the alternatives, and a random residual, also known as the error term. The error term captures all factors which influence an individuals' choice that are not captured in the mean utility.

$$U^i_j = V^i_j + \varepsilon^i_j \; \forall j \in I^i \tag{2.2}$$

The systematic utility V^i_j is a function of attributes relative to the alternatives and the decision-maker. It is assumed to be a linear function with the attribute level and the coefficients, also known as the weight of the attribute. The utility function can be rewritten as follows:

$$U^i_j = \beta * x^i_j + \varepsilon^i_j \; \forall j \in I^i \tag{2.3}$$

The beta within the equation represents the attribute weight associated with the preference of the respondent, but is yet unknown (Chorus, 2020). The variable multiplied with the beta is the attribute level.

2.4.2. LCCM

Greene and Hensher (2003) and Shen (2014) both compare LCCM with mixed logit models, they conclude that the LCCM is better at explaining behavioral performance and at estimating predicted choice probability. Furthermore, LCCM is able to capture the variation in preference for an individual decision-maker and links the heterogeneity in preference to the attitude of the individual (Chen and He, 2023). The LCCM consists of two models, the class membership model and the class-specific model (Hernandez, 2023), as shown in the conceptual framework in 2.2, which is also the basis of the research of Krueger et al. (2018). The maximum likelihood algorithm is used to obtain the different classes among the respondents, which then influence the relation between attributes and utility. It is assumed that the latent classes have different betas for the attributes, also known as taste parameters.

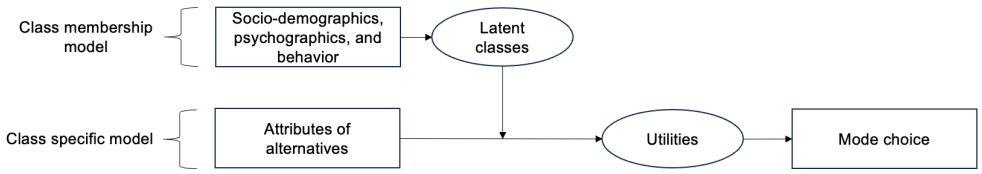


Figure 2.2: Conceptual framework of the Latent Class Choice Model

The class membership model groups individuals together based on their socio-demographics and latent variables into a number of predefined classes. The model is then able to calculate the probability that a decision-maker is part of a certain class, subject to the characteristics of the individual. The equation to calculate the probability that individual i who is part of class Q chooses alternative j, observed in T choice situations is given in 2.4. The denominator estimates the chance that individual i chooses alternative j, based on the beta corresponding with class Q. Furthermore, the numerator represents the summation of the chance of all alternatives j being chosen by individual i, based on the beta corresponding with class Q.

$$P_{jitq} = \frac{exp(x'_{itj}\beta_q)}{\sum_{j=1}^{J} exp(x'_{itj}\beta_q)} = F(i,t,j|Q) \tag{2.4}$$

To obtain the full latent class choice model, the class-specific model is multiplied with the class membership model. The class-specific model represents the likelihood of an individuals' opting for an alternative, in the context of the class that the individual is part of and the attributes and levels of the alternative. The final model is estimated with the software Apollo, to generate classes with significantly different characteristics. It is not certain whether a specific individual is part of a certain class, but the probability of belonging to a certain class can be calculated. Furthermore, every class has its own attribute weights. The added value of an LCCM compared to an MNL model, is the fact that LCCM accounts for the heterogeneity across the segments within the population where MNL calculates the mean of the population. The LCCM modeling approach is discussed in detail below.

The first step of LCCM is to find the number of classes that suits the data best (Hernández et al., 2023). The two measures most applied to find the number of classes is the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC). Both criteria are used to determine the best global fit of the model, where the model that generates the smallest value means the best fit. To check the best local fit of the model, bivariate residuals (BVR) are used. The BVR calculates to what extent the LCCM has locally independent variable indicators. To obtain the model with the best fit, the BIC value is used in combination with analyzing the applicability of the distinguished classes. The applicability is of added value since it is possible that the model with the lowest BIC value has differentiated classes that are illogical or inexplicable by their characteristics. When the model with the ideal number of classes is found, the attribute weights can be determined. The estimation of the model gives the weights, which can be interpreted as the relative loss or gain an individual experiences when the attribute is increased with one unit. A weight of zero means the attribute has no impact on the choice. On the contrary, a large weight means that the attribute is important for the respondent when choosing their alternative. Since the attributes have different units, they can not be set directly side to side but need to be recalculated by taking the sum of the parameter with the attribute level.

2.5. Linking data and purpose

The questions posed in the interviews with the academic medical center employees will try to stimulate the employees to give honest answers on their needs regarding the commute, in alternatives but also in extra services that might stimulate sustainable modes. Furthermore, the employees are asked about how they perceive the fit between their needs and the current and new alternatives, to indicate the feeling of equity among the employees. Last, the questions will retrieve information on the communication approach used within the organization. How they feel about the current way of communicating, regarding the tone as well as the communication platforms used. They are also asked how they would approach internal communication to reach a broader audience and increase the acceptation of the alternatives. All this data retrieved from the interviews will have as purpose to inform the academic medical center and Pon on how their considered alternatives fit the needs of the employees and what the chances of success are. Furthermore, points of improvement for communication will be given, to match the tone and way of communicating of the employees.

Three subjects of information will be retrieved from the survey responses of the employees of the academic medical center. First, the personal characteristics, psychographics and behavior of the employees will be combined with the choice behavior regarding the travel alternatives. The latent classes will be generated based on mode choice behavior, the trade-offs made between attributes and levels, and subsequent the personal characteristics within the groups will be analyzed. These classes represent the user segments among the hospital employee population, that are to be named after their most striking characteristic and alternative preference. The second piece of information that the survey responses will produce, is the attribute weights of the different alternatives. These weights can be retrieved from how the computed user segments trade off the attributes of the alternatives between the given choice sets. This is valuable information since the academic medical center is able to create alternatives and measures that specifically target the user segments who express a preference for an alternative or attribute via their choice behavior in the experiment, increasing the chance of success during the implementation. The last subject of information that is crucial to form an all-round advice is the measured perception of equity regarding the alternatives. The perception and feeling towards the alternatives by the employees is significant for the process of implementation, since this is one of the main reasons for the unsuccessful implementation of previous travel alternatives at the academic

medical center. Combining the experienced level of equity per alternative with the effectiveness of the alternative, using a qualitative approach, will give a comprehensive analysis of how the two should be balanced in order to implement a successful travel alternative option.

2.6. Linking the two phases

The report is split into two phases: the exploratory phase and the test phase, which compliment each other in their approach and in the knowledge/data they retrieve. The initial method applied in the research was a stand alone survey, now part of the test-phase. However, the planning of the academic medical center and the planning of this graduation thesis did not align and therefore the spread of the survey would be too late to fit the timeline of this project. Therefore, a new method was explored, that would also enable conclusions on travel behavior to advise the academic medical center and Pon on the travel alternatives. A survey is a structured method that generates quantitative (mathematical) data. The conduction of interviews is chosen as the qualitative method, since it is feasible in the given time frame and will generate valuable insights into the behavior and beliefs of the employees of the academic medical center. The academic medical center has previously focused primarily on push measures for car users, to destimulate the use of the car. However, a combination of push and pull measures is thought to be most effective. Therefore, the interviews will focus on pull measures for the travel alternatives, implementation and communication strategy. Then, the survey will combine push and pull measures in the choice experiment and as part of the questions, to be able to establish what balance between push and pull will increase the success of the mobility goals stated by the academic medical center. The knowledge obtained from the interviews can then sequentially be used to optimize the survey questions and possible tone of voice.

Interviews provide a deeper understanding of the rationale of the involved individuals. The combination of the interview and the survey, although out of scope for this research, will provide a stronger-grounded approach for the academic medical center regarding their mobility transition.

3

Literature review

The literature review will help with gaining better understanding of mode choice behavior in general and what behavioral models are applied to individuals. The conceptual framework will be formed based on theories that match the objective of this research as well as provide a clear guide for the method used. Last, literature will be accessed for attributes that fit the experiment that is recommended for the test phase, answering the question: ”What person-related characteristics and mode-related attributes are relevant when analyzing mode choice behavior?”. The approach for the literature review and selection process is elaborated on in the methodology chapter, in section 2.1.

3.1. Mode choice behavior

People travel to get from one place to another, which is necessary when wanting to participate in certain work-related, social or other activities. For every trip a series of decisions are made, which are dependent on personal and circumstantial factors of the traveler. Conventional research assumes that commuters are rational and will opt for the choice generating the highest utility (Schwanen and Mokhtarian, 2005). Generally, the utility is a sum of the costs and level of service, travel time and travel costs, as well as perception, typically socio-demographics or household characteristics (Ben-Akiva and Lerman, 1985; Cervero, 2002). The decision process, determining among others the mode choice, is performed consciously or unconsciously. Unconscious decision making occurs when a habit forms due to repetitively choosing a certain mode for the same trip. Especially commuting travelers tend to be habitual towards their choice of mode. Both Kuhnimhof (2009), over the course of a 7-day travel diary, and Ton and Duives (2021), after half a year of analyzing commuting individuals, conclude that commuters dominantly use one and the same mode. This habit also causes the traveler to use less information regarding the trip as well as for alternative transport options (Brechan, 2006).

In order to create a full picture of what triggers the behavior of travelers when opting for a mode of transportation, a more thorough process than rational decision making needs to be taken on. Other research has shown that emotional and psychological parameters should therefore be considered when analyzing travel behavior. Koppelman and Lyon (1981) find that the perceptions about convenience and service as well as feelings of affect correlate positive with the preference and consequently the choice of mode. These factors are crucial when implementing policy measures to tackle the environmental concerns, such as air quality, increasing emissions and global warming (Fujii and Kitamura, 2003; Golob and Hensher, 1998; Hagman, 2003). As Hunecke et al. (2010) states, psychological factors are of bigger influence on mode choice than socio-demographic and infrastructural factors and are therefore also better at predicting the choice of mode. The intention to behave a certain way, one of the biggest psychological factors, is of bigger influence on the travel choices made than the attitude towards the alternatives (Brechan, 2006). Therefore, besides socio-demographics and measurable mode-related factors, it is valuable to consider psychological and behavioral aspects of the decision process.

Reliability, convenience, safety, status and comfort are factors that highly influence the choice of transport mode and the attributes regarding quality of service (Arentze and Molin, 2013). These factors are strongly dependent on personal experience. Using the past personal experiences regarding travel

modes, gives the ability to predict future behavior to a greater extent than non-personal experience (Fazio and Zanna, 1981). When focusing on commute trips and user experience, research has found that individuals tend to travel unimodal, using the same mode each trip (Hensher and Ho, 2016). Also explained by the fact that the repetitive use of a mode increases the chance of choosing that same mode for subsequent trips (Kuhnimhof, 2009). The next section will elaborate further on the impact of behavior on transport choices and how to explain and capture behavior with specific models.

3.1.1. Theories of behavior

To capture the relevant factors for analyzing travel behavior, theories are selected to explain the thoughts behind behavior. These theories propose different intentions and triggers of the behavior when selecting a mode of transportation.

Theory of Reasoned Action by Ajzen and Fishbein (1975) is a mathematical model that uses the function of subjective norms and attitude towards behavior, allowing researchers to predict behavioral intentions. Besides personal beliefs and attitudes, the theory also considers attitude and expectations of other people. As Brechan (2006) explains, if someone who is important to you expects certain choice of transportation from you, this could affect your mode choice.

The previous theory is extended with the factor 'perceived behavioral control' to create a new theory: the Theory of Planned Behavior (Ajzen, 1991). This theory is often applied to understand behavior in more specific context. Reviewing research in which the theory is applied, has generated empirical evidence that different behaviors can be predicted with high accuracy (Ajzen, 2005). The behavioral intentions and perceived behavioral control both cause significant variance in actual behavior, making it crucial to understand them when aiming to influence the behavior. Ajzen (1991) describes intention as the level of determination individuals are prepared to invest in order to execute a certain behavior. The perceived behavioral control is described by the theory as the extent to which the decision-maker has confidence in their abilities to execute.

Despite the accurate prediction of behavior, the theory has received criticism from research that state the theory excludes potentially important variables. Michie et al. (2011) concludes that emotional factors, habit and impulsivity are missing from the theory. Therefore, Michie et al. (2011) has designed a new framework to improve intervention design. The framework considers an approach to understand the nature of the targeted behavior and a system to design interventions that affect the behavior. The basis of the new framework is the behavioral system, shown in 3.1. Where capable means having the skills to perform the behavior, motivation is the strong intention to execute and the opportunity refers to having no environmental constraints that complicate the execution. These three factors are crucial and sufficient when analyzing the motives behind behavior according to Michie et al. (2011). Capability and opportunity influence the motivation of performing behavior, where enacting a behavior affects the capability, opportunity and motivation.

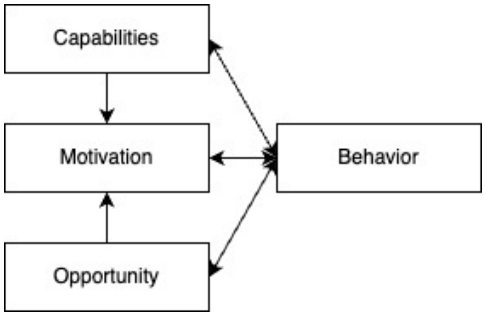


Figure 3.1: A framework to understand behavior, by Michie et al. (2011)

Another research which builds on the Theory of Planned Behavior, extends the theory with psychological factors considered by commuters (Donald et al., 2014). Donald et al. (2014) find that there are two main triggers for behavior: intention and habit. They focus on the behavior that influences the final choice of mode for the commute to work and back home. The study concludes that environmental engagement can not predict the intention to choose a certain transport mode, however, it is able to predict the habit of using the car. When the habit and intentions are analyzed and ways to influence these variables to steer behavior are established, it is important to ensure the implementation of the

desired behavior. According to the Theory of Goal Directed Behavior an intention of traveling has more chance of succeeding when a concrete plan of implementation of the mode of transport is thought of (Gollwitzer, 1999).

3.2. Equity

The Theory of Equity as by Adams (1963) consists of (1) the sum of the inputs and outputs, (2) the fact that people compare to others, (3) what factors contribute to the equity or inequity and how this affects individuals, and (4) how people react to reduce their experienced inequity.

Individuals measure their equity or inequity by the input/output ratio, which is elaborated on based on the findings of the studies of Pritchard (1969) and Adams (1963). The effort/experience/age/education that they deliver, and functions as their input, is compared to the return they receive that they perceive as value for themselves. After establishing their own ratio, individuals compare their ratio to others, whom they have an indirect or direct relation with. This can be in relationships, but also indirect between two coworkers both being paid by an employer. In the case of the academic medical center employees, they compare their output with the output of other employees and experience equality or inequality. Output can be as measurable as income, but also in secondary benefits, as vacation days or offered mobility options. The person who experiences inequity is then motivated to reduce this difference in ratios. The strength of the motivation and behavior depend on the how large the difference in ratio is. Large differences in ratios thus create large tensions between individuals, which can negatively influence the atmosphere at work when the two individuals are coworkers (Pritchard, 1969).

Adams (1963) argues that the person who experiences inequity has four options to bridge the gap between the other individual. First, they can disturb his own or the other's input or outcome. Second, they can influence the other to change their input or outcome. Third, the person can change their own input or outcome. And last, the person can change their comparison individual or quit their job or relationship. The first, second and last approach all have negative effects on the working atmosphere and the motivation of both or one of the parties. Therefore, the employer should ensure that there are no large differences in ratio, by compensating all employees equal to their input and needs.

3.2.1. Transportation equity

Mobility or transportation equity is a phenomenon which determines the level of mobility or transport individuals receive or have access to that is fair seen their circumstances. Savvides (2013) gives the following description: "Transportation equity is concerned with the efficiency of transportation, its cost and people's mobility levels. It is also concerned with accessibility to transportation for the greatest possible number of people, which together with transportation equity leads to seeking fairness in mobility and accessibility levels across race, class, gender and disability (p. 1)." Lower-income groups primarily live in city centers and rely on public transit to get to their work. While higher income travelers live in the suburbs and commute alone in their private vehicles (Savvides, 2013). To satisfy both these groups, a balance should be found in investing in suburb transit lines and subscriptions, while ensuring the lower income groups don't feel undervalued and are also fairly met.

McCann et al. (2000) finds that lower income households spend an average of one-third of their income on transportation, while for higher income households this is only one-sixth of their total income. Numerous low-income households however own a car, since they rely on such private transport to participate in social but mostly in necessary activities such as work (Van Dort et al., 2019). The ownership of a car can be seen as in involuntary financial strain on the low-income households, resulting from insufficient affordable public transport or other modes of transportation.

Additionally, inequality can emerge when considering the digitalization of the travel alternatives and the technology that comes with the alternatives (Durand et al., 2022). Although the majority of individuals have material access to technology and digital services, not everyone benefits from the full range of advantages due to lack of knowledge or instruction. The level of user-friendliness of digital platforms and services partly determines the experienced accessibility of individuals.

3.2.2. Equity-effectiveness trade-off

Golany and Tamir (1995) explains the two definitions as (1) equity is the degree of fairness experienced by the population when resources or services are allocated, and (2) effectiveness is the gap that needs to be bridged between observed outputs and a set of desired goals. Striving for the highest effective-

ness of a measure, can lead to a decrease in (perceived) equity by the units which are subject to the measures. Judgement of the public on effectiveness and equity of measures is greatly based on intuition and on how information is presented to them. Meier et al. (2023) therefore states that information on performance should be carefully stated and must be split into effectiveness and equity. Gärling and Schuitema (2007) has applied the equity-efficiency trade-off to travel demand management, aiming to reduce the use of private cars. Their research found that solely noncoercive measures will not spawn the desired reduction in car use. On the other hand, it is politically infeasible and triggers public resistance to only use coercive means. Therefore, a combination of coercive means, such as increasing parking costs or putting an embargo on car use, and noncoercive means, like enabling the use of attractive alternatives and emphasizing the benefits of public transport and bike use, is needed according to their study. The combination of stimuli and obligations are found to be more widely accepted and effective.

3.3. Alternatives for the commute

Individuals will need to have the intention to change their travel behavior before actual change is implemented (Ajzen, 1991). Although the car is still the dominant mode of transport, especially in Western countries (Verplanken et al., 2008), numerous social, technological and environmental changes are shifting the urban transport system (Webb, 2019). For the case of the academic medical center, a selection of alternatives is made. The transfer hub option, which combines public transport with shared mobility options at Utrecht Central. To give transport security to the employees, an area at the train station is reserved for shared (e-)bikes solely for academic medical center employees. This area is managed by Hely, a joint venture between Pon and NS. Furthermore, the entire trip from home to work, could be planned and booked via the Hely application which is offered by Pon. Second, the alternative for employees to lease an electric bike with the service Lease-a-Bike is currently under investigation for the pilot. Besides these two alternatives that are operated by Pon, the car is considered and two base alternatives: the bus or tram and train + bus or tram. The bus or tram is feasible when employees live within a range of 12 kilometers of the academic medical center, the bus is not able to compete with the other modes regarding travel time on further distances. The (leased) e-bike is deemed as a feasible alternative for employees living within a range of 30 kilometers. Performed research for ASML, by Molin and Kroesen (2023), has shown that employees that live over 20 kilometers from work, still opt for the e-bike. So, to avoid premature exclusion, the maximum distance is set at 30 kilometers. These alternatives are selected based on their low-threshold to use, health of the employee, limiting costs for both the organization and the employee and geographical availability. All aim to reduce the emission of carbon dioxide during the commute and the overall use of the car as transport mode.

Recent research, performed by Bösehans et al. (2023), has analyzed the potential willingness to use shared e-bikes and e-cars for the commute and shopping trips. Half of their respondents have indicated to want to use the shared mobility options, although the willingness decreases to 25-35 % when it is combined with public transport. They find that individuals who are pro-shared mobility and part of the younger age groups are most willing to adopt the shared e-mobility options. Additionally, for commuters to consider the travel alternatives in the first place, awareness about e-bikes needs to be established (Handy and Fitch, 2022). Nevertheless, even when the shared e-bike or e-car is adopted, its use is not a direct implication of the decrease of private car use. Research by Bieliński et al. (2021) states that shared e-bikes tend to substitute public transport trips rather than the private car. A similar conclusion is drafted by Ma et al., 2020, who performed a case study in Delft and found that shared bikes not only reduce public transport trips and private car use, but also walking and private biking. Due to the finding of Bösehans et al. (2023), that occasional public transport and bike use tend to increase the chance of using the combination of public transport with shared e-bikes, they conclude that the shared e-bike has the highest adoption chance as first- or last-mile mode option. For last-mile transport, respondents in the experiment of Bieliński and Ważna, 2020 have stated that costs and uncertain availability of shared e-bikes are the main factors that negatively influence e-bike use.

In 2018 more e-bikes were sold than conventional bikes, especially the individuals who use the e-bike primarily for commuting are rising exponentially, compared to leisure use (de Haas et al., 2022). However, using longitudinal data, they have found that the e-bike dominantly replaces the conventional bike, and specifically for the commute only a slight decrease in car use is identified. The study

recommends to implement a pilot for the use of the e-bike, to familiarize individuals with the transport alternative. Ton and Duives (2021) agree with the need for a trial period, seeing a decrease of more than 20 percent in the use of the car and increase of 16 percent in the use of e-bikes among TU Delft commuters after a three month pilot. Their analysis shows that three factors affect the decrease of car use: purchase of an e-bike, perception of e-bike safety, and the willingness to change their travel behavior by means of the pilot. Respondents in the TU Delft commuters case study have stated that the purchase costs are the main reason for not using an e-bike.

Previously performed research has shown that the shared e-bike is a viable option when implemented as last-mile transport, when costs are low and availability is assured. In the case of academic medical center, they can assure the availability of shared e-bikes at Utrecht Central and the charging of the service can be analyzed. Furthermore, the use of the e-bike from home to work tends to replace the conventional bike rather than the private car. However, implementing a trial period to familiarize individuals with the e-bike has shown to increase the adoption of the mode. Additionally, decreasing or eliminating the purchase costs of the e-bike also increases its use, since this is seen as the biggest threshold by case study participants in Delft. The (e-)bike alternative with a lease period that is currently being considered for the pilot, where costs can be spread over a longer period of time for the employee or can be partly covered by the academic medical center, is therefore deemed as a stimulating success factor.

3.4. Modal choice

The mode choice behavior of individuals is based on various aspects, one of them being the travel alternatives that are available and their characteristics (Chorus, 2020;Hernandez, 2023). These characteristics are called the attributes of the alternatives. These attributes can be alternative specific and allow for variation, which enables the analysis of trade-offs made between alternatives by travelers. This can be done by means of a choice experiment conducted among the targeted travelers population. These trade-offs between attributes enable the calculation of attribute weights, which represents the relative importance of the attribute that is experienced. Research performed in 2013 by De Witte et al. covers the determinants of modal choice and its interdependencies. They distinguish four indicators which influence the modal choice, namely socio-demographic indicators, spatial indicators, journey characteristic indicators and socio-psychological indicators. Other papers covering the factors that influence travel behavior and modal choice agree with the previously mentioned indicators, although they add two more based on experimental output. Romanowska et al. (2019) and Zhou (2012) distinguish six groups of indicators with the following variables included:

- Socio-demographics: age, gender and profession (D. H. Kaplan, 2015), income, household composition, car availability, possession of a driving license, and irregular work schedules.
- Socio-psychological: habit, attitude, environmental engagement, familiarity with alternatives.
- Transport mode specific: costs, comfort, speed, ecology.
- Trip characteristics: distance, time of departure and arrival, purpose, origin and destination.
- Geographical: infrastructure at origin and destination (availability of roads, bike lanes and public transport infrastructure) and parking possibilities.
- Travel Demand Management (TDM): alternative options offered by employer, parking costs, restriction on certain mode use (Rotaris and Danielis, 2015).

The consecutive subsections 3.4.1 and 3.4.2 give a more in-depth review on the different indicator groups and what their significance is with regard to travel behavior of individuals. Then, the attributes which are ought to be important for this research are retrieved from literature. Since travel behavior has been extensively studied, a suitable selection of attributes can be made based on previously performed research. Attributes will be selected when they are deemed valuable for this research and have proven to be in leading and similar research.

3.4.1. Mode and trip related attributes

Mode en trip related attributes are taken up into the survey as part of the alternatives within the various choice sets. The attributes characterize the mode and corresponding trip which remain constant throughout the choice sets, solely the levels of the attributes are varied to analyze their effect on choice

behavior (Esztergár-Kiss et al., 2022). The travel motive is also constant throughout the experiment, namely the commute between home and work. Literature is consulted to retrieve attributes which comply with the hypothesis of the research and are accessible and understandable for the respondents.

Romanowska et al. (2019) conducted a survey among University students and employees. Among their conclusions is that particular commuting groups base their mode choice on car availability, trip origin location, and accessibility. Furthermore, trip quality, costs and ecology also play a role when choosing a mode of transport. Nearly all literature covering travel behavior experiments have included the attributes **travel time** and **travel costs**, since they are highly significant in predicting travel choice (Frank et al., 2008). Additionally, research finds that the **number of transfers and transfer time** when using transit affects the mode choice. Ha et al. (2020) found that when the trip has more than one transfer, commuters opt for the car. The **walking distance** between transfers and for the egress part of the journey also affect the mode choice. The main factor influencing car use for the commute according to Tyrinopoulos and Antoniou (2013) is the **availability of parking space** at the destination. Their research also finds that lack of information, high costs and bad accessibility of transport networks does not discourage the use of the transit network. Nevertheless, other literature state that good accessibility and lower fares stimulate the use of public transport. For instance the research of Washbrook et al. (2006), that finds that the **costs of parking** affect the choice of mode in a stronger manner than incentives for public transport or carpooling. Last, the mode choice concerning shared mobility experiences the difficulty to **guarantee service** to users (Katzev, 2003). Users that want to use shared mobility are often disappointed when there are no vehicles available for rent at the origin, or when the parking place at the destination is full.

3.4.2. Socio-demographic-, psychographic-, and behavioral variables

Perfect competition and pure monopoly have been insufficient in explaining the market for quite some time (W. R. Smith, 1956). W. R. Smith (1956) gave increased heterogeneity as the reason for this insufficiency. His research shows that the heterogeneity of the market is accumulated out of smaller homogeneous markets. These homogeneous segments consist of consumers with overlapping characteristics and choice behavior. The user groups are created by means of the market segmentation theory. This theory states that user groups are identified by their corresponding characteristics, who then become targets of personalized marketing strategy (Tynan and Drayton, 1987). Tynan and Drayton (1987) have divided the market into seven segments, based on the types of market segmentation. According to other resesarch, there are four types of market segmentation (Solomon et al., 2012): socio-demographic segmentation, behavioral segmentation, psychographic segmentation and geographic segmentation. However, according to more recent research the market can also be segmented on a less detailed level into three segments (Vyncke, 2002; Töpfer and Bug, 2015). Following these papers, a selection of the most important and applicable segments is made. The wider defined segments distinguish behavioral segmentation, general physical segmentation and psychological segmentation. Where general physical segmentation consists of geographic and socio-demographic variables. Since this research does not require targeted marketing in a specific area, and requires limited geographic information from the respondents, the segmentation of three is chosen. The individuals with overlaying choice behavior will be analyzed on the three segments, to establish whether there is a relation between choice behavior and personal characteristics. The remainder of this section will elaborate on the three segments and present their corresponding variables found in literature.

Socio-demographic segmentation is based on measurable data about individuals, such as age, gender, occupation and income. Socio-demographics are valuable for describing the travelers in each segment. The socio-demographics are extended with geographic information on the individual, determining which choice sets are representative to their personal situation. Besides socio-demographics, it is of added value to use psychographics and behavior to describe the individuals per segment. Psychographics are based on the lifestyle of individuals, which consists of the values, norms, attitudes, opinions and beliefs (Solomon et al., 2012). Last, behavioral characteristics divide the travelers based on their travel behavior. For example, mode choice and route choice.

Socio-demographics

According to literature which covers research on travel behavior during the commute, specifically mode choice, there are eight socio-demographic variables which influence travelers' behavior. The variables are age, gender, income, car ownership, employment occupation, household composition, full- or part-

time work and irregular work hours.

Meng et al. (2018) performed a study in Singapore, where surveys were conducted on the streets in different areas of the study at different times of the day and week. The outcome of the survey showed that almost half of female travelers (48 percent) are willing to shift from private towards public transport, compared to only 17 percent of male. Furthermore, travelers between the ages of 36 and 45 are relatively willing to shift towards public transport (56 percent) where all other age groups show a strong preference for private (>83 percent).

Research performed by Bhat, in 1997 and in 2006 together with Sardesai, R., show that the income of the commuter and the car ownership strongly influence the choice of mode for the trip to work. As they find, when the income increases, also the ratio of available vehicles to household members increases, which decreases the competition for the private mode (Bhat, 1997). This also considers the household composition, since more members create more competition for the vehicles available. Dobson and Tischer (1977) confirm the importance of income and car ownership, stating that these variables account for 80 to 90 percent of the explained variance.

Kuppam et al. (1999) highlight the impact of employment occupation and the corresponding relative income level (low, medium or high) on the choice of mode for the commute. The research shows that occupations with higher levels of income tend to use the car more than the bus or unmotorized transport.

Working full-time positively influences the willingness and ability to travel together with other coworkers, since full-time workers mostly have the same schedules and times of arrival and departure (Cumming et al., 2019). Irregular schedules obstruct traveling together with coworkers, since synchronizing schedules is difficult when trying to carpool. Also, irregular schedules make using public transport harder, since the level of operation decreases at night and early in the morning.

During the interviews, all the socio-demographics are observed or asked, except the income and household composition. Both due to the sensitivity of the matters, since talking to the researcher face-to-face is not anonymous. However, the function group might roughly indicate the income and the household composition could be retrieved from the employee when the atmosphere feels safe. Both are taken up in the survey, since this is completely anonymous, and will generate more valuable data on a large scale to explain travel behavior of the employees.

Psychographic variables

Latent psychological factors are used to understand the relation between travel behavior, mode choice and lifestyle of travelers (Fu, 2021). Lifestyle being used as the overarching term for norms, values, beliefs, attitude and opinions on preference for mode choice (e.g.: Hunecke et al., 2001; Bamberg and Schmidt, 2003; Heath and Gifford, 2002). Based on the Theory of Planned Behavior, a distinction of four psychographic factors is made, a combination of the research of Haustein et al. (2018) and that of Heath and Gifford (2002). The four factors that receive focus are intention, attitude, norms and perceived behavioral control. Questions are stated, primarily found in existing research and adapted to fit both phases of the research.

- *Intention* to use other modes than the car, rated on a 5-point Likert scale, is measured. Also, if the traveler intends to use the car the next time they drive to work (likely/unlikely).

- *Attitude* is measured by asking for travelers' general preference towards the modes on a scale where they can indicate 'strong preference' to 'strong dislike' with less strong options in between. Attitudinal indicators are applied to the variables comfort, flexibility and convenience.

- *Norms* are derived into two kinds: subjective and moral (Heath and Gifford, 2002). Subjective gives an indication to what extent the traveler is affected by the expectations of important people around them. Moral norms question the possible guilt or conscience travelers have when opting for a specific mode.

- *Perceived behavioral control* measures the extent to which a traveler thinks they have control over their actions. The ownership of a car (yes/no) or the accessibility to a car when necessary (5-point Likert scale) are therefore suitable questions.

The psychographics are retrieved from answers to specific questions during the interviews with the employees, but they are also observed during the conversation, in tone of voice and body language. The intention will be retrieved by asking the fit between their needs and the presented travel alternatives. Furthermore, the ownership of different modes and accessibility to transport networks will indicate the perceived behavioral control they experience. The beliefs and attitude can be observed and provoked by asking direct interview questions concerning the proposed travel alternatives and their current feeling towards the commute.

Applicable for the survey, statements and questions regarding the above listed variables are taken up. Research regarding travel behavior of elderly performed by Haustein (2012) contains attitudinal and norm related statements which are also highly applicable to this research. Part of the statements are taken and some are slightly modified, since other researchers have also found them to be significant (Krueger et al., 2018). Furthermore, the attitudinal factors regarding travel demand management, that were considered significant in the research of Alturif and Saleh (2023), are also used in this research.

Behavioral variables

People who travel multi-modal or sometimes opt for the non-motorized option for commuting, are more likely to cycle to work or use public transport than people who rely on their private car for every home-work trip (Buehler & Hamre, 2015). Besides the attitude that travelers have, their travel behavior is also important to understand (Shaheen and Guzman, 2011). Behavioral indicators can be used when trying to retrieve the safety and environmental orientation of travelers (Johansson et al., 2006). Furthermore, research by Anable and Gatersleben (2005) states that there is a difference between affective evaluation and instrumental evaluation. Where affective evaluation indicates the level of excitement and joy travelers experience due to their chosen mode and instrumental represents the physical characteristics that increase preference. They find that car drivers, cyclists and pedestrians experience the commute more positively than public transport users in terms of joy. However, car drivers expressed that these positive feelings are not their biggest incentive to choose the car, the instrumental benefits of the mode are. The study of Steg (2005) contradicts this conclusion and states that car commuters choose the car due to its affective motives. It is crucial to analyze the behavior of travelers, because of this existing difference in personal preferences towards modes and physical benefits. Habitual indicators are also taken up into the survey, where travelers have to think about their level of awareness when choosing their mode for the commute.

3.5. Contextual variables

Besides the person- and mode-related variables, the context in which the choice is made also affects the final choice of mode. Steg (2005) says that the situation determines the necessity to travel, the availability of the travel mode and its attractiveness.

To start, this research focuses solely on **commuting trips**, giving the first delineation for context. Since commuting trips are frequent trips, usually made several times a week, the decision can become habitual (Kuhnimhof, 2009; Ton and Duives, 2021). Furthermore, the target group are hospital employees, who experience relative high work pressure and sometimes work at irregular hours, making the commute a trip they prefer to be least demanding as possible.

Nankervis (1999) performed a bike commute research in Australia, where he combined the commute perception of travelers with the physical environment of the trip. He was able to conclude that **weather conditions** have a significant influence on mode choice, since the use of the bike decreased when wind and rain increased and the temperature dropped. Temperature and wind were most significantly correlated with bike use, where rain had a relatively small impact. Interestingly, various research found that the circumstantial variable 'the degree of congestion on the road to work' has no to little impact on the choice of mode for the commute. Wall (2006) conducted interviews among commuters in London and the vast majority stated that congestion is "just part of their commute" and "inevitable", but does not change their choice for the car. The same holds in Los Angeles, where the effect of congestion on the choice between transit or car remains unclear (Chakrabarti, 2017). However, it is an interesting factor to consider in the research, since it could be of influence on the mode choice in Utrecht, where there is a dense public transport and bicycle network available. What is proven to stimulate the choice for transit, is the good facilitation, indicated by less transfers and frequent and reliable service. Therefore, an influenceable context variable considered in this research is **level of facilitating**.

Additional to reliability, offering a sufficient number of (e-)bikes at Utrecht Central, and reducing transfers, is the **availability of parking space**, as already mentioned previously in subsection 3.4.1. The academic medical center is currently investigating the use of an application which is able to show the employee the number of employee parking spaces available, before heading to work. The academic medical center namely found that when employees arrive at work and see that the cheaper employee allocated parking spaces are taken, they accept the higher fares. The goal is to destimulate employees to take the car when they see that there are little to no parking spaces with special employee fare left. Nakayama et al. (2001) finds that travel costs are also significant in making a mode choice when commuting. Their research found that when drivers were offered free subway tickets for their trip, a large share made the shift towards the subway, and remained a subway user after the trial. This could vary from offering free alternatives to ranging levels of costs perused to the employee.

The research of Nakayama et al. (2001) highlights the importance of perception, compared to the actual situation, focusing their study on commuters. They found that when asking frequent car drivers to indicate the commuting time by public transport, they tend to strongly overestimate the travel time. However, when these frequent car drivers travel by public transport once, their accuracy immediately increases. Wall (2006) stresses the importance of letting travelers experience other modes, to bridge the gap between personal perception and actual situation. In this research the **perceived access to public transport from home** and the **perceived accessibility of the academic medical center by different modes** are asked from the respondents. This gives insight into how the employees think about traveling to their work and how demanding they perceive the trip, since low perceived accessibility makes the trip to work feel like a larger effort. Also, the **perceived level of equity of offered alternatives** will be asked in the experiment, since it is important that employees do not experience significant drawback or benefit compared to colleagues. Research performed on technology acceptance by Hess et al. (2010) concludes that perceived equity is able to explain the level of acceptance.

3.6. Conceptual framework

3.6.1. Underlying theory

The effect of the travel alternatives proposed by the academic medical center and Pon depend on the use and adoption by the employees. Although the travel alternatives are modes and not technical innovations, the model of unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al. (2003), fits the factors that are important for this research. The model combines eight existing models: theory of reasoned action, the technology acceptance model, the motivational model, the theory of planned behavior, a model combining the technology acceptance model and the theory of planned behavior, the model of PC utilization, the innovation diffusion theory, and the social cognitive theory. UTAUT is useful to understand what influences the acceptance of innovations for individuals and what the probability of success is for the innovation (Z. Yu et al., 2020). The model consists of four user acceptance criteria and three moderators for human behavior. The four acceptance criteria are the performance expectancy, effort expectancy, the social influence and the facilitation conditions. The three moderators are the age, gender and experience.

The *performance expectancy* is the perceived benefits that an individual will endure when using the innovation when performing according activities; *effort expectancy* is the ease of use for the innovation; *social influence* indicates the expectancy others have towards the individual regarding the use of the innovation; and last the *facilitation conditions* are the environmental conditions that support the use of the innovation (Venkatesh et al., 2003).

The UTAUT model is later on expanded to the UTAUT2 model (Venkatesh et al., 2012), by adding three acceptance criteria: hedonic motivation, price value and habit. See the schematic representation of the full model in figure 3.2. First, the UTAUT model was focused on organizational context, but with the addition of the three new contextual variables and their relations, the model expands to consumer use context. The hedonic motivation enriches the model with the motivation theory and establishes the level of fun or pleasure individuals experience from using the innovation. The price value that is added to the model, considers the trade-offs the individuals make when choosing the innovation to use. This can be monetary but also in other units. Finally, the habit is added to the model, to see how automatic user behavior is.

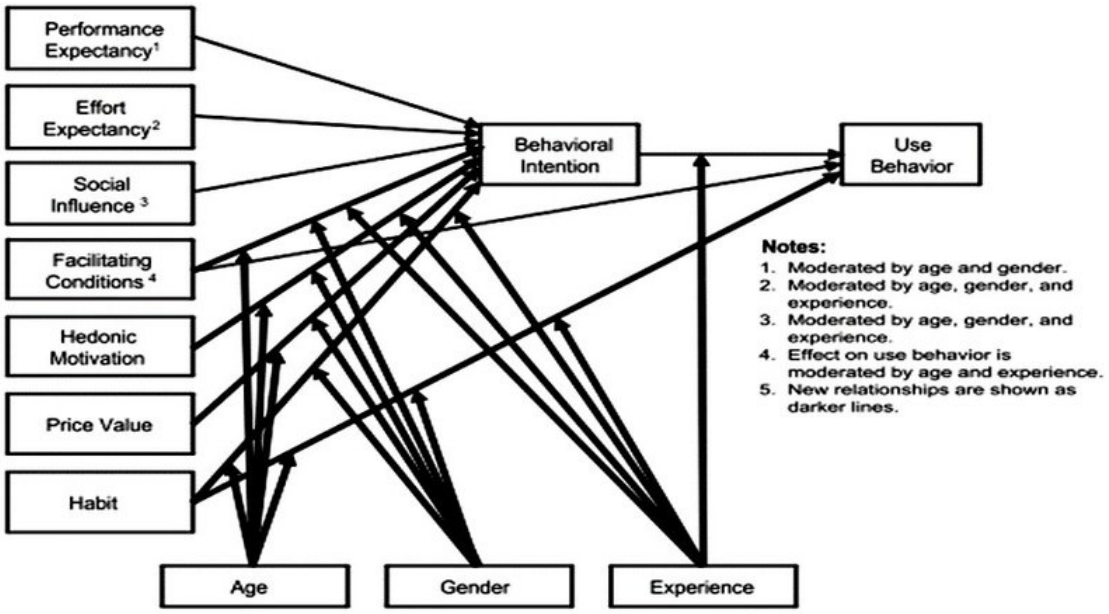


Figure 3.2: Unified theory of acceptance and use of technology (UTAUT2) model (Venkatesh et al., 2012)

3.6.2. Applied theory and final framework

Research performed by De Witte et al. (2013) concludes that economic aspects as well as transport geography and social psychology should be taken into account when analyzing modal choices made by travelers. This conclusion is according to all the variables which are considered in the UTAUT2 model. The UTAUT2 model is adapted to fit the purpose of this research and form a basis for conducting the in-depth interviews. The theory that forms the basis of the survey, is the utility theory, as further explained in section 3.6.3. As can be seen, the hedonic motivation is removed since it is not deemed as significant in this research. The commute from home to work is a necessity, in which fun and pleasure play a negligible part and is therefore not considered. A factor that is of significant value to this research is the equity or fairness that the employees perceive regarding their mobility compensation. This has been a significant factor during previous implementation attempts within the academic medical center, since the feeling of inequity caused dissatisfaction and decreased acceptation among the employees. Since this is a way of assigning value to the alternatives in a more qualitative way, the equity perception is taken up in the interview questions as part of the price value context variable. Furthermore, the moderators are extended with the socio-demographics (not solely age and gender), the psychographics (attitude and norms) and the internal communication. These three factors are expected to moderate between the relation of the context variables and the behavioral intention as well as its relation to the use behavior. Finally, the desired as well as the expected effects are added to the framework, related to the use behavior. A more extensive explanation on the variables, moderators, use behavior and effects is given below the final framework, seen in figure 3.3. The *italic* and red formatted contextual variables and moderators are the focus of this research, which consists of the conduction of interviews. Since the alternatives are already established by the academic medical center and Pon, the focus of the interviews is to gain insight into the psyche of the employees. This insight will provide information on their needs, the perceived fit of the alternatives to their needs, the workplace culture, the equity perception, their preferred internal communication and how the alternatives might fit more seamlessly to their needs with adapted or added secondary services. The remaining variables and moderators are taken up into the survey, recommended for further research. The socio-demographics and psychographics are relevant in both phases of the study.

Contextual variables

The context in which the choice is made strongly affects the final choice of mode. Steg (2005) says that the situation determines the necessity to travel, the availability of the travel mode and its attractiveness. To start, this research focuses solely on commuting trips, giving the first delineation for context. Furthermore, the target group are hospital employees, who experience relative high work pressure and

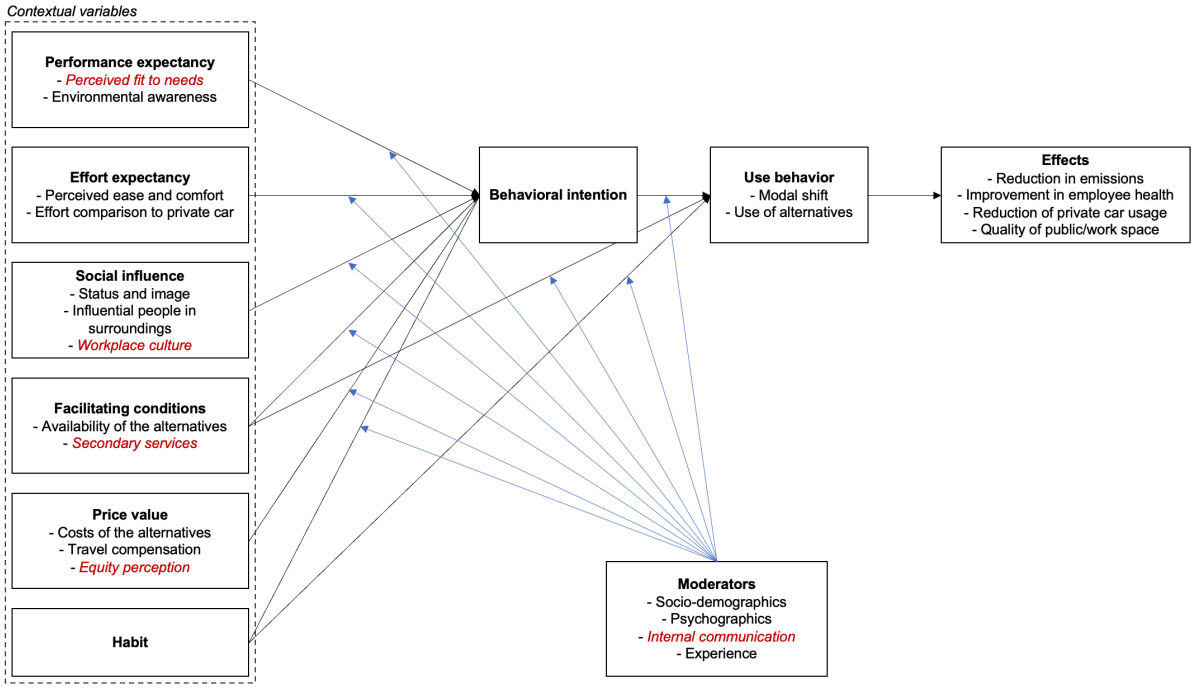


Figure 3.3: Conceptual framework for interviews conduction, adapted UTAUT2 model

sometimes work at irregular hours, making the commute a trip they prefer to be least demanding as possible. A literature review has been done on contextual variables that are found to be significant to consider when analyzing the commute mode choice, found in section 3.5. This section applies the obtained knowledge and information from the literature review to the specific framework used in this research.

The contextual variables affect the behavioral intention of the decision-maker, and two even directly effect the use behavior of the decision-maker. The **performance expectancy** can be explained as the usefulness people expect to receive from the alternative and the job-fit, although some research find these to be similar (Thompson et al., 1991). For this research this translates into the perceived fit to the needs of the employee and the environmental awareness the employee has. How they perceive the travel alternatives to fit their needs is crucial for the adoption of the modes in their everyday life. Current travel alternatives, the bike plan which offers a reasonably priced bike and the regional public transport system, only satisfy the needs of a specific share of the employees. Namely, the ones who live within a close range of the academic medical center, are mobile and have good access to the public transport network. These alternatives, together with push measures for the car, as increased parking fee, have set the tone for the mobility transition within the organization. The employees have a negative perception, both in fit and equity, regarding the mobility approach of the academic medical center. This performance indicator is part of the exploratory phase, questioning the employees on the perceived fit between the alternatives and their needs. The reason for including this in the exploratory phase, is because further steps in the implementation process rely on this information. Furthermore, interviews are believed to be more functional than surveys for this matter, since concluding on the physical reactions of the employee create a more all-round answer to the perception. The environmental awareness is part of the survey, since questions on how environmental aware someone is are straightforward, and can also be answered that way.

The **effort expectancy** can be measured by the ease and comfort the employees experience when using the alternatives and the effort the new mode takes compared to their private car. The variables determining the effort expectancy will be part of the survey, not the interviews. It is more valuable to measure these variables on a large scale as part of the survey, rather than in-depth discussing them in the limited number of interviews.

Furthermore, the **social environment** is expected to influence the behavioral intention, if the employees see their commuting mode as part of their image or status. Also, the opinion and expectancy

of important people in their surroundings regarding their travel behavior are expected to affect the behavior of the employee. Furthermore, the workplace culture and opinion of colleagues is found to be affecting the behavioral intention (Eckhardt et al., 2009). They analyzed innovation implementation in 152 German companies and found that the culture and atmosphere of the workplace significantly influence the adoption of the new technology. Capturing the workplace culture and experienced atmosphere within the organization is difficult in survey questions and is therefore questioned during the interviews. This allows for follow-up questions and a more detailed explanation.

The fourth acceptance criterion is the **facilitating conditions**, which are provided by the academic medical center and will determine both the behavioral intention as well as directly the use behavior. The facilitating conditions are stated by Venkatesh et al. (2003) as the degree to which an individual thinks that there is an organizational infrastructure. To increase the success of the alternatives, sufficient means should be available, to facilitate all the employees who would like to use the alternatives. The availability is taken up in the survey, as part of the choice experiment. Another factor part of the facilitation conditions are the secondary services, such as charging points for e-bikes or showers for people who cycle large distances to work. The preferred secondary services are asked from the interviewees, since it is interesting for the academic medical center and Pon to know what services positively affect the intention to use the alternatives.

Then, the **price value** is an important consumer use criterion that determines the behavioral intention. When the alternatives are not beneficial in travel time or in travel costs, the acceptance will be relatively low and people won't be stimulated to use the offered alternatives. Therefore, it is important to offer the majority of the employees alternatives that are reasonable in price and are affordable seen their circumstances and needs. To determine what costs and other factors the employees value, a discrete choice experiment will contain the proposed alternatives with varying attributes and levels. The variation of levels between the choice sets and the choices the employees make, will show the trade-offs they make and the relative importance they give to the different attributes. The price value impact is more valuable when analyzed quantitative rather than qualitative, therefore the costs and travel compensation are considered in the survey. However, there is one price value variable that is taken up into interview questions, namely the equity perception of the employees regarding the various alternatives. Research performed on technology acceptance by Hess et al. (2010) concludes that perceived equity is able to explain the level of acceptance. The equity perception is difficult to fully capture in questions, without allowing for further elaboration, therefore the in-depth interviews are found as a good fit.

Last, the personal **habit** is an important factor in the model. Both Kuhnimhof (2009) and Ton and Duives (2021) have found that people are habitual when it comes to their choice of mode for the commute, since it is a choice that is frequently made. Donald et al. (2014) extended the Theory of Planned Behavior with intention and habit, that both affect the behavior of an individual. The behavior is affected since the travel habit determines the mode that is chosen for the commuting trip. Since people are habitual in their mode choice for their home-work trip, they tend to be less alert on travel alternatives present (Brechan, 2006). This indicates the importance of external triggers to use or try new travel modes. Therefore, the internal communication of the organization is part of the moderators, elaborated on in the next section.

Both the facilitating conditions and the price value variables are considered in the survey, as part of the choice experiment. The alternatives are varied in attributes and levels, to observe the trade-offs the employees make. This reveals which facilities they find important and what price or time increase would make them shift to another mode. Section 3.6.3 contains the framework solely for the test phase of the research to visualize the how the alternatives are positioned regarding the contextual variables and the mode choice.

Moderators

As elaborated on in section 3.4.2, the socio-demographics and psychographics have proven in previous research to affect the relation between the contextual variables and the behavioral intention and the relation between the intention and the actual use behavior. Therefore, they are included in the model as moderators. Furthermore, the mentioned section also elaborates on which variables are considered in this research and the difference in the considered variables between the interviews and survey.

Individuals are more prone to use the mode they are familiar with and have **experience** with. However, when actively presented with alternatives, their perception could shift. Ton and Duives (2021) and

de Haas et al. (2022) both find in their research that a trial period or pilot of an innovation increases the uptake when fully implemented since the individuals have experienced the alternative in practice. Additionally, Wall (2006) stresses the importance of letting travelers experience other modes, to bridge the gap between personal perception and the actual situation. He found that car users tend to overestimate public transport travel time, purely since they have no experience with the travel mode. Furthermore, enabling free use of public transportation during a trial familiarizes employees with the possibilities, which stimulates the incorporation of the alternative in their everyday life (Nakayama et al., 2001). The implementation of a pilot, in which the employee can gain experience with commute alternatives, is expected to increase the acceptance of alternatives later in the process. Not only because they are able to experience the mode itself, but also because they know how to incorporate the new mode into their lifestyle. According to the Theory of Goal Directed Behavior, people are more likely to adopt a travel alternative when the implementation for personal use is clear (Gollwitzer, 1999).

Furthermore, employees are not in need for alternatives for their commute and will therefore only be alerted by more sustainable options when this is presented to them. This emphasizes the importance of clear, visible, active and positive **internal communication**, to attract employees to the sustainable alternatives. The way the organization communicates and delivers the new travel alternatives is seen as one of the most significant factors that influences the relation between behavioral intention and use behavior. All employees must feel engaged and respected in their needs. However, currently the academic medical center is not fully aware of the needs, beliefs and mobility related attitude of their employees, demanding an approach that will gain insight into these factors. The in-depth open-ended interviews will allow for conversations with a wide variety of academic medical center employees, deepening the knowledge on their needs. This will create valuable information to optimize the survey and to advise the academic medical center on further approach regarding preferred internal communication to maximize the desired effect of decreasing car use among employees.

Behavioral intention and use behavior

The use behavior is the dependent variable in the model, affected by the intention to perform certain behavior (Venkatesh et al., 2003). The intention is critical to understand as the predictor of usage, also researched in other fields (Ajzen, 1991). The behavioral intention is expected to positively influence the usage of an alternative or innovation.

The actual use behavior will determine the modal split among the employee population and the use of the alternatives that are available or will become available in the near future. For the academic medical center it is interesting to make this choice more intentional for employees who now commute by car, breaking through the personal habit. The relations that are most important to target are the relation between facilitating conditions and use behavior, habit and use behavior and behavioral intention and use behavior. The means they have to affect these relations are their internal communication, the offered alternatives and implementing a pilot to increase the experience with the alternatives of the employees.

Effects

The effects that are shown in the framework, are the desired and expected effects when positively influencing the use behavior of sustainable alternatives of the academic medical center employees. There are four effects considered in the model. First, the reduction in emissions, since less employees will travel to work by car and more by (e-)bike and public transit, or a combination of both. Second, the improvement in employee health, since a greater share of the employees will cycle to work and therefore perform more physical movement. Furthermore, the private car usage is expected to reduce. Last, the quality of public and work space will improve. Since there will be less cars on site, there will be less congestion, less unsafe traffic situations for pedestrians and cyclists, and there will be more space for housing or employment for example.

3.6.3. Conceptual framework for test phase: the survey

As the interviews are based on psychological theories to gain insight into the psyche of the employees with performing semi-structured in-depth interviews, the survey is based on a different theory. On the basis of the survey, lies the utility theory, since this theory is rooted in the economy (Fishburn, 1968) and the appropriate framework for discrete choice models (Small & Rosen, 1981). Similar to the intention and use behavior in the UTAUT2 framework, the utility is dependent on various aspects: the offered

alternatives and their corresponding attributes, the personal socio-demographics, psychographics and behavior, and contextual variables. These aspects are combined into a conceptual framework to create a clear overview of the factors that need to be taken into consideration when trying to influence the mode choice. The conceptual framework is based on the performed literature review and information received from Pon and academic medical center. The framework is limited to the alternatives which are considered by the academic medical center and Pon and the attributes and contextual factors that are influenceable by these two parties. The alternatives in the case study and literature found on previous implementations, can be found in section 3.3.

The complete framework with all relevant variables and attributes is displayed in figure 3.4. The framework is a combination of the Random Utility Model (RUM) (Walker and Ben-Akiva, 2002) and the Theory of Planned Behavior (Ajzen, 1991). The RUM states that external variables affect the utility of the various choices available, which in its turn affects the final choice, assuming the highest utility choice is chosen. The Theory of Planned Behavior is based on the fact that the intention to perform a behavior is the main trigger to actually perform the behavior. The Perceived Behavioral Control (PBC), norms and attitudes of the decision-maker affect the intention to perform a behavior. Furthermore, the context variables and socio-demographics, psychographics and behavior affect both the relation between alternatives and utility and also the experienced utility itself. The difference between squared and oval variables, is whether the respective variable is directly observable or not. In this framework the utility is an unobservable variable, also seen as the intention to perform a behavior as in the UTAUT2 framework used for the interviews, both affecting the final mode choice behavior, which can be observed.

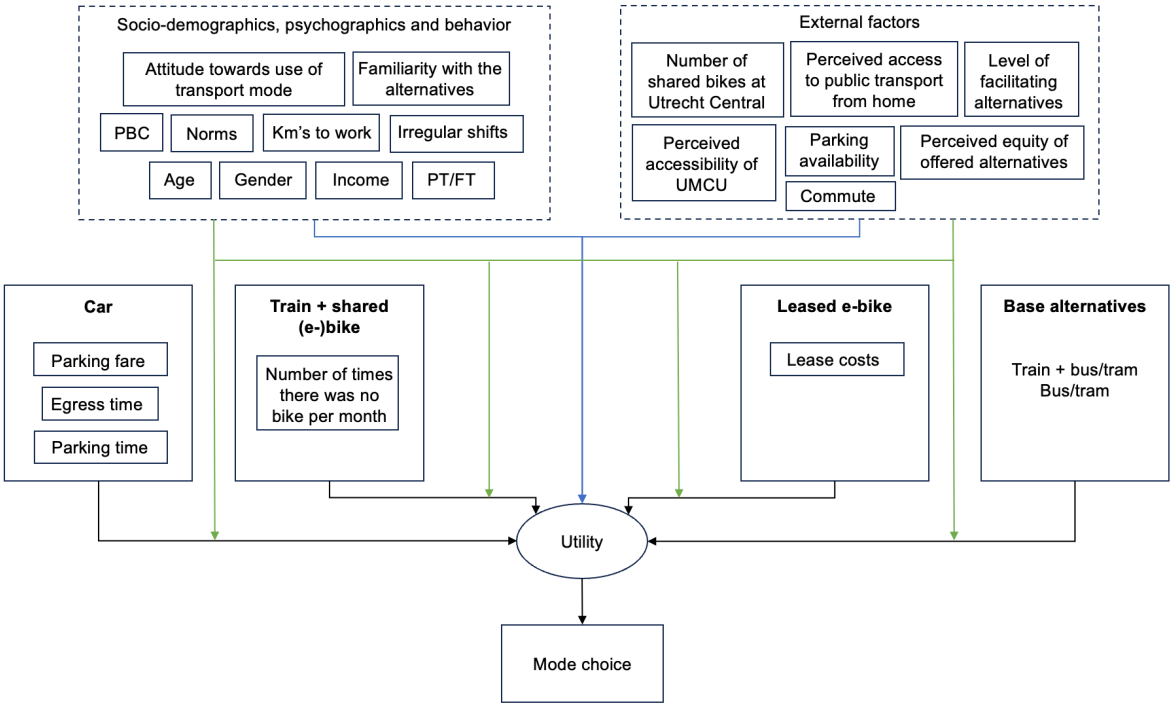


Figure 3.4: Conceptual Framework for the stated choice experiment

The green lines represent the interaction between the variables and the utility of the alternatives. The blue lines are the effect of the variables on the utility. The dashed boxes are socio-demographics, psychographics, behavior and context variables. The solid larger boxes are the alternatives considered in the choice experiment. PBC is Perceived Behavioral Control.

4

Exploratory phase: Interviews

The exploratory phase of this research consists of conducting qualitative and in-depth interviews with academic medical center employees who are carefully selected, ensuring a variety in backgrounds, function groups and work shifts. This will provide insight into the attitude and feelings of a broad share of the employees, to aid the succeeding steps in the mobility transition process within the academic medical center. The in-depth interviews will create a steady base to optimize survey questions and to realize an efficient test pilot of the travel alternatives. The methodology used for the type of interview, drafting of interview questions, and conduction of interviews is given in chapter 2.

This chapter will first give a description of the selection process that took place. Then, the data satisfaction is discussed, consisting of the characteristics of the interviewees and the concepts that are introduced per interview. Last, the analysis approach is stated, to lead to the results in chapter 6.

4.1. Interviewee selection

As previously stated in the methodology chapter, the interviewees are selected by a project team member of the academic medical center, to ask their availability and willingness and to inform them on the topic of the interview. The project team member from academic medical center first approached a mobility focus group which was established two years ago, since these employees would be willing to participate in the interviews. When they approved, their credentials were forwarded to the researcher, who then directly contacted the employees to set an interview date. Since the focus group members were primarily office employees who currently travel by e-bike or public transport, additional employees were approached and contacted via the employees who participated in the research. During these additional interviews, the mentioned project team member was present, to see how the interview would proceed and to take notes on interesting comments made by the employee. The presence of the board member did not seem to affect the openness of the employees, sometimes it even seemed that they were more willing to comment on their mobility problems since they feel that the project team member is able to make the difference. Furthermore, all participants were enthusiastic to have been approached and were open about their preferences for mobility, their preferred internal communication and how they experienced current and proposed alternatives. In total, 17 employees were interviewed, within a three week period. The breakdown of the employees regarding their five most significant socio-demographics: age, gender, commuting mode, home-work distance, and function family, is shown in the succeeding section, 4.2

4.2. Data satisfaction

According to Seidman, 2006, there are two measures to know whether the number of interviewed employees is enough: sufficiency and saturation.

Sufficiency indicates the representation of a wide enough variety of employees, in a way that all employees can relate to someone who participated in the interviews and had the opportunity to comment on their thoughts and feelings regarding the commute. It is based on the variation in individuals and the variation in insights they provide. When the majority of the selected employees indicate the same behaviors and beliefs, so share the same views, less participants are required (Douglas, 1976).

To establish sufficiency, a variety in age, gender, current mode used for the commute, function group, and distance between home and work among the interviewees is guaranteed. According to research performed by Meng et al. (2018), gender and age have shown to affect mode choice, therefore men and women are interviewed as well as various age groups. Furthermore, the employment occupation and the relative according income tend to influence mode choice, due to the probability of car ownership (Kuppam et al., 1999), but also since the function determines whether the employee works regular or irregular hours. Working irregular hours eliminates certain mode options, since public transport is not sufficient in weekends and early in the morning or late at night. Therefore, the presence of functions with regular as well as irregular hours is ensured. Last, the commute related characteristics are documented, where a variety in distance and used mode is important, since the majority of the employees should feel represented in the research in this area. Distance traveled is one of the most important factors that influences mode choice, since larger distances eliminate certain modes as cycling or walking. The actual share of the various groups within the five discussed characteristics can be seen in figures 4.2 and 4.3.

The second criteria to determine whether the gathered data is enough, is the saturation. The saturation is determined by interactive reflection of every step of the process (Seidman, 2006), and will therefore become evident throughout the process of interviewing. When the researcher receives the same information or very similar answers from new interviewees, the data gathered from the previously conducted interviews can be called saturated. During the interviews of this research, the most commented on subjects are mentioned during the first six interviews. The saturation of the arguments given by the employees is visualized in figure 4.1. The detailed overview of the arguments given and how many interviewees gave the same arguments, can be found in appendix D.

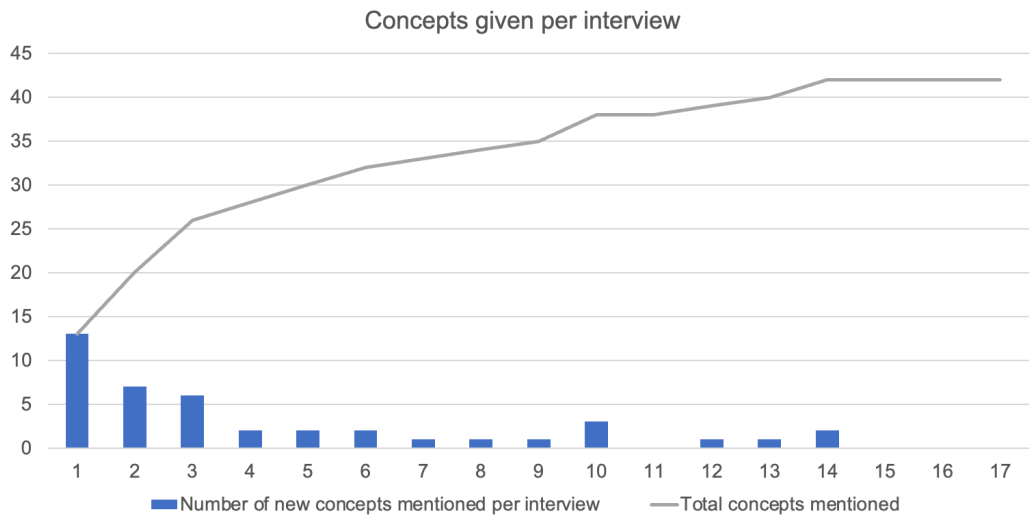


Figure 4.1: Saturation of the data retrieved from the interviews

The saturation graph visualizes the number of concepts introduced in every interview, and how many new concepts are added with every succeeding participant. As can be seen, 67% of all concepts are introduced by the first five participants. Additionally, all the concepts introduced by the participants ten through 14 are secondary services to make sustainable transport modes more appealing or mobility solutions that would fit their needs. The last three interviewees introduced no new concepts or comments. All relevant concepts about the downsides of public transport, the accessibility of the academic medical center, the positive notes of the use of an e-bike and the points of improvement on communication are introduced by the first five interviewees and confirmed by the remaining 12 participants. This is striking, since it indicates that the the most significant dissatisfaction on offered alternatives and communication approach that are experienced by a wide group of employees, can be defined by five employees. Participant number ten distinguishes themselves by having a young child that needs to be taken to daycare before work in combination with working irregular hours. They introduced various solutions to make it easier for parents to combine work and childcare, giving the slight increase in number of concepts.

4.3. Representativeness

An analysis on the socio-demographics of the interviewees is done, to see whether data sufficiency is reached, meaning a wide variety on various aspects is established. Table 4.1 contains the information per interviewee that is deemed important for this research. The names of the interviewees are changed into pseudonames, generated with Chat.ai, to guard the privacy of the participants. For this reason, there is also no exact age given, but a range where the age falls within. After the table, this section will dive deeper into the socio-demographic splits.

Table 4.1: Socio-demographic information of the interviewees

(Pseudo) Name	Age-group	Function	Distance (km)	Commute mode
Esmee	20-25	Nursing and care	18	E-scooter
Femke	40-45	Nursing and care	31	Car
Thijs	55-60	Management	31	Public transport
Roos	30-35	Medical assistant	5	E-bike
Annelies	50-55	Management	29	Car
Jasper	50-55	Management	15	E-bike
Anouk	35-40	Management	10	E-bike
Marian	50-55	Staff and administration	12	E-bike
Helena	40-45	Management	9.5	E-bike
Maria	55-60	Staff and administration	12	E-bike
Marleen	40-45	Nursing and care	33	Car
Dirk	55-60	Staff and administration	21	E-bike
Ilona	50-55	Management	18	Car
Merel	55-60	Clinical support	25	Car
Johanna	30-35	Nursing and care	14	Car
Lotte	35-40	Nursing and care	30	Car
Chris	35-40	Management	80	Car

Figures 4.2 and 4.3 give a clear overview of the various genders, age groups, the function groups, current mode used for the commute, and the distance from home to work of the interviewed employees.

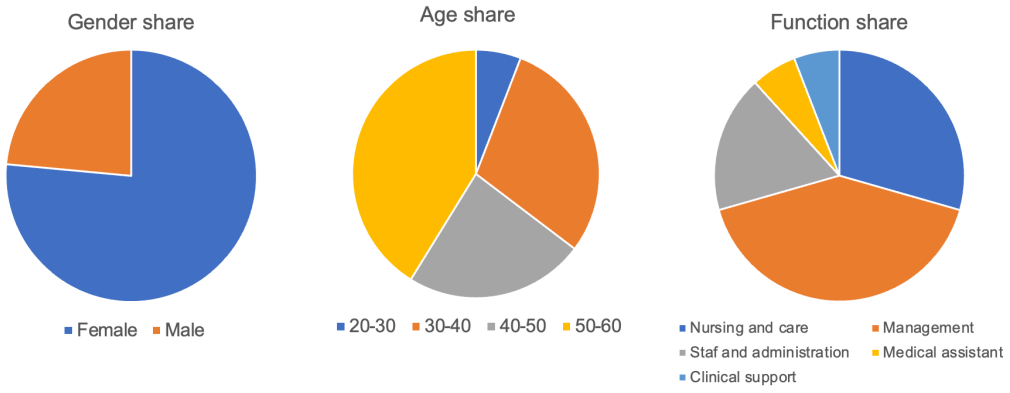


Figure 4.2: Shares of gender, age, and function group among the interviewees

As can be seen, more than 75% of the participants is female. There are two viable explanations for this ratio. First, in 2022 78 percent of the academic medical center employee population was female (internal knowledge received from academic medical center, 2022), which is similar to the ratio within this research. And second, females are more willing to shift to more sustainable modes (Meng et al., 2018) and thus might be more eager to participate in focus groups and consequently this mobility research. Furthermore, the relatively older employees are overrepresented in the research, and the

youngest age group (20-30) is underrepresented. The participants are retrieved from a focus group that was used two years ago within the organization, mainly consisting of office employees with the average age being around 40 or 50. Furthermore, the largest share of the youngest age group is operational on the hospital floor, where the employees have less time and are less approachable for an interview. Third, the function of the interviewees is asked, to enable drawing conclusions on the relation between function, irregular hours, and mode choice behavior. The vast majority of the interviewed employees work office hours, solely the nurses and the clinical supporting employee work irregular hours. Five of the 17 interviewees work in nursing, where all five substantially gave the same answers.

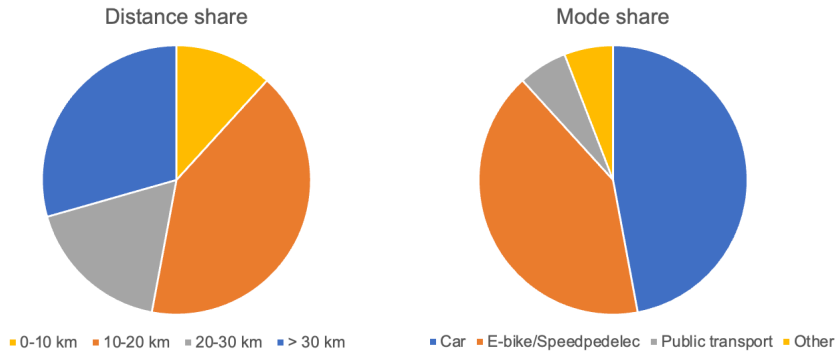


Figure 4.3: Share of current mode used for commuting, and distance from home to work of the interviewees

Figure 4.3 shows the commute related characteristics share of the interviewed employees. On the left, the distance between home and work of the employees who participated is given. The distance that is most common among the participants is 10 to 20 kilometers. This distance allows for all the modes, since cycling, public transport and the car are realistic within this range. The range that is harder to suffice in mobility options, is the 30 kilometers or more. Research performed by Molin and Kroesen (2023) concluded that up to 25 kilometers individuals are willing to cycle to work. However, above this distance, the probability of using the (e-)bike is very low. Therefore, it is necessary to interview the employees who live outside this range, to retrieve their commuting needs and options. This enables the fit between the needs of the employees and the means of the academic medical center and Pon, to eliminate the broad use of the car on the largest distances traveled. Last, the mode share. The aim was to target employees who now commute by car, to retrieve their thoughts on the new alternatives and what measures would make them voluntarily shift from car to (e-)bike or public transport. The employees selected by the academic medical center primarily traveled to work by e-bike, therefore, additional employees were approached who commute by car. There is one 'Other' mode documented, which is the e-scooter. When comparing the two pie charts, the blue parts in particular, a large share of car users (almost 50%) can be seen, while only 30% of the interviewees live farther away than 30 kilometers. Furthermore, the large share of e-bike users among the interviewees is striking, but this is due to the selection of mobility enthusiasts by the academic medical center to participate as previously explained.

4.4. Analysis

The transcription that is computed after the interview, writing out the conversation word-for-word, will enable the analysis of the answers given by all interviewed employees. The transcriptions will be coded, which will be done in three phases: open, axial and selective coding (Scribbr, 2021). The program Atlat.it is used to code the transcriptions of the interviews.

1. **Open coding**: the transcription of each interview is analyzed and each answer section is given a theme, that matches the content of the answer section. In the case of the academic medical center examples of themes that could exist are 'commute comfort' or 'safety of the bike'.
2. **Axial coding**: after all answer sections are labeled by a theme, the themes are critically analyzed once more to see if certain theme can be merged together into one overarching theme. Sometimes themes can be allocated to more than one overarching theme.

3. **Selective coding**: the last phase of coding is to be selective in the axial codes that were assigned to the transcribed interviews. The researcher will assign all the codes from the interviews into main categories that are relevant for the final conclusions. The grouped codes will now show interconnected relations and this is the basis for drawing conclusions and drawing up a theory on the interview subject.

Selective coding automatically leads to the final analysis and conclusions. The relations and overlap, or contrary, found between answers, will show how the employee population of the academic medical center experience their commute, the internal communication and the alternatives that are on the table for their commute. Furthermore, the coded interviews might show the difference in answers and dominant themes that return for specific ages, genders, or function groups. However, the added value of interviews is the context in which the answers are given. The coding of interviews eliminates the broad context of the interviewee, and therefore a combination of coded analysis and qualitative analysis is performed.

5

Test phase: Survey

This chapter applies the survey and stated choice experiment methods explained in chapter 2. First, the results from the test interviews are presented, which gives insight into the attitude, behavior and experienced important factors by the selected employees. Then, section 5.2 provides the selection of attributes and levels which will form the alternatives in the stated choice experiment. The third step is to generate experimental designs with Ngene that will form the choice experiment in the survey, shown in section 5.3. The last experimental design related step is to test how realistic the choice experiments are by asking a test group. After the choice sets are modified based on the feedback, the full survey is designed with all relevant questions and statements, based on the literature review previously performed and the test interviews conducted. The remainder of the chapter shows the final survey questions and statements that are drafted.

5.1. Test interviews

Besides the in-depth interviews that will be conducted in the exploratory phase of the research, test interviews are used to verify the attributes and levels and to establish whether all significant attributes are considered. This will help optimize the questioning in the survey, both in content as in tone. The interviews are conducted with five academic medical center employees. The five participants represent both men and women, have different educational backgrounds, choose different modes of transport for the commute due to their personal situation, and vary in being active at academic medical center from two months to 20 years, all to represent a fair share of the employee population. However, employees who currently work 'beside the bed' so to say, did not participate in these interviews, solely office employees. Although, one of the participants performed 'beside the bed' tasks in the past. During the interviews the employees are asked about their own travel decisions, how they feel about previous policy measures and what they think could benefit the sustainability of the mobility situation in the future.

Multiple factors influence the personal travel decisions, like distance, access to travel modes and other tasks that have to be fulfilled during the commute, like dropping of a child at school. Furthermore, they indicated that weather partly affects the choice of mode. They would choose the electric bike instead of the conventional bike when it rains or opt for the car when they usually cycle to work. None of the interviewees indicated to use public transport, this was mainly due to the fact that their travel time by bike is shorter than by public transport. The popularity of the bike among the interviewees is because they work regular hours and live close to the academic medical center. One of the interviewed employees has worked irregular shifts and explained that biking at the site, where the academic medical center is located, early in the morning or late at night gives a feeling of unease and unsafety, since it feels like a 'ghost town'.

Previous policy measures and current alternatives that are available for the employees receive little support and enthusiasm. Currently the academic medical center offers its employees a 'bike plan' which enables employees to buy a good quality bike for a reasonable price, and a 50% discount on a regional public transport subscription. The bike plan is found beneficial and a good sustainable alternative, however, only for employees who live within cycle range of the academic medical center. Then, the

public transport subscription is also solely for Utrecht region, which is mainly the same region as the bike plan covers. Therefore, employees who live farther away from the academic medical center than 20 kilometers feel left out of the alternatives their employer offers and experience them as insufficient. They have a bitter experience with mobility changes within the academic medical center since the car-user is punished by limiting parking spaces and increasing parking fares, without offering adequate alternatives which they can use for their commute. This approach has left many employees with a negative attitude towards the implementation of commute alternatives and made it a sensitive topic within the organization. It can be concluded that current and previous measures are too inflexible and do not align with the needs of the employees and neither with the mobility goals of the organization.

Then, looking at the future with the interviewees gave valuable insight in what they think is achievable and beneficial for both employees and the academic medical center. The main take-away is that the mobility alternatives need to be sufficient for all employees, so also for the employees who live too far away to cycle to work or use the regional public transport network. Furthermore, the policy should be presented on a positive note, emphasizing the sustainable alternatives that the employees are able to choose from instead of focusing on getting them out of the car. More information should be provided on the benefits of the sustainable alternatives, both for environment as for employee health.

5.2. Attributes and levels

As described in section 2.1.2, attributes are selected when they are expected to strongly influence the opinion of the mode and when the operating actor, academic medical center in this case, is able to manage the attribute. The second reason is important for this research since the goal of the academic medical center is to design alternatives and create travel demand management in such a way that it will steer the car commuters towards more sustainable travel modes. The levels are computed in a way they cover a wide range and that they are logical on their own and in combination with other attribute levels (Molin, 2020).

The travel time is selected in many research as an important attribute of travel modes, since it affects the choice of mode. However, this research focuses on commuting trips, which is a specific route and travel time for every employee. The experiment will ask the respondent which mode they will choose, based on their commuting trip, this is personal and different for every respondent. Therefore, the travel time is a contextual variable which the respondent will have to fill in themselves when choosing between mode alternatives. Also, the academic medical center is not able to decrease the travel time, since this would involve infrastructure or congestion management on governmental levels. The attributes and levels that are influencable by the travel demand management of the academic medical center and are expected to have significant impact on employees' mode choice, are shown in the table below. The selection of the specific levels and attributes is elaborated upon in the remainder of this section.

Table 5.1: Attributes and attribute levels for the three travel alternatives

Alternative	Attribute	Attribute levels
Car	Parking fare	€2, €4, €6 per day
	Parking time	2, 4, 6 minutes
	Egress time	5, 10, 15 minutes
Lease e-bike	Lease costs	€38, €48, €58 per month
Train + shared (e-)bike	Number of times there was no bike available per month	0, 1, 2 times

The parking costs, time it takes to find a parking space, and the walking time from parking space to academic medical center entrance (egress time) are considered as attributes of the car alternative. The levels are selected based on the current highest and lowest value of the attribute. To reduce the number of choice sets, either an even or an uneven number of levels should be chosen for all attributes in the model. For this research, three levels are created, with equidistance (Molin, 2020), that are realistic and will enable valuable analysis. The current lowest parking fare for employees is €2 per day, in the P+R parking lot. When all employee parking spaces are taken, the employee is forced to use a visitor parking space, which is €1,80 per hour (with a maximum of €18 per day) or €30 for a weekpass. The employees opt for the weekpass when they see that there are no more employee parking spaces left, and use that pass for five days, leading to a parking fare of €6 per day. The academic medical center

is investigating effective policy to disable employees to buy this weekpass, since these are meant for long-term visitors of patients in the hospital. The lowest level selected for the parking fare attribute is equal to the current lowest parking fare. The reason for this is that the academic medical center finds it undesirable to decrease the current parking costs, since they want to destimulate car use. The final levels selected are €2, €5 and €8. These levels are determined based on keeping equidistance between the levels, the lowest level is set at €2 and the highest level being above the maximum they are currently willing to pay, the daily €6 for the weekpass. However, after expert consultation and asking various working people, the upper level of €8 was deemed too high and unrealistic. Therefore, the final levels were established to be €2, €4 and €6. Then, the levels for parking and egress time when traveling by car are determined. The academic medical center wants to decrease the number of parking actions with 55%, leading to less chance of a parking space when the use of the car stays the same. The current time spent searching for a parking space, obtained from the test interviews with employees, is between two to four minutes. The lowest level is selected to be two minutes, since the time is not likely to decrease in the future. The other selected levels are four and six minutes. Then, the egress time from parking space to academic medical center entrance depends on the parking lot chosen: P+R medical center, Noord and Zuid. The current shortest time required is five minutes, from Noord and Zuid, and the longest is 15 minutes, from P+R medical center. The levels for egress are therefore selected to be 5, 10 and 15 minutes.

For the electric lease bike, there is only one attribute that will affect the mode choice by the respondents and that is manageable by the academic medical center: the leasing costs. As said before, the travel time varies for each person and is therefore not a stated attribute. The leased e-bike will enable traveling from door-to-door, with no to little access and egress time and the academic medical center guarantees parking space and charging stations for e-bikes. The lease costs are charged monthly and are either €38, €48 or €58 per month for the employee. The lowest costs are achieved when the academic medical center invests in the bike, the €48 is when both the academic medical center and the employee invest, and the highest monthly cost is when the academic medical center solely facilitates and the employee has to invest.

The last alternative that is varied in attribute, is the travel option to take the train in combination with a shared (e-)bike at Utrecht Central station. Numerous aspects of the bike rental are already established and made as beneficial for the user as possible: the (e-)bike use is free, the bikes are stationed at a three minute walk from Utrecht Central, and there are always sufficient parking spaces at both academic medical center and the station. The only attribute that is uncertain, could affect the choice behavior of employees and is manageable by the academic medical center, is service security. The service security is measured by the number of times per month that there was no (e-)bike available when an employee wanted to use the shared service. This attribute is varied in the levels zero, one and two. The level zero means that there are enough bikes for all employees who wish to use the service, at all times. The levels one and two mean that there are employees who experience the disappointment of not being able to rent a bike ones or twice a month, when they wanted to.

5.3. Generation of experimental design

The second step of creating a stated choice experiment is generating the experimental design. There are six decisions to be made before the choice sets can be specified (Metrics, 2018):

1. Are the alternatives labelled or unlabelled?
2. Are the attribute levels balanced?
3. How many levels does each attribute have?
4. What are the ranges for the attribute levels?
5. What design type is used?
6. How many choice situations to use?

The questions 1, 3 and 4 are answered in the previous section, 5.2. The alternatives in this research are labelled, since the alternatives vary in attributes and levels. All attributes have three levels, enabling a smaller number of choice sets for the experiment. The levels of the attributes are determined by the current situation for the academic medical center and possible future scenarios. The ranges are large enough to enable the analysis of future scenarios via interpolation, but not too large, since this could

cause choice sets with dominating alternatives. The attribute levels are determined to be balanced, answering question two, which means that all levels occur an equal number of times. This ensures that the whole level range can be analyzed rather than single data points.

The design type used, question five, is the orthogonal design. This is a type of fractional factorial design, which selects a number of choice sets from the full factorial design. A full factorial design is undesirable for this research since the number of choice situations will become too large. The orthogonal design combines choice sets by means of their attribute levels, where correlation between attribute levels within a choice set is minimized. For the orthogonal design it is assumed that interaction effects do not play a role, to ensure efficient estimation of the model (Molin, 2020).

The last question, aiming to answer how many choice situations are to be used, is approached by using a basic plan. Basic plans are fractional factorial orthogonal designs, that are used to determine the number of choice sets based on number of attributes and levels used in the design. This research uses three designs, based on the distance between home and work of the respondent, see table 5.2. To obtain valuable information from the choice experiment, solely alternatives are given to the respondent which are ought to be realistic in their travel situation. Therefore, a split of three distances is made regarding feasible modes. The first is for respondents who live 0-10 kilometers from work, they will be able to choose between car, electric lease bike and bus or tram. The train is found to be unrealistic on such a short distance. The second distance range, between 10 and 30 kilometers, is found feasible for all modes in the region Utrecht. There are relatively fast bus and tram connections from IJsselstein and Nieuwegein which are over 20 kilometers and also train connections below the 20 kilometers, for example with Bunnik. Furthermore, the electric bike is usually considered up to 20 kilometers, however, research has found that above 20 kilometers, individuals still choose their e-bike as commuting mode (Molin and Kroesen, 2023). Last, the respondents who live 30 kilometers or more from work are given the two options with the train combination and the car as part of the choice experiment.

Table 5.2: Mode options in choice experiment based on home-work distance

Distance	Mode options chosen	Unrealistic mode options
0 to 10 kilometers	Car, electric lease bike, bus or tram	train + shared (electric bike), train + bus or tram
10 to 30 kilometers	Car, electric lease bike, bus or tram, train + shared (electric) bike, train + bus or tram	-
> 30 kilometers	Car, train + shared (electric) bike, train + bus or tram	Electric lease bike, bus or tram

So, the first design contains two alternatives which are varied in attribute levels: the car and the electric lease bike. This design is computed with basic plan two, since this plan suffices for the four attributes (parking fare, parking time car, egress time car and lease costs) with three levels that are considered. This leads to nine choice sets which are varied among the respondents in this design. The second design has the highest level of attributes, namely five (parking fare, parking time car, egress time car, lease costs e-bike and number of times there was no shared (e-)bike available per month). These five attributes are all varied in three levels, therefore basic plan three is suitable for generating the choice sets. This basic plan leads to a total of 18 rows, after running in Ngene. Since 18 choice sets is too many to give to one respondent, 8-10 is found optimal (Molin, 2020), two blocks of nine choice sets are generated with Ngene. Last, the respondents who live 30 kilometers from work and further are given a selection of nine choice sets. The nine choice sets are generated based on basic plan two, which contains the option for four attributes with three levels. The Ngene code of the three designs are shown in appendix B.

The train + bus or tram and bus or tram alternatives are base alternatives, not varied in attributes or levels. They are added to the corresponding choice sets after generating them with Ngene. Louviere et al. (2013) found that for labeled alternatives a choice set of three or four alternatives is optimal. The first and third design have three alternatives within each choice set. However, the second design has five alternatives which are feasible. Therefore, the bus or tram and train + bus or tram are being divided across the two blocks that are distinguished from the second design.

5.4. Test group

The attributes, attribute levels and survey flow are tested by a test group. They receive the survey and during their answer process they elaborate on their way of thinking aloud. This enabled me to experience whether the questions and flow generated the answers that are necessary for the final analysis. The test group existed of employees from Pon, Hely, Lease-a-Bike and academic medical center. Furthermore, people who do not have affinity with mobility and health-care are part of the test group, to filter out professional jargon or other non-subject related mistakes. A wide variety in age and educational background is established among the test group participants, to ensure different points of view to receive the richest feedback. Overall the feedback has helped with creating a smoother flow throughout the survey and match the tone of voice used by the academic medical center. Furthermore, concrete decisions were made regarding the removal of unclear questions or the rearrangement of questions to minimize the chance of causing irritation among respondents. These concrete decisions are discussed below.

”Are you capable of making your own travel decisions” is deleted from the survey, since it was not clear what to consider when answering this question. The goal of this question was to eliminate respondents from the survey that are not able to choose how they commute, for instance due to age or physical or mental restrictions. Participants hesitated whether to consider their shift time, since they are less capable of making their own choice when there are less possibilities late at night or early in the morning. Also, when their partner takes the car to work, they are not able to choose this mode, and therefore they tended to answer this question with ’No’. This was not the aim of this question and the academic medical center employees indicated that all employees are able to make their own travel choices, making the question redundant.

In the beginning of the survey the respondents were asked whether they owned a(n) (electric) bike or car and in the attitudinal part the respondents were asked whether they ever drive by car or (electric) bike. This caused irritation by participants of the test group since they felt like questions are asked double and they had already indicated that they use the bike or car. Therefore, display logic was used in Qualtrics, to eliminate redundant questions for the respondents and limit irritation.

The questions ”When I travel to work by car/(e-)bike/public transport, I can do everything I want to do during my commute”, are deleted from the survey after testing. It raised more questions than clear answers, since respondents did not understand what was asked of them and how they should interpret the question. Only when the question was extensively elaborated on in the meeting, they had a slight idea of how to answer, this would generate too unreliable answers.

Two of the norm related questions were adjusted after expert consultation, to make them come off less strong than found in literature. The statements were stated with the words ”I feel obliged” and are adjusted to ”I prefer to”. Strong words possibly scare people off and therefore generate less reliable answers. Furthermore, the questions about norms were found to be redundant for non-car users after the test group feedback. The questions ask if the social environment thinks that they should use public transport or the electric bike. However, the participants who already commute by public transport and bike said that the opinion of the social environment had little extra impact. The norm related questions are only posed to respondents that currently commute by car, since the questions caused irritation instead of generating valuable answers for the other respondents.

5.5. Survey components

Figure 5.1 shows the components of the survey and how they succeed one another. There are different flows within the survey possible, based on the answers given to the dark blue boxed questions. Light blue blocks are informative texts, dark blue boxes are questions that determine the survey flow for the respondent and the yellow, green and purple boxes are the different choice sets that are computed.

The survey starts with a general introduction. When the respondent proceeds with the survey, the first two blue outlined questions are asked to determine whether the respondent is part of the target population. The third blue outlined question determines the flow further in the survey, in the ’Attitude’ part. Then, the respondent will receive the first part of the socio-demographic questions to relieve the respondent from too many questions at the end of the survey. The division in socio-demographic questions, between part one and two, is made based on the perceived level of sensitivity of the questions. The less sensitive questions are asked at the beginning, to ease the respondents into the questionnaire. This part of the survey concludes with the two questions that determine the

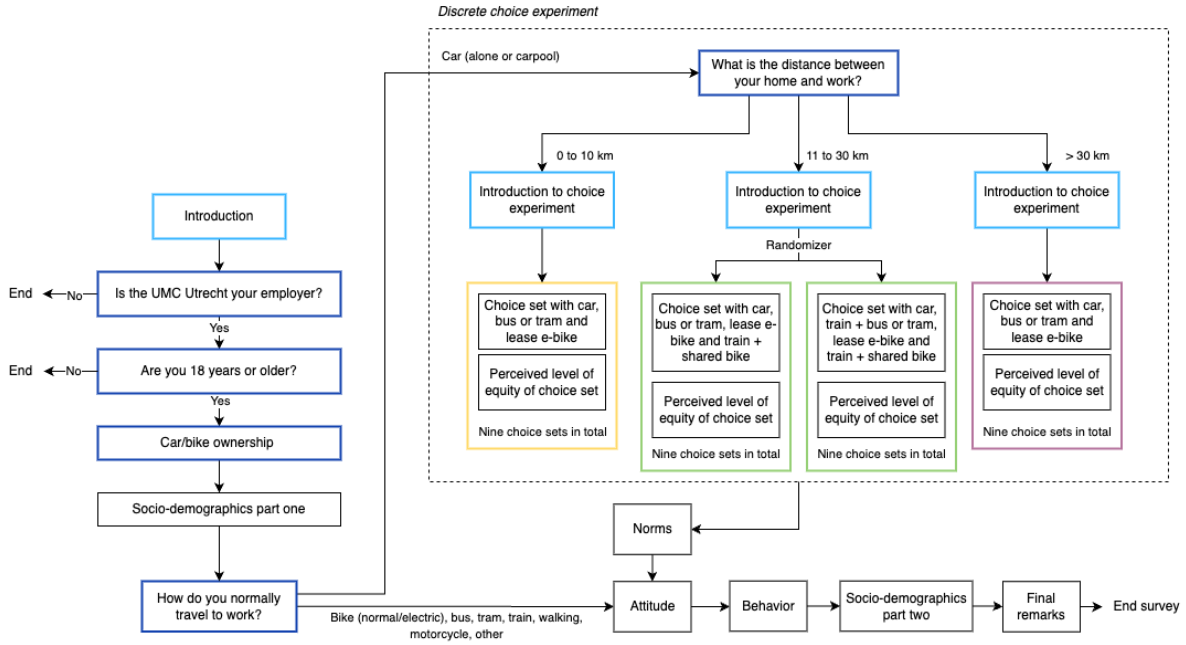


Figure 5.1: Flow chart of the survey design as given to the academic medical center employees

remaining flow of the survey, where car-users receive the choice experiment and norm related questions and commuters that use one of the other modes are directed to the psychographic and behavioral questions. A detailed description of the survey flow and the different parts is given in the subsections below.

5.5.1. Introduction

The introduction is used to invite respondents to participate in the survey and serves as the opening statement, according to HREC guidelines. First a personal introduction is given on who I am, what my study background is and the reason for conducting this research. Then, the respondents are eased into the information on what is asked of them and what effort the survey will demand. The duration is given, which is estimated to be 12 minutes on average. Furthermore, the link between this research and a previous research done by academic medical center is made to familiarize the respondents with the approach. To create transparency about the destination of the findings, the department Strategy and Policy is stated as the party who is advised based on this research. The department is informed based on general findings retrieved from the survey data, to ensure anonymity and data security for the respondents. If respondents have questions or remarks regarding the survey, they are able to contact me via the mail-address which is provided. Last, the respondent is attended to the fact that they will consent to the use of their answers when they proceed with the survey.

5.5.2. Personal questions part one

Once the respondents have started the survey, they are presented with practical questions. First, the respondent is asked whether they are employed by the academic medical center and if they are 18 years or older, to identify the target population. Then, four easy questions are asked to hold the attention of the respondent. These questions are whether they own a car or bike (electric or not), if they work parttime or fulltime and if they are able to perform (some) working tasks at home. This first part of the survey concludes with two questions that determine the continuation of the survey. There are four possibilities of how the survey will continue, the first distinction is made with the answer to the question ”What is your current mode of transport for your commute?”. When the question is answered with ’Car (alone)’ or ’Car (carpool)’, the survey will continue with the choice experiment pertaining to their home-work distance. When the respondent says to take another mode than the car to work, the survey will skip the choice experiment and direct them to the psychographic and behavioral questions. The reason for focusing on car-users in the stated choice experiment is because the academic medical center is

interested in decreasing the number of car users and thus creating alternatives which are beneficial for and meet the needs of these employees. Then, the car users are grouped, based on the answer to the question ”What is the distance from home to work?”. This is necessary since different distances to work also ask for different transport options in the choice experiment. The train is not a realistic option when you live 8 kilometers from work, and the same goes for the electric bike when you live 40 kilometers from work. The division in distances and according mode options are shown in table 5.2.

5.5.3. Introduction of choice experiment

The respondents who answered that they drive to work by car, alone or carpooling, are then directed to the choice experiment. Before the choice sets are presented, a brief introduction and explanation regarding the choice sets is given. Professional jargon like ’choice set’ and ’attribute’ are avoided, to ensure understanding from the respondent. The respondent is told what is expected of them and is shown how the following nine questions look, to familiarize them with the possible travel scenarios they receive. Below the example of the alternatives, a short explanation is given of the two new alternatives, electric lease bike and the shared bike at Utrecht Central. After the general introduction, the respondent will start with the choice experiment that suits their indicated home-work distance.

5.5.4. Choice experiment

There are three distinctions made in home-work distance: 10 kilometers or less, between 10 and 30 kilometers or above 30 kilometers. As explained in section 5.3, each respondents is presented with nine choice sets, where the attribute levels vary in between choice sets. An example of a choice set part of each of the designs, is given in appendix C. Within the distance of 0-10 kilometers the train is found to be infeasible. Therefore, the choice set contains the alternatives car, lease e-bike and bus or tram.

The second design, covering the distance between 10 and 30 kilometers, contains two different choice sets. These two choice sets are generated with the block command in Ngene, to ensure orthogonality. Both blocks have the alternatives car, lease e-bike and train + shared (e-)bike. The blocks differ in the fourth alternative that is added to the set, either bus or tram or train + bus or tram. There is chosen for a maximum of four alternatives per choice set, to avoid overwhelming the respondent which leads to less reliable responses (Louviere et al., 2013).

The last design is for all respondents who live farther away than 30 kilometers. This distance is chosen since research from Molin and Kroesen (2023) has shown that above 20 kilometers employees still choose the e-bike for their commute. To avoid premature exclusion of e-bike users, the range is set at 30 kilometers. Therefore, the employees who live outside of this range, receive the alternatives car, train + shared (e-)bike and train + bus or tram.

After each choice set, the respondent will be able to indicate whether they perceive the given choice set as just and safe, given their personal circumstances.

5.5.5. Psychographic and behavioral questions

After the car-users have finished the choice experiment, they will continue with the norm related questions. These questions investigate the effect the social environment has on the choice behavior of the respondents. The other mode users will continue with the attitudinal and behavioral questions. These questions are part of the survey to determine whether there is segmentation among the academic medical center employees, and if so, what characterizes the segments. According to Spear (1976) and Solomon et al. (2012), attitudinal and behavioral questions or statements improve the capability to predict mode-choice. The questions and statements are computed in two ways, some are found in literature and adapted to this research and others are conceived specifically for this survey, with the help of experts in the field of stated choice experiments. The questions and statements found in the research of Haustein (2012) and Alturif and Saleh (2023) are used as the basis for the psychographic statements in the survey of this research. The answers are either yes/no or Likert-scale, 5 point or 7 point, depending on the level of detail that is beneficial for the analysis. There are four parts distinguished to structure the survey questions:

Norms and values

The influence of the social environment of the respondent and personal intrinsic norms are measured through six statements. The first four are about the external influence people experience when choos-

ing their mode for the commute or in daily life. The last two statements are used to determine whether the respondent perceives themselves as environmentally friendly or finds traveling sustainably important.

Table 5.3: Norms and values statements

People important to me think I should use public transportation to commute to work	1: Strongly doesn't apply; 5: Strongly applies
People important to me encourage me to use public transportation in my daily life	1: Strongly doesn't apply; 5: Strongly applies
People important to me think I should use electric bicycles for commuting to work	1: Strongly doesn't apply; 5: Strongly applies
People important to me encourage me to use electric bicycle in my daily life	1: Strongly doesn't apply; 5: Strongly applies
Because of my personal values, I prefer to use environmentally friendly modes of transportation such as bicycle, train, bus or streetcar for my regular trips	1: Strongly disagree; 5: Strongly agree
I feel the need to contribute to climate protection by choosing environmentally friendly means of transport	1: Strongly disagree; 5: Strongly agree

Attitude
This section in the survey is used to gain understanding of the attitude respondents have towards the car and (e-)bike. The question about how people feel about driving by car, is also asked for the conventional bike and e-bike. Only the respondents who have indicated to own a(n) (e-)bike or car in the first part of the survey or said to have driven one of these modes once, are given the follow-up question about their perceived feeling. Furthermore, the awareness of current policy measures is asked, this will show whether the employer is informative enough regarding their alternatives. Also, the familiarity with the shared (e-)bike is measured, since people who are less familiar are also less eager to use such a mode. Third, a question about the feeling of justice regarding the decrease of low-fare parking spaces was part of the survey. This question was deemed as important to conclude on what the overall feeling and dissatisfaction level is among the employees, but it is deleted due to high sensitivity according to the academic medical center. The aim of posing the last two questions is to gain insight in the perception of the employees regarding public transport costs and duration, when used for their commute. This perception also reveals the relatively negative or positive attitude respondents have towards the modes, based on their given level of under- or overestimation. The final questions with according scale are the following:

Table 5.4: Attitudinal questions and statements

Do you ever drive by car?	Yes/No
How do you feel driving by car? I think driving by car is:	
Status granting	1: Strongly disagree; 5: Strongly agree
Environmentally friendly	1: Strongly disagree; 5: Strongly agree
Relaxing	1: Strongly disagree; 5: Strongly agree
Comfortable	1: Strongly disagree; 5: Strongly agree
Time saving	1: Strongly disagree; 5: Strongly agree
Flexible	1: Strongly disagree; 5: Strongly agree
Safe	1: Strongly disagree; 5: Strongly agree
Awareness of existing travel alternatives offered	1: Strongly doesn't apply; 5: Strongly applies
How familiar are you with the concept (electric) shared bike?	1: Very unfamiliar; 5: Very familiar
Suppose you were to travel to work by public transportation, how much do you think a one-way trip from your home to work costs?	Range from €1 to €25 with steps of one euro
Suppose you were to travel to work by public transportation, how long do you think a one-way trip from your home to work takes?	5-10 minutes to >2 hours

Perceived behavioral control
The PBC statements that were originally drafted were found to be unclear by the test group and thus led to unusable answers. The original questions asked whether the respondents are able to perform all desired tasks during their commute when traveling by (e-)bike or public transport. However, without additional explanation during the meetings, the respondents found it difficult to understand and answer the questions. The newly drafted questions are more practically orientated, leading to attitude related questions rather than PCB statements. Therefore, the perceived behavioral control is not measured through survey questions and statements but during the exploratory part of the research. This enables to give more context when asking questions and elaborate where necessary.

Behavior
The behavioral questions divide the respondents based on their travel behavior and travel habits. The habitual question is focused on car-use, because travel habits are found to be strongest for commuters who use the car.

5.5.6. Socio-demographics part two
The second part of the socio-demographics starts with less sensitive questions about the perceived accessibility of the academic medical center and the public transport network from the respondents

Table 5.5: Behavioral questions

How often do you travel by car as the driver?	Range from almost every day to less than one time a year

home.

Table 5.6: Socio-demographics part 2

How accessible is the academic medical center for you?	1: Very bad; 7: Very good
If you were to travel to work by public transportation, how do you find the connection of public transportation between your home and work?	1: Very bad; 7: Very good
Do you work irregular shifts?	Yes/No

The last two questions receive a follow-up question, based on the answer given. The respondents who said to find their accessibility of the academic medical center 'Poor', 'Bad' or 'Very bad' receive a follow-up question to determine what affects this perception. They are able to choose from the reasons: accessibility of station from home, number of transfers, travel time, accessibility of academic medical center from Utrecht Central Station, costs, flexibility, and other (with room to elaborate).

When respondents work irregular shifts, they are asked what kind of irregular shift: evening, night, weekend or accessibility shift. This question then also generates two follow-up questions, when answered with 'evening shift' or 'night shift'. First they are asked how many times a week they work this shift, varying from once to seven times a week. The second follow-up question asks what level of safety they experience when they travel to and from their shift when traveling by car, public transport or (e-)bike. The level of safety is given on a 5-point Likert scale varying from 'Very unsafe' to 'Very safe'.

The last part of the survey contains the most personal questions, which are due to sensitivity posed at the end. The socio-demographics sketch a profile of the various groups that possibly exist among the employees. Five person-related characteristics are asked, the gender, income, function group, age and education, all while safekeeping the anonymity of the respondent. These characteristics are based on the literature study as discussed in subsection 3.4.2. The less sensitive socio-demographics are posed in the first section of the survey, 5.5.2, to relieve the respondents from too many questions after the choice experiment.

6

Results

This chapter discusses the results found by conducting in-depth one-on-one interviews with academic medical center employees, with the impressionistic representation approach. The answers of the employees to the carefully stated semi-structured interview questions will be used to conclude on mode choice behavior and user acceptance of travel alternatives within the hospital sector. The names used in this section are pseudonames. The three drafted sub questions will be answered chronological throughout this chapter, dividing the chapter into three sections. First, the adapted unified theory of acceptance and use of technology (UTAUT2), from chapter 3 in section 3.6, is used to categorize the concepts and comments made by the interviewed employees to see which contextual variables and moderators have dominated the answers of the employees. Then, a detailed analysis is made of all the conducted interviews. After the theory analysis, the current facilities of the academic medical center and what factors the employees consider when choosing their mode of transport when commuting are elaborated on. These two sections allow for the answer of the first sub question. The second section consists of the reactions given to the proposed alternatives, leased e-bike and shared (e-)bike at Utrecht Central station. Furthermore, this section contains general comments and employees' perception on e-bikes and public transportation. Last, the perceived equity regarding the alternatives and the compensation received from the academic medical center is given. At the end of the second section, sub question two is answered. The third section contains solutions given by the interviewees for the commute as well as secondary services to improve the uptake of the sustainable alternatives. Furthermore, the comments made about the internal communication are presented in this section, after which the third sub question is answered.

This chapter contains the results that are necessary to answer the sub questions, an overview of which sections contain information for what question, is given in table 6.1. The sub questions will be answered in the conclusion of each corresponding section, which will enable the answer to the main research question, found in chapter 7.

Table 6.1: Guide to which sections contain the results to answer the sub questions

Sub question	Answer
1. What factors play a significant role in commute mode choice according to hospital employees?	Sections 6.1.1 & 6.1.2
2. What is the perceived level of equity of the proposed travel alternatives?	Section 6.2.1
3. Which policy strategies and communication approach can the academic medical center use to engage the employees and increase the effectiveness of the implementation?	Sections 6.3.1 & 6.3.2 & 6.3.3

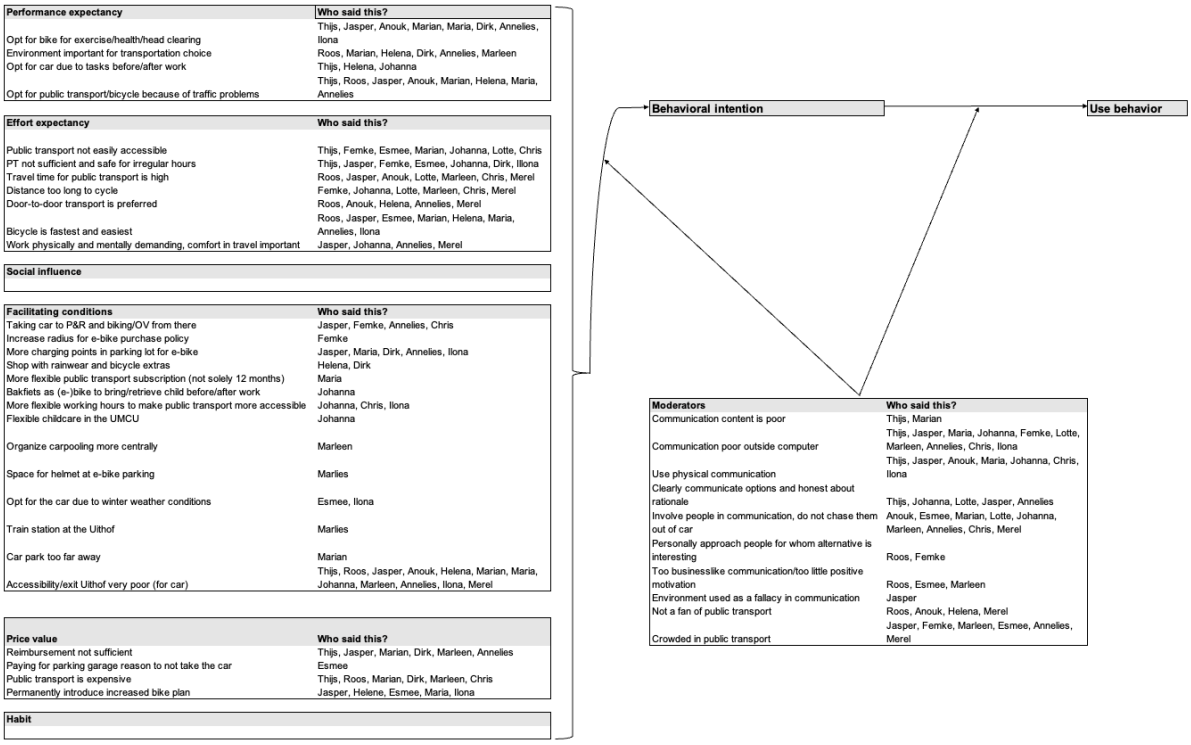
A combination of coding the transcripts and analyzing the conversations is used, to avoid losing the rich context which the interviews provide. The transcripts are coded with the tool Atlas.it, by first applying tags to all the relevant comments and introduced concepts of each interviewee. Then, the tags with similar meaning are grouped together, called axial coding. Last, selective coding is applied,

where the axial codes are grouped under more general tags. This creates an overview of which subject areas are commented on most frequently by the employees and what subjects seem to be less urgent. The coding process from open, axial to selective coding can be found in appendix D, as well as an Excel sheet with color coding.

6.1. SQ 1: What factors play a significant role in commute mode choice according to hospital employees?

6.1.1. Theory of Acceptance and Use

The Excel sheet is used to further categorize the concepts and comments of the interviewed academic medical center employees within the UTAUT2 framework which is applied in this research. This will allow for analysis whether the UTAUT2 model explains the mobility situation at the academic medical center, or if an extension of the framework is necessary. Furthermore, by categorizing the various concepts within this framework, the most dominant contextual variables and moderators will become apparent. As mentioned in chapter 4, the names used in the report are pseudonames of the interviewees. The relations between the contextual variables, the behavioral intention, use behavior and moderators are highly simplified, since this is not the focus of this figure. The framework with all relations between the variables included can be found in figure 3.3.



Performance expectancy	Who said this?
Opt for bike for exercise/health/head clearing	Thijs, Jasper, Anouk, Marian, Maria, Dirk, Annelies, Ilona
Environment important for transportation choice	Roos, Marian, Helena, Dirk, Annelies, Marleen
Opt for car due to tasks before/after work	Thijs, Helena, Johanna
Opt for public transport/bicycle because of traffic problems	Thijs, Roos, Jasper, Anouk, Marian, Helena, Maria, Annelies

Effort expectancy	Who said this?
Public transport not easily accessible	Thijs, Femke, Esmee, Marian, Johanna, Lotte, Chris
PT not sufficient and safe for irregular hours	Thijs, Jasper, Femke, Esmee, Johanna, Dirk, Illona
Travel time for public transport is high	Roos, Jasper, Anouk, Lotte, Marleen, Chris, Merel
Distance too long to cycle	Femke, Johanna, Lotte, Marleen, Chris, Merel
Door-to-door transport is preferred	Roos, Anouk, Helena, Annelies, Merel
Bicycle is fastest and easiest	Roos, Jasper, Esmee, Marian, Helena, Maria, Annelies, Ilona
Work physically and mentally demanding, comfort in travel important	Jasper, Johanna, Annelies, Merel

Social influence

Facilitating conditions	Who said this?
Taking car to P&R and biking/OV from there	Jasper, Femke, Annelies, Chris
Increase radius for e-bike purchase policy	Femke
More charging points in parking lot for e-bike	Jasper, Maria, Dirk, Annelies, Ilona
Shop with rainwear and bicycle extras	Helena, Dirk
More flexible public transport subscription (not solely 12 months)	Maria
Bakfiets as (e-)bike to bring/retrieve child before/after work	Johanna
More flexible working hours to make public transport more accessible	Johanna, Chris, Ilona
Flexible childcare in the UMCU	Johanna
Organize carpooling more centrally	Marleen
Space for helmet at e-bike parking	Marlies
Opt for the car due to winter weather conditions	Esmee, Ilona
Train station at the Uithof	Marlies
Car park too far away	Marian
Accessibility/exit Uithof very poor (for car)	Thijs, Roos, Jasper, Anouk, Helena, Marian, Maria, Johanna, Marleen, Annelies, Ilona, Merel

Price value	Who said this?
Reimbursement not sufficient	Thijs, Jasper, Marian, Dirk, Marleen, Annelies
Paying for parking garage reason to not take the car	Esmee
Public transport is expensive	Thijs, Roos, Marian, Dirk, Marleen, Chris
Permanently introduce increased bike plan	Jasper, Helene, Esmee, Maria, Ilona

Habit

Behavioral intention

Use behavior

Moderators	Who said this?
Communication content is poor	Thijs, Marian
Communication poor outside computer	Thijs, Jasper, Maria, Johanna, Femke, Lotte, Marleen, Annelies, Chris, Ilona
Use physical communication	Thijs, Jasper, Anouk, Maria, Johanna, Chris, Ilona
Clearly communicate options and honest about rationale	Thijs, Johanna, Lotte, Jasper, Annelies
Involve people in communication, do not chase them out of car	Anouk, Esmee, Marian, Lotte, Johanna, Marleen, Annelies, Chris, Merel
Personally approach people for whom alternative is interesting	Roos, Femke
Too businesslike communication/too little positive motivation	Roos, Esmee, Marleen
Environment used as a fallacy in communication	Jasper
Not a fan of public transport	Roos, Anouk, Helena, Merel
Crowded in public transport	Jasper, Femke, Marleen, Esmee, Annelies, Merel

Figure 6.1: The UTAUT2 model with the concepts commented on by the interviewed academic medical center employees

The filled in framework shows that during the interviews, the performance expectancy, effort expectancy and communication moderator are most frequently commented on, with many interviewees agreeing on the same concepts. These areas are therefore deemed as most impactful when improved during the mobility implementation in future scenarios. People value their comfort and ease of the commute to work, where social influence seems to have little impact. Anouk, Johanna and Lotte indicated that the mobility culture is primarily focused on the car, with little social influence to change the mode choice behavior. Most agreed upon is the poor accessibility or flow on site, especially at the end of the day, with 12 out of the 17 people bringing this up during the interview. Of these 12 people, eight say they therefore choose to cycle or use public transport to travel to work. The poor accessibility is a consequence of the high car use rate among the people working on the site of the medical center, which the academic medical center is trying to improve by stimulating other modes of transport. When doing so, the effort

of the new alternatives should not be significantly higher than the car, since convenience is established as important to many of the interviewees. Furthermore, the current reimbursement is experienced as insufficient by interviewees who are unable to use the bike plan or regional public transport, making the alternatives unable to compete with the car. The fourth contextual variable, the facilitating conditions, receives the longest list of concepts introduced by the interviewees, however, many of the concepts are solely experienced or found significant by one employee. Nevertheless, it is worth noting that the majority of the e-bike users requested more charging stations and e-bike parking space at the academic medical center. Besides the practical points of focus, the communication is important to analyze, seen the number of comments and improvements given during the interviews. What came up in the majority of the interviews, was the lack of communication outside of online notices and emails. Consequently, nine of the interviewees proposed to engage people more in the decision making and present the mobility changes in real life, instead of an online message. The framework helps to identify the problem areas regarding mode choice behavior and therefore also the success of implementing the alternatives. There are various facilitating conditions that would improve the experience of commuting for the employees, but the minimization of effort, maximization of performance regarding personal health and site accessibility, and the considerations for internal communication will have the most significant impact on the behavioral intention and therefore the use behavior of the travel alternatives. The framework is found to suffice and there is no need for extension of the framework, since the comments made by all interviewees could be divided among the existing factors within the framework. The only adaption to the framework could be the exclusion of social influence since that seemed to be of no impact from the interviews. However, it is not excluded before the test phase is also executed, which will be an analysis among a significantly larger target group.

Although the conceptual framework allows for a clear division of the concepts among the contextual variables and moderators, a different set up is used for the remainder of the chapter. The coding of the transcripts with Atlas.it and the saturation analysis together with color coding in Excel narrowed the number of labels down to five categories: current facilities and considerations, leased e-bike and shared bike pilot alternatives, proposed mobility solutions, secondary services and communication. The reason for choosing this specific categorization is because these sections will allow for a logic flow of the information and argumentation retrieved from the interviews, to arrive at the conclusion that can be drawn from the research. For each topic, the most frequent used code is elaborated on and furthermore comments of interviewees and their personal context is given. This will provide an insight into the rationale of the academic medical center employees and how their personal situations affect the choice of mode for the commute. The names of the interviewed employees are changed to random Dutch names, retaining the gender of the individual, to protect the privacy of the participants. The quotes that are used in the following sections are translated from Dutch to English to match the report language and maintain a pleasant flow. The original quotes in Dutch that are used, can be found in the second section of appendix E.

6.1.2. Current facilities and considerations

The vast majority, 12 of the 17 interviewees, says they experience the accessibility of the site of the medical center as poor at the end of the working day. From around 4:30 p.m. extreme congestion builds up, which can cause up to 45 minutes of delay, just to leave for home. For cars, this causes long delays in getting home, and for cyclists, it creates unsafe situations at certain intersections. Especially with bad weather, say both Dirk and Anouk, conditions worsen for both road users. Because of this traffic situation at the end of the workday, those who see an opportunity to do so take their bikes or public transportation. Eight of the 17 participants explain their choice to cycle or take the tram to work, because of the extremely long traffic jams. Of these eight employees, seven live within 15 kilometers. Annelies, the eighth who comes to work by bicycle because of the traffic jams, lives 30 kilometers from work. Public transportation is not an attractive option for her due to the number of transfers and the fact that not her entire trip from home to work is reimbursed.

So, employees experience an unfortunate mobility situation at the end of every working day, which they prefer to avoid. However, the alternatives that are offered by their employer, only partly suffice the travel needs. Jasper, a middle-aged male employee who works hours from 9 to 5, indicates that the target audience for the alternatives are high- and middle-educated employees with office positions who live in the Utrecht region. The high- and middle-educated argument relates to the internal communication, which will be discussed in more detail in a subsequent section of the chapter. Furthermore, he is

of the opinion that it is the office functions that benefit from the measures because they have regular working hours, making public transport a viable option and not having to cycle through the dark. Anouk, Lotte, Maria and Johanna also addressed these feeling. They themselves, or know a colleague who does, have to deal with irregular shifts, where they cannot get to work on time by public transport and have to cycle through poorly lit and poorly maintained areas in the dark. The third argument given by Jasper is that the alternatives are only sufficient for employees living within the Utrecht city region. The current options offered by academic medical center are a public transport region subscription, which includes specified bus and tram lines, and a financial allowance when purchasing an (e-)bike. Femke, Chris and Lotte, all three living more than 30 kilometers from the academic medical center, indicate that the options offered to them are no more advantageous than the car, both in terms of cost and effort. In their eyes they relatively do not benefit in any way compared to the car when they opt for the (e-)bike or public transport, so they see little reason to make a more sustainable choice. Even Thijs, who is an avid public transport user, sometimes takes the car because his hometown falls just outside the offered public transport subscription and public transport is therefore as expensive for him as the car. However, he only takes the car when he has other appointments or plans before or after work. As the Theory of Planned Behavior states, behavior is strongly determined on the intention to perform a certain behavior and the perceived behavioral control which an individual experiences (Ajzen, 1991). The strength of the determination to choose a more sustainable alternative, the intention, lacks among the interviewed employees for whom the car is the fastest and their only door-to-door option. Below the quote of Johanna is given, indicating that she would like to be more sustainable, but she is not determined to actually change her behavior due to the practicality and convenience of her car.

“I wish that I could be more sustainable for my commute, but practicality remains most predominant.” - Johanna

The answers to the question whether sustainability considerations affected their mode choice were varying. Remarkable was that sustainability plays a relatively large role in many of the interviewees personal life. They indicated to separate waste, take the bike or walk in their hometown instead of using the car, heating within their homes not needlessly high, and some even had solar panels. However, the same did not always apply for their choice of mode for the commute. Femke said that when she would travel by public transport, she would probably have to leave early, the hesitation indicated that she never considered public transport or had figured out her journey. Furthermore, Annelies explained that when working irregular hours urges you to take the car, the threshold to also take the car on day shifts is very low, if not an ingrained habit. As the quote from Anouk clearly states, employees do not directly associate their work or their commute with sustainability. Also, apart from people not actively considering sustainable modes, some employees just do not have the freedom of choice due to their home-work distance or lacking infrastructure. Chris, for example, has to travel 80 kilometers to work and back home every day. This is unrealistic on the (e-)bike and when he opts for public transportation, he would have to leave 50 minutes earlier compared to when traveling by car.

“Of course, the mobility goals are conceived from sustainability and I understand that. But people haven’t chosen this organization due to their affinity with sustainability.” - Anouk

Besides the time savings and convenience of the car, it allows for more flexibility when needing to

perform additional tasks or appointments before or after work. Thijs and Helena travel to work by public transport and e-bike respectively, but have said to opt for the car when they plan to do groceries after work or are meeting up with friends who live farther away or are poorly reachable with public transport. Johanna, who works irregular hours, has to bring her child to their grand parents before work and pick them up afterwards. Childcare at the academic medical center is not an option, since they work with fixed days and Johanna has a varying schedule. Due to her irregular hours, public transport does not suffice. Furthermore, she experiences the thought of cycling demanding, due to the extra stop during every commute, besides her physical demanding work.

Other, less frequent considerations made when choosing the commuting mode, are the parking facilities at the academic medical center. Esmee, for example, who is a young female nurse, mostly travels to work by electric scooter since this is the fastest and cheapest option she has. She experiences the parking rates at the academic medical center as high compared to her income, making the car unappealing for her. However, despite the high parking rates, she uses the car during the winter to travel to work for her irregular shifts. She feels that the e-bike or e-scooter is not a comfortable or safe option for these commutes, and the public transport services do not match with her irregular schedules. Another comment made on the parking facilities is the distance from the parking lot to the academic medical center entrance. Marian, a female employee in her 50's, indicated that she has to walk quite a few minutes on a path she experiences as unsafe.

The employees who currently travel to work on the e-bike or speedpedelec are positive about the current facilities and alternatives the academic medical center offers, especially when compared to public transport and car users. They indicate that they experience health benefits from the cycle to work and that the time on the bike helps them clear their head before returning home. The vast majority of the e-bikers did share the opinion that the facilities for the e-bikes at academic medical center should be improved. There are charging stations for the e-bike in the parking garage, however, not a sufficient amount for the number of users and sometimes the charging stations have no power at all. Furthermore, the speedpedelec takes up more space than the e-bike and therefore does not fit in the parking spaces where the charging stations are located. Since there is an increase in speedpedelec users, Annelies suggests to add wider parking spaces for these users. Esmee agrees, since her electric scooter also does not fit at the charging station parking spaces.

6.1.3. Answer to SQ 1

In this first section of the results, the answer to sub-question one *"What factors play a significant role in commute mode choice according to hospital employees?"* is established. First, the influential observed and commented on characteristics and behavior of the employees on mode choice is discussed. Then, the factors that affect mode choice from their personal experience is concluded on. Figure 6.2 shows the factors that are found to impact the mode choice of hospital employees, based on the academic medical center case study. Where the factors, from left to right, are chronologically visualized, starting at the highest impact.

Based on the conducted interviews, there are various factors that subsequently affect the mode choice behavior of the employees. The biggest factor that determines the mode used, is the working schedule of the employee, since the start and end time of the employees' shift determine the most significant mobility constraints that the employees experience. The groups are (1) the regular hours, which are shifts during the day from Monday through Friday and vary between 8 a.m. and 6 p.m., and (2) the irregular hours, which start or end before 7:30 a.m. or after 10 p.m. or are during the weekends. Then, the distance between home and work is defining for the mode used, which varies between the regular and irregular shifts. Derived from the conversations, it is concluded that employees with irregular shifts, who often travel through the dark, are willing to travel smaller distances on the (e-)bike than employees who travel by daytime. The third set of factors which are deemed as significant, are a selection of socio-demographics, psychographics, and geographical variables, where there was no clear conclusion on what variables have a stronger effect than others. Striking is that strong gender differences solely came forward for the employees with irregular shifts. These employees have to travel early in the morning and late at night, where they experience an unsafe feeling in public transport and on the (e-)bike. During the daytime shifts this socio-demographic had significantly less impact on mode choice. Furthermore, age determines the willingness to cycle through peak hours in Utrecht city and make the commute by train when two or more transfers are required due to the physical restraints of elderly employees. Geographical constraints are the accessibility to public transport that the employee

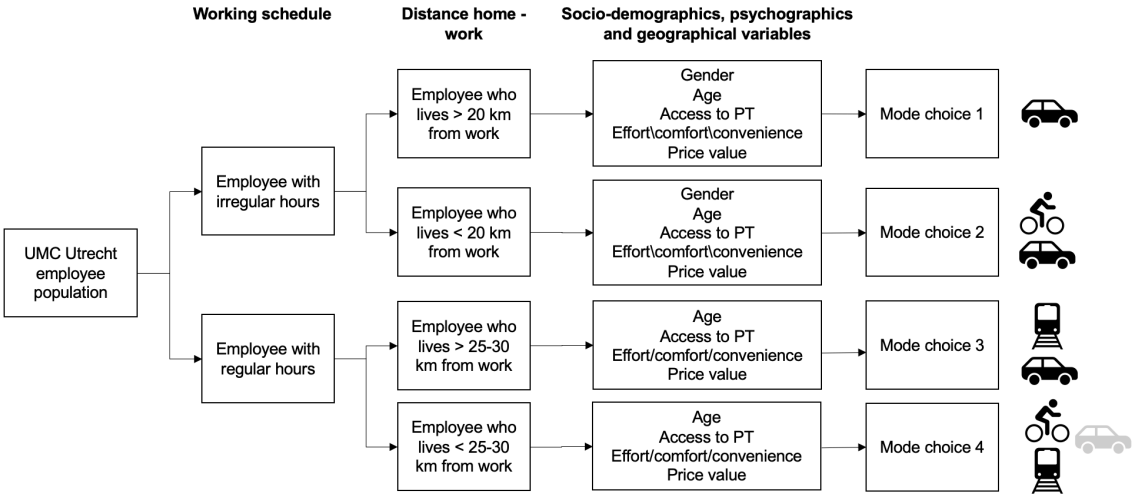


Figure 6.2: Chronological order of factors affecting mode choice of hospital employees (PT = public transport)

experiences, which affects the willingness to use public transport for their commute. When access time is relatively long, compared to their commute by car, the chance that they will use public transport significantly decreases. Furthermore, employees with irregular shifts are environmentally constrained to use public transport, since the metro/tram/bus/train schedules do not operate early or late enough for them to travel between home and work. Last, a large share of the interviewees have indicated to find effort, comfort, and convenience important when choosing their commuting mode. Where effort has a larger impact among employees who work irregular hours, since they experience their work as physically and mentally demanding, nursing patients and being on their feet all the time. They prefer to travel from door-to-door with as little physical impact as possible. Convenience, comfort and flexibility have proven to be significant factors when choosing ones mode for the commute (Arentze & Molin, 2013). A study performed by Bösehans et al. (2023), finds that 50% of its respondents are willing to travel by e-bike or e-car, but this percentage drops to 25% when the e-bike or e-car is combined with public transport. The same seems to be true for the interviewed academic medical center employees. When asked about whether sustainability affected their choice of mode, multiple employees said that first comes practicality and convenience, and then come the costs and sustainability.

The influential factors can be linked back to the used framework, UTAUT2. First, the effort is important for the employees. Hospital employees who work with patients and/or irregular hours experience their work as physically and mentally demanding. Therefore, they prefer their commute to and from work to be as convenient, flexible and comfortable as possible. Travel time is also a significant effort related factor, but seems to be less important to many interviewees compared to convenience. Second, the facilitating conditions are crucial, the access to public transport, since this determines whether employees are able to use all modes offered. Employees have indicated that their poor connection to the public transport network and their long distance to work disable them to use the train or (e-)bike, leaving no other option than the car. Last, employees indicated that the price value is of influence on the mode choice. Currently there are no alternatives that suffice the needs for employees who are poorly connected by public transport in schedule as well as in geographical terms and employees who live farther away than 30 kilometers. Furthermore, since their public transport trip is not reimbursed, the car is more beneficial in comfort, travel time, and in monetary terms, currently unable to compete with more sustainable modes.

Concluding on the final mode choice of the employees, there is variance due to psychological factors as personal preferences and habit, as Donald et al. (2014) also found. But, there are general conclusions that can be drawn which fit in most cases. The employee with irregular hours who lives farther from work than 20 kilometer uses the car to commute to work, since public transport schedules do not suffice and cycling is too far through dark meadows and tree dense areas around Utrecht. Then, the employee with irregular hours but lives within a range of 20 kilometers of the academic medical center, there is an equal chance of choosing (e-)bike or car. The affinity the employee has with the benefits of cycling or with the comfort of the car determines the choice of mode, together with the costs.

Travel time is not named as a significant factor since these employees do not travel through peak hours and thus experience little congestion in the car. Furthermore, parking costs are free for employees with irregular hours at the academic medical center, and costs for refuelling the car are not daily reoccurring costs, making the impact on mode choice smaller as indicated by the interviewed nurses. Third, the employees with regular shifts that live outside of the determined cycle range travel to work by car or by public transport. The choice for public transport highly depends on the affinity with public transport and the connection between home and work, since the costs are higher than when commuting by car due to limited reimbursement (solely the region of Utrecht). Last, the employees who live within cycle range and work during office hours tend to travel to work mostly by (e-)bike or speed pedelec or the bus or tram when their home has a direct connection to the academic medical center. The car is sporadically used when additional tasks need to be performed before or after work, think of picking up kids, doing groceries or visiting a friend who lives farther away. The main reasons for these employees to not take the car to work, is the extreme congestion at the site of the medical center at the end of their working day, and that cycling benefits their health and enables them to clear their mind after work.

6.2. SQ 2: What is the perceived level of equity of the proposed travel alternatives?

6.2.1. E-bike and shared bike alternatives

During each interview, the employee was asked whether an electric bike or a shared bike, stalled at Utrecht Central station which they could use for free to cycle to the academic medical center, would be viable options for their commute. The overall take-away was that the e-bike was experienced as a good alternative, although solely for people within a cycle range from the academic medical center, and the shared (e-)bike at Utrecht Central was less of a popular alternative.

“I feel the shared bike won’t have impact, since most public transport subscriptions are taken out for the city, and the tram is a good option. Also, the journey to Utrecht Central remains cumbersome for many.”
- Maria

Only two people, Thijs and Annelies, find the public transport combined with a shared (e-)bike at Utrecht Central station a viable option. They back up their choices with the health benefits of cycling and the chance to avoid overfull public transport within the city of Utrecht. However, it is worth noting that Annelies already cycles to work and Thijs is an avid public transport user. The other interviewees give two primary reasons for them not perceiving the alternative as a fit to their commute. First, Maria, a female employee in her late 50s, explains, that there is a good connection between Utrecht Central station and academic medical center by tram or bus, which is also reimbursed by the current regional public transport subscription. Maria also adds that the cycling conditions between Utrecht Central and academic medical center can be dangerous and busy, especially for the employees of age, due to the high number of students. The second primary reason given by multiple interviewees, is that Utrecht Central station remains unreachable. Femke, a female nurse who lives 30 kilometers from work, indicates that the problem is not the last mile, from Central station to the academic medical center, but to get to Utrecht Central alltogether. The problem for the acceptance and use of the alternative, thus lies with the environmental constraints the employees experience. Using the theory of planned behavior, the intention might be there, but due to lacking facilities and environmental constraints, the perceived behavioral control is low (Ajzen, 1991). Furthermore, Michie et al., 2011 found that the capability and opportunity affect the motivation to use a mode, where all three influence the enacting of the desired mode choice behavior. With lacking public transport connection for employees living in suburbs or secluded villages, the opportunity to enact a certain behavior decreases. This also negatively affects the motivation, since more effort will be required to enact the desired behavior. The fact that extra effort decreases the motivation to use the alternative, is confirmed by Roos and Marleen. They both said that the extra effort the rental of the shared bike takes in combination with transferring from public transport,

compared to the door-to-door transport of the car, decreases the willingness to use the alternative. Marleen even calls the commute by train together with the shared (e-)bike, a ”world journey”. When she combines the travel time for the access to the public transport network, the journey with the train, which contains one or multiple transfers, and the 20 minute cycle to academic medical center, she concludes that this alternative does not come close to the car seen the effort and loss of comfort.

Another burden which seems to prevent employees from considering the alternatives, is the limited knowledge about the offered modes and how to integrate them into their commute. Merel, Marleen and Femke all said that they thought the commute by train would be very long and many transfers were necessary. However, they have never commuted by train and therefore did not know exactly what the journey would look like. The same holds for Chris, indicated in his quote below, that he did not see how the combination of public transport and shared (e-)bike would become part of his everyday life. This behavior can be explained by the Theory of Goal Directed Behavior by Gollwitzer (1999), which states that people are more likely to adopt a certain behavior when personal implementation is clear.

“I don’t see how these mobility options would become part of my trip to work every day.” - Chris

Public transport perception

The overall perception of public transport is negative among the interviewees, the code in Atlas.it with most quotes is dedicated to the downsides of public transport. Only one interviewee, Thijs, regularly travels to work by train and tram. He chooses this mode due to the extreme congestion at the end of his working day, which makes the commute by car twice as long. Regarding costs, he says that there is not much of a difference between the car and public transport. A large part of his train journey is reimbursed by the regional subscription, however, the part that is excluded from this subscription costs around as much as the gas his car requires. He says when the entire trip by public transport would be reimbursed, he would (almost) never take his car to work.

Costs were a recurring burden when the employees were asked about traveling by public transport. Annelies, a female office employee in her early 50s, often opts for the car instead of the train, since the costs between the car and public transport do not vary much, and then the comfort of the car wins. Marleen, Marian and Maria explain that their trip by public transport is even more expensive than the commute by car. Thijs and Japser both find this unreasonable and are therefore not surprised that people are not motivated to commute by public transport.

Another experienced downside of public transport is the relative high travel time, especially when compared to the car. Lotte, a female nurse in her 30s who lives 30 kilometers from the academic medical center, says her commute by public transport would be four times as long compared to her travel time by car. Also Chris, who lives 80 kilometers from work, says that he would have to leave 50 minutes earlier when choosing the train. This is also due to the inflexible schedules of the train as well as his job. To be on time at work, he has to take the train with which he arrives 25 minutes early at work, when opting for the next train, he arrives five minutes late. When he takes the car he can depart from home to be exactly on time.

The third disadvantage which was addressed multiple times, is the mismatch between public transport schedules and working irregular shifts. The time frame in which the public transport (primarily) operates is not sufficient for the employees working irregular shifts, starting at 7:30 a.m. and ending at 10 p.m.. Femke, Johanna and Esmee work irregular hours and live in suburbs of Utrecht and not one of them travels by public transport, since they would not be able to arrive at work on time due to insufficient service.

Chris, Anouk, Marleen and Annelies used different wording but all four concluded that traveling with public transport is experienced as very demanding compared to the car. It would take a lot of actions, such as access and egress time and transfers in between, sometimes with long transfer time. Other

negative comments are the cold and unpleasant stations where you have to transfer, crowded trains or trams and experiencing an uneasy and unsafe feeling.

E-bike perception

The e-bike is perceived as a viable option which has many benefits. Almost all of the employees who currently travel to work by e-bike, or speedpedelec, state the health benefits and the congestion avoidance as primary reasons. Most of the interviewed e-bike users have office jobs and feel that the commute to work balances their little movement during the day. Furthermore, the cycle time back home gives them time to unwind and clear their minds, say Jasper, Anouk and Marian. For the employees living within the 20 kilometer range, the e-bike is often faster than the car, especially for the trip back home, due to the heavily congested location. Also, Roos enjoys the bike for its door-to-door service and the fact that the use is 'free' after purchase. Solely one employee, Annelies, who cycles 30 kilometers from and to work, named sustainability as a benefit.

However, not all employees experience the convenience of the e-bike. First of all, the e-bike is only a viable option for employees living within a limited range. Within 25 kilometers the chances are significant that the e-bike will be chosen, above 25 kilometers the chances become relatively small. Employees living outside of this range feel physically excluded from the alternative, since the commute will take more than an hour. Then, there are the employees who live within cycle range but have personal objections to cycling to work. Johanna, Lotte and Esmee, three female nurses, do not feel safe when cycling to work for their irregular shifts since they have to cycle in the dark through meadows and tree-dense areas.

Equity

The interviewees found it difficult to directly comment on whether they perceived the travel alternatives as just. Therefore, the question was posed differently, "Do you feel these travel alternatives, the e-bike and the public transport + shared (e-)bike, meet your commuting needs?". The answer to the question varied, dominantly based on current mode use, travel distance to work, and starting or end time of work. As already discussed in the previous three sections, employees who live outside of Utrecht region and are poorly connected by public transport, are feeling discarded by these travel alternatives. Hospitals are specific places of work, not always close to where the needed employees live. Clinical specialists, such as Marleen, but also the nurses who work with patients, Femke, Esmee, Johanna and Lotte, feel that they are not equally met in their mobility needs, while their labor and expertise is necessary for the hospital to function. As the study of Pritchard (1969) finds, individuals measure their perceived equity by the input/output ratio. Hospital employees who work 'on the floor', so the jobs outside of the office jobs, experience their work as physically and mentally demanding. When they then perceive the mobility compensation as insufficient, dissatisfaction arises. Merel explained in her interview, see the quote below, that by increasing the costs for car use and not offering other just alternatives, more employees will consider to leave their place of work while there already is a decrease in hospital employees.

"Do not punish the employees who have no other options than the car. You can't chase them out of the car without offering a reasonable alternative." - Merel

The feeling of injustice does not limit itself to the organization, but also tilts to a higher level, when compared to other organizations. The majority of the interviewees indicated that when comparing the mobility policy of the academic medical center with other health care centers or hospitals within the Netherlands, they receive less reimbursement than others. Especially regarding the feeling that the parking fees are too high, which is a widely shared opinion. By two interviewees, Jasper and Marian, the inequity is even discussed on sector level. They feel that in comparison to other sectors, the educational health-care sector is largely under compensated regarding their commuting costs.

The internal communication is also experienced as unequal by some interviewees. Although all personnel have access to computers and have a academic medical center account, not everyone

regularly checks the online platforms and their emails. Research performed by Durand et al. (2022) concluded that the access to technology does not mean that all individuals experience and use the technology to its fullest extent. Within the academic medical center, this primarily applies to employees who do not have office jobs. They are caught up in their days filled with patients and 'on the floor' emergencies, where the online checks slip in, or they never check the computer at all. Esmee, Femke and Lotte have explained how this also happens to them, which leads to missed mobility updates and advantageous offers. Jasper made his own conclusion regarding the inequity of the communication, namely that the communication targets high educated office employees. The high educated comment refers to the fact that a share of the employees within the academic medical center is illiterate and is therefore excluded from the online messages, as he feels, alongside with Marian.

6.2.2. Answer to SQ 2

Section two aims to answer the sub-question *"What is the perceived level of equity of the proposed travel alternatives?"*, with the analysis of the answers on the proposed travel alternatives and equity perception. The answer is given by using the theory of equity by Adams (1963). He finds that equity perception consists of (1) the sum of the inputs and outputs, (2) the fact that people compare to others, (3) what factors contribute to the equity or inequity and how this affects individuals, and (4) how people react to reduce their experienced inequity

First, the sum of in- and outputs, where in this situation the input is the work the employees perform at the academic medical center and the output is the mobility reimbursement the employees receive. In the health-care sector, a share of the employees work irregular hours and often perform physically en mentally demanding work. Also, a hospital requires medical specialists and employees with specific education who are prepared to always take care of their patients. These requirements have as a consequence that some employees live far away from the academic medical center and have a long daily commute. The employees feel as if they should be taken care of and be compensated with comfortable and financially beneficial mobility alternatives. The outputs, leased e-bike and shared e-bike at Utrecht Central, therefore received mixed reactions, where the travel context of the interviewees is important to consider when concluding on their answers. The interviewees who cycle or take the train to work indicated that they perceive the alternatives as just for them and feel that their travel needs are met. Nevertheless, they also indicated that the alternatives are not adequate for all the employees within the academic medical center. Namely, the interviewed nurses, clinical specialists, and employees living outside the 30 kilometer range, feel that the alternatives are not just regarding their personal circumstances.

The second point from the theory, that individuals compare to others, was less applicable to the hospital employees, since they find that the distance to work is something very personal, making it hard to compare the justification of the alternatives among colleagues. There was no mutual feeling of injustice among the employees. Some interviewees however do experience injustice between themselves and their employer, since they feel undervalued seen the restraints of their offered mobility policy.

Third, what factors contribute to the feeling of (in)equity, is found in the answer to why the e-bike or shared bike is found viable or not. The main factors contributing to the feeling of inequity is the fact that a share of the employees feel unconsidered by the alternatives, as if the employer did not take into account the employees performing physical labor, working irregular hours and specialist employees who live far away from the hospital. The overall feeling is that the e-bike is perceived as just and the shared (e-)bike at Utrecht Central is unjust. It seems to be accepted that the bike is viable for a limited range and that it has many benefits seen sustainability, personal health and costs. Solely the interviewed female employees that need to cycle through the dark indicated that the e-bike is not feasible for them, due to poorly lit cycle lanes and the widespread meadows and tree-dense surroundings. Then, the reasons for the shared (e-)bike at Utrecht Central to be perceived as unjust. The interviews have gained insight in the fact that the last-mile of the trip, the connection between Utrecht Central and academic medical center, is not the problem, since there is a fast tram connection which is also reimbursed by their employer. The problem lies with the connection to Utrecht Central station, which for some employees requires many transfers and for others a large detour, since they live on the East side of Utrecht, where the academic medical center is also located. Although they might be willing to change their commuting behavior, the proposed alternatives part of the mobility pilot still suffer from environmental constraints for some of the employees, leaving a feeling of inequity.

The fourth and last part of the theory, how people react to decrease their inequity, has become

evident during the last mobility implementation in the academic medical center where there was a widespread feeling of inequity. Ilona explained that employees who felt chased out of their car without being offered an alternative that was perceived reasonable, considered to leave their job.

6.3. SQ 3: Which policy strategies and communication approach do hospital employees experience as positive and motivational for travel alternative adoption?

6.3.1. Proposed mobility solutions

During the interviews, the participants proposed various mobility solutions which they found feasible, just, and sustainable. 'Solutions' is one of the top coded subjects from the interviews, with the most recurring one being the permanent implementation of the enhanced bike plan. Jasper, Esmee, Helena, Maria and Ilona mentioned this, all current e-bike users, since they feel that the enhanced amount of €2500 allows for the purchase of a better quality e-bike than the €1500 that was first reimbursed. Maria feels that she has to pay an unusual high amount for her commute by e-bike, summarizing the previous reimbursement amount of €1500, the costs of an e-bike being a minimal of €3000 and the average lifetime of an e-bike being five years. They all concluded that more people would purchase an e-bike when the bike plan would be permanently increased, especially when the offer is extended to the spring and summer months, Ilona adds. Besides making the e-bike a more attractive alternative, by making the financial benefits higher, Esmee and Jasper are both proponents of introducing e-scooters and e-motorcycles. The primary argument for these transport modes is the fact that scooters and motorcycles take up less space and will relieve the location of the medical center from the parking pressure. Johanna adds that adding a 'bakfiets' to the bikeplan, would make the plan more attractive for employees who have to bring and pick-up their kids to school or daycare before and after work.

For employees who are unable to commute by bike and live in places where public transport is hard to reach, the solution of a P+R was proposed multiple times. Jasper, Femke, Annelies, Lotte and Chris said to find the alternative of a P+R on the outskirts of Utrecht with the possibility to rent a(n) (e-)bike or take a bus very attractive. Various locations were mentioned that would suit the employees for a P+R facility. Jasper said Bunnik, Femke mentioned Vianen for employees from the south and Annelies said Maarssen would suit the employees living west from Utrecht. Annelies argumented to give people more options than just the static options of e-bike and public transport, since many employees are left out due to physical and environmental constraints. When multiple P+R facilities are established on varying sides of Utrecht, employees keep the flexibility of the car, avoid congestion in the center of Utrecht and medical center site, and also benefit from the health benefits of the bike. Lotte confirms these arguments for multi modal transport facilitated with a P+R by saying it would help her avoid the multiple transfers she would have when commuting by public transport, and also allows her to avoid the congestion on the work end. Femke also advises to expand the range of home-work distance for who the bike plan is applicable, so people can take their bike with them in their car and choose their own P+R.

Other solutions are also interesting to mention, but are not as largely mentioned as the permanent bike plan and P+R alternative. Helena indicates that many bus lines in region Utrecht have been deleted in the last years, making various cities, such as Soest and Houten, less connected with the academic medical center. She said it would benefit the use of public transportation, when these busses, that directly connect the villages and cities to the academic medical center, are reintroduced. Even when only operational during peak hours. Another solution that targets the public transportation, is introduced by Maria. She explains that currently employees can only purchase a 12-month subscription, while she says that many employees would like to cycle during the spring and summer and would like the regional public transport subscription for just a part of the year. Since this is not an option, Maria says to hear that many employees refrain from the subscription in its entirety and take the car during the colder months. Marleen, who carpools to work herself, says that organizing a carpool system more centrally would make it easier to find a schedule and destination match, which would eventually decrease the total number of cars used by employees at the academic medical center. The final solution that is raised during the interviews, is not mobility related but work schedule related, which would consequently benefit the mobility options. Chris and Johanna both mention the adaptation of the working hours at the academic medical center to the public transport schedules, or at least give a little flexibility. This

would allow Chris to take a train later, which saves him 30 minutes every morning, while he arrives five minutes later than scheduled.

6.3.2. Secondary services

The interviewees were asked whether certain services would make the proposed travel alternatives more attractive to use. All the services that were mentioned, concerned the e-bike. Five of the seven e-bike users plead for more charging stations in the parking garage for the bikes. Jasper, Dirk, Maria, Annelies and Ilona all said that currently the availability is insufficient and Dirk adds that sometimes the charging stations are completely out of power. The e-bike users say that having your employer facilitate the charging of the e-bike, affects the acceptance and uptake of the alternative in a positive manner. Esmee and Annelies also advocate for charging points for other kinds of e-modes, like the e-scooter and speedpedelec. These modes require larger parking spaces due to their wider tires.

The other services are indicated by Dirk, Helena and Annelies. Dirk and Helena would like to have a shop with high quality rain clothes, where they can purchase e-bike necessities and rain clothes with discount. Helena also feels a bicycle shop would come in handy and would increase the satisfaction of (e-)bike users. Last, Annelies says it would be functional to have lockers in the garage where she can store her helmet and her rain clothes when they're wet.

6.3.3. Communication

The results regarding communication retrieved from the interviews can be divided into three parts: the content and tone of voice of the internal mobility related communication, the visibility of the communication and the proposed points of improvement for the communication.

The conception of the content of the internal communication strongly varied among the interviewees. Some were content with the communication and had little improvement points, while others experience the communication as notions on what the Project Team Sustainable Transport Pilot will implement to reach their own sustainability goals, without ensuring an alternative for all employees. Thijs understood the latest communication as "We're going to introduce a new plan, but it can't cost us any money". Also Jasper felt negative about the approach, saying he felt as if the sustainability argument was a cover up for them to save money on parking spaces. There were however interviewees who felt that the communication was sufficient and was nicely presented. These positive comments were given by office employees who currently benefit from the alternatives of the academic medical center. Some said to prefer concise updates with solely the necessary information, while others preferred more extensive elaboration on the decision-making process and what trade-offs were made by the board when choosing the mobility alternatives.

"In communication, there is a strong reliance on online notice, while a large share of the employees have no access to a computer or simply don't have the time to check the posted messages." - Jasper

The visibility of the communication also evoked division. Esmee, Femke, Johanna and Lotte, four female nurses, said to miss a lot of the information spread via email and Connect (the online platform for academic medical center employees). Due to the communications online focus and because the mobility matters are usually taken up into a bigger newsletter or email, which do not induce urgency and are therefore often disregarded by the employees who work 'on the floor'. This was confirmed by stories of Thijs, Jasper and Maria. They said that the employees who do not have immediate access to a computer, miss most of the updates, and are possibly not aware of the mobility alternatives which are active. Maria adds that she believes a large share of the facilitating staff do not know their login credentials. On the other side employees were positive about the visibility of the communication, which were dominantly employees working behind computers during office hours. They felt that the academic medical center reached most of its employees by posting on Connect and sending out emails to everyone. However, every interviewee had a point of feedback regarding the communication, which

leads to the next paragraph.

A widely shared opinion among the interviewees is that it is important to involve employees in the decision process, and to avoid creating the feeling of chasing employees out of the car. The current experience regarding implementation and communication, visualized in the quote of Lotte, can be solved according to the interviewees by asking employees about their opinion and for their input on Connect or in real life. Especially the employees who work irregular hours and have physical exhausting work feel unseen by the decision-making board.

"But if you can look back and say, well, we've considered this, we've looked into this, this can work because, this can't work because. And not have decisions made somewhere in the management room that might be convenient for them but often isn't for us." - Lotte

Seven interviewees have proposed to use a physical approach when communicating new mobility plans. Every department in the hospital has day- or week-starts, in which the executive could briefly update its department on new mobility plans and alternatives. For more detailed information, the executive can direct the employees to the online notices. This way, the interviewees are convinced that, all employees are reached. Anouk also suggests to have a person from the Project Team Sustainable Transport Pilot of the academic medical center visit these day- or week-starts to explain the mobility plans and give employees the opportunity to ask any questions. Furthermore, five interviewees indicated they find it important to feel included in the process, which can be realized by sharing the reasoning behind the decisions made. Also, three of the interviewees feel that the true reasoning behind the mobility plans should be honestly shared with the employees, since they currently do not feel this way. Two female employees in their thirties, Roos and Femke, recommend the academic medical center to make a more personalized approach. For example, send an email to employees living "X" kilometers from work, for who the alternative might be interesting. This will engage more than a generalized section in the newsletter or a post on Connect. Femke has namely indicated to disregard all the mobility related emails, since she thinks they won't be in favor of her situation, a nurse with irregular hours who lives 30 kilometers from work.

6.3.4. Answer to SQ 3

This last section of the results chapter aims to answer the third sub-question: *"Which policy strategies and communication approach can the academic medical center use to engage the employees and increase the effectiveness of the implementation?"*. First, the policy strategies are listed which are thought to have most effect on the acceptance of the alternatives, and second the communication approach preferred by the interviewed employees is elaborated on.

The policy strategies of the academic medical center, also known as their objectives, are to decrease their total emissions that are emitted by the commute of its employees, decrease the number of parking actions and to keep their employees healthy and satisfied. It is clear after the 17 interviews and seen earlier attempts that it will be a challenge to balance these three objectives. The employees seem to be most satisfied when they are able to freely choose their commuting mode which seamlessly fits their commute situation, for many employees this being the car. However, the interviewees have indicated that there are alternatives to the car that satisfy their needs and will also help the academic medical center reach their mobility related objectives. For employees who live within cycling range, the bike plan is a viable alternative, although it is advised to extend the enhanced bike plan, since the enhanced amount enables the purchase for a higher quality e-bike, without the financial burden for the employee. Furthermore, employees who have reasonable access to public transport, explain not to choose the train due to the high costs compared to the car. They have said that when the academic medical center will reimburse the total trip by public transport, they would opt for the train more often, since the car will become financially unfavorable. Last, the employees who live outside of cycling range and are poorly connected by public transport, either geographically or time schedule wise, propose to establish multiple P+R facilities just outside of Utrecht. On these P+R stations, the employees are able to park

their car and travel the last mile to the academic medical center either by (e-)bike or by bus, when this is available. All these mobility solutions decrease the total emissions, decrease the number of parking actions at the work location and satisfy the employees' mobility needs, according to the interviewed employees.

However, not only the alternatives themselves are important, also the way they are presented within the organization has significant impact on the intention to use and the use behavior, as concluded from the number of codes dedicated to communication. The main take-away from the interviews with the employees was that they would like to feel more engaged in the decision-making process. They said they would like to know what the trade-offs are and why certain alternatives are not considered and others are. The interviewees have indicated to find it important that the board lets the employees know that they are seen and informs them on what employee groups are targeted with the mobility plans. Namely, the interviewed nurses and clinical specialist said that they felt chased out of their car and misunderstood in their mobility needs, while the academic medical center explained to leave the employees with irregular shifts and physical demanding work out of scope. Furthermore, ten employees brought up during the interviews that the communication is limited to an online approach, using email and Connect. Therefore, various employees have given the advice to use a more physical approach, for example hanging posters, and joining day- or week-starts to inform all employees on the new mobility plans. These physical information moments have two major benefits compared to the online approach. First, the chance of employees missing updates due to limited computer access or being illiterate is disregarded. Second, it allows the employees to ask questions, which enhances the feeling of engagement in the process.

7

Conclusion and discussion

The goal of this last chapter of the report is to elaborate on the report's contribution, implications, and relation to the literature. First a brief overview of the approach used in this research is given. Then, the main research question will be answered to conclude on the report's aim. After the most important conclusions, the results are compared to existing literature, how this study is the same or adds new insights to literature. Furthermore, the limitations will be discussed and how validity is guarded during the process. Last, recommendations will be given, both for the involved actors as for further research, partly to overcome the listed limitations.

7.1. Conclusion

7.1.1. Overview of research approach

The goal of the research is to advise the academic medical center and Pon on whether the considered mobility alternatives for the pilot are deemed successful, what factors affect the take-up of the alternatives and what measures could improve the adoption among the employees. Furthermore, the perceived equity of the proposed alternatives is asked of the employees, to take their perception into account during implementation. In order to reach this goal, a survey was drawn up, which contains a stated choice experiment. However, due to misalignment of planning schedules, it was not possible to conduct and analyze the survey within the time frame of the graduation thesis. To pursue the objective of the research, a new method was taken up, namely conducting interviews. In-depth one-on-one interviews were selected to expand and deepen the knowledge on mode choice behavior of hospital employees. This method allows for open conversations with the academic medical center employees, who are a key actor in the implementation process of the mobility options within the organization. Previous attempts have been unsuccessful within the organization, leaving the Project Team Sustainable Transport Pilot with a challenge to decrease the use of the car as commuting mode. The interviews aim to retrieve detailed information and personal experiences from the interviewees, to design an implementation plan and alternatives which have a higher chance of success.

Due to the sensitive nature of the mobility plan within the organization, the interviewees are selected and informed by the Project Team Sustainable Transport Pilot of the academic medical center. In total, 17 employees agreed to participate, varying in age, function group, commute mode, and gender. All the interviewees were asked about their current way of traveling to work, their motivation to do so, their perception on the proposed alternatives, what alternatives would suit their needs best, and their take on the internal communication about mobility. The interviews were recorded and transcribed afterwards. The transcription were then coded and manually analyzed, to retrieve the most significant factors from the conversations and determine where the opportunities lie to increase acceptation and adoption of the travel alternatives among the employees.

In hindsight, the interviews have proven to be extremely valuable. The employees were able to express their mobility related issues and also discuss solutions that they perceive as just and that would satisfy their needs regarding the commute. This would not have been possible with just the survey, since no open-ended questions are asked and solely the proposed alternatives for the pilot by Pon and academic medical center are considered as mobility options, giving no extra insight into

how the alternatives may be adjusted to better fit the needs and consequently increase the chance of acceptance and adoption.

7.1.2. Answer to the main research question

To meet the employees in their mobility needs, help the academic medical center reach their mobility goals and investigate the acceptance of the mobility alternatives of Pon, the following research question is drafted and answered:

"What is the perceived equity and opinion on the fit between the personal needs and the proposed travel alternatives among hospital employees?"

Based on the conducted interviews, it is concluded that working schedules have the biggest impact on mode choice behavior of hospital employees. The start and end time of the employees' shift determines the most significant mobility constraint that the employees experience, since employees who work irregular shifts are unable to travel by public transport due to insufficient service and female employees are less willing to cycle due to safety reasons. Then, especially for employees working during office hours, the distance is the most significant factor, since it determines whether employees are able to cycle. Daytime employees have expressed themselves to be eager cyclists when they live within cycle range due to monetary, health, travel time, and sustainability benefits. Public transport is experienced as a more challenging mode, since the accessibility of the access stations and the number of transfers are experienced as high effort when commuting. Additionally, since solely the public transport in the region of Utrecht is reimbursed, the train is more expensive than the car for the majority of the employees.

Zooming in on the proposed travel alternatives, the leased e-bike and the shared (e-)bike at Utrecht Central, a clear division in popularity between the two alternatives can be seen. The leased e-bike is received enthusiastically by all employees who live within cycle range, since the e-bike is often faster than the car at the end of the working day, since it is able to avoid the work location related congestion. Furthermore, the e-bike is cheaper than the car, and generated health and mental benefits, as experienced by the current (e-)bike users. Even an interviewee who lives outside of cycle range is positive about the e-bike, suggesting to put the e-bike in the back of her car to combine the e-bike with a P+R facility just outside of Utrecht. It is found to fit the personal preferences due to the door-to-door possibility and the previously mentioned benefits. Then, on the other side, the shared (e-)bike at Utrecht Central receives less positive feedback. Although people are eager to cycle, the location of Utrecht Central and the combination with public transport are high barriers as indicated by the interviewees. For people who work irregular hours or are poorly connected to public transport, the alternative is not an option, which excludes them from the mobility transition altogether. Furthermore, the cycle from Utrecht Central to academic medical center is still 20 minutes, passes through the city of Utrecht in peak hours, and competes with the fast reimbursed tram connection.

Concluding on the fairness of the two alternatives, the perceived equity is high for the (e-)bike, as explained by the high experienced fit to personal needs and the fact that cycling to work enables health, monetary and travel time benefits for employees within the cycle range. The shared bike combined with public transport is not perceived as just, due to the fact that a large share of the employees are environmentally constrained to use the alternative, while this should be the alternative to serve the employees outside of the cycle range. Employees who are poorly connected by public transport or who work irregular hours, feel left out of the mobility transition by the alternative. Nevertheless, the employees are enthusiastic about multi-modal transport and being able to cycle as part of their commute. Therefore, interviewees have proposed the alternative of P+R facilities around the city of Utrecht, from different sides of the city, where academic medical center offers parking spaces for the car and shared (e-)bikes or buses to travel the last mile to the academic medical center. This would relieve the medical center site from the parking pressure and reduce the number of parking spaces, and it would reduce a share of the commute emissions since the cars avoid the most congested part of their journey. Furthermore, the last mile cycling benefits employee health and this alternative serves all employees which enhances the employee satisfaction regarding mobility.

Besides the need for the alternatives to fit to the commute needs of a large share of the employees, so should the internal communication. Interviewees have indicated to find the communication pleasant and sufficient, however, this was concluded by office employees who have immediate access to the online platforms of the academic medical center. The employees who work 'on the floor', with patients or as facilitating service, have little time and limited access to computers and therefore miss the internal

communication which is currently solely done via online notices. Therefore, the employees, office employees as well as nurses and specialists, recommend to engage the employees on a deeper level by organizing focus groups with a wide variety of employees and visit day- or week-starts to physically spread the mobility related updates.

Last, it is difficult to conclude on what the impact of a factor will be on the uptake of travel alternatives, that employees indicate to find important. The reasons employees give to not use public transport are the crowds on board, the (numerous) transfers and corresponding transfer time, and the high costs of public transport since solely the region of Utrecht is reimbursed. They indicate that they would use public transport more frequently when it is completely reimbursed since then the monetary benefits are higher compared to the car. However, the employees who have said to use public transport more when completely reimbursed are the employees who have not negatively spoken about transfers and on board crowding. Additionally, it is the question whether they would actually use public transport when there is full reimbursement. So, there is no conclusion possible whether total reimbursement will overrule the downsides of crowding and transfers. Furthermore, the costs between the travel modes are compared by the majority of the employees, where they conclude that the (e-)bike is the cheapest option, then the car, and last and thus most expensive is public transport. Nevertheless, the employees limit their comparison to their day costs, where their train ticket seems more expensive than their trip by car. However, they disregard long-term costs of the car and the fuel costs which do not occur daily. Various employees have argued that their car costs are there regardless, since they use the car privately as well, therefore not calculating these costs into their commute trips.

7.1.3. Conclusion on theories related to mode choice behavior

In this research, two different motivators for mode choice behavior were distinguished, namely the perceived utility of the mode alternatives and the attitude and perceived behavioral control (PBC). This section aims to conclude on which of the two explain the mode choice behavior best, based on the performed literature review and the conducted interviews.

First, a short description of both factors is given. As stated by Ben-Akiva and Lerman (1985) and Cervero (2002), the utility is a sum of the costs and level of service, travel time and travel costs, as well as perception, typically socio-demographics or household characteristics. An individuals' attitude is part of their psychographics, which is also used and explained in the 'Theory of Reasoned Action' by Ajzen and Fishbein (1975). He states that personal norms and an individuals' attitude explain the behavioral intention. The previous theory is expanded with the PBC, to the 'Theory of Planned Behavior' (Ajzen, 1991). The theory states that the behavioral intention and PBC cause significant variance in actual behavior and thus are crucial to understand. The PBC is explained as the extent to which the decision-maker has confidence in their abilities to execute.

The conceptual framework used for the survey part of the test phase, builds on the theory of utility, which can be seen in the literature review in section 3.6.3. On the other hand, the conceptual framework which is applied to form the interview conduction and questions, the UTAUT2 framework, relies on the intention to perform a behavior which leads to the actual use behavior, found in section six of chapter 3. Based on the interviews conducted, this research shows that the utility that employees perceive to receive from the alternatives have a stronger sense of explaining mode choice behavior than the attitude and PBC of the individuals.

Although certain aspects can be explained by the psychological theories, such as the influence of habit and the negative attitude towards public transport, the main reasons given to choose or not choose a certain mode are based on context variables and circumstances, and consequently influence the utility experienced. So, the academic medical center employees tend to be habitual towards their choice of mode. This is backed up by literature, as both Kuhnimhof (2009), over the course of a 7-day travel diary, and Ton and Duives (2021), after half a year of analyzing commuting individuals, conclude that commuters dominantly use one and the same mode. Many of the interviewees have said to not have tried another mode of transport than their current mode, since they are content with their mode choice and the convenience, flexibility and comfort it brings. Hunecke et al. (2010) states that psychological factors are of bigger influence on mode choice than socio-demographic and infrastructural factors and are therefore also better at predicting the choice of mode. However, the interviews performed in this research show the emphasis the employees lay on the importance of accessibility, travel time, travel costs and most of all effort in their argumentation. In a lesser sense, a select few of the interviewees, have indicated to not consider a travel option due to the aversion against the mode. Furthermore, this

research finds that socio-demographics significantly affect the mode choice, as the female nurses were less likely to cycle through the dark than their male counterparts, and the employees of age were more cautious to cycle through the peak periods in the city, seen the dangerous circumstances. Additionally, the social norms which are part of the psychological theory in the UTAUT2 framework, does not seem to have an effect on the behavioral intention or mode choice, therefore making the theory based on psyche less of a fit. This research concludes that the utility theory better explains the choice of mode than the attitude or PCB of the employee, due to the expressed importance of comfort, costs, effort, and travel time, as opposed to personal feelings and aversion or affection with modes.

7.1.4. Policy recommendations for actors

The recommendations are based on the objectives of this research, namely to advise Pon and the academic medical center regarding their pilot alternatives, whether they are ought to be successful and are perceived as just among the employees, and what implementation strategy improves acceptation and intention to use of the alternatives. First, policy recommendations are given to the stakeholders involved, from short-term to long-term implications. The three main actors who have the power to make changes and decisions within the mobility transition, are Pon and the academic medical center, and indirectly the municipality of Utrecht. Therefore these three parties are given concise and practical implications for future steps based on the conclusions previously drawn.

Pon

Pon supports the academic medical center in their decision making process regarding the mobility transition, while also providing them with sustainable travel alternatives. Currently the travel alternatives are the leased e-bike and the shared bike at Utrecht Central station. However, it became clear through the interviews that the shared bike at Utrecht Central station did not solve the accessibility problem of the employees and thus did not meet their commuting needs. Therefore, based on proposed solutions by the interviewees, it is recommended for Pon to pursue further research into what locations would be suitable to place the shared bikes, to meet the employees' needs. During the interviews, the employees who proposed the P+R combination with shared (e-)bikes or public transport are asked which locations would suit them best, and why. An overview of these answers is given below.

- Station Bilthoven, proposed by Jasper, who lives on the east side of Utrecht. There is sufficient space next to the station to establish a parking facility for the arriving cars, as well as shared (e-)bikes for the employees to use. Furthermore, the station allows for avoiding the congested roads in the morning and evening peaks and is a 14 minute bike ride when opting for the electric bike.
- Houten, chosen by Femke, Thijs and Marleen, as the most convenient location for employees who live south of Utrecht. Here, the question is to choose a location close to the station, which is less accessible for cars who are on the highway, or a location close to the highway to lower the threshold to use the P+R facility for car users. Next to Expo Houten is sufficient parking space and this is a convenient location regarding the employees living south from Utrecht, being connected with the A27. This way they will eliminate the highly congested parts of their commute and avoid the congestion on site at the end of the day. The cycle time by e-bike will be 20 minutes, when placing the P+R facility along the A27 at the exit of the Van der Valk hotel, which is close to the highway for car users and has enough land to facilitate such a parking lot.
- Maarssen is proposed by Ilona, since she lives on the west side of Utrecht. It is recommended to facilitate the P+R at the side of the A2, intead of at Maarssen station. Traveling from Maarssen to academic medical center with public transport is 30 minutes with one transfer, while a trip by e-bike from Maarssen exceeds 30 minutes, with the extra steps of exiting the train, grabbing the shared bike, figuring out the cycle route and cycling to academic medical center. The shared bike is not more convenient than the public transport connection, however, it is more convenient than the car seen the opportunity to avoid the highly congested roads in Utrecht Center and at the medical center location. At the Heldinnenlaan, there is more than enough parking space for the academic medical center and Pon to rent a lot for employees to park their car and for the organization to stall the shared (e-)bikes. The e-bike travel time from Heldinnenlaan would be around 30 minutes, eliminating the congestion time and parking fees which accompany the car.

Furthermore, it is advised to perform a pilot study, as Pon and academic medical center are already planning, which familiarizes the employees with the travel alternatives. As according to Ton and Duives (2021), people's mode choice behavior changed during the trial period of using a free electric-bike. Since a large share of the interviewees have not tried other modes of transport or did not know how the implementation into their personal life would look like, a trial period for the employees is ought to be of added value, to positively impact the acceptance and use of the travel alternatives. Also, it is recommended to perform a trial period in which a group of participating employees are able to freely choose from the alternatives. The current plan is to equally divide the 300 participating employees over the travel alternatives. However, when letting the employees choose freely, actual choice behavior between the alternatives becomes apparent which also indicates which alternative(s) are perceived to fit the needs of the employees best.

academic medical center

The main take-away from the interviews is that employees who work irregular hours will be very challenging to shift from car to a more sustainable mode, due to environmental and safety constraints. However, they have indicated to be open to multi-modal solutions, such as a P+R facility where they can park their car and cycle the last-mile to the academic medical center. This will relieve the site of the medical center from car related congestion, reduce a small share of the commuting emissions, and lastly benefit the employee health and satisfaction. Thus, the employees with irregular hours should be left out of the mobility transition obligations, unless there is a P+R facility alternative initiated. This is already partially implemented, but should be communicated more clearly to the employees who it concerns. The employees working during office hours experience no constraints regarding public transport service schedules or unsafe dark cycle lanes and are therefore expected to be more willing to shift to more sustainable modes when their mobility preferences are (partly) met. Secondly, the recommendation for the academic medical center which is thought to be a large impact and low effort, is to engage the employees in the decision-making process and make communication more active by giving physical updates during week-starts. Organizing focus groups at various time to be able to include a wide variety of employees, not just the office employees, will give the employees the feeling of being heard and valued. Furthermore, the new Connect site should be designed in a way that employees can easily find the mobility related updates and documents, to eliminate the application threshold for the sustainable options. Additionally, posters or other offline notices should be implemented, to avoid exclusion of employees who do not have the time or access to check online updates. The last communication related recommendation is to emphasize the numerous sustainable travel options available and their benefits, instead of focusing on getting the employees out of the car.

Then, the alternative related recommendations, which primarily focus on the e-bike. Various employees have indicated that they would like to have more e-bike charging stations in the parking garage of the academic medical center, since currently only a share of the employees is able to charge their e-bike. Furthermore, it would be beneficial to facilitate larger charging parking spaces in the bike garage, to stimulate the use of speedpedelecs and e-scooters.

A more long-term advice, is the recommendation to monitor personal travel experience of the employees, by means of travel diaries or a survey, over a longer period of time. Reliability, convenience, safety, status and comfort are factors that highly influence the choice of transport mode and the attributes regarding quality of service (Arentze and Molin, 2013). These factors are strongly dependent on personal experience. Using the past personal experiences regarding travel modes, gives the ability to predict future behavior to a greater extent than non-personal experience (Fazio and Zanna, 1981).

Last, the academic medical center is advised to contact the municipality of Utrecht to enhance the cycling conditions in and around Utrecht and propose the reintroduction of certain buslines connecting suburbs to the academic medical center. The municipality of Utrecht is responsible for the safety and flow of the infrastructure in and around Utrecht, with the aim of supporting and stimulating sustainable behavior of its citizens and travelers. In order to stimulate the use of public transport and cycling, the services and cycle lanes should be well maintained and minimize disruptions. Based on comments from the interviews, it is recommended for the municipality of Utrecht to optimize the lighting on cycle paths in and around the city, especially the paths connecting the suburbs. Furthermore, two interviewees indicated that the bushes and other nature around the cycle paths sometimes overgrow and disturb the flow of cycling and enhance the feeling of unsafety.

A long-term and heavy effort advice is to perform research among the citizens and employed in

Utrecht, in the form of a survey, whether bus lines connecting suburbs of Utrecht should be reintroduced. Interviewees indicated that bus lines between Soest and Houten once existed, allowing for a fast connection between home and work for employees. A survey with a large response is able to indicate whether this is a wide shared opinion and need for individuals. With the implementation of the bus lines, when the need and preference is high, roads can be relieved from congestion and less emissions will be emitted in and around the city.

7.2. Discussion

This section will discuss the scientific and practical relevance of the study. Then, the limitations are discussed together with how the validity of the study was guarded throughout the process and which trade-offs were made and are questioned on their righteousness.

7.2.1. Scientific relevance

To be able to conclude on the scientific relevance of this study, a comparison is made with existing literature, to see what the differences, similarities and possibly new findings are. First, the found influential factors for commuting mode choice are compared, to see if the health-care sector substantially differs in commuting behavior. Then, the methodology used in existing literature and this research are compared and the main findings are reported.

This research distinguishes itself from other literature on commuting behavior and policy to decarbonize the commute, by focusing on the health care sector, hospital employees in particular, where employees operate under special circumstances. They work irregular hours, experience high work pressure, have a high turnover within the sector, and perform heavy physical work with patients. Due to these circumstances, the hypothesis was that a different approach for a commute mobility transition is necessary compared to other sectors, where a focus lies on protecting travel convenience and comfort while enhancing employees' health.

The majority of research did not focus on one sector in particular, but examined the commuting behavior of individuals in general (Katzev, 2003; Tyrinopoulos and Antoniou, 2013; Washbrook et al., 2006;Frank et al., 2008; Ha et al., 2020). They find that the main factors which affect mode choice among commuters are the travel time, travel costs, number of transfers and transfer time, availability of parking space, parking costs, and guarantee of service for shared services. Romanowska et al. (2019) has studied University students and employees their commute mode choice behavior. Their conclusion was that car availability, trip origin location, and accessibility largely affect the mode choice. Furthermore, trip quality, costs and ecology have also showed to play a role when choosing a mode of transport. This research compared to other sectors, or commuting in general, presents various similarities as well as differences. Where the trip quality or convenience are secondary to the average commuter, they are primal for the academic medical center employees. The interviews in this research gave insight into the rational of the hospital employee, which shows the importance the employees give to travel comfort and ease after work. Furthermore, they indicated that travel time, travel costs, number of transfers and transfer time are also important factors which influence the choice of mode. Research by Ha et al. (2020) finds that when public transport trips contain more than one transfer, commuters opt for the car. This is also found during the conversations with the employees, where the public transport option was experienced as unfitting, partly due to the numerous transfers. Parking availability, parking costs and guarantee of service for shared vehicles however are not mentioned by the employees. There is no restriction on parking availability and the employees are so highly attached to their car, that the parking costs do not influence their choice of mode, although there is dissatisfaction about the increased parking costs. Where the parking costs seem to be of less significance, the public transport costs are experienced as too high, especially when compared to the trip by car. Among University students and employees the ecology was also a significant factor to their mode choice behavior, this however was almost the opposite for the academic medical center employees. As they indicated, they did not choose this sector and/or this place of work because of their ecological affinity. Concluding, the main differences between the mode choice behavior of the hospital employees and other researched sectors, are the fact that personal flexibility, comfort, minimal effort and the opportunity of door-to-door travel are highly important for hospital employees while other sectors emphasize the travel time and travel costs. However, the travel time and costs do play a role in mode choice of hospital employees,

although secondary to ease of travel, as said by various employees. For employees within cycle range and who work during the day, the (e-)bike is a viable solution, similar to other sectors. Public transport is the sustainable option for employees outside of cycle range, especially when completely reimbursed, which has found to be effective in previous case studies elaborated on in 3.3. Another differentiating factor from other sectors, is the fact that hospital employees work irregular hours. This rises two main travel challenges: insufficient public transport service and feeling unsafe while cycling. The solution to meet the needs of these employees are P+R facilities which allows the employees to take their car just outside of Utrecht city center or a nearby station, to proceed the last-mile of the commute by shared (e-)bike or bus when possible. This solution overcomes the environmental and personal constraints the challenging hospital employees experience by offering door-to-door service with one transfer while traveling on personal modes. This solution meets the mobility goals of reducing emissions, reducing parking actions at the work end, while enhancing employee health and satisfaction.

The only research found that has specifically analyzed health-care personnel on their commuting behavior is of S. Kaplan et al. (2016). They conducted small-scale surveys among three hospitals in the area of Chicago, in the United States, and interviewed key staff of five major hospital across the country on their mobility programs. They concluded from the surveys that the employees might shift from driving alone to other modes when they are financially incentivized, are able to travel convenient and the roads to work are decreased in crime and increased in safety. They find that convenience and safety are prioritized mostly by female and night-shift workers, confirmed by the conducted interviews in this research. The interviews with major hospitals who focus on sustainable mobility programs have given insight into what triggers their employees to disregard the car. Financial incentives are most effective, they see decreases in car use when parking pricing is increased, yearly bonuses are given to pedestrians and cyclists, or transit is offered completely free. Their research concludes there is no one-size-fits-all, and that among employees there should be differing mobility alternatives. The largest difference with this research, is the location of the study. The research of S. Kaplan et al. (2016) is conducted in the United States, while this research is performed in The Netherlands, these two countries vary greatly in their use of transport. The United States relies dominantly on the car, since there is less dense cycling or transit infrastructure, compared to the Netherlands. This study therefore adds new knowledge to literature for countries who are similar to the Netherlands in their transport infrastructure. Since, public transport and cycling are both sustainable and widely available options. The conclusion on these two alternatives is that total reimbursement is required to stimulate use of transit to enable competition with the convenience of the car. Furthermore, the e-bike is popular among employees who live within 25 to 30 kilometers of the academic medical center, when there are enough charging facilities at work and cycle lanes are well maintained and well lit in the dark. Despite the difference in mobility accessibility, the findings share many similarities. The main take-away from this research was that the employees are very protective of their travel convenience and comfort, seen their physical demanding work, and feel undervalued seen the current financial incentives. Furthermore, both studies conclude that female night-shift workers prioritize convenience and safety most. This study adds that female employees with irregular shifts tend to feel unsafe in public transport at night and abandon the (e-)bike due to unsafe cycle lanes between home and work. They additionally propose to implement P+R facilities at cycling distance of the academic medical center, to allow them to partly decarbonize their commute.

From the methodology that is applied in this research, there is also additional scientific relevance compared to existing literature. All the literature concerning commuting behavior used in this research is based on survey/questionnaire conduction among small and large samples. The benefits of surveys are the wide reach when spread online, the relatively small time frame necessary to reach the target group, monetary benefits and the fact that quantitative data analysis is possible with the retrieved answers. However, the conduction of a survey misses the personal contact with the respondent and is unable to capture physically observable data. Furthermore, during an interview the participant is able to elaborate on their answers, unlike in most surveys where questions are closed-ended and multiple choice. For example in research of Romanowska et al. (2019), Tyrinopoulos and Antoniou (2013), and Katzev (2003) surveys and travel diaries are used to determine what affects individuals mode choice. They were able to establish the practical factors of travel time, travel costs, and the availability of a parking space at the destination end. However, they failed to capture the authentic attitude and behavior of the commuters. They were unable to comment on what gave the commuters joy or what mobility options might even scare them off in their first reaction, observable in body language. In

more generic research with a large sample size this might be unnecessary and undesired to analyze, however, in the case study of this research, it is of added value to be able to draw conclusions on the feelings, attitudes and perceptions of the employees, derived from their spoken answers as well as from their body language. Namely, the employees from the academic medical center were very willing to participate in the interviews and comment on their opinion regarding the mobility approach of their employer. Furthermore, the introduction of the two proposed alternatives gave bodily and facial objection from the employees who live farther than 30 kilometers from work or work irregular shifts. This observed objection, apart from the fact they answered that the alternatives do not fit their needs and are not perceived as just by them, adds to the conclusion that the mobility transition is a sensitive matter in which the employer should ensure that all employees feel considered and valued equally by their input.

7.2.2. Practical relevance

The practical relevance of this study is primarily aimed at the stakeholders involved in the case study. This research gave insight into how the employees perceive and experience the proposed alternatives, what they suggest would ultimately fit their mobility needs, and what communication and policy approach would increase the probability of user acceptance.

The generic take-away when designing mobility alternatives for hospital employees, is that the convenience and comfort of the car should be tried to be matched. Also, the case study showed how the employees feel undervalued when their commute to work is not reimbursed, or only partly. Hospital employees, especially the employees who work with patients and work irregular shifts, feel that their job is physically and mentally demanding and that their input of labor is not equalized with a partly reimbursed mobility policy which does not meet their travel needs. When hospital organizations design mobility options, they should ensure that all employees feel considered by the options, or otherwise receive an explanation why they are not considered and which exception to the rule applies for them. Communication is found to be key with this matter, since hospitals are large organizations with a wide variety of professions. When the employees 'on the floor' feel as if their way of commuting is being determined by the management, the willingness and intent to use the proposed alternatives decreases.

The alternatives, part of the pilot by Pon and academic medical center, the e-bike, the shared bike and complete public transport reimbursement at Utrecht Central station, are discussed during the interviews. This led to the conclusion that the e-bike is a viable alternative and widely experienced as just, although merely usable for employees within cycling range. The shared bike was less popular and the almost unanimous answer was that they did not intend to use the alternative when it became operational. The two employees who were favorable about the shared bike at Utrecht Central, explained the health benefits and the option to avoid crowded trams and buses. A share of the remaining 15 interviewees proposed a solution for the shared bike alternative. Namely, to choose other points of service than Utrecht Central station, since the problem lies with the public transport connection to this station. After the conversation on mobility needs and preferences, the interviewees gave clear advice for the academic medical center regarding their communication approach. They advise the academic medical center to facilitate more focus groups or moments of feedback to engage the employees more, ensuring there is a wide variety of employees who participate, not just office employees with regular hours as in previous focus groups. Also, the communication should be extracted to physical communication, instead of relying solely on online updates. This increases the chance that no employees are excluded based on illiteracy and inability to use the online services.

Besides the practical relevance for the academic medical center and Pon, and of course the employees who's opinion and suggestions are taken into account, the municipality of Utrecht is able to derive practical improvements from this research. However, since the municipality is not involved in the research, it is an indirect advise for the academic medical center to investigate the possibilities to partner up with the municipality to discuss and improve certain mobility situations. Various employees, dominantly female with irregular shifts, have indicated that the cycle lanes in and around Utrecht city feel unsafe due to poorly maintained bushes and sprawl and the poor lighting. To stimulate sustainable modes, as the (e-)bike, within its city, the municipality is advised to improve the safety of the cycle lanes. How to best improve the safety can be analyzed by performing a research of its own to analyze the needs of the cyclists and draw up a cost-benefit analysis.

Furthermore, the research is valuable to adapt the original survey to the newly obtained knowledge from the interviews, to investigate the proposed mobility and communication solutions of the employees

among a larger share of the population than the 17 interviewees. With the current knowledge, some survey questions are deemed as irrelevant and there is a need for additional questions that were missed in the first attempt. Additionally, the interviews emphasized the sensitivity of the mobility matter, which means that questions should be posed in a way that employees are less likely to become upset or expect certain mobility alternatives to be true instead of hypothetical. The list of questions to add and/or delete from the survey, are listed in section 7.3, the recommendations for the test phase.

7.2.3. Limitations

It is important to discuss the limitations of the study, to be made aware of the scope it is framed in and what limitations can be overcome in possible further research. First, it is discussed how the validity and the trustworthiness are warranted throughout the research and possible restrictions that arose. Then, the limitations regarding the scope of the research are elaborated on. Last, the effectiveness-equity trade-off is discussed in relation to the disregarded factor of efficiency.

When conducting interviews, the goal is to remain objective while also engaging into the conversation to ask detailed and meaningful follow-up questions. The objectivity was guarded by drawing up an interview script which was to be followed during every interview, with the follow-up questions developing throughout each conversation. Also, by coding the interviews and analyzing the transcripts based on the wording and comments made by employees, the personal opinion and view of the researcher was minimized. However, there is no use of intercoder reliability (ICR) regarding the codes of the transcribed interviews. Due to limited time and limited added value in this research of ICR, since there was more focus on the context of the interviews than the actual codes, it is disregarded. Nevertheless, ICR does make the coding process scientifically proven and reliable, since the coding process is done multiple times and compared to each other by experts in the field of qualitative research.

Before being able to conduct interviews, the participants should be recruited. The optimal recruitment process would be to select random employees from various divisions within the hospital, to minimize the chance of creating bias among the interviewees. However, due to the high sensitivity of the mobility topic within the academic medical center, the interviewees were selected by a member of the Project Team Sustainable Transport Pilot of the organization. The employees were contacted, asked whether they were interested to participate and informed about the topic of the interview. On top of that, the employees who were approached to participate were part of a focus group that discussed the mobility matter two years ago. This implies that these employees have a certain level of affinity with mobility for their commute. Furthermore, the approached employees were all office employees who work during the day and dominantly commute to work by e-bike or public transport. Due to the lack of variety among the recruited employees, additional employees were approached who were known to commute to work by car and worked irregular shifts, to increase the sufficiency of the socio-demographics among the interviewees. During these additional interviews, a member of the Project Team Sustainable Transport Pilot of the academic medical center was present, to ensure no misinformation was spread or insensitive mobility related questions were posed. So, due to the high sensitivity, not everyone who was intended to be featured has been approached to participate in the interviews.

The third limitation regarding the interview conduction, is the possible mobility related bias and subjectivity among the participants. As previously mentioned, a large share of the interviewees was recruited by a board-member who chose the employees based on their participation in a mobility related focus group. This implies that these employees are engaged with the mobility problems at the academic medical center and are willing to invest time to brainstorm about fitting solutions. The fact that these employees have been in group discussion together about mobility before could be seen in some similarities in answers. For example, two of the interviewees argued their dissatisfaction about the exclusively online communication with the statistics that one in seven people is illiterate. Furthermore, three of the interviewees found the idea of commuting by public transport a ”world journey” or ”extremely physically exhausting”. It is possible that the same problems are experienced by all employees. However, it is also possible that the same stories and complaints circle around in the organization and are echoed by the employees, due to the dissatisfaction about the mobility approach. This hypothesis is confirmed by the repetition in answers given by the various participants, some using similar wording to make their point.

The scope of the research has been carefully selected to be able to draw concise and effective con-

clusions that will give clear practical actions to Pon in collaboration with the academic medical center. Since the goal of the academic medical center is to minimize the use of the car to reduce commute emissions and reduce the number of parking actions, the target group was employees who commute by car. Although these employees are able to elaborate on why they choose the car as their commute mode and what factors could positively affect the shift to more sustainable modes, they are unable to provide insights on the benefits of the more sustainable modes as public transport and the (e-)bike. It is proven that a balance between push and pull measures is most effective to shift individuals from their current choice behavior to new choice behavior. Therefore, it might be of added value to widen the scope of the research to all academic medical center employees. A distinction can be made in questions posed to both parties, where push measures can be derived from the car users and pull measures can be derived from both car and (e-) bike and public transport users. This also ensures that the (e-)bike and public transport users do not feel excluded from the internal research, since they might also have certain aspects and policies they feel unsatisfied about. Additionally, not solely the car users should be targeted to seduce them to leave their car in their driveway, but the current (e-)bike and transit users should also be kept satisfied by providing attractive privileges, since this also positively affects the internal word of mouth advertising on the sustainable alternatives.

Furthermore, another choice of scope, regarding the considered travel options, is also limited. Currently, the interviews and survey focus on the two alternatives part of the pilot, the leased e-bike and shared bike at Utrecht Central station. However, the interviews have shed light on the fact that solely these two are not the alternatives that best serve the needs of a wide variety of employees. During the interviews, the alternative of various P+R facilities around Utrecht with the possibility to rent or use a bike or bus to the academic medical center have arisen to better fit the mobility needs of employees who work irregular hours, or live outside the 30 kilometer range of academic medical center and are poorly connected by public transport and (e-)bike.

Last, it is discussed whether the addition of efficiency in the effectiveness-equity trade-off is relevant. In the literature review, the effectiveness and equity are compared with one-another and concluded on that in order to implement a travel alternative which is deemed as just for the employees, effectiveness must be partly sacrificed. However, in literature there is much discussion on the efficiency-equity trade-off, which is dominantly economy related. When the efficiency of a market is optimized, there is a less equitable distribution of wealth (CFI, n.d.). The choice for one of the two trade-offs depends on specific goals, priorities, and considerations. Below, both trade-offs are explained in how they would be applied within this research:

1. Effectiveness-Equity trade-off:
    - Applicability: This trade-off is more relevant when the primary concern is ensuring that the mobility alternative is effective in achieving its intended goals, such as reducing carbon emissions from commuting.
    - Consideration: The focus is on achieving a positive environmental impact and meeting sustainability targets. Equity concerns may involve ensuring that the benefits and accessibility of the alternative are distributed fairly among employees.
2. Efficiency-Equity trade-off:
    - Applicability: This trade-off is more relevant when the primary concern is optimizing resources, minimizing costs, and ensuring a streamlined and efficient implementation process.
    - Consideration: The focus is on maximizing the efficiency of the mobility alternative, potentially through cost-effectiveness, streamlined processes, or resource optimization. Equity concerns may involve ensuring that the implementation process does not disproportionately burden certain groups within the organization.

Concluding from these two descriptions, the effectiveness-equity trade-off remains most applicable to the case-study of this research, since the ultimate goal is to reduce carbon emissions that relate to the commute while distributing the mobility alternatives evenly among employees. However, the monetary restrictions the organization has also makes the efficiency-equity trade-off of value, since the academic medical center would like to minimize costs without dissatisfying any of the employees. Due to the focus on mode choice behavior, attitude, feelings and equity, this research endures no

limitations from the focus on the first trade-off. Nevertheless, when costs are taken into account for implementation, the second trade-off is deemed as a valuable addition to research.

7.3. Recommendations

This last section provides recommendations for further research to minimize the limitations of this research. The section concludes with next steps for the test phase for recommended further research which fits seamlessly to this study.

7.3.1. Recommendations for further research

To minimize the experienced limitations of this research, recommendations are presented. As explained in the discussion of the report, the selection of the employees who participated in the research was done by the Project Team Sustainable Transport Pilot of the academic medical center, who have carefully selected and informed the participants. This could affect the openness and unbiased nature of the interviewees, which affects the answers and thus the research results. Therefore, it is recommended to conduct interviews with employees who are randomly selected and not informed beforehand. Although this would benefit the scientific sense of the research, the practical side might be harmed, due to the sensitive nature of the mobility transition within the academic medical center. Which leads to the second recommendation, namely to perform qualitative research with interviews among hospital employees of other hospitals, within the Netherlands as well as in foreign countries. This allows to compare the research findings and draw more generic conclusions, since more case studies lie on the basis of the conclusions.

Currently, the research focuses on hospital employees, because of their special work circumstances (irregular hours, high work pressure, demanding physical en mental work). However, there are other professions who also work with irregular hours and in demanding high-pressure environments such as military personnel, aircraft personnel, and the entertainment industry. It is recommended to also perform similar research to these professions, to see if the commute behavior is to be dedicated to the irregular hours and high work pressure, or if other factors play a significant role.

Regarding the interview analysis method used, it is recommended to ensure ICR by having a couple of qualitative research experts also code the transcripts. This way, the codes of the researcher and of the experts can be compared, to assess the consistency or agreement.

7.3.2. Recommendations for the test phase

To allow for a seamless flow from the exploratory phase to the test phase, multiple recommendations are given. The interviews have given insight into the attitude, feelings and needs of the employees in a way that the survey needs adjusting by adding and deleting certain questions or statements.

Discrete Choice Experiment

For the choice experiment, it should be discussed with the responsible parties from Pon and academic medical center whether it is desirable to take up the P+R alternative. Then, a choice option would be added, ”P+R facility + shared (e-)bike”, to be determined what P+R facility and what the implications are for the employees who are participating in the survey. Furthermore, it is recommended to consider travel compensation in the choice experiment. This will provide insight into what travel compensation might persuade the employee to opt for the (e-)bike, shared bike or public transport. It is therefore recommended to vary with the compensation for car, (e-)bike and public transport.

Questions and statements

The following two tables present the recommendations for the survey regarding the uptake or elimination of questions and statements. The questions are in Dutch, to match the exact tone of the existing survey questions.

During the interviews, it became apparent that employees experienced little to no impact on their mode choice based on the opinion from the people in their surroundings. Furthermore, interviewees explained that they choose their commute mode based on practicalities rather than social considerations. Therefore, these questions are deemed as redundant and can be eliminated from the survey.

The current survey has no open questions since reading open questions from all the respondents is very time consuming. However, it could be of added value to ask the respondents where they would like

Table 7.1: List of redundant questions of the survey

Questions to delete
1. Mensen die belangrijk voor me zijn, vinden dat ik het openbaar vervoer moet gebruiken voor woon-werkverkeer 2. Mensen die belangrijk voor me zijn moedigen me aan om in mijn dagelijks leven het openbaar vervoer te gebruiken 3. Mensen die belangrijk voor me zijn, vinden dat ik de elektrische fiets moet gebruiken voor woon-werkverkeer 4. Mensen die belangrijk voor me zijn moedigen me aan om in mijn dagelijks leven de elektrische fiets te gebruiken

Table 7.2: List of additional questions for the survey

Questions to add	Answer options
1. Wat is het maximaal aantal transfers wat je zou aanvaarden tijdens je reis naar werk met het openbaar vervoer?	1, 2, 3, 4 of meer
2. Als er om Utrecht heen P+R gebieden zouden zijn waar jij gratis je auto kan parkeren om vanaf daar een elektrische fiets te pakken, zou je dat dan doen?	Ja, Nee
3. Als je een locatie mag kiezen voor een P+R waar je de auto gratis kan parkeren en een gratis elektrische deelfiets kan pakken, waar zou dit dan zijn?	Open vraag

to have a P+R facility in their personal situation, for further implementation strategy for the stakeholders of the study.

According to Bocarejo and Oviedo (2012) if you want to know the real accessibility of the employees, you should ask the ”time and percentage of income spent on transportation to work”. This refers back to the mobility (in)equity that individuals experience, since low income households tend to spend a larger share of their income on transportation than high income households, increasing the inequity. For the test phase, when equity is still considered, the level of inequity can be quantified by asking the above mentioned question. Combining the time and percentage of income spent on transportation to work, with socio-demographics and mode choice behavior of employees, gives insight into which employee groups might need extra incentive or extra financial support to stimulate sustainable travel choices.

In the current version of the survey, there are not questions regarding working from home as ’travel’ option. Giving monetary compensation to work from home is however a method the academic medical center is considering to reduce the number of commute trips and consequently the emissions. It is to be determined by further research whether this is part of the scope of the test phase or not, since it does not relate to travel or mode choice behavior, but it does have affect on the choice whether a trip is going to be made that day.

Last, the social influence, that is part of the UTAUT2 framework, had no significant comments or codes retrieved from the interviews. However, this does not allow for a general conclusion. Therefore, it is recommended to uptake questions or statements within the survey that allow the analysis of the social environment within the academic medical center, to conclude on whether there is or there is not a social influence on mode use.

Data collection and implementation

To ensure rich data collection, it is recommended to analyze the socio-demographics of the survey respondents during the active period of the survey. When certain socio-demographics, like age, gender, mode user, function group, are underrepresented, a more targeted approach should be applied. With consent from the Project Team Sustainable Transport Pilot of the academic medical center, the department heads could be approached, to increase the response of specific employees. Also, as the communication feedback implied, it could be beneficial to spread to survey outside of online services, to prevent premature exclusion of certain employee groups.

The research of Esztergár-Kiss and Zagabria (2021) provides a Travel Demand Management approach to decarbonize the commute related to a company or organization. Furthermore, the research lists 64 measures to stimulate the use of travel alternatives to the car. It is therefore recommended

to read the paper and see whether the same Travel Demand Management approach can be applied, maybe partly, within the academic medical center.

References

Abenoza, R. F., Ettema, D. F., & Susilo, Y. O. (2018). Do accessibility, vulnerability, opportunity, and travel characteristics have uniform impacts on the traveler's experience? *Transportation research part A: policy and practice*, *114*, 38–51.

Abiiro, G. A., Leppert, G., Mbera, G. B., Robyn, P. J., & De Allegri, M. (2014). Developing attributes and attribute-levels for a discrete choice experiment on micro health insurance in rural malawi. *BMC health services research*, *14*(1), 1–15.

Adams, J. S. (1963). Towards an understanding of inequity. *The journal of abnormal and social psychology*, *67*(5), 422.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179–211.

Ajzen, I. (2005). *Ebook: Attitudes, personality and behaviour*. McGraw-hill education (UK).

Ajzen, I., & Fishbein, M. (1975). A bayesian analysis of attribution processes. *Psychological bulletin*, *82*(2), 261.

Alreck, P. L., & Settle, R. B. (1995). The survey research handbook: Guidelines and strategies for conducting a survey.

Alturif, G., & Saleh, W. (2023). Attitudes and behaviour towards more sustainable travel options in the kingdom of saudi arabia: An emerging social change?

Amaya-Amaya, M., Gerard, K., & Ryan, M. (2008). Discrete choice experiments in a nutshell. *Using discrete choice experiments to value health and health care. Dordrecht: Springer*, 13–46.

Anable, J., & Gatersleben, B. (2005). All work and no play? the role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A: Policy and Practice*, *39*(2-3), 163–181.

Appleyard, B., Frost, A. R., Cordova, E., & McKinstry, J. (2018). Pathways toward zero-carbon campus commuting: Innovative approaches in measuring, understanding, and reducing greenhouse gas emissions. *Transportation Research Record*, *2672*(24), 87–97.

Arentze, T. A., & Molin, E. J. (2013). Travelers' preferences in multimodal networks: Design and results of a comprehensive series of choice experiments. *Transportation Research Part A: Policy and Practice*, *58*, 15–28.

Azari, K. A., Arintono, S., & Hamid, H. (2011). Modeling tourist's mode choice behavior under parking and cordon charge policies. *2011 Fourth International Conference on Modeling, Simulation and Applied Optimization*, 1–4.

Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? predicting students' car use for university routes with the models of ajzen, schwartz, and triandis. *Environment and behavior*, *35*(2), 264–285.

Ben-Akiva, M., & Lerman, S. R. (1985). *Discrete choice analysis: Theory and application to travel demand* (Vol. 9). MIT press.

Ben-Akiva, M., McFadden, D., Train, K., et al. (2019). Foundations of stated preference elicitation: Consumer behavior and choice-based conjoint analysis. *Foundations and Trends® in Econometrics*, *10*(1-2), 1–144.

Bernasco, W., & Block, R. (2013). Discrete choice modeling. *CrimeStat IV: A Spatial Statistics Program for the Analysis of Crime Incident Locations (version 4.0)*, 21–21.

Bhat, C. R. (1997). Work travel mode choice and number of non-work commute stops. *Transportation Research Part B: Methodological*, *31*(1), 41–54.

Bhat, C. R., & Sardesai, R. (2006). The impact of stop-making and travel time reliability on commute mode choice. *Transportation Research Part B: Methodological*, *40*(9), 709–730.

Bieliński, T., Kwapisz, A., & Ważna, A. (2021). Electric bike-sharing services mode substitution for driving, public transit, and cycling. *Transportation research part D: transport and environment*, *96*, 102883.

Bieliński, T., & Ważna, A. (2020). Electric scooter sharing and bike sharing user behaviour and characteristics. *Sustainability*, *12*(22), 9640.

Bierlaire, M. (1998). Discrete choice models. In *Operations research and decision aid methodologies in traffic and transportation management* (pp. 203–227). Springer.

Bocarejo, S. J. P., & Oviedo, H. D. R. (2012). Transport accessibility and social inequities: A tool for identification of mobility needs and evaluation of transport investments. *Journal of transport geography*, *24*, 142–154.

Bösehans, G., Kavta, K., Bell, M. C., & Dissanayake, D. (2023). Exploring the potential of shared electric vehicles from e-mobility hubs as an alternative for commute and food shopping trips. *IET Intelligent Transport Systems*.

Brechan, I. (2006). Psychological factors influencing transport mode choice. a literature study. *TØI-report*, *830*, 2006.

Bridges, J., et al. (2003). Stated preference methods in health care evaluation: An emerging methodological paradigm in health economics. *Applied health economics and health policy*, *2*(4), 213–224.

Buehler, R., & Hamre, A. (2015). The multimodal majority? driving, walking, cycling, and public transportation use among american adults. *Transportation*, *42*, 1081–1101.

Cascetta, E., & Cascetta, E. (2009). Random utility theory. *Transportation Systems Analysis: models and applications*, 89–167.

CBS. (2021). *Hoeveel reisden inwoners van nederland van en naar het werk?* https://www.cbs.nl/nl-nl/visualisaties/verkeer-en-vervoer/personen/van-en-naar-werk#:~:text=Vooral%20met%20de%20auto%20van,auto%20afgelegd%2C%20meestal%20als%20bestuurder. (accessed: 25.09.2023).

CBS. (2022a). *Helft zorgwerknemers vindt werkdruk te hoog*. https://www.cbs.nl/nl-nl/nieuws/2022/46/helft-zorgwerknemers-vindt-werkdruk-te-hoog#:~:text=Gemiddeld%20in%20de%20zorg%20en,procent)%20was%20dit%20het%20hoogst. (accessed: 27.09.2023).

CBS. (2022b). *Zorguitgaven stegen in 2021 met 7,6 procent*. https://www.cbs.nl/nl-nl/nieuws/2022/27/zorguitgaven-stegen-in-2021-met-7-6-procent#:~:text=De%20zorguitgaven%20als%20percentage%20van,procentueel%20ongeveer%20evenveel%20zijn%20gegroeid. (accessed: 13.09.2023).

CBS. (2023). *Opnieuw meer werknemers in zorg en welzijn, ondanks grotere uitstroom*. https://www.cbs.nl/nl-nl/nieuws/2023/34/opnieuw-meer-werknemers-in-zorg-en-welzijn-ondanks-grotere-uitstroom (accessed: 13.09.2023).

Cervero, R. (2002). Built environments and mode choice: Toward a normative framework. *Transportation Research Part D: Transport and Environment*, *7*(4), 265–284.

CFI. (n.d.). *Equity efficiency tradeoff*. https://corporatefinanceinstitute.com/resources/economics/equity-efficiency-tradeoff/ (accessed: 01.01.2024).

Chakrabarti, S. (2017). How can public transit get people out of their cars? an analysis of transit mode choice for commute trips in los angeles. *Transport Policy*, *54*, 80–89.

Chen, C.-F., & He, M.-L. (2023). Exploring heterogeneous preferences for mobility-as-a-service bundles: A latent-class choice model approach. *Research in Transportation Business & Management*, *49*, 101014.

Chorus, C. (2020). *Slides chorus week 1: Discrete choice modeling and the logit model*. https://brightspace.tudelft.nl/d2l/le/content/279907/viewContent/2001052/View

Coast, J., Al-Janabi, H., Sutton, E. J., Horrocks, S. A., Vosper, A. J., Swancutt, D. R., & Flynn, T. N. (2012). Using qualitative methods for attribute development for discrete choice experiments: Issues and recommendations. *Health economics*, *21*(6), 730–741.

Comrey, A., & Lee, H. (1992). Interpretation and application of factor analytic results. *Comrey AL, Lee HB. A first course in factor analysis*, *2*, 1992.

Coomber, R. (1997). Using the internet for survey research. *Sociological research online*, *2*(2), 49–58.

Craik, K. H. (1973). Environmental psychology. *Annual review of psychology*, *24*(1), 403–422.

Cudeck, R., & O'dell, L. L. (1994). Applications of standard error estimates in unrestricted factor analysis: Significance tests for factor loadings and correlations. *Psychological bulletin*, *115*(3), 475.

Cumming, I., Weal, Z., Afzali, R., Rezaei, S., & Idris, A. O. (2019). The impacts of office relocation on commuting mode shift behaviour in the context of transportation demand management (tdm). *Case Studies on Transport Policy*, *7*(2), 346–356.

De Witte, A., Hollevoet, J., Dobruszkes, F., Hubert, M., & Macharis, C. (2013). Linking modal choice to motility: A comprehensive review. *Transportation Research Part A: Policy and Practice*, *49*, 329–341.

de Haas, M., Kroesen, M., Chorus, C., Hoogendoorn-Lanser, S., & Hoogendoorn, S. (2022). E-bike user groups and substitution effects: Evidence from longitudinal travel data in the netherlands. *Transportation*, *49*(3), 815–840.

Dobson, R., & Tischer, M. L. (1977). Comparative analysis of determinants of modal choices by central business district workers. *Transportation Research Record*, (649).

Donald, I. J., Cooper, S. R., & Conchie, S. M. (2014). An extended theory of planned behaviour model of the psychological factors affecting commuters' transport mode use. *Journal of environmental psychology*, *40*, 39–48.

Douglas, J. D. (1976). *Investigative social research: Individual and team field research.* Sage.

Durand, A., Zijlstra, T., van Oort, N., Hoogendoorn-Lanser, S., & Hoogendoorn, S. (2022). Access denied? digital inequality in transport services. *Transport Reviews*, *42*(1), 32–57.

Eckhardt, A., Laumer, S., & Weitzel, T. (2009). Who influences whom? analyzing workplace referents' social influence on it adoption and non-adoption. *Journal of information technology*, *24*, 11–24.

Esztergár-Kiss, D., Tordai, D., & Lizarraga, J. C. L. (2022). Assessment of travel behavior related to e-scooters using a stated preference experiment. *Transportation Research Part A: Policy and Practice*, *166*, 389–405.

Esztergár-Kiss, D., & Zagabria, C. B. (2021). Method development for workplaces using mobility plans to select suitable and sustainable measures. *Research in Transportation Business & Management*, *40*, 100544.

Fazio, R. H., & Zanna, M. P. (1981). Direct experience and attitude-behavior consistency. In *Advances in experimental social psychology* (pp. 161–202, Vol. 14). Elsevier.

Fishburn, P. C. (1968). Utility theory. *Management science*, *14*(5), 335–378.

Frank, L., Bradley, M., Kavage, S., Chapman, J., & Lawton, T. K. (2008). Urban form, travel time, and cost relationships with tour complexity and mode choice. *Transportation*, *35*(1), 37–54.

Fu, X. (2021). How habit moderates the commute mode decision process: Integration of the theory of planned behavior and latent class choice model. *Transportation*, *48*(5), 2681–2707.

Fujii, S., & Kitamura, R. (2003). What does a one-month free bus ticket do to habitual drivers? an experimental analysis of habit and attitude change. *Transportation*, *30*, 81–95.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction*. Longman Publishing.

Garcia-Sierra, M., & van den Bergh, J. C. (2014). Policy mix to reduce greenhouse gas emissions of commuting: A study for barcelona, spain. *Travel Behaviour and Society*, *1*(3), 113–126.

Gärling, T., & Schuitema, G. (2007). Travel demand management targeting reduced private car use: Effectiveness, public acceptability and political feasibility. *Journal of social issues*, *63*(1), 139–153.

Gates, R., McDaniel, C., & Braunsberger, K. (2000). Modeling consumer health plan choice behavior to improve customer value and health plan market share. *Journal of Business Research*, *48*(3), 247–257.

Golany, B., & Tamir, E. (1995). Evaluating efficiency-effectiveness-equality trade-offs: A data envelopment analysis approach. *Management science*, *41*(7), 1172–1184.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American psychologist*, *54*(7), 493.

Golob, T. F., & Hensher, D. A. (1998). Greenhouse gas emissions and australian commuters' attitudes and behavior concerning abatement policies and personal involvement. *Transportation Research Part D: Transport and Environment*, *3*(1), 1–18.

Gorsuch, R. L. (1990). Common factor analysis versus component analysis: Some well and little known facts. *Multivariate behavioral research*, *25*(1), 33–39.

Greene, W. H., & Hensher, D. A. (2003). A latent class model for discrete choice analysis: Contrasts with mixed logit. *Transportation Research Part B: Methodological*, *37*(8), 681–698.

Groves, R. M., Fowler Jr, F. J., Couper, M. P., Lepkowski, J. M., Singer, E., & Tourangeau, R. (2009). *Survey methodology* (Vol. 561). John Wiley & Sons.

Ha, J., Lee, S., & Ko, J. (2020). Unraveling the impact of travel time, cost, and transit burdens on commute mode choice for different income and age groups. *Transportation Research Part A: Policy and Practice*, *141*, 147–166.

Hagman, O. (2003). Mobilizing meanings of mobility: Car users' constructions of the goods and bads of car use. *Transportation research part D: Transport and environment*, *8*(1), 1–9.

Handy, S. L., & Fitch, D. T. (2022). Can an e-bike share system increase awareness and consideration of e-bikes as a commute mode? results from a natural experiment. *International journal of sustainable transportation*, *16*(1), 34–44.

Haustein, S. (2012). Mobility behavior of the elderly: An attitude-based segmentation approach for a heterogeneous target group. *Transportation*, *39*(6), 1079–1103.

Haustein, S., Thorhauge, M., & Cherchi, E. (2018). Commuters' attitudes and norms related to travel time and punctuality: A psychographic segmentation to reduce congestion. *Travel Behaviour and Society*, *12*, 41–50.

Heath, Y., & Gifford, R. (2002). Extending the theory of planned behavior: Predicting the use of public transportation 1. *Journal of applied social psychology*, *32*(10), 2154–2189.

Hely. (n.d.). *All your shared mobility in one app*. https://hely.com/about-hely (accessed: 26.09.2023).

Hensher, D. A., & Ho, C. Q. (2016). Experience conditioning in commuter modal choice modelling–does it make a difference? *Transportation Research Part E: Logistics and Transportation Review*, *95*, 164–176.

Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). *Applied choice analysis: A primer*. Cambridge university press.

Hernandez, J. I. (2023). *Lc discrete choice models*. https://brightspace.tudelft.nl/d2l/le/content/501076/viewContent/2876320/View

Hernández, J. I., Kroesen, M., & Molin, E. (2023). *Travel behavior research*. https://brightspace.tudelft.nl/d2l/le/content/501076/viewContent/3126344/View

Hess, T. J., Joshi, K., & McNab, A. L. (2010). An alternative lens for understanding technology acceptance: An equity comparison perspective. *Journal of Organizational Computing and Electronic Commerce*, *20*(2), 123–154.

Hunecke, M., Blöbaum, A., Matthies, E., & Höger, R. (2001). Responsibility and environment: Ecological norm orientation and external factors in the domain of travel mode choice behavior. *Environment and behavior*, *33*(6), 830–852.

Hunecke, M., Haustein, S., Böhler, S., & Grischkat, S. (2010). Attitude-based target groups to reduce the ecological impact of daily mobility behavior. *Environment and behavior*, *42*(1), 3–43.

Johansson, M. V., Heldt, T., & Johansson, P. (2006). The effects of attitudes and personality traits on mode choice. *Transportation Research Part A: Policy and Practice*, *40*(6), 507–525.

Joshi, A., Kale, S., Chandel, S., & Pal, D. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology*, *7*, 396–403. https://doi.org/10.9734/BJAST/2015/14975

Kaplan, D. H. (2015). Transportation sustainability on a university campus. *International Journal of Sustainability in Higher Education*, *16*(2), 173–186.

Kaplan, S., Ai, N., Orris, P., & Sriraj, P. (2016). Green commuting in the health care sector: Obstacles and best practices. *Journal of Occupational and Environmental Medicine*, *58*, e34–e38.

Katzev, R. (2003). Car sharing: A new approach to urban transportation problems. *Analyses of social issues and public policy*, *3*(1), 65–86.

Kitchenham, B., & Pfleeger, S. L. (2002). Principles of survey research: Part 5: Populations and samples. *ACM SIGSOFT Software Engineering Notes*, *27*(5), 17–20.

Kjaer, T. (2005). *A review of the discrete choice experiment-with emphasis on its application in health care*. Syddansk Universitet Denmark.

Kløjgaard, M. E., Bech, M., & Søgaard, R. (2012). Designing a stated choice experiment: The value of a qualitative process. *Journal of Choice Modelling*, *5*(2), 1–18.

Koppelman, F. S., & Lyon, P. K. (1981). Attitudinal analysis of work or school travel. *Transportation science*, *15*(3), 233–254.

Krueger, R., Vij, A., & Rashidi, T. H. (2018). Normative beliefs and modality styles: A latent class and latent variable model of travel behaviour. *Transportation*, *45*, 789–825.

Kuhnimhof, T. G. (2009). *Measuring and modeling multimodal mode use in the longitudinal section* (tech. rep.).

Kuppam, A. R., Pendyala, R. M., & Rahman, S. (1999). Analysis of the role of traveler attitudes and perceptions in explaining mode-choice behavior. *Transportation Research Record*, *1676*(1), 68–76.

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing*. sage.

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of political economy*, *74*(2), 132–157.

Lease-a-Bike. (n.d.). *Fiets van de zaak voor kleine en grote bedrijven*. https://www.lease-a-bike.nl/werkgever?utm_term=lease%20a%20bike&utm_campaign=B+-+Lease+a+Bike&utm_source=adwords&utm_medium=ppc&hsa_acc=3572756819&hsa_cam=2085713662&hsa_grp=104631112799&hsa_ad=657417652701&hsa_src=g&hsa_tgt=kwd-2887732776&hsa_kw=lease%20a%20bike&hsa_mt=b&hsa_net=adwords&hsa_ver=3&gclid=CjwKCAjwyY6pBhA9EiwAMzmfwVvWDmrg3xrn0SQ0g4BBEiLIXJxEH8TZSan0g1FybDI0lQKkTG-7ZBoCkOoQAvD_BwE (accessed: 09.10.2023).

Louviere, J. J., Carson, R. T., Burgess, L., Street, D., & Marley, A. A. (2013). Sequential preference questions factors influencing completion rates and response times using an online panel. *Journal of Choice Modelling*, *8*, 19–31.

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: Analysis and applications*. Cambridge university press.

Ma, X., Yuan, Y., Van Oort, N., & Hoogendoorn, S. (2020). Bike-sharing systems' impact on modal shift: A case study in delft, the netherlands. *Journal of Cleaner Production*, *259*, 120846.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological methods*, *4*(1), 84.

Mangham, L. J., Hanson, K., & McPake, B. (2009). How to do (or not to do)… designing a discrete choice experiment for application in a low-income country. *Health policy and planning*, *24*(2), 151–158.

McCann, B., et al. (2000). Driven to spend; the impact of sprawl on household transportation expenses. *Surface Transportation Policy Project and the Center for Neighborhood Technology, Chapter Three. See also "The Costs of Sprawl—Revisited*, 6–7.

McFadden, D. (2017). Stated preference methods and their applicability to environmental use and non-use valuations. *Contingent Valuation of Environmental Goods: A Comprehensive Critique*, *153*.

Meier, K. J., Davis, J., & Xu, X. (2023). Effectiveness, efficiency and equity tradeoffs in public programs: A citizen experiment. *Public Administration Review*.

Meng, M., Memon, A. A., Wong, Y. D., & Lam, S.-H. (2018). Impact of traveller information on mode choice behaviour. *Proceedings of the Institution of Civil Engineers-Transport*, *171*(1), 11–19.

Metrics, C. (2018). *Ngene 1.2 user manual & reference guide*. ChoiceMetrics.

Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation science*, *6*(1), 1–12.

Miralles-Guasch, C. (2011). Dinámicas metropolitanas y tiempos de la movilidad. la región metropolitana de barcelona, como ejemplo1. *Anales de geografía de la Universidad Complutense*, *31*(1), 124.

Molin, E. (2005). Causal analysis of hydrogen acceptance. *Transportation research record*, *1941*(1), 115–121.

Molin, E. (2020). *Stated choice: Lecture 1*. https://brightspace.tudelft.nl/d2l/le/content/279907/viewContent/1720072/View

Molin, E., & Kroesen, M. (2023). *Hoe motiveer je werknemers om met de fiets of ov naar het werk te gaan in plaats van met de auto?* Retrieved October 31, 2023, from https://www.tudelft.nl/2023/tbm/hoe-motiveer-je-werknemers-om-met-de-fiets-of-ov-naar-het-werk-te-gaan-in-plaats-van-met-de-auto

Nakayama, S., Kitamura, R., & Fujii, S. (2001). Drivers' route choice rules and network behavior: Do drivers become rational and homogeneous through learning? *Transportation Research Record*, *1752*(1), 62–68.

Nankervis, M. (1999). The effect of weather and climate on bicycle commuting. *Transportation Research Part A: Policy and Practice*, *33*(6), 417–431.

Nardi, P. M. (2018). *Doing survey research: A guide to quantitative methods*. Routledge.
Nederland, R. O. (2023). *Rapportageverplichting werkgebonden personenmobiliteit*. https://www.rvo.nl/onderwerpen/rapportage-wpm (accessed: 13.09.2023).
Nelson, T. E., & Oxley, Z. M. (1999). Issue framing effects on belief importance and opinion. *The journal of politics*, *61*(4), 1040–1067.
Paulssen, M., Temme, D., Vij, A., & Walker, J. L. (2014). Values, attitudes and travel behavior: A hierarchical latent variable mixed logit model of travel mode choice. *Transportation*, *41*, 873–888.
Pedersen, M. J., & Nielsen, C. V. (2016). Improving survey response rates in online panels: Effects of low-cost incentives and cost-free text appeal interventions. *Social Science Computer Review*, *34*(2), 229–243.
Plyushteva, A. (2021). Commuting and the urban night: Nocturnal mobilities in tourism and hospitality work. In *Tourism and the night* (pp. 37–51). Routledge.
Pritchard, R. D. (1969). Equity theory: A review and critique. *Organizational behavior and human performance*, *4*(2), 176–211.
Ritchie, H. (2020). Co2 emissions from transport. *Our world in data*. https://ourworldindata.org/co2-emissions-from-transport#:~:text=Transport%20accounts%20for%20around%20one%2Dfifth%20of%20global%20carbon%20dioxide,CO2%20emissions%20from%20energy%5D
Romanowska, A., Okraszewska, R., & Jamroz, K. (2019). A study of transport behaviour of academic communities. *Sustainability*, *11*(13), 3519.
Rotaris, L., & Danielis, R. (2015). Commuting to college: The effectiveness and social efficiency of transportation demand management policies. *Transport Policy*, *44*, 158–168.
Savvides, A. (2013). Equity of mobility in sustainable transportation. *WIT Transactions on Ecology and the Environment*, *179*, 1091–1101.
Schwanen, T., & Mokhtarian, P. L. (2005). What affects commute mode choice: Neighborhood physical structure or preferences toward neighborhoods? *Journal of Transport Geography*, *13, issue 1*, 83–99.
Scribbr. (2021). *Stappenplan om interviews te coderen | uitleg en voorbeelden*. Retrieved November 29, 2023, from https://www.scribbr.nl/onderzoeksmethoden/coderen-interview/
Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. Teachers college press.
Shaheen, S., & Guzman, S. (2011). Worldwide bikesharing. *Access Magazine*, *1*(39), 22–27.
Shen, J. (2014). Latent class model or mixed logit model? a comparison by transport mode choice data. In *The applied economics of transport* (pp. 127–136). Routledge.
Small, K. A., & Rosen, H. S. (1981). Applied welfare economics with discrete choice models. *Econometrica: Journal of the Econometric Society*, 105–130.
Smith, M. A., & Leigh, B. (1997). Virtual subjects: Using the internet as an alternative source of subjects and research environment. *Behavior Research Methods, Instruments, & Computers*, *29*, 496–505.
Smith, W. R. (1956). Product differentiation and market segmentation as alternative marketing strategies. *Journal of marketing*, *21*(1), 3–8.
Solomon, M., Russell-Bennett, R., & Previte, J. (2012). *Consumer behaviour*. Pearson Higher Education AU.
Spear, B. D. (1976). *Generalized attribute variable for models of mode choice behavior*.
Starmer, C. (2000). Developments in non-expected utility theory: The hunt for a descriptive theory of choice under risk. *Journal of economic literature*, *38*(2), 332–382.
Steg, L. (2005). Car use: Lust and must. instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, *39*(2-3), 147–162.
Sue, V. M., & Ritter, L. A. (2012). *Conducting online surveys*. Sage.
Teichert, T., Shehu, E., & von Wartburg, I. (2008). Customer segmentation revisited: The case of the airline industry. *Transportation Research Part A: Policy and Practice*, *42*(1), 227–242.
Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. *MIS quarterly*, 125–143.
Ton, D., & Duives, D. (2021). Understanding long-term changes in commuter mode use of a pilot featuring free e-bike trials. *Transport Policy*, *105*, 134–144.
Töpfer, M., & Bug, P. (2015). Classical consumer lifestyle segmentation methods.

Train, K. (1986). *Qualitative choice analysis: Theory, econometrics, and an application to automobile demand* (Vol. 10). MIT press.
Turner III, D. W., & Hagstrom-Schmidt, N. (2022). Qualitative interview design. *Howdy or Hello? Technical and professional communication*.
Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *science*, *211*(4481), 453–458.
Tynan, A. C., & Drayton, J. (1987). Market segmentation. *Journal of Marketing Management*, *2*(3), 301–335.
Tyrinopoulos, Y., & Antoniou, C. (2013). Factors affecting modal choice in urban mobility. *European Transport Research Review*, *5*(1), 27–39.
van de Coevering, P., & Schwanen, T. (2006). Re-evaluating the impact of urban form on travel patternsin europe and north-america. *Transport policy*, *13*(3), 229–239.
Van Dort, L., Guthrie, A., Fan, Y., & Baas, G. (2019). Advancing transportation equity: Research and practice.
Van Selm, M., & Jankowski, N. W. (2006). Conducting online surveys. *Quality and quantity*, *40*, 435–456.
Velicer, W. F., Peacock, A. C., & Jackson, D. N. (1982). A comparison of component and factor patterns: A monte carlo approach. *Multivariate Behavioral Research*, *17*(3), 371–388.
Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425–478.
Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS quarterly*, 157–178.
Verplanken, B., Walker, I., Davis, A., & Jurasek, M. (2008). Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses. *Journal of Environmental Psychology*, *28*(2), 121–127.
Vyncke, P. (2002). Lifestyle segmentation: From attitudes, interests and opinions, to values, aesthetic styles, life visions and media preferences. *European journal of communication*, *17*(4), 445–463.
Walker, J., & Ben-Akiva, M. (2002). Generalized random utility model. *Mathematical social sciences*, *43*(3), 303–343.
Wall, R. (2006). Psychological and contextual influences on travel mode choice for commuting.
Washbrook, K., Haider, W., & Jaccard, M. (2006). Estimating commuter mode choice: A discrete choice analysis of the impact of road pricing and parking charges. *Transportation*, *33*, 621–639.
Webb, J. (2019). The future of transport: Literature review and overview. *Economic analysis and policy*, *61*, 1–6.
Westin, R. B., & Gillen, D. W. (1978). Parking location and transit demand: A case study of endogenous attributes in disaggregate mode choice models. *Journal of Econometrics*, *8*(1), 75–101.
Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5). sage.
Yu, J., & Cooper, H. (1983). A quantitative review of research design effects on response rates to questionnaires. *Journal of Marketing research*, *20*(1), 36–44.
Yu, Z., Feng, Z., Jiang, K., Huang, Z., & Yang, Z. (2020). Riding personal mobility vehicles on the road: An analysis of the intentions of chinese users. *Cognition, Technology, Work*, *22*, 801–814.
Zhou, J. (2012). Sustainable commute in a car-dominant city: Factors affecting alternative mode choices among university students. *Transportation research part A: policy and practice*, *46*(7), 1013–1029.

A

Interview questions

Naam:
Leeftijd:
Afstand woon-werk:
Functie:
Soorten diensten:

1. Hoe reis je nu van huis naar werk en waarom?
2. Hoe vaak doe je dat?
3. Wat is je motivatie om dit vervoermiddel te gebruiken?
4. Bij speciale dienst: hoe reis je dan naar werk en waarom? Welk van deze vervoermiddelen gebruik je wel/niet en wat is je motivatie om het wel/niet te gebruiken.
5. Als ik reis met de auto dan doe ik dat omdat:
6. Als ik reis met de fiets, dan doe ik dat omdat:
7. Als ik reis met het OV, dan doe ik dat omdat:
8. Wat vind je naast bovengenoemde factoren belangrijk bij het kiezen van je vervoermiddel naar je werk?

Fit behoeften en middelen

9. Vind je de huidige alternatieven (fietsplan en regio OV abbo) aansluiten op jouw behoeften? Waarom wel, waarom niet?
10. Zou een (elektrische) fiets een oplossing zijn? Waarom wel, waarom niet?
11. Welke extra diensten zouden het gebruik van de (elektrische) fiets positief beïnvloeden?
12. Als er op Utrecht Centraal deelfietsen zijn die je gratis mag gebruiken, zou je deze dan gebruiken? Waarom wel, waarom niet?
13. Kan je uitleggen waar je tegenaan loopt indien je met de deelfiets vanaf Utrecht Centraal naar werk komt?
14. Wat is de invloed van een gratis OV abonnement op uw keuze?
15. In hoeverre vind je deze alternatieven in verhouding tot je behoeften? Waarom wel, waarom niet?
16. Vind je de nieuwe alternatieven toereikend voor alle medewerkers? Waarom wel, waarom niet?

Communicatie

17. Hoe speelt de manier van communiceren een rol in je ervaring van de alternatieven?
18. Hoe zou je de bedrijfscultuur omtrent mobiliteit omschrijven?
19. Wat vind jij een prettige manier van communiceren als het gaat om reisopties voor woon-werk verkeer? (Hoe word jij graag benaderd?)

Duurzaamheid

20. Wat doe je op het moment al aan duurzaamheid? (Biodiversiteit, afval scheiden, vega eten, etc.)
21. Wat doe jij al aan duurzaamheid in je werk?
22. In hoeverre speelt duurzaamheid een rol in je keuze voor vervoer?

B

Experimental designs

B.1. Ngene labels and code

Alternative	Attribute	Attribute label	Abbreviation of label	Attribute weight
Car	Parking fare Parking time Egress time	parkcost_car park_time_car egress_car	pcost ptime egr	b_parkcost_car b_parktimecar b_egress_car
Lease e-bike	Lease costs	costlease	lease	b_costlease
Shared bike	Number of times there was no bike available per month	nobike	nobike	b_nobike

Table B.1: Ngene syntax with labels for the attributes and attribute weights.

Design one: Individuals living 0 to 10 kilometers from work

```
?
design
;alts = car, lease e-bike
;rows = 9
;orth = sim
;model:
U(car) = b0 + b_parktimecar * park_time_car[2,4,6] + b_egress_car * egress_car[5,10,15] + b_parkcost_car
* parkcost_car[2,4,6] /
U(lease e-bike) = b_costlease * costlease[38,48,58]
$
```

Design two: Individuals living 10 to 30 kilometers from work

```
?
design
;alts = car, lease e-bike, shared bike
;rows = 16
;orth = sim
;block = 2
;model:
U(car) = b0 + b_parktimecar * park_time_car[2,4,6] + b_egress_car * egress_car[5,10,15] + b_parkcost_car
* parkcost_car[2,4,6] /
U(lease e-bike) = b_costlease * costlease[38,48,58] /
U(shared bike)= b_nobike * nobike[0,1,2]
$
```

Design three: Individuals living 30 kilometers or further from work

```
?
design
;alts = car, shared bike
;rows = 9
;orth = sim
;model:
U(car) = b0 + b_parktimecar * park_time_car[2,4,6] + b_egress_car * egress_car[5,10,15] + b_parkcost_car
* parkcost_car[2,4,6] /
U(shared bike)= b_nobike * nobike[0,1,2]
$
```

B.2. Generated experimental designs

Design one: Individuals living 0 to 10 kilometers from work

Choice situation	car.ptime	car.egr	car.pcost	lease e-bike.lease
1	2	5	2	38
2	6	10	4	38
3	4	15	6	38
4	4	10	2	48
5	2	15	4	48
6	6	5	6	48
7	6	15	2	58
8	4	5	4	58
9	2	10	6	58

Table B.2: Experimental design 1

Design two: Individuals living 10 to 30 kilometers from work

Choice situation	car.ptime	car.egr	car.pcost	lease e-bike.lease	shared.nobike	Block
1	2	5	2	38	0	1
2	4	10	4	48	0	1
3	6	15	6	58	0	1
4	4	10	2	38	1	1
5	6	15	4	48	1	1
6	2	5	6	58	1	1
7	6	5	4	38	2	1
8	2	10	6	48	2	1
9	4	15	2	58	2	1
10	4	15	6	38	0	2
11	6	5	2	48	0	2
12	2	10	4	58	0	2
13	2	15	4	38	1	2
14	4	5	6	48	1	2
15	6	10	2	58	1	2
16	6	10	6	38	2	2
17	2	15	2	48	2	2
18	4	5	4	58	2	2

Table B.3: Experimental design 2

Design three: Individuals living 30 kilometers or further from work

Choice situation	car.ptime	car.egr	car.pcost	shared.nobike
1	2	5	2	0
2	6	10	4	0
3	4	15	6	0
4	4	10	2	1
5	2	15	4	1
6	6	5	6	1
7	6	15	2	2
8	4	5	4	2
9	2	10	6	2

Table B.4: Experimental design 3

For all three the designs, the correlation was analyzed. Since the generated choice situations are orthogonal, it was expected that there was no correlation within the alternatives among the attributes. Also, the correlation between the alternatives is zero, for all designs.

C

Survey components

C.1. Introduction of survey

MAAK KANS OP ÉÉN VAN DE 5 BOL.COM BONNEN T.W.V. €25.

Geachte heer/mevrouw,

U wordt uitgenodigd om deel te nemen aan het afstudeeronderzoek 'Een reisgedrag experiment onder UMC Utrecht medewerkers'. Dit onderzoek wordt gedaan door Emma Zadeits, master student Transport, Infrastructuur en Logistiek van de Technische Universiteit Delft, in samenwerking met Pon Mobility.

Het doel van dit onderzoek is om inzicht te krijgen in de afwegingen die medewerkers van het UMC Utrecht maken tussen vervoerswijzen voor hun woon-werk vervoer. Dit onderzoek borduurt voort op de enquête die is afgenomen in 2017. Het invullen van de enquête neemt ongeveer 12 minuten in beslag. De gegevens worden gebruikt voor mijn afstudeeronderzoek en om uiteindelijk Strategie en Beleid van het UMC Utrecht te adviseren welke reisalternatieven zouden kunnen aansluiten bij de voorkeuren en behoeften van de medewerkers.

Uw antwoorden in dit onderzoek zullen vertrouwelijk blijven en het onderzoek wordt volledig anoniem uitgevoerd en de antwoorden beveiligd opgeslagen. Verder zal alleen samengevatte informatie worden gebruikt in het eindrapport, zodat individuele antwoorden niet traceerbaar zijn. Uw deelname aan dit onderzoek is geheel vrijwillig en u kunt zich op elk moment terugtrekken.

Bedankt dat u mee wil werken aan mijn onderzoek.

Als u start met de enquête gaat u akkoord met het gebruik van uw antwoorden voor mijn afstudeeronderzoek. Als deelnemer zult u een samenvatting van de bevindingen ontvangen zodra de data is verwerkt.

C.2. Graphics of choice sets

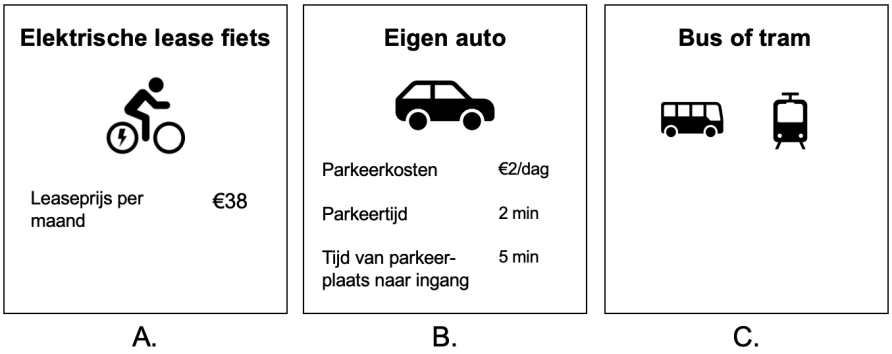


Figure C.1: Choice set for employees who live 0-10 kilometers from work

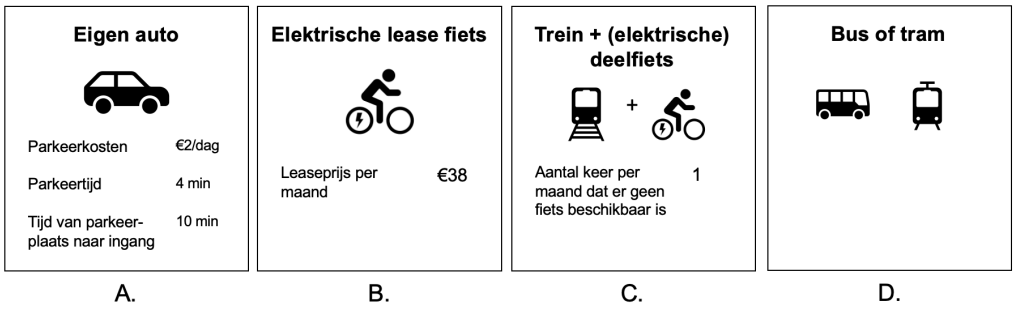


Figure C.2: Choice set for employees who live 10-30 kilometers from work

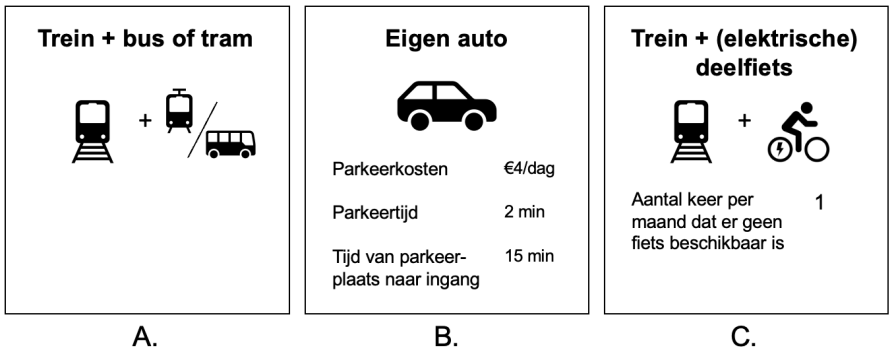


Figure C.3: Choice set for employees who live more than 30 kilometers from work

D

Coding and saturation analysis

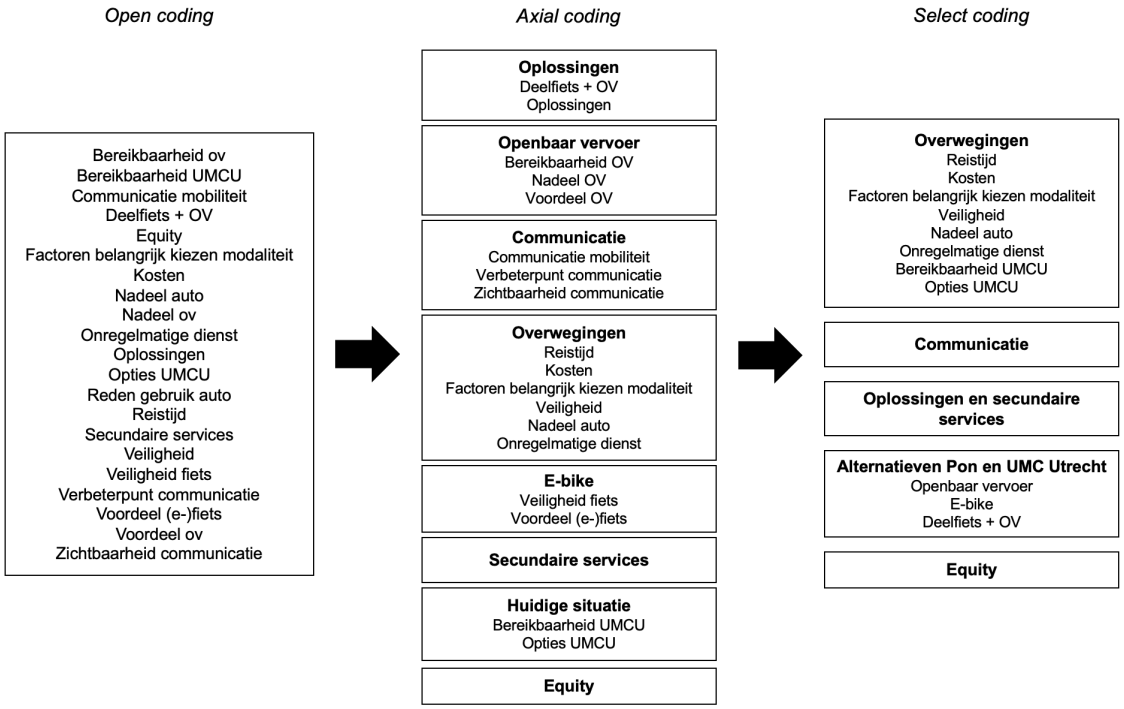
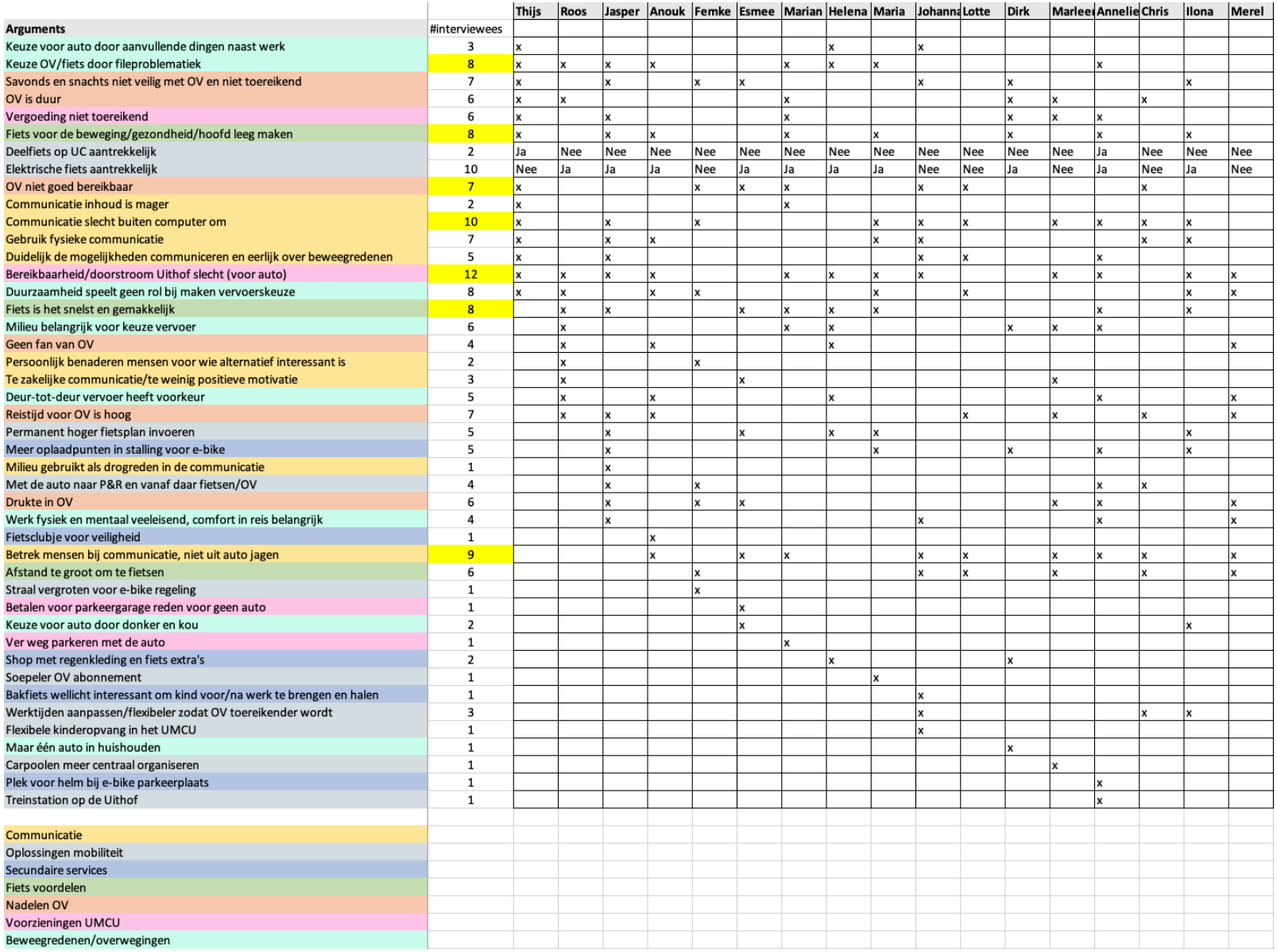


Figure D.1: Coding process in Atlas.it



Arguments	#interviewees	Thijs	Roos	Jasper	Anouk	Femke	Esmee	Marian	Helena	Maria	Johanna	Lotte	Dirk	Marleen	Annelie	Chris	Ilona	Merel
Keuze voor auto door aanvullende dingen naast werk	3	x							x		x							
Keuze OV/fiets door fileproblematiek	8	x	x	x	x			x	x	x					x			
Savonds en snachts niet veilig met OV en niet toereikend	7	x		x		x	x				x		x				x	
OV is duur	6	x	x					x					x	x		x		
Vergoeding niet toereikend	6	x		x				x					x	x	x			
Fiets voor de beweging/gezondheid/hoofd leeg maken	8	x		x	x			x		x			x		x		x	
Deelfiets op UC aantrekkelijk	2	Ja	Nee	Nee	Nee	Nee	Nee	Nee	Nee	Nee	Nee	Nee	Nee	Nee	Ja	Nee	Nee	Nee
Elektrische fiets aantrekkelijk	10	Nee	Ja	Ja	Ja	Nee	Ja	Ja	Ja	Ja	Nee	Nee	Ja	Nee	Ja	Nee	Ja	Nee
OV niet goed bereikbaar	7	x				x	x	x			x	x				x		
Communicatie inhoud is mager	2	x						x										
Communicatie slecht buiten computer om	10	x		x		x				x	x	x		x	x	x	x	
Gebruik fysieke communicatie	7	x		x	x					x	x					x	x	
Duidelijk de mogelijkheden communiceren en eerlijk over beweegredenen	5	x		x							x	x			x			
Bereikbaarheid/doorstroom Uithof slecht (voor auto)	12	x	x	x	x			x	x	x	x			x	x		x	x
Duurzaamheid speelt geen rol bij maken vervoerskeuze	8	x	x		x	x				x		x					x	x
Fiets is het snelst en gemakkelijk	8		x	x			x	x	x	x					x		x	
Milieu belangrijk voor keuze vervoer	6		x					x	x				x	x	x			
Geen fan van OV	4		x		x				x									x
Persoonlijk benaderen mensen voor wie alternatief interessant is	2		x			x												
Te zakelijke communicatie/te weinig positieve motivatie	3		x				x							x				
Deur-tot-deur vervoer heeft voorkeur	5		x		x				x						x			x
Reistijd voor OV is hoog	7		x	x	x							x		x		x		x
Permanent hoger fietsplan invoeren	5			x			x		x	x							x	
Meer oplaadpunten in stalling voor e-bike	5			x						x			x		x		x	
Milieu gebruikt als drogreden in de communicatie	1			x														
Met de auto naar P&R en vanaf daar fietsen/OV	4			x		x									x	x		
Drukte in OV	6			x		x	x							x	x			x
Werk fysiek en mentaal veeleisend, comfort in reis belangrijk	4			x							x				x			x
Fietsclubje voor veiligheid	1				x													
Betrek mensen bij communicatie, niet uit auto jagen	9				x		x	x			x	x		x	x	x		x
Afstand te groot om te fietsen	6					x					x	x		x		x		x
Straal vergroten voor e-bike regeling	1					x												
Betalen voor parkeergarage reden voor geen auto	1						x											
Keuze voor auto door donker en kou	2						x										x	
Ver weg parkeren met de auto	1							x										
Shop met regenkleding en fiets extra's	2								x				x					
Soepeler OV abonnement	1									x								
Bakfiets wellicht interessant om kind voor/na werk te brengen en halen	1										x							
Werktijden aanpassen/flexibeler zodat OV toereikender wordt	3										x					x	x	
Flexibele kinderopvang in het UMCU	1										x							
Maar één auto in huishouden	1												x					
Carpoolen meer centraal organiseren	1													x				
Plek voor helm bij e-bike parkeerplaats	1														x			
Treinstation op de Uithof	1														x			

Communicatie
Oplossingen mobiliteit
Secundaire services
Fiets voordelen
Nadelen OV
Voorzieningen UMCU
Beweegredenen/overwegingen

Figure D.2: Saturation analysis of the concepts and comments of the interviewees

E

Interview quotes

Who	Dutch quote	Translated quote
Johanna	”En ik zou ook in die zin wel willen dat ik daar duurzamer in kan zijn. Maar ja, nog steeds dat praktische is het meest overheersend.”	“I wish that I could be more sustainable for my commute, but practicality remains most predominant.”
Anouk	”Het wordt natuurlijk bedacht vanuit duurzaamheid en dat snap ik. Maar mensen die hier werken hebben eigenlijk niet zoveel met duurzaamheid te maken, zeg maar. Dat is niet hun hoofd reden om hier te komen.”	“Of course, the mobility goals are conceived from sustainability and I understand that. But people haven’t chosen this organization due to their affinity with sustainability.”
Maria	”Nee dat zal weinig impact hebben, de meeste abonnementen worden afgesloten voor de stad. Daarnaast is Utrecht Centraal voor veel niet goed bereikbaar.”	“I feel the shared bike won’t have impact, since most public transport subscriptions are taken out for the city, and the tram is a good option. Also, the journey to Utrecht Central remains cumbersome for many.”
Chris	”Ik snap dat het UMC Utrecht alternatieven bedenkt, maar ik zie niet hoe ik deze in mijn persoonlijke leven zou moeten passen”	”I don’t see how these mobility options would become part of my trip to work every day.”
Merel	”Ga niet mensen straffen die niet uit de auto kunnen komen. De zorg is al één grote leegloop, maak dat niet erger door ze uit de auto te jagen zonder er iets tegenover te zetten”	“Do not punish the employees who have no other options than the car. You can’t chase them out of the car without offering a reasonable alternative.”
Jasper	”Communicatie hangt volledig af van online berichten, terwijl een groot deel van de werknemers niet geregeld achter een computer zit en sommigen niet eens toegang hebben tot een computer.”	”In communication, there is a strong reliance on online notice, while a large share of the employees have no access to a computer or simply don’t have the time to check the posted messages.”
Lotte	”Maar als je terug kan lezen van, nou hier hebben we aan gedacht, hier hebben we naar gekeken, dit kan wel, want, dit kan niet, want. En dat er niet ergens in de managementkamer wat besloten wordt, wat dan voor ons handig zou zijn. Wat vaak niet het geval is.”	”But if you can look back and say, well, we’ve considered this, we’ve looked into this, this can work because, this can’t work because. And not have decisions made somewhere in the management room that might be convenient for them but often isn’t for us.”

Table E.1: Original and translated quotes from interviews