MSc Programme in Urban Management and Development

Rotterdam, the Netherlands

August 2020

Understanding the acceptance towards sustainable commuting in Munich, Germany

Name: Miriam Meral Ildiko MUSTÓ

Supervisor: Somesh Sharma

Specialisation: Managing Infrastructure for Green Cities

Country: Germany

Report number: 1377

UMD 16

IHS Making cities work Erasmus

Institute for Housing and Urban Development Studies of Erasmus University Rotterdam

Summary

As cities becoming the centre of global problems, urban mobility and accessibility are becoming more and more prominent in urban areas. The demand for affordable and convenient modes of transport has resulted in an increase in emissions from the transport sector worldwide, including Germany, even though the total volume of emissions has been declining over the past few years. An important contributory factor here is commuter traffic, which is responsible for a major share of traffic emissions in Germany. As the city of Munich aims to achieve emission neutrality by 2050, a change in the behaviour of the population is inevitable. And although there is indeed externally induced behaviour change, an intrinsic and self-chosen behaviour change requires accepting the significance of environmental and resource friendly transportation for commuting. To guarantee genuine change and strive for sustainable urban mobility in the long term, public acceptance towards the importance of sustainable modes of transportation is indispensable, as it represents an intermediate step between information and action.

This thesis therefore intends to examine this acceptance towards sustainable modes of transport for commuting in more detail by first determining influencing factors that emerge from the literature as relevant. These include awareness factors such as benefit and problem awareness as well as information and education about sustainable modes of transport, but also perception factors such as the symbolic status of a car and the safety and cost perception of sustainable modes of transport. In order to avoid a distortion through unequal distribution of the data in relation to socio-demographic factors, these were included as control variables. Subsequently, these factors were related to each other using a variety of statistical techniques, in particular the multiple linear regression model. Not only was the relationship between dependent and independent variables measured, but also the size, significance and direction of the influence. The statistical analysis showed that the personal characteristics of the commuters appear to play a subordinate role. According to the calculations, benefit and problem awareness as well as safety and cost perception of sustainable modes of transport compared to conventional motorised individual transport have a significant influence on the level of acceptance. Surprisingly, the variable of information and education about sustainable transport seemed to show no connection to the measured level of acceptance. The same applies to the status of the car in society as an object of prestige. The most striking aspect of the results was that the awareness factors have a positive influence on acceptance, while the perception factors have a negative influence. Roughly speaking, this means that with increasing awareness the level of acceptance increases, while with increasing perception the level of acceptance decreases.

However, this work does not provide any insight into the emergence of awareness and perception. Neither how these indicators are formed, nor their composition is revealed by this research. Furthermore, it would be of interest to investigate the influence of this measured acceptance on actual mobility behaviour. In the long term, in addition to increasing the efficiency of transport, it is above all necessary to achieve a change in the behaviour of the population. The extent to which formation and support for acceptance can help in this can be investigated in a separate study. However, promoting acceptance through policies and communication work is always advisable and can help the city of Munich to reach emission neutrality by 2050.

Keywords

Urban mobility, sustainable commuting, acceptance towards sustainable commuting, sustainable travel behaviour

Acknowledgements

I would like to take this opportunity to thank all the people who in one way or another have contributed decisively to the success of this work, either through knowledge and expertise or by providing emotional support.

Special thanks go to my supervisor Somesh for his countless tips and his professional input. His enthusiasm was contagious at times and provided a constant repository of vigour in times of demotivation.

Thanks to my fellow alumni for the fun distraction and laughter. Despite the local separation in the last few months, I would hardly have survived without them.

To my partner for keeping my spirits up with good food and for being an endless source of patience and encouragement, both morally and statistically.

And especially to my family for their unwavering support in all my decisions and for enabling me to pursue my educational journey.

Abbreviations

IHS	Institute for Housing and Urban Development Studies
SDG	Sustainable Development Goals
GHG	Greenhouse Gas
MIV	Motorized Private Transport
EU	European Union
PT	Public Transport
TPB	Theory of Planned Behaviour
VIF	Variance Inflation Factor

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

1.1 Background information and problem statement

Due to the strong population growth and additional urbanization, cities are increasingly becoming the centre and focus of global problems. According to the European Environment Agency (2019) the transport sector accounted for the largest share of greenhouse gas emissions in Europe with 27 % in 2017 and increased by 2.2 % compared to 2016. Since mobility and transport, as the foundation of our society and economy, shape the quality of public life, the European Commission has published its White Paper in 2011, in which the European goal of a 60 % reduction in emissions compared to 1990 is set for the year 2050 (European Commission, 2011). The enormous economic, ecological and social benefits that sustainable transport can generate for a society demonstrate the importance of national and international organisations and funds (Ardila-Gomez and Ortegon-Sanchez, 2016). Since the publication of their Sustainable Development Goals (SDG) in 2015, the UN, too, has set a new focus on the transport sector. Access to safe, affordable, available and sustainable transport systems should be ensured for everyone, special attention should be given to people in vulnerable situations (United Nations, 2015).

Although overall greenhouse gas (GHG) emissions in Germany were reduced by about 31 % between 1990 and 2018, they increased in the transport sector. With a share of 18.4 %, the transport sector is the third largest emitter of greenhouse gases in Germany. Road transport is responsible for 96 % of these emissions, with passenger cars accounting for almost 61 %. Policy measures to reduce emissions in the transport sector include increasing energy efficiency, switching to low-emission vehicles and fuels and shifting traffic to low-emission modes of transport such as public transport, walking and cycling, and new mobility concepts like carsharing (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2019).

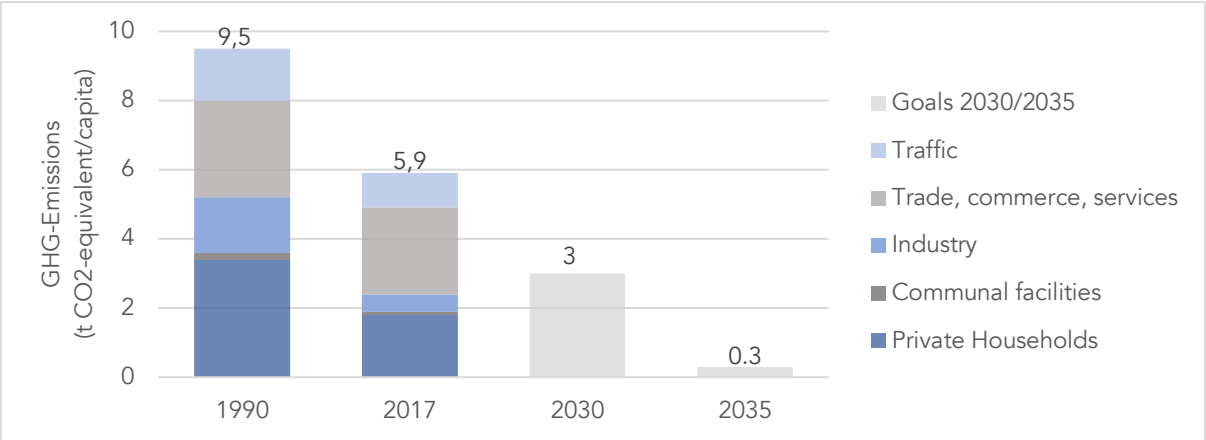

Figure 1: GHG-emissions by sectors in Munich (Hauf, 2020)

Between 1990 and 2017, overall GHG emissions in Munich have been reduced by about 38 % - with 18.4 %, traffic again accounts for the third largest share (Hauf, 2020). In addition to traffic avoidance and traffic-reducing urban planning, a municipal action strategy to reduce Munich's emissions in the area of transport primarily involves traffic reduction through behavioural change. Apart from the expansion of public transport, conditions must be established for shifting traffic to cycling and walking (Referat für Gesundheit und Umwelt, 2018). In addition to traffic-reducing urban planning by expanding climate-neutral alternatives, the City of Munich is attempting to reduce traffic through behavioural changes by educating

and involving citizens in planning processes (Referat für Gesundheit und Umwelt, 2018). On its way to the 2050 emission neutrality target, Munich has set its own sub-goals, which can be seen in figure 1 (Hauf, 2020). GHG emissions still need to be decreased drastically in order to meet the aspired targets.

The figure below presents the modes of transport that are used inside the city, in the area covered by public transportation and the sub-urban area (Landeshauptstadt München, 2020b). When combining the light grey and dark grey parts that represent motorised private transport (MIV), as driver or passenger, it is noticeable that they account for the largest share. This can have major implications for society and individuals at different levels.

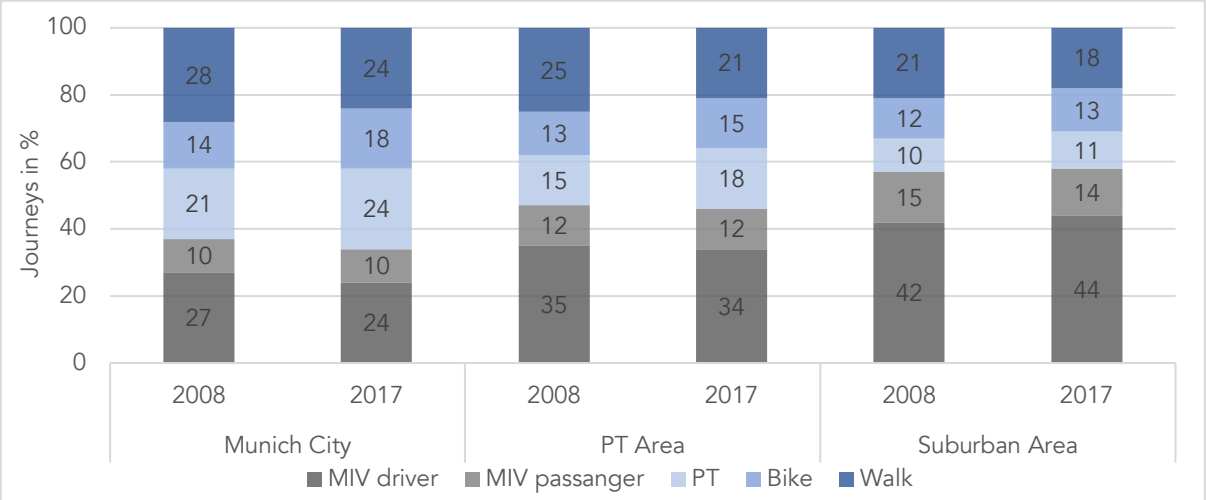

Figure 2: Modes of transportation used in Munich (Landeshauptstadt München, 2020b)

A majority of these journeys involve work or education related trips. To comprehend the meaning of commuting traffic, it needs to be clarified that commuting is to be seen as a component of travel behaviour. The purpose of travel is understood as the reason for a journey - besides leisure and shopping, the way to work or educational institution is also an important point in the subdivision of travel purposes. In order to better understand mobility and travel behaviour, it is necessary to consider the different purposes of travel. Not only is it useful to determine when a person leaves the house and what mode of transport he or she is using, but also why they leave the house. Differentiating the traffic volume and the choice of transport mode according to the purpose of the journey thus represents an important planning parameter (Lenz et al., 2010).

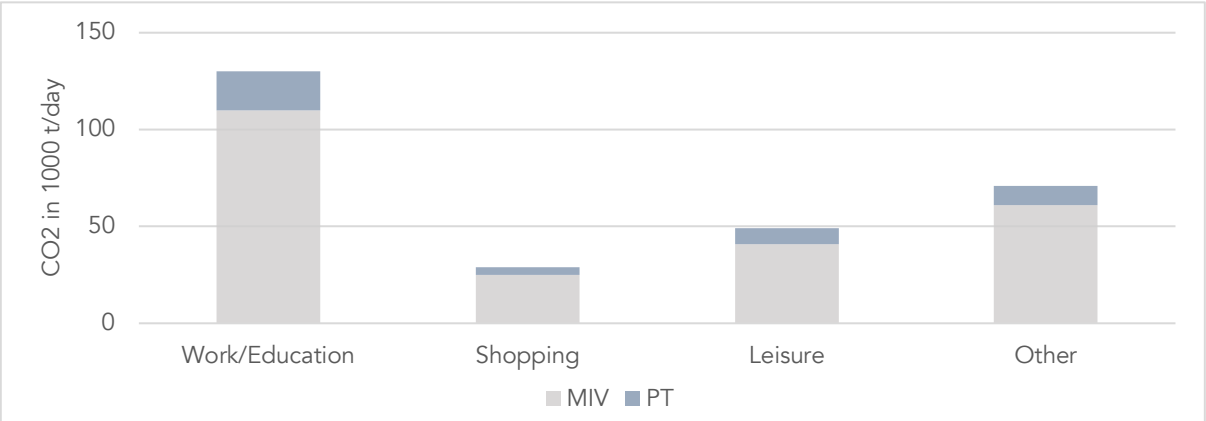

Figure 3: Modes of transportation used in Germany per purpose (Ahrens et al., 2013)

The share of commuter traffic in the overall traffic volume is steadily increasing, mainly due to rising employment levels in relation to a declining population (Follmer and Belz, 2019). Moreover, factors such as precarious employment, other forms of job flexibility and specialisation in the labour market, increasing motorisation and the modernisation of transport infrastructure favour and strengthen the share that commuting holds in the transport sector (Guth et al., 2011). Between 2000 and 2015, commuter volumes in Munich increased by over 20 % (Horn et al., 2018). This is often attributed to the German labour market reforms in the 2000s, which impose requirements in terms of regional mobility as an explicitly reasonable demand on those who are unemployed (Bundesagentur für Arbeit, 2017). With short-term and uncertain employment conditions, the willingness to adapt the place of domicile when transferring from one employment to another is also declining. It should also be emphasised that not only commuter volumes themselves, but travel time is increasing (Fina et al., 2018).

Figure 3 shows the carbon emissions in the transport sector by mode and travel purpose in Germany. Quite clearly, commuting to work and educational institutions is responsible for almost half of all emissions from passenger transport, although it accounts for only about 34 % of all journeys (Ahrens et al., 2013). The choice of transport mode for commuting can thus be seen as one of the biggest day-to-day decisions on emissions that each of us faces (Timperley, 2020). Nevertheless, measures for a modal shift among commuters have not proved particularly successful in recent years (Cass and Faulconbridge, 2016).

Our modern mobility is increasingly associated with negative effects on the environment, noise, accidents and congestion problems, which not only generate high economic costs (Becker, 2011). Besides enormous environmental pollution caused by current traffic systems, it can also generate many additional problems. According to the Umweltbundesamt (2019b), the urban area used for traffic in Germany increased since 1992, and in 2017 approximately 5 ha per day were consumed for traffic purposes. It is not only urban land that is being used intensively, furthermore the country's primary energy consumption depends on the transport sector for about a quarter of its total energy consumption, which is tending to rise (Umweltbundesamt, 2019b). Moreover, there are always mental and physical health consequences of excessive traffic. In addition to short-term stress and immense time losses due to traffic congestions, hearing damage, cardiovascular diseases, high blood pressure and heart diseases are possible long-term consequences of chronic noise pollution (Umweltbundesamt, 2019b). These long-term consequences for the environment and the physical and mental health of the population must be weighed up and addressed in traffic planning. Despite the scientifically proven consequences and damage to people and the environment caused by motorised private transport, questions arise as to the extent to which these effects are recognised and a transition to environmentally friendly forms of mobility is accepted. According to Horn et al. (2018), a sustainable mobility policy can only succeed when commuter traffic is taken into account and should offer appealing alternatives to the private car in addition to active control measures. New offers can therefore help to regulate traffic and steer it towards a sustainable mobility system, but it is crucial that offers are first perceived and accepted in order to be utilised in the long run.

1.2 Relevance

So far, the literature and urban transport policies have focused strongly on travel behaviour and behaviour change in order to meet certain climate-related goals. To change people's behaviour towards a more environmentally friendly solution it is important to first understand the reasons behind their behaviour.

While profit maximisation still is the main focus in the economy, the desire for sustainable mobility is gaining importance in society and should be embraced in societal dimensions (Banister, 2008). According to Banister (2008), the sustainable mobility paradigm implies reducing the reasons for travel and thus the number of trips themselves, switching to different modes of transport and at the same time making the transport sector more efficient. This concept is generally understood as a shift-avoid-improve approach (Perschon, 2012). The shift-approach is receiving increasing attention both in theoretical transport literature and in the practical mobility context, however, the focus is rarely on the acceptance as a basic prerequisite for behavioural change. A strong focus on the shift-avoid-improve model is also evident in Germany in its efforts to achieve an environmentally friendly and emission-neutral transport system by 2025, whereas acceptance has been neglected so far. Although there is indeed externally induced behaviour change, an intrinsic and self-chosen behaviour change requires accepting the significance of environmental and resource friendly transportation for commuting. To generate genuine change and strive for sustainable urban mobility in the long run, public acceptability is indispensable (Banister, 2008). Thus, this work aims to make an important contribution to the existing literature by further exploring this acceptance and how it emerges.

The scope of this study refers particularly to commuters in Munich and is intended to reflect as diversely and broadly as possible the degree to which they have internalised the importance of sustainable modes of transport for commuting and the factors that play a crucial role. An online questionnaire was designed to measure these views. Due to the time limit of one month for data collection in particular, an exact distribution of socio-demographic data among the respondents could unfortunately not be guaranteed. The representativeness of this study must therefore be treated with caution and cannot be applied to other contexts without further adjustments and considerations. The constant innovations of a city and its infrastructure additionally contribute to the fact that especially opinions and impressions may change quickly. The limitations of this study are discussed in more detail in chapter 3.8.

1.3 Research objective

This thesis seeks to identify future measures in urban spaces quicker by clarifying and analysing factors that determine the prevailing level of acceptance towards sustainable commuting for individuals. For this purpose, the influencing factors are first identified and then quantitatively related to each other in order to be able to map relationships between them and the level of acceptance towards sustainable commuting. More specifically, this study aims to investigate the significance of certain predictors altering the people's acceptance towards sustainable commuting in Munich. This should help to improve the general traffic situation in Munich and to contribute to environmentally friendly urban planning in the transport sector in the long run.

1.4 Preliminary research question and research sub-questions

Factors that influence the acceptance of people towards sustainable commuting can be very manifold and individual. In order to make statements beyond single persons, it is important to obtain an overview of different factors, which led me to the following preliminary research question and sub-questions:

Preliminary Research Question:

To what extent can the level of acceptance towards sustainable commuting in Munich be explained by encouraging and discouraging factors as well as personal characteristics?

Preliminary sub-research questions:

I. How can encouraging factors explain the level of acceptance towards sustainable commuting in Munich?
II. How can discouraging factors explain the level of acceptance towards sustainable commuting in Munich?
III. How do personal characteristics affect the acceptance towards sustainable commuting in Munich?

This preliminary research question and the sub-research question were modified and adapted after a thorough study of the literature. The revised research question can be found in paragraph 3.1 of chapter 3.

Chapter 2: Literature review and theory

In this chapter, the concepts used in this study will be explained and classified in more detail. This literature review aims to further link these concepts. A first step is the introduction of the concepts of travel behaviour and travel choice. These are necessary in understanding how and why behavioural change can be of societal importance and acceptance needs to be considered. Subsequently a definition of sustainable commuting as a part of sustainable travel behaviour is elaborated, in order to get a more precise impression of which transport options are considered as sustainable for commuting in the following study. Furthermore, it should be clarified what the level of acceptance refers to in this context and, finally, which factors determine it.

2.1 Travel behaviour and travel choice

A number of strategies to move towards a more environmentally friendly transport sector aim to change people's behaviour. Perschon (2012) believes that any avoid-shift-improve approach must always consider the travel behaviour of users, which according to Ken (2015), simply refers to the way people use transportation. In order to solve current mobility problems, it requires more than simply optimising technology and innovation, otherwise known as the improving aspect of the avoid-shift-improve approach (Dalkmann and Brannigan, 2007); it demands a change in people's travel behavior and thus an influence on the travel choice of people, as sustainable mobility cannot exist without a radical change in people's behavior (Perschon, 2012). Although research on people's travel behaviour commenced in the 1970s, it was not until 20 years later that the research on travel choice gained widespread attention (Pronello and Gaborieau, 2018). Furthermore, there seems to be a distinct difference between travel behaviour and travel choice (Manaugh and El-Geneidy, 2012). In their research, Manaugh and El-Geneidy (2012) found that often people did not choose their travel behaviour but were forced into a certain behaviour by mobility limitations. Hence, the distiction appears to be that for a travel choice there might be a possibility of selection, whereas the travel behaviour is not a decision, but rather a simple observation of one's conduct. Jing et al. (2018) specify travel choice as an interplay of travel mode and travel route. The objective is to achieve the highest efficiency and satisfaction of the traveler by choosing the right travel mode and travel route. Both travel choice and travel behaviour seem to play a decisive role in rendering the transport system more environmentally friendly and sustainable in the long term, as they can make their contribution to switching to a more sustainable mode of transport.

As already mentioned, work and education related traffic accounts for a major part of daily transport emissions (see figure 3). A change in travel behaviour for these routes is therefore particularly interesting and desirable. Commuting travel is often a matter of regularity, following habits rather than pragmatic decisions, such as leisure or shopping behaviour regarding the transport of luggage and suchlike. Since this work examines attitudes rather than actual behaviour, a focus on commuting can help to ensure that results do not overly depend on operational considerations.

2.2 Sustainable commuting

The following chapter seeks to illustrate the role of commuting and thus explain why the focus in this thesis is primarily on work-related and educational transport. Commuting includes journeys between home and work or educational institution that are made within 24 hours (Interplan Consultant, 2010). In Germany, commuting accounts for approximately 21 % of all passenger transport (Umweltbundesamt, 2020a). In other words, a large proportion of the population spends a considerable amount of their time commuting to and from work or educational institutions (Stutzer and Frey, 2007). In contrast to leisure travel, commuting is not a voluntary but rather a compulsory trip (Interplan Consultant, 2010) and a routinised daily activity (Cass and Faulconbridge, 2016). In 2019, 68 % of commuting journeys were made by car (Kunst, 2019), which is the main reason for daily peaks in exhaust emissions from traffic at rush hour times (Berghmans et al., 2009; Knibbs et al., 2011) and usually a significant decrease at off-peak hours and weekends (Wermelt, 2015). For a urban population, commuting is, in addition to the significant increase in emissions at rush hours, the activity that causes the highest time-loss in traffic congestions (Liu et al., 2020) and leads to a significant increase in traffic-related environmental pollution for the public (Rodt et al., 2010). Although the choice of transport to and from work or educational institutions is one of the biggest daily decisions we face regarding personal CO_2 emissions and has a huge impact on an individual's carbon footprint (Timperley, 2020), modal shift measures aimed at commuters appear to have been ineffective for decades (Cass and Faulconbridge, 2016). While it is not clear what contributed to the ineffectualness of policy measures towards commuters, these factors can be addressed by focusing on commuting in this paper and deepen the insight of commuters' attitudes. In the long run, more attention should be paid to commuters by initially examining their awareness and acceptance towards sustainable commuting.

When attempting to shape a society and leading people to forego their own habits into switching to more sustainable modes of transport, a definition for what modes of transport are understood by sustainable travel behaviour is needed first. In this work the focus is not only the general travel behaviour and its sustainability. However, since commuting is to be understood as part of travel behaviour, sustainable commuting refers to the same modes of transport as general sustainable travel behaviour.

2.3 Sustainable urban mobility

Although individual vehicles have become significantly cleaner and quieter, motorised traffic still causes multiple negative environmental impacts by emitting greenhouse gases, air pollutants and noise, as well as land use and resource consumption. In order to decarbonise transport in Munich by 2025, i.e. making it greenhouse gas neutral, strategies for achieving sustainability in the transport sector in Germany comprise four main aspects: (a) Traffic is to be avoided when possible, (b) traffic is to be shifted to environmentally friendly modes of transport, (c) energy efficiency is to be increased and (d) emission-neutral fuel or electricity is to be used (Umweltbundesamt, 2020b). While the distinction between the "avoid-reduce-improve" approach is evident (Lindfield and Steinberg, 2012), the question inevitably arises as to which modes of transport should be considered environmentally friendly and sustainable.

The literature provides different views on this issue, most of them resemble each other apart from minor details in the definition. The United Nations Rio Conference in 1992 introduced the concept of sustainability into the political and social debate - the needs of present generations should be met without compromising the ability of future generations to meet their

needs (Schade et al., 2011). Not only ecological dimensions are of interest, but also social and economic aspects. Applying this definition to the transport sector, Schade et al. (2011) define sustainability in terms of mobility needs of present and future generations that are to be satisfied in an environmentally friendly manner while being available and affordable for everyone as well as organised in an economically efficient way. For them, sustainable transport options are mainly public transport, car sharing, cycling, walking and micro-vehicles (Schade et al. 2011).

According to Xenias and Whitmarsh (2013), walking, cycling, car-sharing, car-clubs and public transport in particular should be treated as sustainable modes of transport. Similarly, Benthin and Gellrich (2017) see a significant contribution to the achievement of climate protection targets by 2050 in the shift from current transport options to more environmentally friendly modes of transport, like cycling, walking and the shared use of vehicles, for example car-sharing. For the Ministerium für Verkehr Baden-Württemberg (s.a.), sustainable modes of transport include public transport, cycling, electric cars and car-sharing. According to Vonderstein (2010), people who walk, cycle or use public transport can alleviate the burden on the roads and thus cause less noise and emissions. In urban traffic, the car causes around three times as many emissions per person over the same distance as the use of public transport, while a comparison with walking and cycling is not necessary, as these completely dispense with emissions (Vonderstein, 2010). Similarly, Zentrum für Umfragen, Methoden und Analysen (1995) focuses more on a shift away from non-environmentally friendly modes of transport and specifically describes the car as such.

Thus, the literature on the definition of sustainable modes of transport is most consistent for cycling, walking and public transport. Since car-sharing is seldom used for commuting, it is not expected to play a significant role in this research. Although user numbers for car-sharing have annually risen steadily in Germany since around the millennium, it is evident that the trips are mainly done at weekends or in the evening until night-time, suggesting that they are used especially for leisure time travel (Riegler et al., 2016). It can thus be assumed that car-sharing currently does not play a major role in commuter traffic and commuting in German-speaking countries and can therefore be neglected at this point. In this research, sustainable modes of urban transport and with that sustainable commuting modes are understood to refer to cycling, walking and public transport, which also corresponds to the official definition of the Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (2020), although cycling and walking have only been part of transport policy strategies in Germany for some years (Schwedes et al., 2016). The acceptance of these modes will therefore be the focus of this study and shall be investigated.

2.4 Level of acceptance

To answer the research questions, it is necessary to clarify what is to be understood by the level of acceptance towards sustainable commuting. As mentioned before, it is assumed that the acceptance of the significance of a cause is of the utmost importance to induce a change in behaviour (Keller, 2004). The act of changing one's behaviour can be a big leap especially if the change of behaviour is not to be achieved by one's own beliefs. Acceptance thus represents an intermediate step between information and action and simultaneously constitutes the basis for an intrinsic change in behaviour.

Somuncu (2017), for example, argues that, according to the value belief norm theory, acceptance of new environmentally friendly ideals presupposes an awareness of one's own responsibility and thus engagement in environmentally friendly behaviour. Among the most

frequently used theories regarding environmentally friendly actions is the theory of planned behaviour (TPB), which is often used to predict travel behaviour or mode choice. This theory again implies that behaviour is composed of several aspects, of which the attitude towards a certain behaviour becomes an important part. This attitude is composed of the awareness, as well as the weighing of the consequences of individual actions and strongly contributes to the intention to act (Somuncu, 2017). The attitude towards the behaviour in the TPB model thus corresponds to what Keller (2004) described as acceptance. This has also been proven from a psychological point of view. Already in 2000, Stradling et al. determined in a psychological test series that a change in behaviour is best achieved when several steps are allocated for this purpose, which particularly and most importantly include recognising and accepting their share of the problem and thus being theoretically willing to change their behaviour. As Banister (2008) noted, public acceptance can be crucial for the success of any kind of urban changes. He is convinced that, in contrast to conventional measures of superficial changes in people's behaviour, it is essential to involve all stakeholders in urban decision-making and implementation processes to not only persuade the public of the need for sustainable modes of transport, but to encourage them to internalise and embrace such sustainable paradigms (Banister, 2008). According to Widmer et al. (2000), the easiest way to achieve acceptance is through collaboration with those affected. That led to the recognition that public acceptance can be seen as a necessary requirement for growth (Devine-Wright, 2007).

What is more, Perschon (2012) believes that the acceptance of sustainable forms of mobility play a crucial role in influencing people's behaviour with regard to sustainability and the future. Zoellner et al. (2008) seem to agree on this opinion. For them, public acceptance is particularly important in order to meet possible targets, such as the climate targets of the city of Munich. Moreover, Politis et al. (2012) also believe that a change in behaviour implies that people abandon their previous habits and opt for other alternatives. They see an opportunity in explaining the discrepancy between the belief that there is an urgent need for action and the ultimate translation of this idea into reality. They refer to this gap as the level of acceptance. Acceptance, however, is not a characteristic trait of a person, but a dynamic construct that seems to be constantly changing and depending on factors that evolve over time (Arndt, 2011). Consequently, acceptance can arise out of a former rejection just as it can turn back into refusal (Arndt, 2011). In contrast to perception, which is understood as a mere experience of the environment and represents a detection and interpretation of information in the form of sensory stimuli (Williams, 2020), the level of acceptance in this context goes beyond just experiencing the surrounding, but should be understood as describing the share of personal belief that sustainable commuting can be a major contribution to solving climatic and ecological urban problems in the long term. This makes it all the more urgent for society to examine this acceptance more thoroughly in order to ascertain what causes it and what it depends on. Zoellner et al. (2008) also emphasise once again the urgency of a closer examination of acceptance. For this to be actively applied, however, it should be adaptable to dynamic and fast-changing systems. However, the influence of acceptance in relation to innovations has often been underestimated (Moula et al., 2013) and should therefore be included to a greater extent in planning processes in future. To this end, influencing factors must first be examined more closely.

2.5 Determinants for the level of acceptance

There are several approaches and views in the literature on what might have an impact on the level of acceptance towards sustainable commuting. The most important ones are described more precisely in the following.

Already in 1994, the social psychologist Schwartz (1994) noted that there are three essential factors that induce people to act in an environmentally friendly way, which are awareness of the consequences, realization of one's responsibility and personal values and norms. To go one step deeper, it is important to identify the factors that may affect not only environmentally friendly behaviour but also the attitudes and acceptance towards it. In 2010, Eliasson found out that the acceptance of traffic changes often follows similar patterns. In a first stage, depending on the project and communication, acceptance by the population is semi intensive. As soon as more details are made public, acceptance seems to decrease significantly, a phenomenon often described as 'acceptability decreases with detail'. However, as soon as the project begins, it usually also begins to slowly establish itself. He describes this phenomenon as 'familiarity breeds acceptability'. According to Eliasson (2010) there are four main reasons for this: (I) positive effects are larger than expected (II) the fear of the population that travel costs might increase for them is often unfounded (III) once a project is already underway or completed, it takes too much effort to resist the inevitable and (IV) once familiar with it, reluctance may tend to decrease. On the other hand, it is argued that the reasons for the acceptance of sustainable transport options lie more in political and administrative factors (Pridmore and Miola, 2011). Strong leadership, political consistency and the right timing are particularly important to increase the acceptance. Furthermore, Pidmore and Miola (2011) believe that in order to increase acceptance, the population must have easy access to information and education, as well as real-life examples to which they can refer in their decision- and opinion-making. In addition, a general attitude towards environmental issues, personal values and norms or the recognition of the advantages of sustainable transport seem to have an influence on acceptance (Pridmore and Miola, 2011). Waqas et al. (2018) have established for themselves that, in addition to government strategies to make sustainable transport more attractive and awareness of the existence of a transport problem, personal factors can also determine acceptance. These include, similar to Pridmore and Miola (2011) a general environmental awareness and the recognition of the advantages of sustainable modes of transport, but also to a great degree the symbolic significance of a private car (Waqas et al., 2018). Kim et al. (2013) agree on the idea that trust in government and environmental awareness in general are important factors influencing the acceptance of sustainable modes of transport. However, in their view, personal perception such as the perceived effectiveness of changing environmental conditions, as well as perceived justice and restrictions on personal freedom, also contributes significantly to the acceptance of sustainable transport. They further assume that personality characteristics can strongly influence acceptance (Kim et al., 2013). A far more personal approach is adopted by Eriksson et al. (2006). For them, personal norms and moral obligations are crucial to building acceptance towards alternative modes of transport.

What many authors seem to agree on is the assumption that a general interest and awareness of the environment seems to have a significant impact on the level of acceptance (Kim et al., 2013; Pridmore and Miola, 2011; Waqas et al., 2018). There also seems to be a further consensus among many authors: they see awareness of how the switch to sustainable commuting can have a positive impact on society, the environment and individuals as a prerequisite for a certain degree of acceptance (Kim et al., 2013; Pridmore and Miola, 2011; Waqas et al., 2018). Referring to this as a fundamental prerequisite creates the impression that a general environmental awareness alone is not enough but the focus should be on the *benefit awareness*, which will be looked at and discussed in this research.

Although Waqas et al. (2018) refer to the Chinese context, which in many respects is not easily comparable with the German context, they do have one aspect in common, namely the high status of the car as a status symbol. Although status symbols generally tend to lose their relevance among younger generations in Germany or shift from the once important car to other forms of displaying one's status (Ayberk et al., 2017), nevertheless 20 % of all Germans in 2017 indicated that for them the car still represented an important status symbol (Ahlswede, 2019). Schwedes et al. (2016) argue that automobility among young people is declining, while car use and ownership among older people still continues to increase. Since the car as part of the private motorised transport is largely seen as an unsustainable mode of transport, the *symbolic status of a car* therefore seems comprehensible and relevant in the context of this research.

Assing et al. (2010) pursue another interesting approach. For them, an essential element of acceptance with regard to changes in mobility relates to the road safety of the different transport modes; it poses an important criterion for the acceptance of a certain mode of transport. According to Perschon (2012), road deaths in our society are acquiesced as part of the existing transport system, which suggests that the perception of safety differs from the actual safety of the various modes of transport. Most accidents involving personal injury occur in towns and cities in particular during the week (Statistisches Bundesamt, 2019). According to Polizeipräsidium München (2019), a traffic accident involving personal injury occurs in the state capital approximately every one and a half hour and a traffic accident involving fatalities every 17 days. The subjective perception of safety also poses a great challenge to experts in operationalising a difficult construct, which, however, seems to be a guiding principle for human action, as it affects the perception of risk and thus also the frequency of use. The subjective desire for security thus represents an increasingly central argument for political action (Gerhold, 2020). These circumstances are of relevance to the context as well and should therefore be included in this research in the form of *perceived safety*.

Similar to Eliasson (2010), Howarth and Polyviou (2012) also describe the private cost factor as a component of the acceptance of sustainable commuting. It is particularly important to bear in mind that individuals often fail to consider the real costs when calculating transport costs for different modes of transport, but rather perceive a distorted picture that ignores the current fixed costs, especially for cars. Insurance, repair or vehicle taxes, for example, are then no longer considered as costs for the private car (Howarth and Polyviou, 2012). People estimate the cost of a car to be only about half as high as they actually are, and they put it at a similar cost level to public transport (Andor et al., 2020). However, only few people are aware of the fact that public transport costs in particular are only about 13 % of those of a private car (Andor et al. 2020; MVV, 2020). Whether and how this discrepancy between estimations and reality affects the acceptance of sustainable modes of transport will be investigated in the form of *perceived costs* instead of actual costs, as it can therefore make a valuable contribution to clarifying acceptance.

Another approach that many authors seem to agree on is the assumption that information about more environmental-friendly alternatives and education about environmental issues related to transport emissions and commuting play an essential role in the acceptance of sustainable commuting as subitem of the travel behavior itself. According to Perschon (2012), for example, acceptance of innovative and sustainable forms of mobility should be promoted more vigorously. This can be easiest achieved through a learning process and targeting information. Although there are many differences in the positions that information and education occupy, it seems clear to most authors that without them there can be no intrinsic change in either acceptance or behavior (Eriksson et al., 2006; Kim et al., 2013; Pridmore and Miola, 2011; Waqas et al., 2018). What Eliason (2010) referred to by the expression 'acceptability decreases

with detail' therefore no longer seems to be applicable in the light of current and relevant research on this particular topic. Due to the unanimity of a large number of authors in this point, *information and education* should also be included in this research.

Already in 1968 Hardin described the tragedy of the commons. Applied to this context, the short-term personal benefit of commuting by car outweighs the long-term social damage caused by the own actions. Only by changing perspectives and recognizing the problem no longer only as an individual but as a society, this tragedy can be overcome (Hardin, 1968). Another supposition that is shared in the literature is that this exact awareness of general problems related to the transport sector, particularly in connection with motorized private transport, can contribute to a level of acceptance towards sustainable commuting (Kim et al., 2013; Schlag and Schade, 2000; Waqas et al., 2018). This *problem awareness* is relevant in many ways and should therefore also be examined in this research.

Although socio-demographic factors are rarely mentioned in the literature, the distribution of the population according to different social and economic criteria seems to be a potential approach to explain the differences in acceptance. In 2013, the Bayerische Staatsregierung noted that sustainable mobility must also take appropriate account of demographic change and must increasingly include people with disabilities, families with children or older people. It is thus assumed that socio-economic and demographic characteristics can provide at least a partial explanation of how environmental awareness and behaviour can be developed. This assumption is supported by Politis et al. (2012), who say that the level of acceptance varies from person to person. Since according to them socio-economic and demographic factors are also particularly noteworthy (Politis et al., 2012), personal characteristics, such as age, income, state of health, trip length and suchlike shall therefore be considered in the following and serve as control variables.

Only by understanding what causes acceptance towards sustainable commuting, it can help to improve our understanding of environmental problems in general, and thus to address and solve them systematically.

2.6 Conceptual framework

The figure below illustrates the considerations of the interrelationships in this study. The theories and concepts from the literature review were compiled in a conceptual framework. It is assumed that the level of acceptance towards a more sustainable way of commuting is influenced by various factors. As discussed, the literature suggests that the following are of particular importance:

The literature clearly confirms that motorized individual traffic causes a variety of problems. The concept of *problem awareness* is therefore an assessment of the extent to which people are aware of the negative effects of the current mobility system. A further aspect can be found in the awareness of how strongly a sustainable mobility system can have a positive effect on one's own life and, above all, on the long-term environment and for society. This can be described by the *benefit awareness*. According to the relevant literature, the amount and quality of information that is available and accessible in relation to an alternative transport concept is also an important basic element for acceptance and is described in more detail by the concept of *information and education*.

While these three reflect an awareness of actual aspects, the perception factors are more related to personal opinions and impressions that people perceive on different aspects. These include

an assessment of how expensive and safe sustainable transport is compared to motorized individual transport, described as *safety perception* and *cost perception*. It is not important how accident-prone or expensive they are in fact; rather, the measurement is about mapping people's perceptions and pointing out the extent to which these perceptions differ from reality. While these realities are theoretically measurable using concrete spendings or accident statistics, the importance of the private car as a symbolic status and prestige object in society cannot be measured quantitatively that easily. This indicator, therefore, in turn reflects the respondent's own perception of it and describes on a personal level how much the respondent values the *car as a status symbol* and how much prestige they believe to generate by owning a car.

The differing approaches and views on acceptance towards sustainable commuting from the literature seem to share the common characteristic that they can be divided into awareness factors and perception factors and therefore will be treated as sub-variables. Again, awareness involves determining how conscious people are of their environment. Thus, the focus is not only on their impressions alone, but also on their consciousness of the reality. In contrast, perceptions are mainly about the personal opinions that people have, regardless of the prevailing academic consensus or statistical evidence. The assumption behind this is that various awareness and perception factors may explain the general environmental awareness and the level of acceptance towards sustainable commuting, which, as already mentioned, can ultimately help to stimulate behaviour change. As it can be seen in figure 4, the awareness and perception factors represent the independent variables, which are assumed to be able to explain the level of acceptance as dependent variable. Each of these factors separately has already been used in the literature and has been shown to influence acceptance towards sustainable travel behaviour and therefore sustainable commuting as well. This study aims to show, however, which indicators are applicable in the specific context of Munich and contribute with a renewed combination of those indicators.

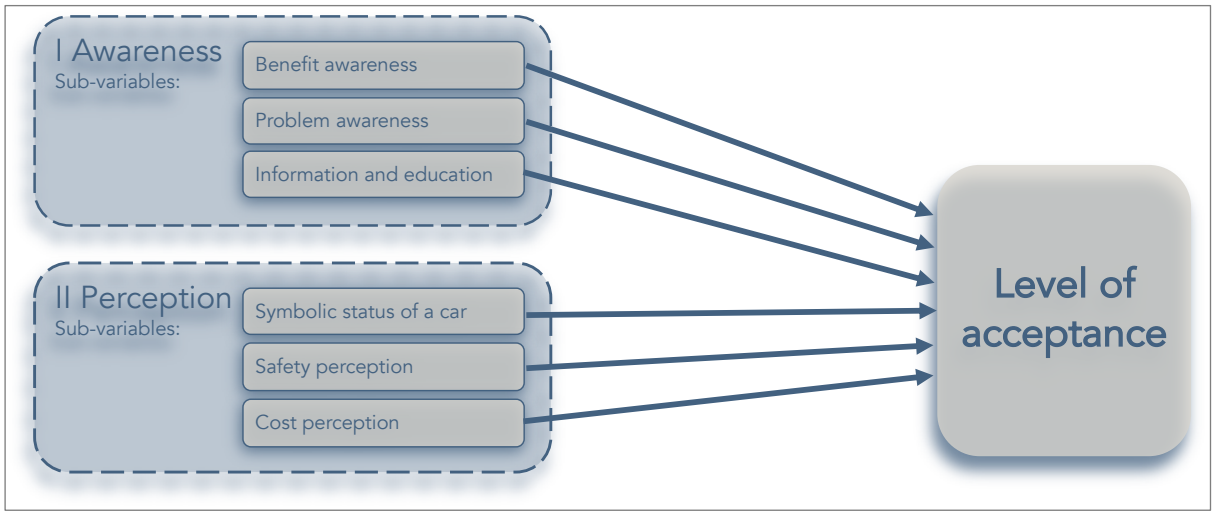

Figure 4: Conceptual framework (Author, 2020)

Chapter 3: Research design, methods and limitations

This chapter provides an overview of the research method and strategy applied in order to link the previous two chapters and apply them in the further course of the study. The research strategy is introduced first. In order to apply it, the variables from the research question and the conceptual framework must be provided with measurable indicators and translated from the theoretical level to a practical layer. Subsequently, the data collection method is presented, which will be used in the further process. It is not only the collection itself that is important, but also a clear idea of how the sample is to be composed and produced, and how the data collected will be analysed. Finally, in this chapter, validity and reliability will be examined and evaluated in more detail, thus also highlighting limitations.

3.1 Revised research question

After a profound examination of the existing literature, it became evident that a revision of the research question was required. Therefore, the research question and the sub-questions have been adapted to the following:

Revised Research Question:

To what extent is the level of acceptance towards sustainable commuting in Munich explained by different awareness and perception factors?

The following sub-questions should help to answer the main research question:

I. What is the current level of acceptance towards sustainable commuting in Munich?

II. How do awareness factors explain the level of acceptance towards sustainable commuting in Munich?

III. How do perception factors explain the level of acceptance towards sustainable commuting in Munich?

3.2 Research strategy

The research question tries to shed more light on the acceptance of commuters in Munich towards sustainable modes of transport. Since there is no in-depth study on this topic available yet and therefore no secondary data, a primary data collection is necessary. Since the independent variables are mainly personal impressions, assessments, perceptions and feelings that cause varying degrees of acceptance among people, a survey is most useful and appropriate. In order for the results of this study to be generalisable, so that the statements can be applied to a greater context, a large number of samples is required, which are best collected by an online survey. The survey thus represents the main research strategy in which quantitative data will be collected through empirical research and aims to guarantee external validity. In this case, the total examined population refers to commuters in Munich, i.e. a large share of the total population in Munich. In order to be able to generalise statements about this large population and to ensure that the sample consists of enough responses, an online questionnaire will be carried out. A cross-sectional approach based on probability-based multiple method sampling will be applied, in which a specific group, in this case the commuters, will be interviewed at the same time (Van Thiel, 2014). When designing a questionnaire, it is also advisable to investigate whether other authors have already examined similar questions using

a questionnaire, which can and should be used for orientation. In general, however, in written questionnaires the formulation of closed questions is preferable to open questions, which also considerably facilitates the analysis (Bortz and Döring, 2007).

3.3 Operationalization

The tables below summarize the most relevant variables, indicators and their values in which data collection should be carried out. In this study mostly the concept of sustainable travel behaviour was adopted to explain the level of acceptance towards the importance of sustainable travel behaviour, which can be seen in the first part of the table below. Subsequently, the three theories are listed, which represent the independent variables, which are awareness and perception factors with their respective sub-variables. The following concepts should help illuminate and better understand the concept of acceptance.

The commuters characteristics describe different socio-demographic aspects of the respondents, such as their age, income or educational level, and serve as a control variable. Control variables are regarded as controlling variables, as they are not the focus of research, but could nevertheless influence a relationship and should therefore be included in any research (Bortz and Döring, 2007).

It is important to clarify how acceptance can be measured. Since these are not numerable observations, but rather impressions, emotions and thought constructs, they can be quantified using a Likert scale. From the literature it is clear that the measurement of acceptance is best performed using a 5-point Likert scale based on the theory of planned behaviour (TPB) (Khoo and Ong, 2015). In particular, it is important to find out to what extent respondents believe that the use of sustainable modes of transport for commuting can make a significant contribution to the reduction of environmental issues and can therefore be an important step to hinder climate change. Environmental impacts refer to different areas of ecology, examples are air and noise pollution, carbon emissions or land consumption (LaRue et al., 2015).

The independent variables awareness factors will be measured by describing the respondents' awareness using a 5-point Likert scale. It is important to find out how aware people are of the effects of the current mobility system and the advantages of an alternative mobility system. The awareness factors also include an impression of how well-informed people feel about sustainable transport. A last set of variables, the independent variables perception factors, are intended on the one hand to show how important the car is as a status symbol, both in terms of the importance for oneself and the importance of the car in one's environment and society, and on the other hand to show the safety and cost perception of sustainable modes of transport in comparison to conventional modes of transport such as the private car.

Table 1: Operationalisation of the dependent variable (Author, 2020)

Concept	Variable	Definition	Sub-Variable	Indicator	Value	Source
Acceptance	Level of Acceptance	share of personal belief that sustainable commuting can be a major contribution to solving climatic and ecological urban problems in the long term.		intention to use sustainable transport options	five-point Likert scale from "strongly angree" to "strongly disagree"	Arndt (2011) LaRue et al. (2015) Liu et al. (2015) Polis et al. (2012) Xiang et al. (2017)
				importance of motorized reduction from an environmental point of view	five-point Likert scale from "strongly angree" to "strongly disagree"	
				General environmental concern	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Generl willingness to make personal sacrifices for the environment	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Awareness of the importance of sustainable commuting for batteling climate change and other great urban problems	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Importance of commuting in transport emmisions	five-point Likert scale from "strongly angree" to "strongly disagree"	
				role of cycling for commuting regarding urban solutions	five-point Likert scale from "strongly angree" to "strongly disagree"	
				role of walking for commuting regarding urban solutions	five-point Likert scale from "strongly angree" to "strongly disagree"	
				role of cars for commuting regarding urban solutions	five-point Likert scale from "strongly angree" to "strongly disagree"	
				role of public transport for commuting regarding urban solutions	five-point Likert scale from "strongly angree" to "strongly disagree"	

Table 2: Operationalisation table for personal characteristics (Author, 2020)

Concept	Variable	Definition	Sub-Variable	Indicator	Value	Source
	Personal characteristics	distribution of the population according to different social and economic criteria		age	15 to 24 25 -34 35 - 44 45 - 54 55 - 65	Bayerische Staatsregierung (2013) Polis et al. (2012)
				gender	female identifying male identifying divers identifying Prefer not to reply	
				Household structure	Single, no children Single, children Living with partner, no children Living with partner, children Shares apartment Living with family	
				educational level	Secondary school Middle Maturiy University Qualification Bachelor Master PhD	
				income level	< 1,000 1,000 - 2,000 2,000 - 3,000 3,000 - 4,000 >4,000 Prefer not to reply	
				Occupation	Pupil Student Self-Employed Employed In Aprenticeship	
				car ownership	Yes, I own a car No, I don't own a car but I can use one of my family member No, I don't own a car and I can not use one	
				bike ownership	Yes No	
				Public transport transcription	None Weekly Monthly	

Table 3: Operationalisation table for awareness factors (Author, 2020)

Concept	Variable	Definition	Sub-Variable	Indicator	Value	Source
Sustainable Commuting	Awareness factors	factors that show the peoples' awareness towards different aspects of sustainable commuting	Benefit awareness	Awareness of the positive influence that STB can have on congestion	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Awareness of the positive influence that STB can have on mental health	five-point Likert scale from "strongly angree" to "strongly disagree"	Kim et al. (2013)
				Awareness of the positive influence that STB can have on physical health	five-point Likert scale from "strongly angree" to "strongly disagree"	Pridmore and Miola (2011)
				Awareness of the positive influence that STB can have on accidents	five-point Likert scale from "strongly angree" to "strongly disagree"	Waqas et al. (2018)
				Awareness of the positive influence that STB can have on air quality	five-point Likert scale from "strongly angree" to "strongly disagree"	
			Problem awareness	Awareness of congestion due to current traffic situation	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Awareness of the global impact that the current traffic situation has due to emissions	five-point Likert scale from "strongly angree" to "strongly disagree"	Khoo and Ong (2012)
				Awareness of the mental health problems due to the current traffic situation	five-point Likert scale from "strongly angree" to "strongly disagree"	Kim et al. (2015)
				Awareness of the danger of accidents due to the current traffic situation	five-point Likert scale from "strongly angree" to "strongly disagree"	Lindfield and Steinberg (2012)
				Awareness of the amout of time lost due to the current traffic situation	five-point Likert scale from "strongly angree" to "strongly disagree"	Schlag and Schade (2000)
				Awareness of the amout of land-use due to the current traffic situation	five-point Likert scale from "strongly angree" to "strongly disagree"	Waqas et al. (2018)
				Awareness of physical health problems due to traffic emissions	five-point Likert scale from "strongly angree" to "strongly disagree"	
			Information and education	Recognition of the amount of available information regarding STB	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Recognitionof the quality of available information regarding STB	five-point Likert scale from "strongly angree" to "strongly disagree"	Eriksson et al. 2006) Kim et al. (2003)
				Recognitionof the comprehensibility and clarity of available information regarding STB	five-point Likert scale from "strongly angree" to "strongly disagree"	Perschon (2012) Waqas et al. (2018)
				Recognition of difficulty to acquire information regading STB	five-point Likert scale from "strongly angree" to "strongly disagree"	

Table 4: Operationalisation table for perception factors (Author, 2020)

Concept	Variable	Definition	Sub-Variable	Indicator	Value	Source
Sustainable Commuting	Perception factors	factors that show the attitudes towards different aspects of sustainable commtuing	Symbolic status of a car	personal valuation of the symbolic importance of the car	five-point Likert scale from "strongly angree" to "strongly disagree"	Ahlswede (2019)
				Perception of the importance of the car as a status symbol for the society	five-point Likert scale from "strongly angree" to "strongly disagree"	Waqas et al. (2018)
			Safety percepti	Perception of safety of cycling	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Perception of safety of car use	five-point Likert scale from "strongly angree" to "strongly disagree"	Assing et al. (2010)
				Perception of safety of walking	five-point Likert scale from "strongly angree" to "strongly disagree"	Perschon (2012)
				Perception of safety of public transport use	five-point Likert scale from "strongly angree" to "strongly disagree"	
			Cost perception	Perception of costs of cycling	five-point Likert scale from "strongly angree" to "strongly disagree"	
				Perception of costs of car use	five-point Likert scale from "strongly angree" to "strongly disagree"	Eliasson (2010)
				Perception of costs of walking	five-point Likert scale from "strongly angree" to "strongly disagree"	Horwath and Polyviou (2012)
				Perception of costs of public transport use	five-point Likert scale from "strongly angree" to "strongly disagree"	

3.4 Data collection method

This research tries to gain an insight into the motives of commuters, how acceptance is formed and what influences it. For this purpose, it is important to include as many individuals of a society as possible and not only to show single impressions and opinions. The population size of the survey therefore includes every Munich resident who regularly commutes to work, school, university or any other educational institution. Since the number of residents would exceed the time, financial and effort capacities of this study, a representative number of people will be used as a sample instead. The distribution within the sample should be similar to the distribution of the whole population.

Figure 5: Districts of Munich (Dörrbecker, 2007)

Due to time and financial constraints, the most obvious way to conduct the survey will be an online questionnaire. It provides a fast, cheap and easy way of dispersing the survey. The online questionnaire will be shared and distributed on all common social media platforms and forums. Furthermore, the questionnaire will be sent to family members and friends with the request to spread it in the manner of a snowball system. Another way of distributing the questionnaire widely will be to divide the city into districts (see figure 5), in each of which 5 streets will be randomly selected using the random generator in Excel (see table 5). A letter with an access link and a QR-code will be thrown into the mailbox of every 5th house in the street. This should guarantee the social mix of the sample and include people of all generations, social classes and levels of digitality. The questionnaire will be accessible online via the qualtrics platform provided by the Erasmus University and will be available for one month.

Table 5: Selected streets for Questionnaire Distribution (Author, 2020)

District	Street 1	Street 2	Street 3	Street 4	Street 5
Altstadt-Lehel	Salvatorstraße	Paradiesgartenweg	Deroystraße	Heiliggeiststraße	Gabelsbergerstraße
Ludwigsvorstadt-Isarvorstadt	Linprunstraße	Marsstraße	Kaufingertor-Passage	Landschaftstraße	Maderbräustraße
Maxvorstadt	Dillisstraße	Alfons-Goppel-Straße	Josephstraße	Elisabeth-Kohn-Straße	Karmeliterstraße
Schwabing-West	Bonner Platz	Eisenacher Straße	Moltkestraße	Lüneburger Straße	Gernotstraße
Au-Haidhausen	Hängebrücke	Eggernstraße	Schmedersteg	Innsbrucker Ring-Tunnel	Isarweg
Sendling	Allmannshausener Straße	Brunecker Straße	Daxenbergerstraße	Passauerstraße	Dietramszeller Platz
Sendling-Westpark	Narzissenweg	Ehrwalder Straße	Rappenseestraße	Barmer Straße	Lilienweg
Schwanthalerhöhe	Wredestraße	Sandstraße	Trappentreutunnel	Wredestraße	Holzapfelstraße
Neuhausen-Nymphenburg	Merxmüller-Weg	Reiche-Weg	Anita-Augspurg-Allee	Prinzenstraße	Hartliebstraße
Moosach	Peter-Müller-Straße	Weishauptstraße	Kerbelweg	Gutenbergstraße	Am Hartmannshofer Bächl
Milbertshofen-Am Hart	Alois-Wolfmüller-Straße	Wilhelm-Raabe-Straße	Harthofanger	Sonnleitnerstraße	Schneeheideanger
Schwabing-Freimann	Wundtstraße	Ladenburger Straße	Berzeliusstraße	Werner-Egk-Bogen	Krautwieselweg
Bogenhausen	Kronstadter Straße	Rößeler Straße	Bayreuther Straße	Johann-Straub-Weg	Marienburger Straße
Berg am Laim	Frauenalplweg	Kreillerstraße	Dachsteinstraße	Haffstraße	Oderstraße
Trudering-Riem	Leisnerweg	Jankstraße	Helenenstraße	Pilatusstraße	Vallettastraße
Ramersdorf-Perlach	Imma-Mack-Weg	Leifstraße	Carlo-Schmid-Straße	Berger-Kreuz-Straße	Flossenbürger Straße
Obergiesing-Fasangarten	Albanistraße	Hohenschwangauplatz	Ruhestraße	Grünwalder Straße	Ruhestraße
Untergiesing-Harlaching	Vierheiligstraße	Wilhelm-Kuhnert-Straße	Deisenhofener Straße	Siebenbrunner Straße	Feuerbachstraße
Thalkirchen-Obersendling-	Holzhausener Straße	Josef-Schwarz-Weg	Rappenseestraße	Gasparistraße	Strähuberstraße
Forstenried-Fürstenried-Solln	Allgäuer Straße	Hunkelestraße	Humpelstraße	Argelsrieder Straße	Bleicherhornstraße
Hadern	Hahndorfer Straße	Kapruner Straße	Eichhornstraße	Ehrenfelsstraße	Silberblattstraße
Pasing-Obermenzing	Feichthofstraße	Verdistraße	Zaunerstraße	Vohburger Straße	Batzenhoferstraße
Aubing-Lochhausen-Langwied	Teufelsbergstraße	Riesenburgstraße	Apfelkammerstraße	Grabenstraße	Marzellgasse
Allach-Untermenzing	Hochmuttinger Straße	Gröbenzeller Straße	Prälat-Höck-Bogen	Höcherstraße	Schrämelstraße
Feldmoching-Hasenbergl	Auf den Schrederwiesen	Reigersbachstraße	Grashofstraße	Eberhartstraße	Marderstraße
Laim	Ettenhueberstraße	Lechfeldstraße	Bernabeistraße	Palestrinastraße	Kreuzeckstraße

In order to further encourage participation, a straightforward and user-friendly version of the online portal was chosen. The remarks and suggestions from the pilot study were gratefully accepted and incorporated into the final version of the questionnaire. Precise instructions are always given before and during the questionnaire itself. In addition, a prize draw among all participants was intended as a further incentive to partake in the survey.

3.5 Sample size

This study is particularly concerned with people who frequently undertake similar journeys to work or educational institutions. Therefore, the population size does not consist of all residents of Munich.

The publication of the Annual Economic Report of the (Landeshauptstadt München, 2019) shows that in 2018 the employment rate in Munich was 65.7 %, the highest in major German cities, with an overall upward trend. This employment rate describes the proportion of people aged between 15 and 65 who are subject to social security contributions and are marginally employed, regardless of whether they work part-time or full-time (Landeshauptstadt München, 2019). This age group should therefore also represent the population size. The current population size in Munich is approximately 1.56 million inhabitants according to the Landeshauptstadt München (2020a). About 66 % of them are in the so-called commuting age group, i.e. between 15 and 65 years, which corresponds to a population size of about 1.03 million people (Statistische Ämter des Bundes und der Länder, 2018). The formula used

$n \geq N/(1 + \frac{(n-1)*\varepsilon^2}{z^2*P*Q})$ for calculating the minimum necessary sample size indicates the desired size of the sample (Mossig, 2012). With a population size of 1.03 million people, a 5 % margin of error, .5 standard deviation and a 95 % probability of certainty, this results in a sample size of ideally 384 people. However, due to severe time constraints regarding the collection of data, this goal could not be met in its entirety. Over a period of four weeks, 312 responses were

gathered, with over 100 additional questionnaires started but not terminated. After cleaning the data with regard to control questions and consistency of the answers as well as examining the frequency and traveled distance per week for work and educational purposes, the final sample consisted of 304 responses, representing about 80 % of the desired goal.

3.6 Data analysis method

The data generated by the online questionnaire was available in quantitative form and can be further evaluated using the SPSS statistics program. Invalid responses were deleted, for instance, questionnaires that were detected and sorted out due to the control questions. These were deliberately included to ensure that participants were reading carefully and completing the questionnaire conscientiously. Furthermore, those that did not fall into the age group of 15 to 65 years were also excluded. The data was then evaluated and interpreted using descriptive and inferential statistics.

Of relevance here were simple t-tests for variables with two groups and f-tests and single factor ANOVAs for variables with more than two groups to check mean and variance differences, and where appropriate post-hoc tests to gain deeper insight into the comparisons (Field, 2009). A special focus is also placed on the correlation coefficient according to Pearson, before moving on to the final regression models, which are the core of this work, to determine the significance of certain indicator variables for a particular criterion. Especially with large sample sizes such as this one, a multiple linear regression model by cross validating the weights is the optimal method for addressing the research question (Bortz and Döring, 2007).

Since this research model involves one dependent and several independent variables, the best method for finding the appropriate predictors is a multiple linear regression (Hemmerich, 2020). For this purpose, first descriptive and then inferential statistics will be applied. A data inspection on population mean and standard deviation for ordinal variables help to make sure that the data set follows the normal distribution, which serves as a basis for several following statistical procedures. Inferential statistical analysis helps to ascertain the systematology of the relation and influence between the variables (Van Thiel, 2014). The evaluated data will be presented in written form with the support of figures, graphs and tables.

3.7 Validity and reliability

The **external validity**, meaning whether or not results can be generalized to a broader context (Broniatowski and Tucker, 2017), will be supported by a mixture of different methods of distributing the questionnaire. Moreover, the feedback from my peers, supervisors and teachers help to ensure the validity. A further improvement of the validity is the implementation of a pilot study, which will be carried out for five peers prior to the publication of the questionnaire. The representativeness and generalizability of this study depends on a broad representation of the society through a sufficient sample size. Since the share of the population with access to internet in the age group considered is over 95 % (Verband Internet Reisevertrieb, 2020), a disadvantage or exclusion from the study due to lack of internet access can be largely ruled out and can therefore be neglected. This additionally supports the assurance of external validity. According to Lütters (2013) research there is no significant difference in external validity

between online and paper-pencil surveys. This view is also held by Nolden (2008), who found no difference between online and offline surveys, neither in validity nor in reliability.

According to Van Thiel (2014), the correct operationalisation of variables is the most important and effective way to strengthen **internal validity**. Internal validity in this case refers to the extent to which the data actually describes what it should measure (Broniatowski and Tucker, 2017). A pilot study will help to find out whether the questionnaire covers what should be researched. Building on that, a questionnaire should measure not only what the researcher is trying to measure, but also what the literature suggests for this particular scenario. Whether the data collected really correspond to the state of the art in the literature is described by construct validity. This is especially important if a study is to fit into existing theories and research and wants to contribute to those (Broniatowski and Tucker, 2017). In this case, intensive examination of the current scientific research, which served as a basis for the design of the questionnaire, ensures this.

Reliability is a strong indicator of the quality of a questionnaire and is often referred to as replicability (Rammstedt, 2004). It can be assured best by using control questions, which refers to asking certain questions in the questionnaire several ways using different formulations (Van Thiel, 2014). These control questions seek to ensure respondents' attentiveness by identifying those replies that did not match the control questions exactly contrary to the usual answer pattern, so-called click-throughs (Niklas, 2014). In addition to control questions, the online questionnaire tool also offered the possibility of displaying items in a randomized sequence. Thus, the sub-questions always remain the same, but the order in which they are presented changes from respondent to respondent. This should exclude answer tendencies due to the sequence. In addition, answering tendencies like social desirability are also reduced by control items and are generally lower when conducting a questionnaire online, since respondents seem to feel less influenced by the researcher and tend to answer more honestly. Instructions, simple and unambiguous formulations and prior testing of the questions will also contribute to a stronger reliability.

3.8 Challenges and limitations

As already mentioned, the biggest challenge will be to ensure external validity. This should be counteracted by mixing different methods of distributing the questionnaires. With the precautions already mentioned above, it can be assumed that the external validity of this work can be secured.

Another difficulty may be that due to the overload of online surveys, the non-response rate can be high. In the simplest case, this can be remedied by a reminder that is sent out after some time (Van Thiel, 2014). In addition to non-responses, not only can the choice of answers to online questionnaires be made not according to one's own opinion but also according to what the respondents consider socially desirable. This bias is attempted to be eliminated through control questions. In addition to these substantive challenges, this work is confronted with the fact that there is only a limited amount of time to gather and prepare the data.

A new and unforeseen limitation in this study were be the changed circumstances caused by the ongoing pandemic, which not only put the conduct of the questionnaire to the test but may also have an impact on how people perceive, assess and evaluate the issue of transport. In order to prevent this, precise and detailed instructions for the questionnaire were given to the respondents before it is carried out. In addition, the questions were asked in such a way that

people do not report on their current commuting behaviour but are encouraged to think about their previous behaviour and perception and answer the questions with these impressions.

A further unforeseeable limitation arose after the data had been collected and evaluated. With a clear majority, mainly people who identify as men participated in this survey. According to Yetter and Capaccioli (2010), the number of male responses is often predominant, at least for online questionnaires. However, as it quickly becomes apparent after starting to analyse the data, there is no significant difference between the genders in their attitudes on acceptance. Although there is a strong overrepresentation of male participants, this does not seem to have any effect on the generalisability of this study.

In this thesis the main focus is on regression models that test assumptions regarding the mutual causal relationships. However, in statistical research, there is also the possibility of additionally testing hypotheses for latent relationships by means of a structural equation model. The main difference to regression models is that several causal hypotheses can be considered simultaneously (Weiber and Mühlhaus, 2014). For practical and time reasons, however, this type of analysis could not be applied here; since a structural equation model, by contrast, examines the causal relationships of several variables simultaneously, the execution of several regression equations can approximate this process.

Chapter 4: Presentation of data and analysis

4.1 Sample description

4.1.1 Commuters characteristics

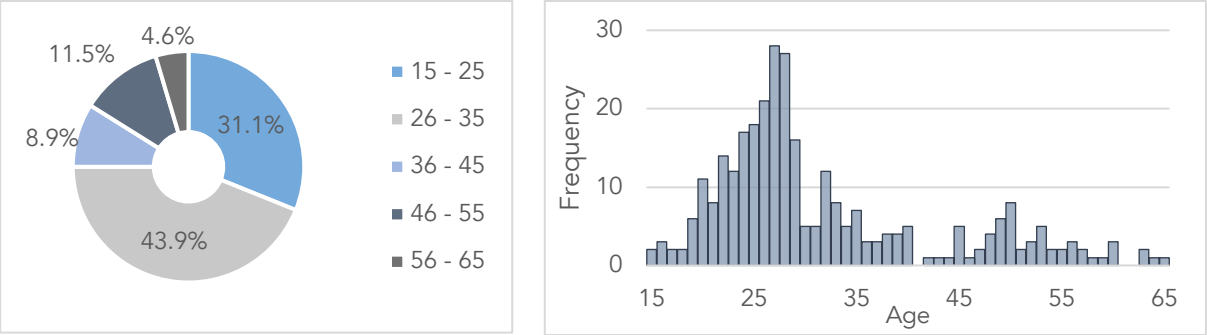

Figure 6: Age distribution by groups and individual age structure of the sample (Author, 2020)

Since the aim of this study is to illustrate the acceptance towards the importance of sustainable modes of transport for commuting, the respondents should be aged between 15 and 65 years and should have a regular way of commuting in Munich. With a mean age of 31.7 years and a standard deviation of 11.07, respondents appear to be rather young, although a broad distribution of the data can be expected (see table 6, Annex 4). For greater clarity, the age was divided into groups of 10 years each, which can be seen in figure 6. It is apparent that the group of 26 to 35-year-olds accounts for the majority of respondents (43.9 %). Looking at the individual age structure, an average age of 28 to 32 years is shown (see figure 6), depending on whether the median or the mean value is considered, both being relatively similar. As for the distinctive distribution of age, there is no consistent opinion in the literature about the age distribution of online surveys (Yetter and Capaccioli, 2010). It is noticeable that people between the ages of 15 and 35 account for 75 % of respondents, making the age distribution highly inequitable. Beyond a general internet affinity of younger people, there may be a far more obvious reason behind it. It appears to be obvious that personal distribution and circulation of the questionnaire constitute a large part of the participations which explains the age focus. Chapter 4.2 will clarify whether this results in a distortion of the study.

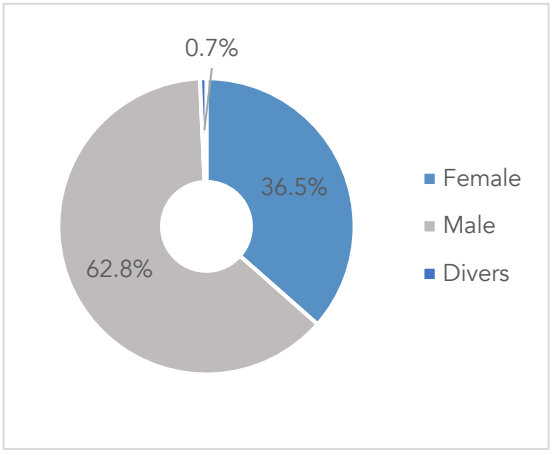

Figure 7: Gender identification distribution of the sample (Author, 2020)

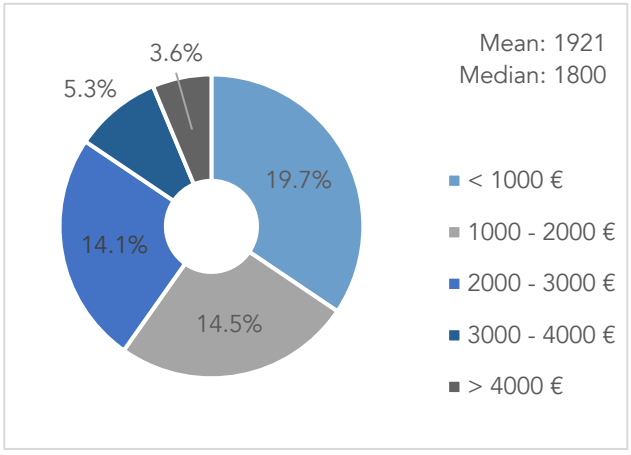

Figure 8: Income distribution by groups of the sample (Author, 2020)

More than 63 % of the respondents identified themselves as male, only 37 % said they identified themselves as female, and not even 1 % preferred the gender identification divers for themselves (see figure 7). One striking aspect is the large difference in the gender identification distribution, which raises the question of why the majority of the participating people are male identifying. While according to Yetter and Capaccioli (2010) paper-pencil questionnaires do not indicate that either gender is more likely to participate in surveys, the situation is different for online questionnaires, which are generally more likely to be completed by male identifying people. While there is no precise explanation for this, theories suggest that female identifying people are less self-confident when confronted with online media (Yetter and Capaccioli, 2010). However, it is questionable whether this explanation is sufficient in this case and can explain such a disproportion. More likely, this bias was caused by the way data was collected and represents a randomness. Chapter 4.2 will thus examine whether there is a difference in the level of acceptance between the groups in order to clarify if a gender bias must be assumed in this context.

Monthly income after tax has been divided into groups for greater clarity. These are illustrated in figure 8. It is noticeable that the largest group is made up of those with an income below 1,000 €, while the mean and median differ considerably. This indicates the existence of individual outliers which somewhat distort the pattern. It must also be mentioned that this particular question due to the private information was labelled as voluntary and was therefore only answered by 57 % of the respondents. A reliable statement about the acceptance pattern in different income groups can therefore presumably not be given, but a more detailed analysis can be found in chapter 4.2. The average interviewed person is thus an approximately 30-year-old, employed man whose highest education is a university qualification diploma. He lives with a partner and no children, has a monthly income of 1,900 € and, in addition to his own bike, has no public transport subscription and does not own a car (see table 6, Annex 4).

The personal characteristics also include the modes of transport used for work or education. It is particularly interesting to see how frequently different modes were used and what distances were covered. To reflect the average trips, respondents were given the choice of options that they regularly use for commuting (see figure 9). 62 % of the respondents stated a frequent use of public transport, while 48 % of the respondents regularly use the bike to commute. A surprisingly large number of people (28 %) also use walking as a way of commuting, while the car is the least frequently used mode of transport, only 20 % indicated a frequent use.

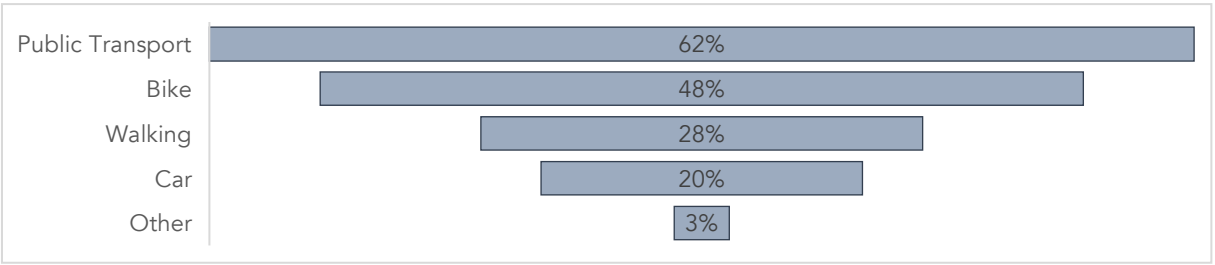

Figure 9: Frequently used modes of transport for commuting (Author, 2020)

However, it is not solely interesting which modes of transport people use to commute, but also the frequency with which they travel, and how far. The weekly frequency of each mode of transport was indicated between 0 and 15 times. For the weekly distance, options between 0 and 200 km were given.

Although public transport is a mode of transport indicated by the majority of people regularly commuting (see figure 9), figure 10 reveals that the most common mode of transport used for commuting is the bike. In the analysis, the frequency of use of each mode of transport per week of all respondents was first examined, and then only those who indicated that they used the

particular mode of transport. In addition to a better assessment, the number of people who reported using the respective mode of transport is also shown. Among all users of bikes, they are used on average 6 times a week for commuting whereas public transport is used 5.4 times a week. The use of a car and walking occur slightly less frequently.

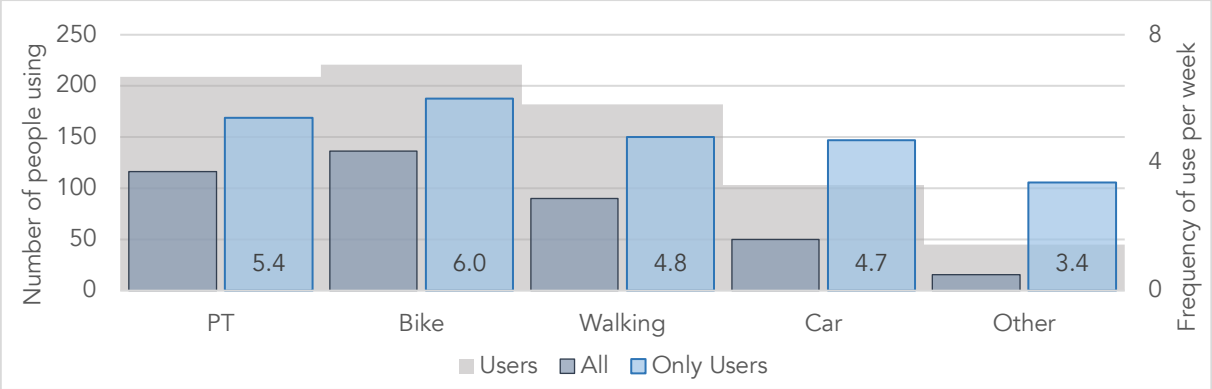

Figure 10: Frequency of different modes of transport for commuting (Author, 2020)

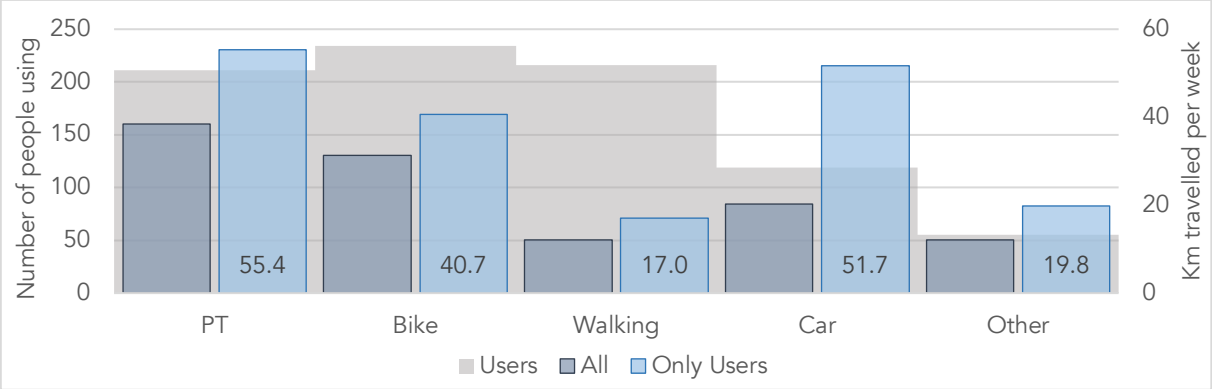

Figure 11: Distance travelled of different modes of transport for commuting (Author, 2020)

Figure 11 displays the average number of km travelled by each mode of transport. Again, a distinction is made between all respondents and the users of the respective mode of transport. Although the car is not used most commonly, it is the mode of transport with the most km travelled among users after public transport. While the total number of km covered by bike is significantly higher among all respondents, the average distance covered by bike users is only 40.7 km per week, while the average distance covered by car users is 51.7 km per week. This is due to the fact that considerably fewer people indicated the car as a mode of transport and if so, the distances covered are further. The literature shows that about 50 % of inner-city car routes are shorter than 5 km and could therefore easily be replaced by a bike (Statistisches Amt der Landeshauptstadt München, 2019). Unsurprisingly, the shortest distances are travelled on foot, both among those who said they walked and among all respondents.

4.2 Level of acceptance description

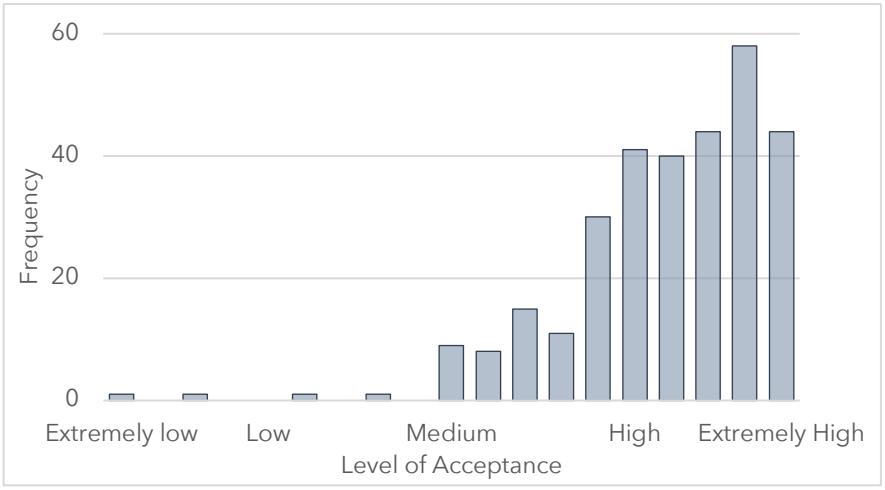

Figure 12: Distribution of the level of acceptance (Author, 2020)

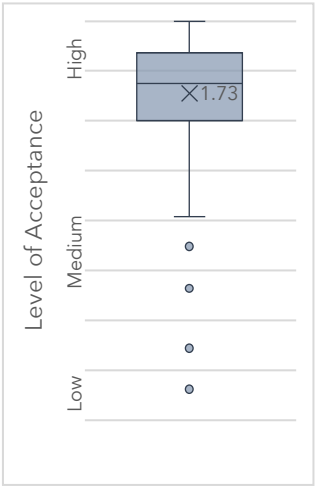

Figure 13: Boxplot for the level of acceptance (Author, 2020)

The components from the operationalisation table were measured using a 5-point Likert scale. Questions asked can be seen in Annex 3 and focus on a personal environmental responsibility and the role of commuting traffic. In addition, the potential willingness to abstain from travelling by car in order to contribute to the environment was measured, as well as a general opinion on how sustainable and environmentally friendly different modes of transport were seen. A further key aspect was to determine to what extent the role and importance of commuting in the transport system was considered to be, since this research specifically focuses on the acceptance of sustainable modes of transport for commuting. The items evolved from the operationalisation table and were measured by agreement using a Likert scale, while 1 corresponds to strong agreement and 5 to no agreement. It should be noted, however, that control variables were measured in exactly the opposite way, i.e. they had to be adjusted and reversed afterwards. To ensure that these items all measure the same thing and can be easily combined into one variable, a Cronbach's alpha test was performed before combining them. The Cronbach's Alpha is used to determine the internal consistency (Moosbrugger and Kelava, 2012). While the values of a Cronbach's Alpha always range between 0 and 1, there is no exact threshold value (Schecker, 2014), however, a value of at least .50 is suggested to be used in this context. For the items of acceptance, the test shows a value of .912 and is therefore very internally consistent (see table 9, Annex 4). The consent of a total of 20 items were then combined and computed into one variable using a mean value, which serves as the basis and focus of the model and this study. It captures respondents' attitudes towards the importance of integrating sustainable and environmentally friendly modes of transport into urban mobility.

As shown in figures 12 and 13, the level of acceptance towards sustainable modes of transport for commuting is generally high in Munich. The average level of acceptance is 1.73, while 1 indicates the highest level of acceptance possible and 5 the lowest. The mean value is thus situated near the lower third and indicates a very distinct level of acceptance. Figure 13 shows with a boxplot that mean and median are quite close and indicates a narrow distribution of the data with the exception of a few downward outliers. With values between 1 and 4.69 (standard deviation .54) the data indicates a narrow distribution (see table 8, Annex 4). By means of the Shapiro-Wilks test, the normal distribution of the dependent variable was checked (see table 10, Annex 4). A significance of p = .000 for all three awareness factors indicates a rejection of the null hypothesis of the normal distribution, which means that a normal distribution cannot be assumed. However, according to Field (2009), since it often happens with large sample sizes

that the Shapiro-Wilks test generates a significant value although a normal distribution is present, this is additionally subjected to a visual inspection on the basis of figure 30 (Annex 4); which too does not show a normal distribution of the data. Although the normal distribution is often considered a condition for a regression analysis, it should not be assumed to be a mandatory condition for a large sample size (Lumley et al., 2002).

Taking the level of acceptance differentiated by gender identification, the answers hardly differ between those identifying as men and women while they share the overall acceptance mean of 1.73 (see table 8, Annex 4). Merely persons who identify as diverse show slightly increased acceptance at 1.33, whereby only two units of study are available here making the result uncertain. As mentioned earlier, it was important to determine whether a gender bias reflects a distorted acceptance. Since mean, median and standard deviation of both male and female identifying people hardly differ, it can be assumed that the unequal distribution of the gender identifications in the sample has no effect on the result.

The largest age group in this study consists of people aged 26 to 35 years (see table 6, Annex 4). Following the age group 56 to 65 years (1.79), as it can be seen in figure 14, they show the lowest average acceptance at 1.78. The highest level of acceptance can be found among the age group 46 to 55 years (1.55), followed by the age group 36 to 45 years (1.66). The youngest participants in this study, aged 15 to 25 years, are thus placed right in the midfield with a level of acceptance of 1.73 and correspond to the mean of the entire sample. As can be seen from the boxplot in figure 15, all age groups show a similar level of acceptance and narrow distribution of the data, there are only a few outliers visible.

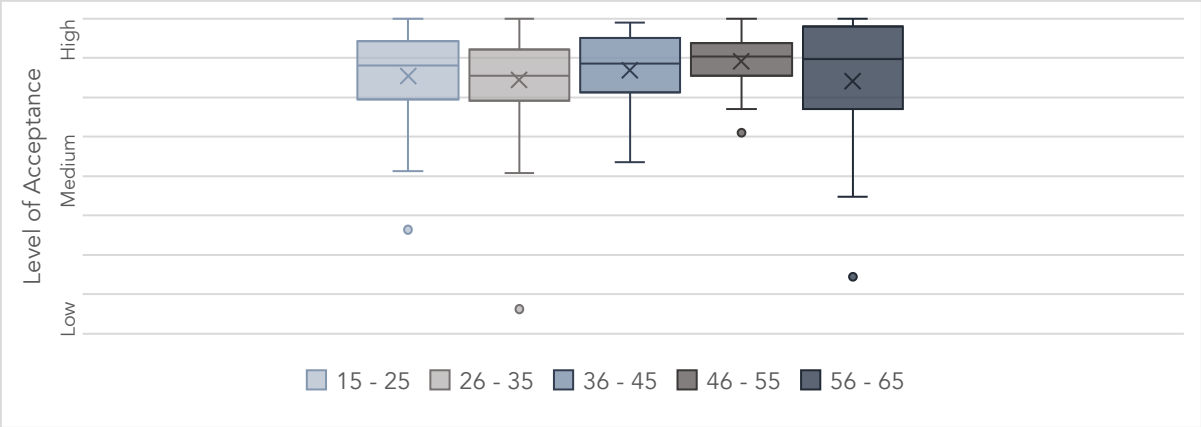

Figure 14: Boxplot for acceptance by age groups (Author, 2020)

Comparing the level of acceptance within different educational groups, it becomes apparent that education alone cannot explain acceptance (see table 8, Annex 4). There seems to be no clear relation between level of education and acceptance. At 1.50, the highest level of acceptance can be found among people with a secondary school education (SecSchool), while the lowest level of acceptance can be found among those with a middle maturity (MidMat) with a mean of 1.78. Hence, individuals with an university qualification (UniQual) (1.75) or a Bachelor's degree (1.75) are in the lower middle range with lower acceptance than those with a Master's degree (1.68) or a Diplom (1.68). When looking at the distribution in figure 15, it is noticeable that acceptance seems to be independent from the educational level. The distribution of the data in the box plot shows that in all groups the data seems to be more closely related, only University Qualification and Diplom show few outliers downwards. The level of acceptance is most broadly distributed among those persons who do not fall into this educational classification.

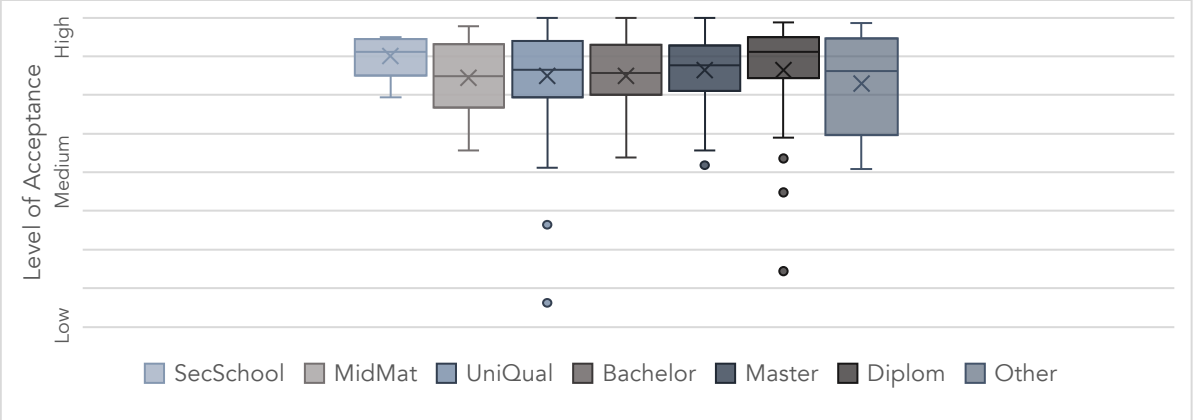

Figure 15: Boxplot for acceptance by educational groups (Author, 2020)

As mentioned above, the question of income was only answered by 57 % of respondents. Nevertheless, when looking at table 8 (Annex 4), it is striking that the highest level of acceptance occurs in the group with the lowest income of less than 1,000 € per month (1.54). Among those who provided information on their income, acceptance is lowest among those with a monthly income between 3,000 and 4,000 € (1.75), followed closely by those with a monthly income between 1,000 and 2,000 € (1.69) and over 4,000 € (1.68). Individuals with an income between 2,000 and 3,000 € (1.59) are in the middle range of the observations. In the group which did not provide any information on their income, however, acceptance seems to be lowest at 1.87. The box plot in figure 16 shows that the acceptance of all income groups is very near to each other and shows little dispersion. The broadest distribution occurs among those groups that have not provided any information on their income, in addition two outliers can be seen here.

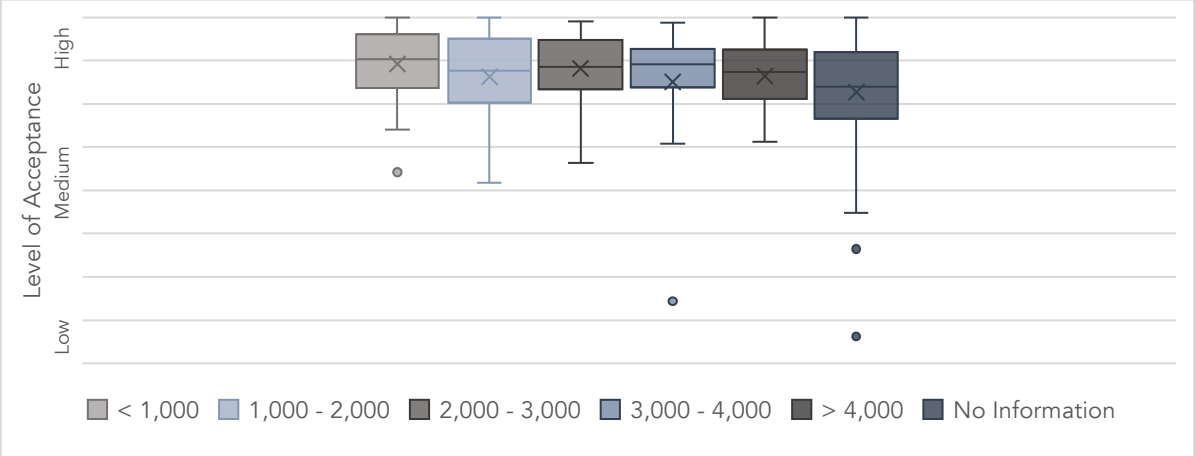

Figure 16: Boxplot for acceptance by income groups in Euro (Author, 2020)

It is striking that the level of acceptance among those who claimed to own a car is significantly lower (1.94) than among those without a car of their own (1.60) or only access to a car by friends or family (1.63) (see table 8, Annex 4).

Besides the superficial comparisons of the mean values in this chapter, a step further is to be taken in chapter 4.4.1. First impressions, which could be gained here, will not only be compared by eye, but will be statistically tested to compare groups with each other and to test their mean values and variances statistically for homogeneity.

4.3 Independent variables description

4.3.1 Awareness factors

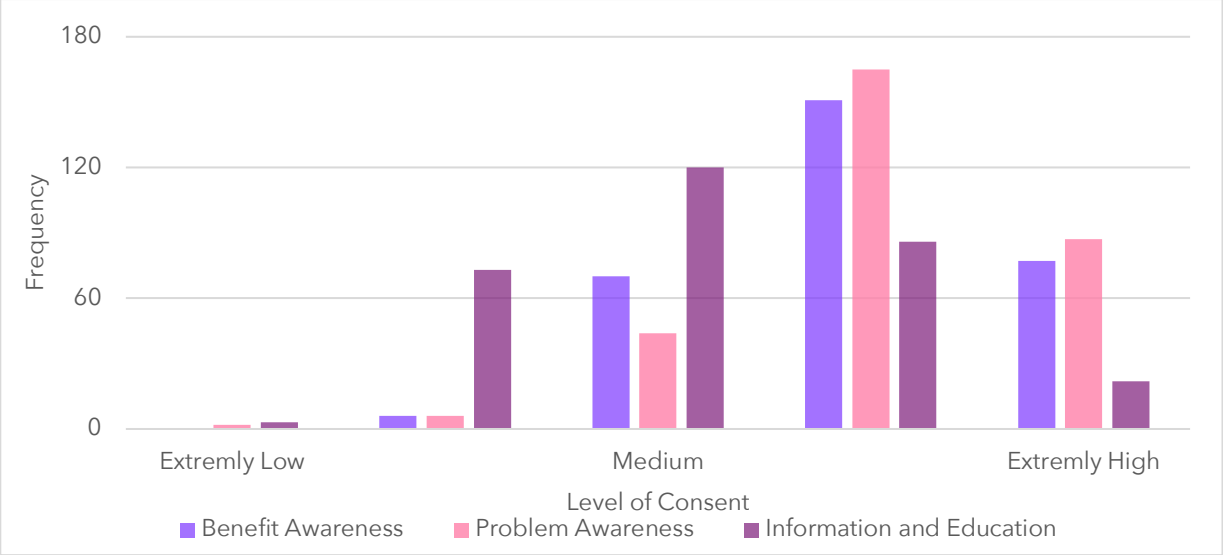

Figure 17: Distribution of awareness factors (Author, 2020)

Awareness factors studied include understanding and consciousness of the benefits that a greener transport system can provide to the city and quality of life for individuals, awareness of the problems that the current transport system poses and how well and comprehensively respondents feel informed about a sustainable and environmentally friendly transport system. Respondents were measured from 1 to 5, with 1 representing an extremely high level of consent to statements that tested the awareness of these aspects and 5 representing an extremely low level of consent to those statements. Individual items measured by a Likert scale were tested to determine whether they measured the same thing. In Annex 3 it can be seen which questions were considered for an item and were then tested using the Cronbach's Alpha Test to see if they actually show internal consitancy. Those combinations with a value above .50 were computed to a new variable using a mean value. For benefit awareness, this value of .655 is close to the lower limit; problem awareness and information and education variables proved to be well chosen with values of .811 and .900 and can be computed as new variables (see table 9, Annex 4). Figure 17 shows that the distribution of benefit and problem awareness follows a similar pattern, while information and education seem to differ slightly in its consent.

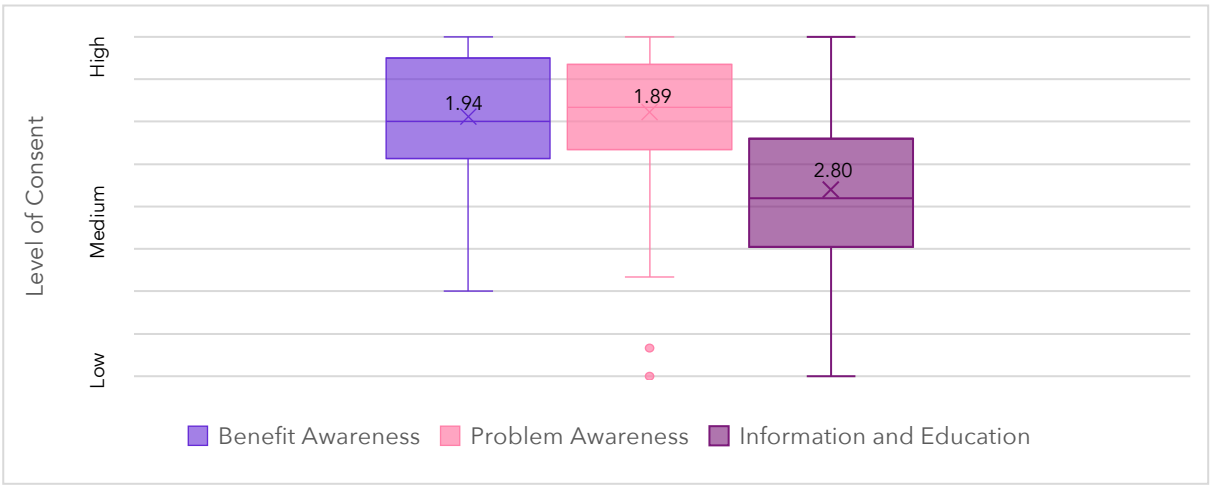

Figure 18: Boxplot of awareness factors (Author, 2020)

Although problem awareness is slightly higher, the mean values of 1.94 (standard deviation .66) for benefit awareness and 1.89 (standard deviation .66) for problem awareness are also quite close and indicate a narrow distribution of the data (see table 7, Annex 4). However, the level of information and education is significantly lower. The mean value here with 2.80 and the distribution of the data (standard deviation .883) suggest that respondents feel only moderately informed about sustainable travel behaviour and commuting.

The data for the independent variables benefit awareness, problem awareness and information and education were then tested for normal distribution (see tables 10, Annex 4). For all three variables, the Shapiro-Wilks test shows a strong significance of p = .000, thus the null hypothesis of normal distribution must be rejected. The histograms (figure 20, Annex 4) also show that there is no normal distribution. As already mentioned, these variables can nevertheless be used in further calculations, since a normal distribution for a sample of this size is no longer a prerequisite (Lumley et al., 2002). The box plots in figure 18 indicates that there are only a few outliers, while the data is distributed more broadly for information and education than for benefit and problem awareness.

4.3.2 Perception factors

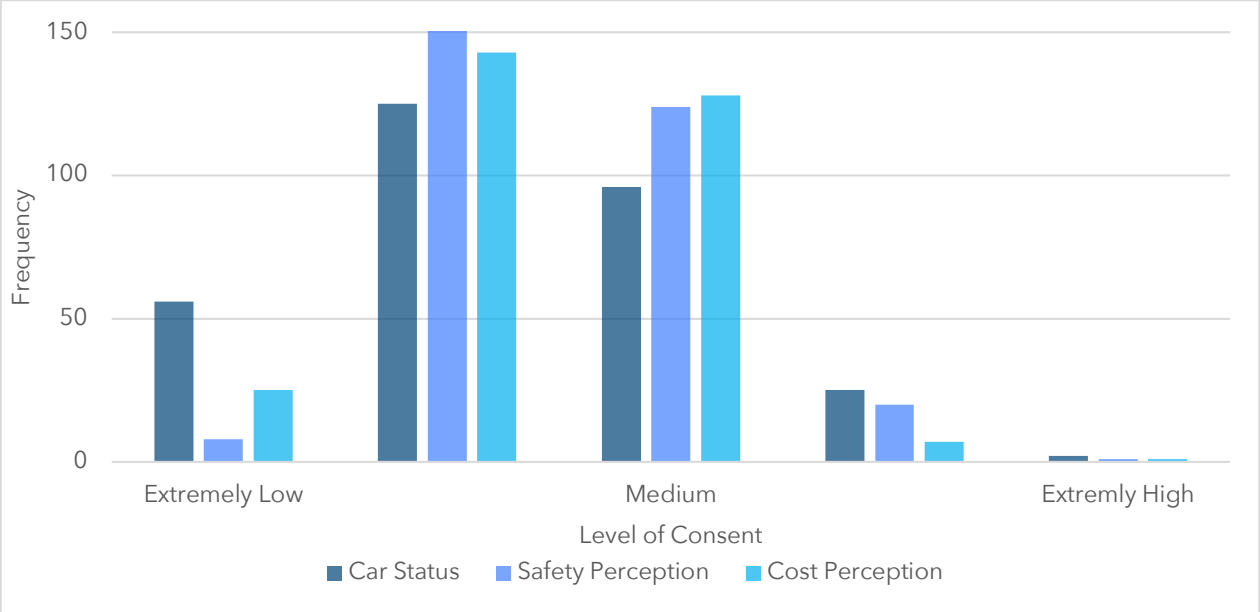

Figure 19: Distribution of perception factors (Author, 2020)

The perception factors in figure 19 were measured in contrast to the awareness factors. These include on the one hand the significance of cars as a status symbol in society and in the respondents' own image, and on the other hand the perception of safety and costs of sustainable modes of transport compared to motorised individual transport.

Again, the survey measured the extent to which respondents agreed with statements about how important the car is to them as a status symbol, how safe sustainable modes of transport are compared to the car, and how expensive sustainable modes of transport are compared to the car. As before, 1 corresponds to a very high and 5 to a very low level of agreement. The questionnaire in Annex 3 shows which questions were combined to a new question based on the mean values, but only after a screening by the Cronbachs Alpha test. It revealed that car status with a value of .768 is very close to internal consistency, but safety (.605) and cost perception (.531) are close to the lower limit of .50 (see table 9, annex 4). Figures 19 and 20

show that the car still has a high status in society. With an average value of 3.71 (standard deviation .85), this means that respondents on average strongly believe that a car gives prestige and reputation and conveys a lot about its owner. The feeling of safety is more moderate with a mean of 3.45 (standard deviation .61), which means that respondents largely feel safer in a car than in sustainable modes of transport when participating in road traffic. The level of cost perception is comparable to that of the feeling of security. With an average value of 3.60 and a similar distribution (standard deviation .61), this means that a large proportion of the respondents consider sustainable modes of transport to be very expensive compared to motorised private transport (see table 7, Annex 4). The box plot of the safety perception, however, shows outliers in both directions indicating a broad distribution of the variable. Additionally, the perception factors were checked to ensure normal distribution. The Shapiro-Wilks test reveals that these variables are not normally distributed as well since they show a significant p-value of .000 (see table 10, Annex 4). The null hypothesis must therefore be rejected again. The histogram for symbolic status of a car (figure 30, Annex 4) shows no strong signs of a normal distribution, while the histograms for safety and cost perception point to a slightly right-skewed normal distribution. As already mentioned, however, a normal distribution as a prerequisite for linear regression can be dispensed, provided that the sample size included in this study permits a large number of participants (Lumley et al., 2002).

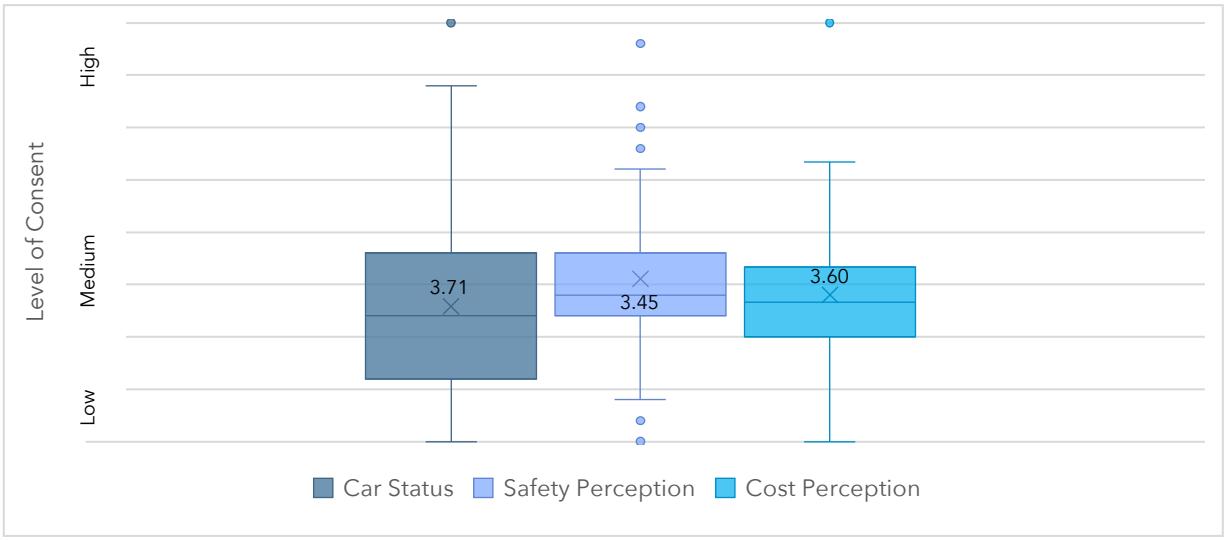

Figure 20: Boxplot of the perception factors (Author, 2020)

Moreover, an assessment of safety for the various modes of transport was queried. 0 corresponds to a very insecure feeling and 10 to a very safe feeling. Figure 21 also includes the respective mean values. It can be seen that the bike was perceived as being the least safe mode of transport in road traffic with a mean value of 5.23 and public transport was classified as the safest mode of transport with a mean value of 8.43. Car (6.78) and walking (7.64) share the middle places, with the car still clearly below walking, therefore deemed to be safer. The Statistische Amt der Landeshauptstadt München (2019) also notes that the safety of cyclists is often criticised.

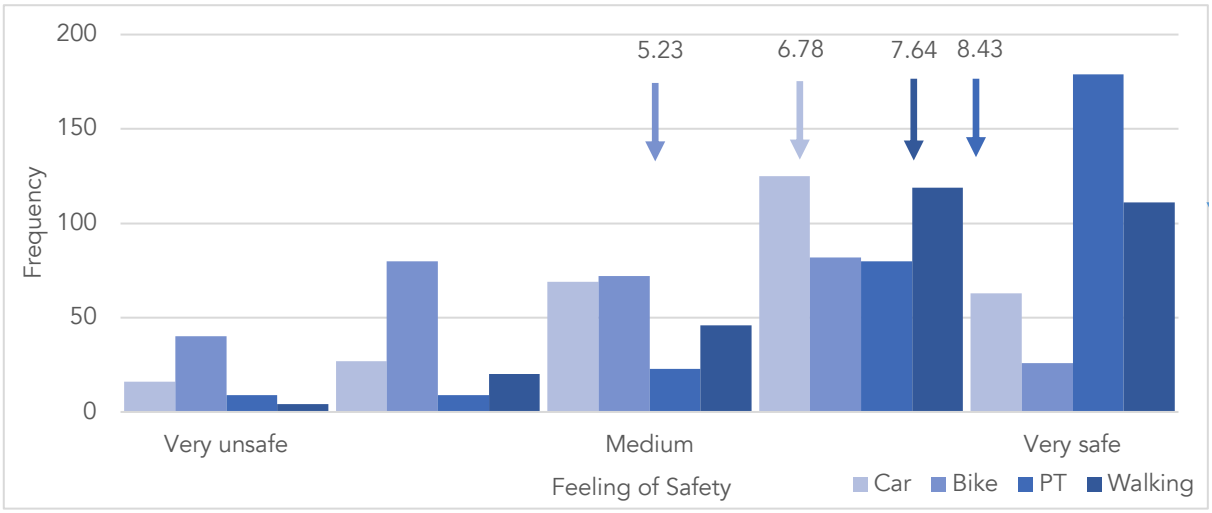

Figure 21: Distribution of safety perception (Author, 2020)

Regarding the estimation of costs, figure 22 indicates that the bike is generally considered to be a very cheap mode of transport. This is not surprising. Interestingly, however, it appears to vary only slightly in perception between the costs of a car and those of public transport. Data between 0 and 10 were used for the measurements, 0 meaning very cheap and 10 meaning very expensive. While the mean value for bikes is relatively low at 2.30, meaning that bikes are generally perceived as a very inexpensive mode of transport, the mean values for public transport (5.85) and cars (7.58) are relatively close to one another and are considered to be medium to expensive. According to a study by Andor et al. from 2020, respondents estimated the cost of maintaining a car to be significantly lower than the actual costs. Monthly expenses for an ordinary car in Germany include fuel, maintenance, taxes, insurance and depreciation and are estimated by the study to amount up to 425 €. The respondents however only estimated expenses of 204 €, barely half of the actual costs. Buying an annual subscription to public transportation in Munich will cost a maximum of € 213 per month (MVV, 2020). It must be emphasized, however, that a ticket for the entire city area and beyond only costs 55 € per month. This represents about 13 % of the monthly cost of a private car. So what influence can it have on acceptance that these two modes of transport are perceived as similarly expensive despite major financial discrepancies?

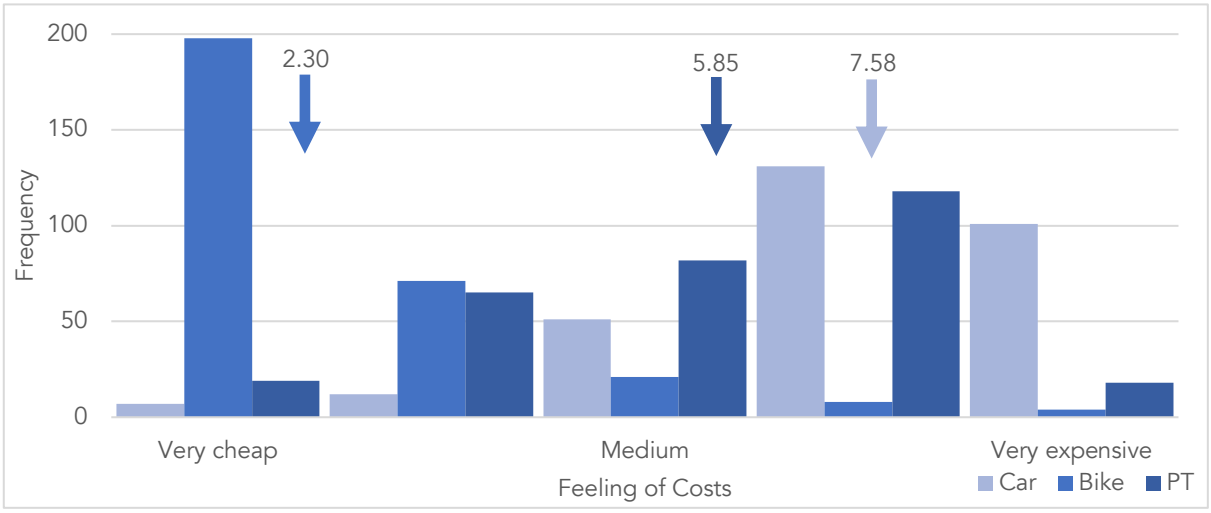

Figure 22: Distribution of cost perception (Author, 2020)

4.4 Inferential analysis

In the following chapter, the findings from the previous sections will be combined and tested with regard to their relationships and influences. Initially, those items with a significant correlation were identified. After intensive consideration, the independent variables were finally reduced in a way that only such variables remained that actually display a significant correlation, in order to then include these in the final regression models. This shall culminate in the research question "*to what extent the level of acceptance towards sustainable commuting in Munich is explained by awareness and perception factors*".

4.4.1 Commuters characteristics

As already mentioned, the majority of respondents are between 26 and 35 years old. In figure 23, instead of using the age groups for further analysis, the actual age data obtained from the respondents can be seen. Despite the slightly decreasing trend line, this scatterplot reveals no obvious distribution of the acceptance in regard to age. This is to be further investigated in a variance analysis. For this purpose, the Leverne-test was first carried out to verify the homogeneity of variance between the age groups. An F-test is used to evaluate whether the variances of different groups are homogeneous. This is especially important for different group sizes. Since the Levene-test shows a significant p-value of .002 and thus is below the typical error probability of .05, the null hypothesis can be rejected, i.e. the groups show different variances. The F-value indicates whether the between-group variance and the within-group variance differ. According to the calculations of Cohen (1988), an F-value of 1.462 corresponds to a low effect strength of the model. Due to the variance heterogeneity of the groups, the Welch-ANOVA should provide additional clarification (see table 12, Annex 4). Results obtained indicate that the equality of the mean values must be rejected, a significant difference between the groups can therefore be assumed. In a Games-Howell post-hoc test (see table 13, Annex 4) it becomes evident that particularly the age groups 26 to 35 and 46 to 55 differ with regard to their level of acceptance; cautiously said: the younger the person is, the higher the level of acceptance seems to be. This correlation is to be investigated more intensively by applying a regression. A correlation alone cannot sufficiently explain a relationship. It must be determined whether, in addition to a correlation, there is also an influence of one variable on the other.

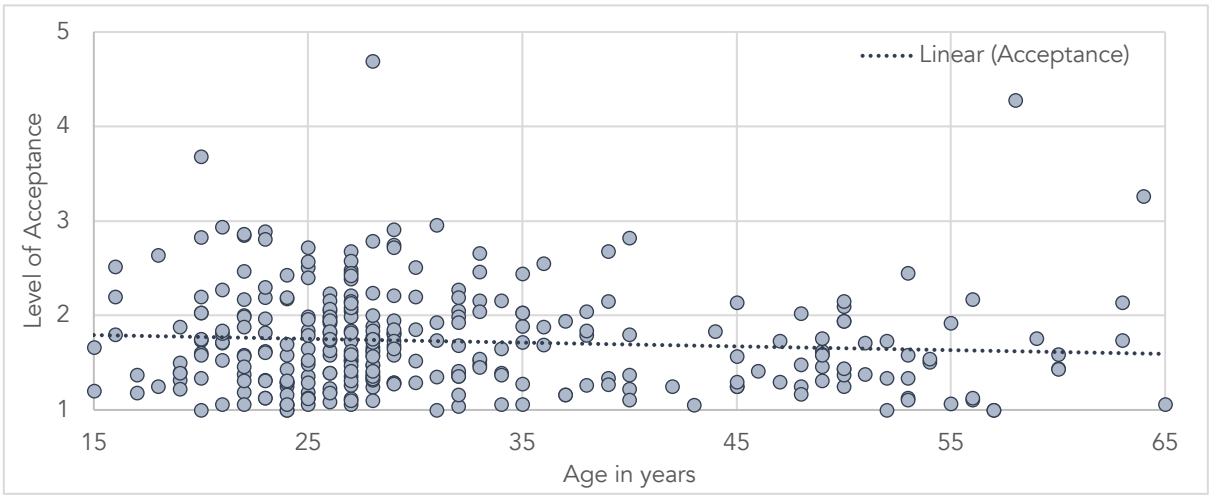

Figure 23: Level of acceptance by age (Author, 2020)

Considering that barely 1 % of the respondents identify themselves as diverse and that this group is therefore too small for a relevant statistical analysis, in the following the groups male and female identifying will be considered. The t-test of acceptance for the gender groups shows that there is no significant difference between the two groups (see table 14, Annex 4), thus the null hypothesis cannot be rejected. With a significance of .956, this value is far above the commonly used p-value of .05, the homogeneity of variances is thus given.

The scatterplot in figure 24 illustrates the level of acceptance in relation to a monthly income. At a first glance there seems to be no clear pattern, yet a look at the trend line reveals that acceptance is slightly lower when income is lower. This was further tested by evaluating the effect size by calculating an ANOVA for the different income groups as described in chapter 4.1.1. The effect strength of ANOVA (see table 11, Annex 4) amounts to a small effect of the model according to calculations based on the f-value of 1.05 (Cohen, 1988). The Welch-ANOVA demonstrates that with a p-value of .463, the null hypothesis with the assumption of variance equality, cannot be rejected, which means that there is no significant difference between the different income groups (see table 22, Annex 4).

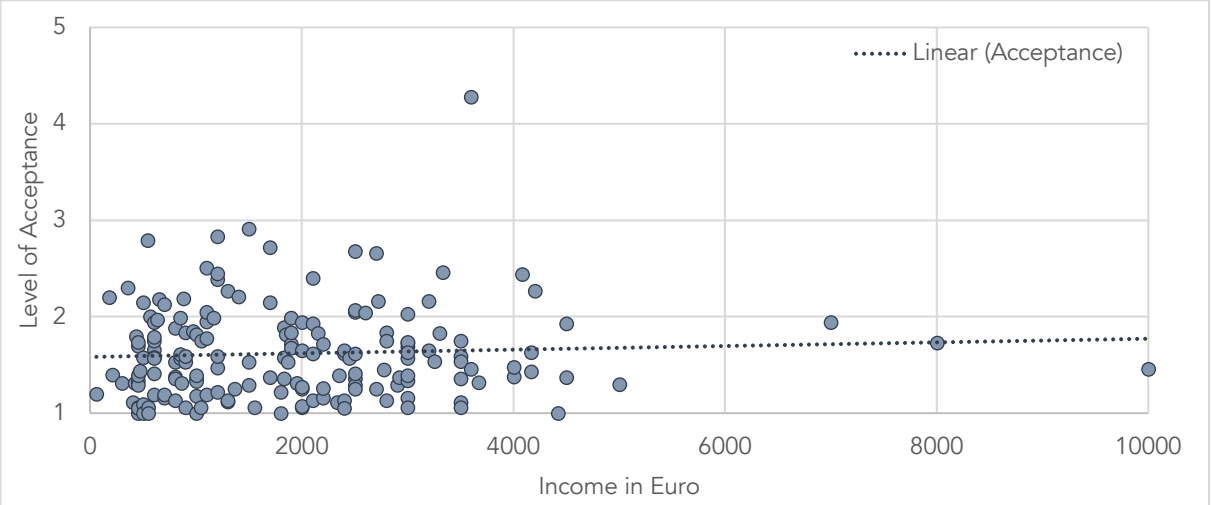

Figure 24: Level of acceptance by income (Author, 2020)

For the different education groups, the f-value amounts to .44 (see table 11, Annex 4) and thus, according to Cohen's calculations (1988), a medium effect of the model. Since the various educational groups differ greatly in size, a Welch-ANOVA must be performed here as well (see table 12, Annex 4), which, however, shows a p-value of .671 and thus no statistical significance can be assumed, which means that the null hypothesis cannot be rejected.

The composition of the household constitutes another interesting aspect. The ANOVA (see table 11, Annex 4) shows an f-value of 2.772 and thus, according to Cohen's (1988) calculations, shows a medium effect strength. According to the Welch-ANOVA, the household composition shows a strong significance of .005 (see table 12, Annex 4). Thus the null hypothesis of variance equality can be rejected. In a Games-Howell post-hoc test it can be seen that people living with their partner without children show a higher level of acceptance than people living in a shared household (see table 15, Annex 4). People living with their parents or other family members likewise exhibit a significantly higher level of acceptance than those sharing a flat. However, since this variable cannot be arranged in a meaningful order due to the fact that no more or less or better or worse occurs, it is unsuitable for further analysis in a regression.

4.4.2 Awareness factors

According to the literature, personal characteristics as well as various awareness factors are responsible for the shaping of acceptance. As already mentioned, the awareness factors were divided into benefit awareness, problem awareness and information and education. For these sub-variables, it will first be examined whether there is a connection between their characteristics and the level of acceptance using a correlation analysis. This should guarantee that only reasonable variables are included in the regression model.

The Pearson correlation (see table 16, Annex 4) for benefit awareness shows a correlation coefficient of .685 at a significant level (p = .000), indicating a strong positive correlation. This means that with increased benefit awareness, an increased level of acceptance can be expected. The Pearson correlation coefficient also reveals a strong positive significant (p = .000) correlation with a correlation coefficient of .732 for problem awareness and level of acceptance. If, on the other hand, the correlation between acceptance and information and education is examined, it can be seen that there is no significant correlation (p = .331). This variable is therefore probably not relevant for the following regression model and can thus be excluded in any further analysis. Above all, however, this means that the correlation coefficient does not provide meaningful results.

4.4.3 Perception factors

Another independent variable is the perception factors, which, as already mentioned, consist of different perspectives. These include the perception of how important the car is in society and for the individual as a status symbol, as well as one's own assessment of how expensive and safe sustainable modes of transport are compared to conventional motorised individual transport such as the car.

Looking at the correlation (see table 16, Annex 4) between acceptance and car status, it can be seen that there appears to be a strongly significant (p = .000) correlation with a negative correlation coefficient of -.314. This indicates that the higher the value that a person attributes to the car as a status symbol, the lower the level of acceptance can be expected. The situation is similar with the perceived safety of sustainable modes of transport compared to the car. Again, a significant (p = .000) correlation to acceptance can be seen with a negative correlation coefficient of -.473. A similar correlation coefficient occurs for the cost estimation of sustainable modes of transport compared to motorised private transport in terms of acceptance. A correlation coefficient of -.477 (p = .000) is evident, a negative correlation can be expected. In more general terms: the higher the safety and cost perception that people attribute to sustainable modes of transport compared to conventional motorised private transport such as the car, the lower the level of acceptance of sustainable modes of transport can be expected.

4.4.4 Final regression models

After reviewing the correlations between the dependent and independent variables in the previous paragraph, these results can now be deepened in a regression. At this point, the correlations only make statements about whether the independent variables follow a similar pattern as the dependent variable. However, this does not include any statement about the effects they have on each other. Therefore, this will be evaluated in the following regression models.

To obtain information beyond the correlation, a multiple linear regression was performed. This should not only show which predictors display a correlation to the measured acceptance, but also provide information about whether the chosen independent variables function as predictors and have a measurable influence on the dependent variable and how strong that influence is. The purpose of a multiple linear regression analysis is to provide an estimation equation to describe as accurately as possible the average linear dependence of one variable on several other variables. Thus, multiple linear regression analysis can be used both for explanatory and prognostic applications (Fromm, 2008). The variables to be considered are provided in scale form and are therefore well suited for linear regression.

Before carrying out the regression, a number of conditions for a meaningful regression analysis should first be examined. The discrepancy between the actual criterion values and the criterion values of a regression analysis, so-called residuals, should be independent and normally distributed in order to adequately describe a regression (Bortz and Döring, 2007). Figure 30 (Annex 4) demonstrates that this assumption can be fulfilled; the residuals lie well on the normal distribution line. The Cook distance helps to show outliers which should be avoided. A cut-off value of 1 is usually used for this. If, as in our case, the Cook values are between 0 and .288, it can be assumed that there are no concerns about possible outliers (Field, 2009).

A close examination of the correlations has so far shown that not all of the initially assumed variables are suitable for a regression model. It became apparent that hardly any correlation can be identified among the personal characteristics. Only the age indicates a slight correlation and will therefore be further investigated in the following. R^2 represents the coefficient of determination and indicates what percentage of the dependent variable can be explained by the independent variables. An adjusted R^2 should be used instead of R^2 if there is more than one independent variable, since R^2 becomes higher the more independent variables are considered in the model, without a better explanatory model actually causing it. The multiple linear regression model I (see table 19, Annex 4; figure 31, Annex 4) shows an R^2 of .007, which means that not even 1 % of the dependent variable can be explained by this model. This is not surprising, since the ANOVA shows a p-value of .156, which is far above the significance level. It can therefore be assumed that this model is not suitable. In order to avoid the risk of possible errors, it will nevertheless be applied in the final regression. The final regression model automatically eliminates those predictors that do not contribute to the clarification of the model.

The correlation analysis also revealed that only the benefit awareness and the problem awareness, but not the information and education parameters, are suitable to be tested in a regression model. As a result, information and education will not be discussed in the following; multiple linear regression model II (see figure 25; table 20, Annex 4; figure 32, Annex 4) no longer includes this variable. In this case, 62.7 % of the variance is explained by this model. The ANOVA table proves that the results obtained with this model are very significant with a p-value of .000, thus the model can be used. The coefficient table indicates that the coefficients have a significant effect ($p = .000$). Where variables with different scales occur, the standardised coefficient should be used. A change of one unit in the standardised beta means a change of one unit in the standard deviation of an independent variable, which causes a change of one unit in the standard deviation of the dependent variable. Since the variables used in this model share the same scale, the unstandardised B coefficient should therefore be applied. Thus, in the case of the non-standardized coefficients, the influence of these coefficients on the dependent variable can be seen more directly. In terms of benefit awareness, this means that with each unit increased awareness of the benefits of sustainable transport systems, the level of acceptance increases by .312 units. A similar impact is observed regarding problem awareness, with each unit more, the level of acceptance increases by .408 units. Using the

formula $y = 0.349 + 0.312x_1 + 0.408x_2$, the model estimates the level of acceptance with an average benefit awareness of 1.94 and an average problem awareness of 1.90 to 1.73, which consequently corresponds to the average level of acceptance. The correlation table shows that a strong correlation between the variables is to be expected. Therefore, the variance inflation factor should be applied to test for collinearity. The variance inflation factor (VIF) indicates whether variables have a strong linear relationship to other predictors. There is no hard line in which range this and the tolerance value should lie, but Field (2009) points out that a VIF should remain below 10 and that a tolerance value below .1 should be considered critical. Since the VIF values with 1.572 and the tolerance values with .636 are far away from these limits, collinearity does not seem to play a role in this model and can therefore be neglected. The adjusted R^2 of .627 indicates that this model already provides an explanation for a great portion of the acceptance, but it appears to have other influences that can influence the level of acceptance.

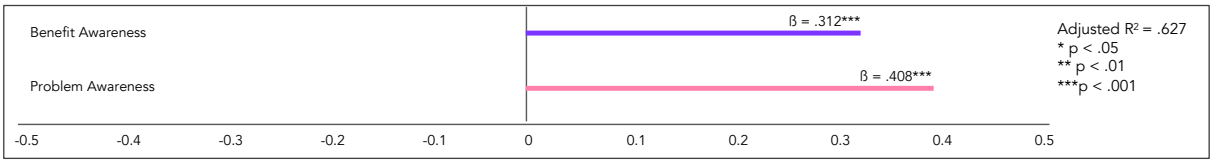

Figure 25: Multiple linear regression model II (Author, 2020)

Another aspect that needs to be considered more closely at this point are the perception factors (see table 21, Annex 4; figure 33, Annex 4). In this multiple linear regression model III, adjusted R^2 shows that 32 % can be explained by the perception factors. The p-value of .000 in the ANOVA table demonstrates the strong significance of the model. The coefficients table presents the unstandardized coefficients and states that with each unit of importance of the symbolic status of a car, the level of acceptance decreases by .093 units. The same applies to safety and cost perception, where with each unit the level of acceptance decreases by .256 and .268 units respectively (see figure 26). Using the formula $y = 3.917 - 0.093x_1 - 0.256x_2 - 0.268x_3$, an average symbolic value of the car of 3.71, an average safety perception of 3.45 and an average cost perception of 3.60, an acceptance level of 1.724 can be estimated, coming quite close to the mean value of 1.73. Again, the correlation table indicates a correlation between the independent variables of this model, which is why the VIF should again help to exclude a collinearitiy effect. VIF values between 1.127 and 1.338, as well as tolerance values between .747 and .887 indicate that a collinearity effect cannot be assumed here either.

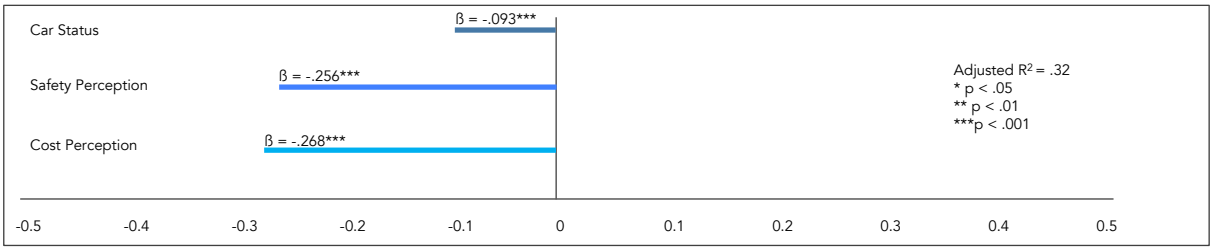

Figure 26: Multiple linear regression model III (Author, 2020)

A more holistic multiple linear regression model IV (see table 22, Annex 4; figure 34, Annex 4) now seeks to integrate these separate models. This requires in particular a backward stepwise regression considering all possible dependent variables, as well as suitable socio-demographic variables. The backward stepwise model was selected due to the lower error of type II (no effect is expected but in reality there is an effect) and includes all variables under consideration, only those variables with a relevant influence, however, were gradually included by the model (Field, 2009). Therefore, the awareness factors benefit awareness, problem awareness and information and education, as well as the perception factors symbolic status of a car, safety

perception and cost perception were initially included. Furthermore, age was also incorporated into the model. The correlation table again shows that age and the information variable reveal no significant influence on acceptance. Benefit and problem awareness, as well as symbolic status of a car and safety and cost perception, on the other hand, show a high significance (p = .000). It can thus be expected that only the latter will be included in the final model. In a first step all variables were considered, in a second step the variable information and education was excluded from the model, in a third step the age variable was excluded from the model. The model summery shows the change of the adjusted R^2, which describes the part of the variance explained by the model. The adjusted R^2 reveals no major change, the first model explains 66.7 % of the variance, the second model 66.8 % and the third model again can explain 66.7 % of the variance. The ANOVA table presents a strong significance for all three models with a p-value of .000, making each of them theoretically applicable. The coefficients table indicates how the significance for the coefficients and the coefficients themselves change after removing individual variables. Of particular interest, however, are the unstandardized ß coefficients, which show a slight change from model 1 to model 3. Benefit awareness has increased from .241 to .246 by excluding the non-significant variables, while problem awareness has decreased minimally from .368 to .367. The symbolic status of a car increased slightly from a low value of -.049 to -.053, while safety and cost perception decreased from -.107 to -.103 and -.104 respectively (see figure 27). Overall, however, it can be argued that the exclusion of non-significant variables by the model has no strong effect on the strength of any of the remaining coefficients.

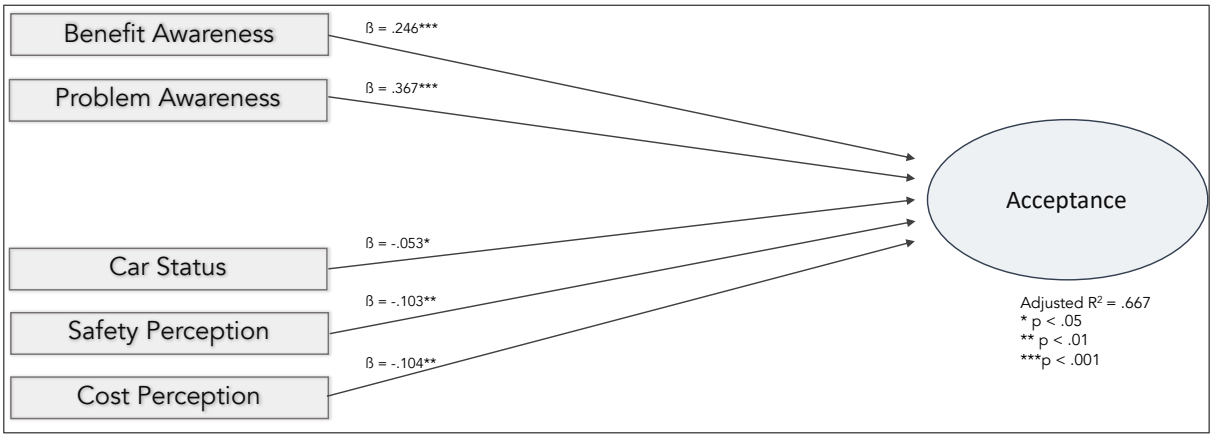

Figure 27: Multiple linear regression model IV (Author, 2020)

Figure 27 illustrates the summery of this regression analysis even more concisely. The awareness factors benefit and problem awareness show a positive influence on the level of acceptance, while the perception factors car status, safety and cost perception indicate a negative influence. To summarize, it can be said that with each unit of awareness the level of acceptance increases, while with each unit of perception the level of acceptance decreases. The model allows an estimation of the acceptance using the formula $y = 1.481 + 0.246x_1 + 0.367x_2 - 0.053x_3 - 0.103x_4 - 0.104x_5$.

Since the correlation table shows strong correlations between the independent variables, the collinearity must also be examined. With VIFs between 1.036 and 1.779, as well as tolerance values between .563 and .965, the values of all predictors are therefore sufficiently far away from any limit values, meaning that the model does not show any collinearity effect worth considering.

The test for homoscedasticity of the five remaining independent variables (benefit awareness, problem awareness, car status, safety perception and cost perception) was carried out by means

of the Breusch-Pagan test. This test shows a strong significance (p = .000), thus heteroskedasticity can be assumed (see table 18, Annex 4). Since homoscedasticity is a prerequisite for a multiple linear regression (Field, 2009), standard errors can be distorted. In order to be able to apply a regression with heteroskedasticity nevertheless, a parameter estimation with robust standard errors is conducted. This provides a good method to correct heteroskedastic effects on the standard errors. Since in large samples the significance often turns out to be higher than it actually is, according to Hayes and Cai (2007), the HC3 method is the most suitable one for fitting the robust standard errors, even if there is no heteroskedasticity. The data in table 23 (Annex 4) thus now show the beta coefficients of multiple linear regression V after overcoming heteroskedasticity. It is clear that these remained unchanged compared to the previous regression model IV, only the significances have shifted slightly. Benefit and problem awareness still have the same level of significance (p = .000), while the variable car status is now scarcely significant (p = .058). As a result, the significances of the other perception variables have apparently also altered minimally. The significance of safety perception was reduced from .004 to .015 and that of cost perception from .003 to .006. However, figure 28 illustrates once again that the adjustment to heteroscedasticity only has a minor effect on the validity of the model. The directions and variables of influence have not changed, only the variable car status could no longer withstand the model, which is expressed by the new formula $y = 1.481 + 0.246x_1 + 0.367x_2 - 0.103x_4 - 0.104x_5$. A comparison of tables 20, 22 and 23 (Annex 4) shows, however, that here too a tendency for the level of acceptance of sustainable transport to decrease as the symbolic value of the car increases is visible.

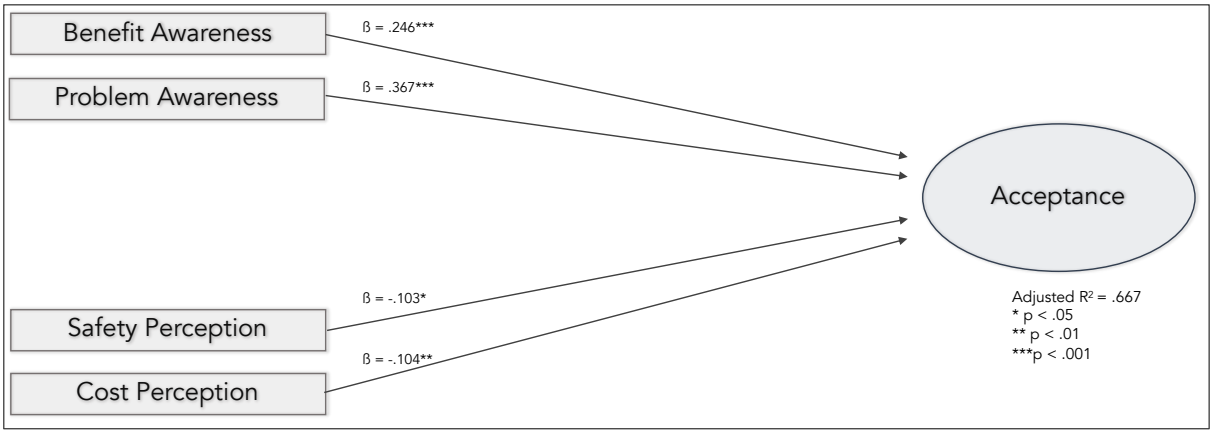

Figure 28: Multiple linear regression model V (Author, 2020)

Overall, it can be said for both models (model IV and V) that the awareness factors have a positive effect on acceptance, while the perception factors have a negative effect. In both cases, problem awareness seems to have the strongest influence on acceptance, followed by benefit awareness. Safety and cost perception, on the other hand, have a much smaller influence on acceptance. Since a regression does not provide any information about the reasons why some variables show a stronger impact, this can only be speculated about. In order to answer the research questions and thus to achieve the goal of this study, it can be concluded that the level of acceptance of sustainable modes of transport for commuting in Munich is generally very high. Particularly, middle-aged people seem to be the most accepting, with people between 46 and 55 years of age showing the highest acceptance among all commuters studied. Furthermore, after intensive data analysis it was found that the awareness factors benefit and problem awareness show a strong positive influence on acceptance. With increasing awareness of the problems that a transport system with a strong focus on motorised private transport entails and the benefits that a more environmentally friendly transport system brings for one's

own life and society, the expected acceptance of the importance of sustainable transport for commuting increases. In contrast, the perception factors investigated reveal the following. As the cost of sustainable transport compared to conventional motorised modes of transport such as the car increases, the level of acceptance towards sustainable modes of transport decreases. A similar picture emerges with regard to the assessment of safety. The safer the car is perceived to be in comparison to sustainable modes of transport, the lower the level of acceptance of the latter. Not all models have been able to prove that the consistently high position of the car as a status symbol in German society has a negative influence on the acceptance of alternative modes of transport. And although this can also be interpreted as a slight tendency in this work, the earlier assumption seems to have perhaps been proven true that status symbols are becoming less and less important in our society, especially the car.

Chapter 5: Conclusions

After decades in which the car was the focus of German city planning, the demand for alternative forms of urban mobility is now increasing. Awareness of the extent to which conventional mobility systems restrict personal life and society, and how sustainable forms of transport can contribute to improving the quality of life and preserving the environment, is becoming increasingly widespread. This thesis addresses the appreciation and acceptance of sustainable modes of transport, especially with regard to commuter traffic in Munich. While there is no literature on this topic with a German focus so far, this work is intended to fill a gap in this field. As a reminder: The purpose of this project should be to shed light on the factors that contribute to the acceptance towards sustainable modes of transport for commuting and the extent of their influence. For this purpose, awareness factors, such as benefit and problem awareness, as well as the quantity and quality of available information on sustainable transport, and perception factors, such as the feeling of safety and cost of sustainable modes of transport in comparison to conventional motorized individual transport, as well as the continuing importance of the car as a status symbol in German society, were examined more closely.

By drawing on the existing literature on this topic, this work attempts to contribute its part to the search for knowledge specifically for the context of the city of Munich. An insight into the reasons for appreciation and acceptance of sustainable modes of transport can help in the future to shape the city to become more accessible and open to the constant changes that come with an increasingly rapid changing lifestyle. This requires a high degree of adaptability and open-mindedness towards innovation, including in the urban infrastructure and functionality.

There were two main challenges in implementing this study. One was the time constraint. In addition to the data collection, the evaluation of the data had to be carried out and implemented within a minimum period of time. The former resulted in a lower response rate than expected, whereby the sample size turned out to be smaller than recommended by academia, however, under these circumstances, due to the number of participants, it can still be considered a success. In a second major challenge, this work, which commenced in the midst of a globally significant and novel pandemic, had to be completed under special circumstances. In order to obtain a meaningful study despite these adversities, the focus was placed on achieving the broadest possible distribution through all social layers and groups. For this purpose, the online questionnaire offered an ideal tool. In addition to all common social media platforms and distribution in the author's personal environment, the questionnaire was also distributed manually via flyers and QR codes at various locations in the city.

The data collected was then examined using analysis and statistics software utilizing both descriptive and inferential statistics. Initially, descriptive statistics were used to provide a superficial overview of the data. In order to map the causal relationships that are theoretically represented in the conceptual framework, multiple linear regressions were used, which not only describe the relationship of the variables but also the strength of influence between independent and dependent variables.

In the previous chapter, the correlation and regression models were used to show which predictors proved to be relevant. It was found that personal characteristics have less influence on the level of acceptance than the literature suggests, which indicated that socio-demographic criteria are relevant for the formation of acceptance of sustainable transport and led to the assumption that these characteristics should be examined for correlations and regressions. However, the analysis of the data made it clear that gender identification, income level and educational attainment cannot be used to explain differences in measured acceptance, as they all show variance and mean homogeneity. Only the demographic variable age seems to provide

an explanation, at least at first glance. While the age group of 46 to 55 years shows a particularly high level of acceptance, the group of 26 to 35 years surprisingly shows a significantly lower level of acceptance. Since this variable allowed for a classification into a sequence, it was then examined more closely in the regression model. In addition to the commuters characteristics, the awareness and perception factors were also examined for their correlation to acceptance and were further analysed using various regression models. It became clear that especially four of the independent variables proved to be relevant and showed a clear influence on the level of acceptance. The relationship can be simplified by summarising the results: A high level of awareness results in a high level of acceptance, whereas a high level of perception results in a decreasing acceptance.

The assumptions of the literature have therefore only partly proved to be appropriate for this context. While the assessments of numerous authors on the topic have confirmed that benefit and problem awareness in fact have a positive effect on acceptance, this could not be confirmed for the assumption of information and education. Perhaps Eliasson's (2010) approach 'acceptability decreases with detail' was more appropriate than initially assumed. Alternatively, the lack of influence of information and education on the level of acceptance may simply be due to a measuring bias. More intense research would be beneficial here.

The literature widely agreed on the incorrect estimation of the costs of different modes of transport. This study has now been able to show additionally that this discrepancy between perception and reality obviously affects the level of acceptance of sustainable transport. It remains questionable, however, how such a misjudgment can occur despite available information. The situation is similar with the perception of safety. The assessment of how safe sustainable modes of transport are in comparison to the car influences acceptance. Unfortunately, it could not be clarified with any clear certainty how much acceptance depends on the fact that the car still plays an enormous role in German, and especially Munich, society. Relevant literature also points out that there is a connection here, but this could not be clearly confirmed in this study. However, it is important to mention at this point that clear tendencies can still be seen, but these could not be supported by all models. This circumstance gives cause for separate and thorough research in this direction, since in literature there are differing perspectives on the influence of the car as a symbolic status.

However, to provide a conclusive answer to the research question, it can be said that the awareness factors benefit and problem awareness have a strong positive influence on acceptance, while the perception factors safety and cost perception prove to be exactly the opposite. Acceptance seems to increase with increasing benefit and problem awareness, while it decreases with increasing cost and safety perception. And although this work could help to gain insights into the background of acceptance, it has, like any good research, raised many new questions. It remains unclear, for example, how to raise awareness of the benefits and problems of urban transport, or how to bring the cost and safety perception of transport closer to reality. This work could shed light on the acceptance of sustainable modes of transport for commuting. Beyond that, however, the question of course arises as to how these findings can be used to promote and support acceptance. Since acceptance building has not been the main focus of research so far and policies have mostly focused on behavioural change without considering acceptance, it would be advisable to extend studies on influences of acceptance to actual behaviour. However, that would have exceeded the scope of this work and could therefore not be the focus of research but should direct attention one step further towards sustainable urban mobility. However, the significance of this work must be treated with caution. A sample size of more than 300 people can provide a good first insight, but before implementing any measures emerging from these results, there should be a closer examination of the details and, if necessary, a larger sample should be investigated. In addition, it should be

made clear at this point that the sample does not fully correspond to the socio-demographic distribution of the city, therefore in reality these results may be distorted. Although clear trends can be identified, generalisation without adaptation should be avoided and the context and circumstances should be carefully examined and dealt with before each application. Further insights into the subject can be gained, for example, by applying a structural equation model, as this can also shed light on previously hidden relationships between variables. In a further step, it would also be advisable to include factors in the analysis that have not previously been described or hinted at in the literature, instead identifying new connections and relationships.

But of course, the most interesting aspect following this research is how a knowledge about acceptance can be transformed into a change in behaviour. How can the high measured level of acceptance of sustainable modes of transport for commuting in Munich be used to ensure that the avoid-shift-improve approach is not limited primarily to improving technologies, but is also applied to avoidance and change strategies? Although energy efficiency is indeed also to be pursued in the transport sector, it should only be considered after possible avoidance and an alternative choice could have been made.

Bibliography

Ahlswede, A., 2019. Bedeutung von Autos als Statussymbol in Deutschland 2017. Available at: https://de.statista.com/statistik/daten/studie/164063/umfrage/umfrage-bedeutung-von-auto/ [Accessed 15/08/2020].

Ahrens, G.A., Becker, U., Böhmer, T., Richter, F. et al., 2013. Potenziale des Radverkehrs für den Klimaschutz. Dresden: Technische Universität Dresden. Available at: https://www.bmu.de/fileadmin/Daten_BMU/Pools/Forschungsdatenbank/fkz_3708_45_101_radverkehr_bf.pdf [Accessed 02/06/2020].

Andor, M.A., Gerster, A., Gillingham, K.T. and Horvath, M., 2020. Running a car costs much more than people think — stalling the uptake of green travel. Nature, (580), pp. 453–455 Available at: https://media.nature.com/original/magazine-assets/d41586-020-01118-w/17904042.

Ardila-Gomez, A. and Ortegon-Sanchez, A., 2016. Sustainable urban transport financing from the sidewalk to the subway: capital, operations, and maintenance financing. Washington, DC: International Bank for Reconstruction and Development / World Bank. Available at: https://eur.on.worldcat.org/oclc/936055927.

Arndt, S., 2011. Evaluierung der Akzeptanz von Fahrerassistenzsystemen. Wiesbaden: Springer.

Assing, K., Höhnscheid, K., Kranz, T. and Schönebeck, S., 2010. Straßenverkehrssicherheit als wichtige Voraussetzung für nachhaltige Mobilität. Vierteljahrshefte Zur Wirtschaftsforschung, 79 (2), pp. 61-76.

Ayberk, E., Kratzer, L. and Linke, L., 2017. Weil Führung sich ändern muss. Aufgaben und Selbstverständnis in der digitalisierten Welt. Wiesbaden: Springer.

Banister, D., 2008. The sustainable mobility paradigm. Transport Policy, 15 (2), pp. 73-80.

Bayerische Staatsregierung, 2013. Bayrische Nachhaltigkeiststrategien. Langfassung. München: Bayerisches Staatsministerium für Umwelt und Gesundheit. Available at: https://www.bundesregierung.de/resource/blob/975274/317992/ee6249176635801bdcba0bc9a5c4de7d/2013-01-15-bayern-nachhaltigkeitsstrategie-data.pdf?download=1 [Accessed 04/05/2020].

Becker, U., 2011.Verkehr und Umwelt. In: Verkehr und Umwelt. In: Verkehrspolitik. Wiesbaden: Springer. pp. 77-89.

Benthin, R. and Gellrich, A., 2017. Umweltbewusstsein in Deutschland 2016: Ergebnisse einer repräsentativen Bevölkerungsumfrage. Berlin: Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB). Available at: https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/umweltbewusstsein_deutschland_2016_bf.pdf.

Berghmans, P., Bleux, N., Panis, L.I., Mishra, V.K. et al. , 2009. Exposure assessment of a cyclist to PM10 and ultrafine particles. Science of the Total Environment, 407 (4), pp. 1286-1298.

Bortz, J. and Döring, N., 2007. Forschungsmethoden und Evaluation für Human-und Sozialwissenschaftler: Limitierte Sonderausgabe. Wiesbaden: Springer-Verlag.

Broniatowski, D.A. and Tucker, C., 2017. Assessing causal claims about complex engineered systems with quantitative data: internal, external, and construct validity. Systems Engineering, 20 (6), pp. 483-496.

Bundesagentur für Arbeit, 2017. Fachliche Weisungen Arbeitslosengeld-Drittes Buch Sozialgesetzbuch SGB III-§ 140 SGB III: Zumutbare Beschäftigungen. Nürnberg: Bundesagentur für Arbeit. Available at: https://www.arbeitsagentur.de/datei/fw-sgb-iii-140_ba015147.pdf [Accessed 19/08/2020].

Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2019. Klimaschutz in Zahlen. Fakten, Trends und Impulse deutscher Klimapolitik. Ausgabe 2019. Berlin: Available at: https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/klimaschutz_zahlen_2019_broschuere_bf.pdf [Accessed 28/03/2020].

Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2020. Auf dem Weg zur Nachhaltigen Mobilität. [Accessed 05/07/2020].

Cass, N. and Faulconbridge, J., 2016. Commuting practices: New insights into modal shift from theories of social practice. Transport Policy, 45 pp. 1-14.

Cohen, J., 1988. Statistical power analysis for the behavioral sciences. Hillsdale: Erbaum Press.

Dalkmann, H. and Brannigan, C., 2007. Transport and climate change. Module 5e - Sustainable Transport: a Sourcebook for Policy-makers in Developing Cities. Eschborn: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. Available at: http://siteresources.worldbank.org/EXTAFRSUBSAHTRA/Resources/gtz-transport-and-climate-change-2007.pdf?fbclid=IwAR0zuxOPx-ryySM5k6FfcxRuf-WhN5AYLb_YsHtoopRpjOgJlyOQdSYyWis [Accessed 07/02/2020].

Devine-Wright, P., 2007. Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review. Beyond Nimbyism: A Multidisciplinary Investigation of Public Engagement with Renewable Energy Technologies, 15 .

Dörrbecker, M., 2007. München - Stadtbezirke. Available at: https://de.wikipedia.org/wiki/Datei:München_-_Stadtbezirke_(Karte).png [Accessed 04/06/2020].

Eliasson, J., 2010. So you're considering introducing congestion charging? Here's what you need to know. OECD/ITF Joint Transport Research Centre Discussion Paper , no. 2010-4, Available at: https://www.econstor.eu/bitstream/10419/68784/1/618962352.pdf.

Eriksson, L., Garvill, J. and Nordlund, A.M., 2006. Acceptability of travel demand management measures: The importance of problem awareness, personal norm, freedom, and fairness. Journal of Environmental Psychology, 26 (1), pp. 15-26 .

European Commission, 2011. White Paper. Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. Brussels: Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0144&from=EN [Accessed 26/03/2020].

European Environment Agency, 2019. Greenhouse gas emissions from transport in Europe. Copenhagen: Available at: https://www.eea.europa.eu/downloads/7009a89effc04dbea8b5f94ff0a39912/1576584662/transport-emissions-of-greenhouse-gases-12.pdf [Accessed 26/03/2020].

Field, A., 2009. Discovering statistics using SPSS: (and sex and drugs and rock'n'roll). 3. London: Sage.

Fina, S., Rusche, K. and Gerten, C., 2018. Indikatoren zur Abbildung der Gleichwertigkeit der Lebensverhältnisse in deutschen StadtRe-gionen. Bonn: Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (BBR). Available at: http://www.gws-os.com/downloads/bbsr-online-11-2018-dl.pdf#page=15 [Accessed 19/08/2020].

Follmer, R. and Belz, J., 2019. Mobilität in Deutschland - Stadt München, Münchner Umland und MVV-Verbundraum. Bonn: Bundesministerium für Verkehr und digitale Infrastruktur. Available at: https://www.muenchen-transparent.de/dokumente/5499206/datei[Accessed 02/06/2020].

Fromm, S., 2008.Multiple lineare regressionsanalyse. In: Multiple lineare regressionsanalyse. In: Datenanalyse mit SPSS für Fortgeschrittene. Wiesbaden: Springer. pp. 345-369.

Gerhold, L., 2020. Sicherheitsempfinden, Sicherheitskommunikation und Sicherheitsmaßnahmen. Ergebnisse aus dem Forschungsverbund WiSima. Berlin: Forschungsforum Öffentliche Sicherheit. Available at: https://refubium.fu-berlin.de/bitstream/handle/fub188/27505/Schriftenreihe_Sicherheit_27.pdf?sequence=1#page=9 [Accessed 21/08/2020].

Guth, D., Holz-Rau, C., Killer, V. and Axhausen, K.W., 2011. Räumliche Dynamik des Pendelverkehrs in Deutschland und der Schweiz: Die Beispiele München und Zürich. disP-the Planning Review, 47 (184), pp. 12-28.

Hardin, G., 1968. The tragedy of the commons. Science, 162 (3859), pp. 1243-1248 .

Hauf, S., 2020. Rathaus Umschau. Rathaus Umschau, (45), Available at: https://ru.muenchen.de/pdf/2020/ru-2020-03-06.pdf [Accessed 20/03/2020].

Hayes, A.F. and Cai, L., 2007. Using heteroskedasticity-consistent standard error estimators in OLS regression: An introduction and software implementation. Behavior Research Methods, 39 (4), pp. 709-722.

Hemmerich, W., 2020. Multiple Lineare Regression in SPSS. [Accessed 15/08/2020].

Horn, B., Kiel, T. and Lojewski, H.v., 2018. Nachhaltige städtische Mobilität für alle. Agenda für eine Verkehrswende aus kommunaler Sicht. Positionspapier des Deutschen Städtetages. Berlin: Deutsches Institut für Urbanistik. Available at: https://repository.difu.de/jspui/bitstream/difu/249784/1/DS1837.pdf [Accessed 19/08/2020].

Howarth, C.C. and Polyviou, P., 2012. Sustainable travel behaviour and the widespread impacts on the local economy. Local Economy, 27 (7), pp. 764-781.

Interplan Consultant, 2010. „Verkehrsprognose 2025 als Grundlage für den Gesamtverkehrsplan Bayern–Abschlussbericht “. München: Bayerischen Staatsministeriums für Wirtschaft, Infrastruktur, Verkehr. Available at: https://www.stmb.bayern.de/assets/stmi/vum/handlungsfelder/iie_verkehrsprognose_2025.pdf [Accessed 31/05/2020].

Jing, P., Zhao, M., He, M. and Chen, L., 2018. Travel mode and travel route choice behavior based on random regret minimization: A systematic review. Sustainability, 10 (4), pp. 1185.

Keller, S., 2004. Motivation zur Verhaltensänderung-aktuelle deutschsprachige Forschung zum transtheoretischen Modell. Zeitschrift Für Gesundheitspsychologie, 12 (2), pp. 35-38.

Ken, T., 2015. Handbook of research on sustainable development and economics. Hershey: IGI Global.

Khoo, H.L. and Ong, G.P., 2015. Understanding sustainable transport acceptance behavior: a case study of Klang valley, Malaysia. International Journal of Sustainable Transportation, 9 (3), pp. 227-239.

Kim, J., Schmöcker, J., Bergstad, C.J., Fujii, S. et al. , 2013. The influence of personality on acceptability of sustainable transport policies. Transportation, 41 (4), pp. 855-872.

Knibbs, L.D., Cole-Hunter, T. and Morawska, L., 2011. A review of commuter exposure to ultrafine particles and its health effects. Atmospheric Environment, 45 (16), pp. 2611-2622.

Kunst, A., 2019. Modes of transportation for commuting in Germany 2019. Available at: https://www.statista.com/forecasts/998727/modes-of-transportation-for-commuting-in-germany [Accessed 03/05/2020].

Landeshauptstadt München, 2019. Münchner Jahreswirtschaftsbericht. München: Referat für Arbeit und Wirtschaft. Available at: http://www.wirtschaft-muenchen.de/publikationen/pdfs/Jahreswirtschaftsbericht-muenchen-2019.pdf [Accessed 13/05/2020].

Landeshauptstadt München, 2020a. Bevölkerung. Daten zur Demografie. Available at: https://www.muenchen.de/rathaus/Stadtinfos/Statistik/Bev-lkerung.html [Accessed 19/06/2020].

Landeshauptstadt München, 2020b. Mobilität in München 2017: Haushaltsbefragung. [Accessed 19/06/2020].

Larue, G.S., Rakotonirainy, A., Haworth, N.L. and Darvell, M., 2015. Assessing driver acceptance of Intelligent Transport Systems in the context of railway level crossings. Transportation Research Part F: Traffic Psychology and Behaviour, 30 pp. 1-13.

Lenz, B., Nobis, C., Koehler, K., Mehlin, M. et al., 2010. Mobilität in Deutschland 2008. Bonn: infas institut für angewandte sozialwissenschaft gmbh. Available at: http://www.mobilitaet-in-deutschland.de/pdf/MiD2008_Abschlussbericht_I.pdf [Accessed 05/06/2020].

Lindfield, M. and Steinberg, F., 2012. Green cities. Mandaluyong City: Asian Development Bank.

Liu, X., Gao, L., Ni, A. and Ye, N., 2020. Understanding Better the Influential Factors of Commuters' Multi-Day Travel Behavior: Evidence from Shanghai, China. Sustainability, 12 (1), pp. 376.

Lumley, T., Diehr, P., Emerson, S. and Chen, L., 2002. The Importance of the Normality Assumption in Large Public Health Data Sets. Annual Review of Public Health, 23 (1), pp. 151-169 doi: 10.1146/annurev.publhealth.23.100901.140546 Available at: https://eur.on.worldcat.org/oclc/4656283807.

Lütters, H., 2013. Online-Marktforschung: eine Positionsbestimmung im Methodenkanon der Marktforschung unter Einsatz eines webbasierten analytic hierarchy process (webAHP). Wiesbaden: Deutscher Universitätsverlag.

Manaugh, K. and El-Geneidy, A.M., 2012. What makes travel'local' Defining and understanding local travel behavior. Journal of Transport and Land Use, 5 (3), pp. 15-27 Available at: http://tram.mcgill.ca/Research/Publications/dispersal_WSTLUR.pdf.

Ministerium für Verkehr Baden-Württemberg, s.a. Pionierregion für nachhaltige Mobilität. Available at: https://www.baden-wuerttemberg.de/de/bw-gestalten/nachhaltiges-baden-wuerttemberg/verkehr/ [Accessed 24/05/2020].

Moosbrugger, H. and Kelava, A., 2012. Testtheorie und Fragebogenkonstruktion. 2. Berlin: Springer.

Mossig, I., 2012. Stichproben, Stichprobenauswahlverfahren und Berechnung des minimal erforderlichen Stichprobenumfangs. Beiträge Zur Wirtschaftsgeographie Und Regionalentwicklung, 1 Available at: https://www.econstor.eu/bitstream/10419/90425/1/73621089X.pdf.

Moula, M.M.E., Maula, J., Hamdy, M., Fang, T. et al. , 2013. Researching social acceptability of renewable energy technologies in Finland. International Journal of Sustainable Built Environment, 2 (1), pp. 89-98.

MVV, 2019. Alle Preise im Überblick. Available at: https://www.mvg.de/dam/mvg/dienste/tickets/tarifreform/TSR_Preisuebersicht.pdf [Accessed 20/08/2020].

Niklas, S., 2014. Onlineforschung: Antworttendenzen, Durchklicker und Kontrollfragen. [Accessed 20/08/2020].

Nolden, M., 2008. Online-Marktforschung: Möglichkeiten und Grenzen. Hamburg: Diplomica Verlag GmbH.

Perschon, J., 2012. Sustainable Mobility. Recommendations for Future-Proof Transport Strategies. Development and Peace Foundation, Policy Paper, 36.

Politis, I., Gavanas, N., Pitsiava–Latinopoulou, M., Papaioannou, P. et al. , 2012. Measuring the level of acceptance for sustainable mobility in universities. Procedia-Social and Behavioral Sciences, 48 pp. 2768-2777.

Polizeipräsidium München, 2019. Verkehrsbericht 2019. München: Polizeipräsidium München. Available at: https://www.polizei.bayern.de/content/1/5/6/5/verkehrsbericht_2019_internet.pdf [Accessed 20/08/2020].

Pridmore, A. and Miola, A., 2011. Public acceptability of sustainable transport measures.

Pronello, C. and Gaborieau, J., 2018. Engaging in pro-environment travel behaviour research from a psycho-social perspective: A review of behavioural variables and theories. Sustainability, 10 (7), pp. 2412 Available at: https://www.mdpi.com/2071-1050/10/7/2412/htm.

Rammstedt, B., 2004. Zur Bestimmung der Güte von Multi-Item-Skalen: Eine Einführung. Mannheim: Zentrum für Umfragen, Methoden und Analysen. Available at: https://www.gesis.org/fileadmin/upload/forschung/publikationen/gesis_reihen/howto/how-to12br.pdf [Accessed 16/05/2020].

Referat für Gesundheit und Umwelt, 2018. Klimaschutzziel und -strategie München 2050. Zusammenfassung des Fachgutachtens. München: Landeshauptstadt München. [Accessed 26/04/2020].

Riegler, S., Juschten, M., Hössinger, R., Gerike, R. et al., 2016. Carsharing 2025–Nische oder Mainstream. Berlin: Institut für Mobilitätsforschung. Available at: https://www.ifmo.de/files/publications_content/2016/ifmo_2016_Carsharing_2025_de.pdf [Accessed 04/05/2020].

Rodt, S., Georgi, B., Huckestein, B., Mönch, L. et al., 2010. CO2-Emissionsminderung im Verkehr in Deutschland: Moegliche Massnahmen und ihre Minderungspotenziale-ein Sachstandsbericht des Umweltbundesamtes. Dessau-Roßlau: Umweltbundesamt. Available at: https://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/3773.pdf [Accessed 31/05/2020].

Schade, W., Peters, A., Doll, C., Klug, S. et al. , 2011. Vision für nachhaltigen Verkehr in Deutschland. VIVER-Vision Für Nachhaltigen Verkehr in Deutschland, Available at: https://www.isi.fraunhofer.de/content/dam/isi/dokumente/sustainability-innovation/2011/WP03-2011_VIVER.pdf.

Schecker, H., 2014.Überprüfung der Konsistenz von Itemgruppen mit Cronbachs α. In: Springer-Verlag ed., Methoden in der naturwissenschaftsdidaktischen Forschung. Berlin: Springer-Verlag.

Schlag, B. and Schade, J., 2000. Public acceptability of traffic demand management in Europe. Traffic Engineering Control, 41 (8), pp. 314-318 Available at: https://www.researchgate.net/profile/Bernhard_Schlag/publication/283815048_Public_acceptability_of_traffic_demand_management_in_Europe/links/574c15f108aef066fde9489b/Public-acceptability-of-traffic-demand-management-in-Europe.pdf.

Schwartz, S.H., 1994. Are there universal aspects in the structure and contents of human values? Journal of Social Issues, 50 (4), pp. 19-45.

Schwedes, O., Canzler, W. and Knie, A., 2016.Verkehrspolitik: Ein problemorientierter Überblick. In: Verkehrspolitik: Ein problemorientierter Überblick. In: Handbuch verkehrspolitik. Wiesbaden: Springer. pp. 3-31.

Somuncu, Y., 2017. Influence of the users' behaviour on the energy performance of the buildings. s.l.: Seventh Framework Programme. Available at: http://need4b.eu/wp-content/uploads/2018/02/NEED4B_D6.5_Influence-of-users-behaviour-on-energy-performance_FV.pdf [Accessed 17/08/2020].

Statistische Ämter des Bundes und der Länder, 2018. Bevölkerung in der Metropolregion München nach Altersgruppen 2018. [Accessed 05/08/2020].

Statistisches Amt der Landeshauptstadt München, 2019. Münchner Statistik - 4. Quartalsheft. München: Statistisches Amt München. [Accessed 20/08/2020].

Statistisches Bundesamt, 2019. Verkehr. Verkehrsunfälle. Wissen.Nutzen., 8 (7), Available at: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Verkehrsunfaelle/Publikationen/Downloads-Verkehrsunfaelle/verkehrsunfaelle-monat-2080700191124.pdf?__blob=publicationFile.

Stradling, S.G., Meadows, M.L. and Beatty, S., 2000. Helping drivers out of their cars Integrating transport policy and social psychology for sustainable change. Transport Policy, 7 (3), pp. 207-215.

Stutzer, A. and Frey, B.S., 2007. Commuting and life satisfaction in Germany. Informationen Zur Raumentwicklung, 2 (3), pp. 179-190.

Timperley, J., 2020. How our daily travel harms the planet. Bbc, Available at: https://www.bbc.com/future/article/20200317-climate-change-cut-carbon-emissions-from-your-commute [Accessed 01/06/2020].

Umweltbundesamt, 2019a. Öffentlicher Personennahverkehr. Available at: https://www.umweltbundesamt.de/themen/verkehr-laerm/nachhaltige-mobilitaet/oeffentlicher-personennahverkehr [Accessed 27/05/2020].

Umweltbundesamt, 2019b. Umweltbelastungen durch Verkehr. Available at: https://www.umweltbundesamt.de/daten/verkehr/umweltbelastungen-durch-verkehr#verkehrslarm-kann-krank-machen [Accessed 20/06/2020].

Umweltbundesamt, 2020a. Fahrleistungen, Verkehrsaufwand und „Modal Split“. Available at: https://www.umweltbundesamt.de/daten/verkehr/fahrleistungen-verkehrsaufwand-modal-split#fahrleistung-im-personen-und-guterverkehr [Accessed 03/06/2020].

Umweltbundesamt, 2020b. Nachhaltige Mobilität. Available at: https://www.umweltbundesamt.de/themen/verkehr-laerm/nachhaltige-mobilitaet [Accessed 07/06/2020].

United Nations, 2015. Transforming our World: The 2030 Agenda for Sustainable Development. Available at: https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf [Accessed 27/03/2020].

Van Thiel, S., 2014. Research methods in public administration and public management: An introduction. New York: Routledge.

Verband Internet Reisevertrieb, 2020. Anteil der Bevölkerung in Deutschland mit Internetzugang nach Altersgruppen im Januar 2020. [Accessed 29/04/2020].

Vonderstein, A., 2010. Klimabewusst unterwegs - Verkehrsmittel im Umwelt-, Zeit- und Kostenvergleich. Berlin: Verbraucherzentrale Bundesverband e. V. Available at: https://www.verbraucherzentrale-bayern.de/sites/default/files/migration_files/media221043A.pdf [Accessed 03/06/2020].

Waqas, M., Dong, Q., Ahmad, N., Zhu, Y. et al. , 2018. Understanding acceptability towards Sustainable Transportation Behavior: A Case Study of China. Sustainability, 10 (10), pp. 3686 .

Weiber, R. and Mühlhaus, D., 2014. Strukturgleichungsmodellierung: Eine anwendungsorientierte Einführung in die Kausalanalyse mit Hilfe von AMOS, SmartPLS und SPSS. 2. Berlin: Springer-Verlag.

Wermelt, M., 2015. Bestandsaufnahme einer individuellen Feinstaubaufnahme in öffentlichen Verkehrsmitteln im Großraum München über die Jahre 2005 bis 2009 . Ludwig-Maximilians-Universität zu München.

Widmer, T., Schenkel, W. and Hirschi, C., 2000. Akzeptanz einer nachhaltigen Verkehrspolitik im politischen Prozess: Deutschland, Niederlande und Schweiz im Vergleich. 13),

Bern: Programmleitung NFP 41. Available at: https://www.zora.uzh.ch/id/eprint/163039/1/ZORA163039.pdf [Accessed 20/08/2020].

Williams, Y., 2020. What is Perception in Psychology? - Definition & Theory. Available at: https://study.com/academy/lesson/what-is-perception-in-psychology-definition-theory-quiz.html [Accessed 15/08/2020].

Xenias, D. and Whitmarsh, L., 2013. Dimensions and determinants of expert and public attitudes to sustainable transport policies and technologies. Transportation Research Part A, 48 pp. 75-85 doi: 10.1016/j.tra.2012.10.007 Available at: https://eur.on.worldcat.org/oclc/5901558400.

Yetter, G. and Capaccioli, K., 2010. Differences in responses to Web and paper surveys among school professionals. Behavior Research Methods, 42 (1), pp. 266-272 Available at: https://link.springer.com/content/pdf/10.3758/BRM.42.1.266.pdf .

Zentrum für Umfragen, Methoden und Analysen, 1995. ZUMA-Nachrichten 37. Neustadt: Verlag Pfälzische Post GmbH. Available at: https://www.gesis.org/fileadmin/upload/forschung/publikationen/zeitschriften/zuma_nachrichten/zn_37.pdf [Accessed 27/04/2020].

Zoellner, J., Schweizer-Ries, P. and Wemheuer, C., 2008. Public acceptance of renewable energies: Results from case studies in Germany. Energy Policy, 36 (11), pp. 4136-4141 Available at: https://www.sciencedirect.com/science/article/abs/pii/S0301421508003121.

Annex 1: Time schedule

Dates 2020	Event/ Task	Explanation
8th June	research proposal submission	2st submission for the research proposal aiming for the GO decision for fieldwork
12th June	"GO" – "NO GO" decision	
8th – 11th June	Pilot study preparation	Preparing the pilot survey
12th – 14th June	Pilot study execution	Conducting the pilot study with peers
15th – 17th June	Pilot study analysis	Analysis of the pilot study
14th – 17th June	Fieldwork preparation	Preparing the questionnaire Designing questions Incorporation of the feedback from the pilot study
18th June – 15th July	Manual questionnaire distribution	Manual distribution of the questionnaire link
18th June – 15th July	Online questionnaire distribution	Online distribution of the questionnaire link
18th June – 15th July	Snowball questionnaire distribution	Snowball distribution of the questionnaire link
18th June – 20th July	Data collection	Questionnaire will be online in this period
21th – 30th July	Data presentation	Presentation of the gathered quantitative data
21th – 31th July	Data visualisation	Visualisation of the gathered and presented quantitative data
30th July - 14th August	Data presentation description	Describing and textualizing the gathered data
15th– 20th August	Data analysis and interpretation	Analysing and interpreting the gathered data
10th August	Submission draft thesis	1st submission for the draft thesis
21st – 27th August	Concluding	After describing, visualising, analysing and interpreting the gathered data, concluding and recommending
31th August	Submission final thesis	1st submission for the full thesis

Annex 2: IHS copyright form

In order to allow the IHS Research Committee to select and publish the best UMD theses, participants need to sign and hand in this copy right form to the course bureau together with their final thesis.

Criteria for publishing:

1. A summary of 400 words should be included in the thesis.
2. The number of pages for the thesis is about 50 (without annexes).
3. The thesis should be edited

Please be aware of the length restrictions of the thesis. The Research Committee may choose not to publish very long and badly written theses.

By signing this form you are indicating that you are the sole author(s) of the work and that you have the right to transfer copyright to IHS, except for items cited or quoted in your work that are clearly indicated.

I grant IHS, or its successors, all copyrights to the work listed above, so that IHS may publish the work in *The IHS thesis series*, on the IHS web site, in an electronic publication or in any other medium.

IHS is granted the right to approve reprinting.

The author(s) retain the rights to create derivative works and to distribute the work cited above within the institution that employs the author.

Please note that IHS copyrighted material from *The IHS thesis series* may be reproduced, up to ten copies for educational (excluding course packs purchased by students), non-commercial purposes, providing full acknowledgements and a copyright notice appear on all reproductions.

Thank you for your contribution to IHS.

Date : 31.08.2020

Your Name(s) : Miriam Meral Ildiko MUSTÓ

Your Signature(s) : 

Please direct this form and all questions regarding this form or IHS copyright policy to:

The Chairman, IHS Research Committee Burg. Oudlaan 50, T-Building 14th floor, 3062 PA Rotterdam, The Netherlands	j.edelenbos@ihs.nl Tel. +31 10 4089851

Annex 3: Questionnaire

German

Deutsch

Default Question Block

.

Hallo!

Mein Name ist Miriam. Für meine Masterarbeit an der Erasmus Universität Rotterdam führe ich eine Umfrage durch, dabei interessiert mich besonders, wie verschiedene Verkehrsmittel genutzt und wertgeschätzt werden. Die Umfrage sollte nicht mehr als 10 Minuten Ihrer Zeit in Anspruch nehmen.

Mit Ihrer Teilnahme haben Sie die Chance, einen von **drei** Amazon Gutscheinen im Wert von **15 Euro** zu gewinnen.

Datenschutzerklärung:
Sämtliche in dieser Studie erhobenen Daten werden streng vertraulich behandelt und nicht an Dritte weitergegeben. Ihre Anonymität bleibt stets gewahrt. Die Daten werden ausschließlich gruppenbezogen analysiert. Selbstverständlich können Sie jederzeit vor, während und auch nach der Studie weitere Informationen über Zweck, Ablauf usw. der Studie von den Personen erfragen, die die Datenerhebung durchführen. Die Teilnahme an dieser Studie ist vollkommen freiwillig. Sie können die Umfrage jederzeit - auch ohne Angabe von Gründen - abbrechen, ohne dass sich aufgrund dessen Konsequenzen für Sie ergeben.

○ Ich bin damit **einverstanden**
○ Ich bin **NICHT** damit einverstanden

. Die COVID-19- Pandemie hat unser alltägliches Leben in vielen Bereichen verändert, so auch unser Mobilitätsverhalten und unsere Eindrücke dabei. Versuchen Sie daher bitte sich bei allen Antworten auf Ihre Situation **VOR** COVID-19 und die damit einhergehenden Maßnahmen zur Einschränkung der Pandemie im März 2020 zu beziehen.

.

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an.

Acceptance items

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Wir müssen Wege finden, um unser Verkehrssystem nachhaltiger zu gestalten	○	○	○	○	○
Umweltgedanken spielen eine wichtige Rolle in meiner Entscheidung, welche Verkehrsmittel ich für Arbeits- oder Bildungswege benutze	○	○	○	○	○
Aus ökologischer Sicht ist es wichtig, den Autoverkehr reduzieren	○	○	○	○	○
Aus ökologischer Sicht ist es wichtig, Abgase aus dem Verkehr zu reduzieren	○	○	○	○	○
Die Verkehrssituation in der Stadt spielt eine wichtige Rolle in meiner Entscheidung, welches Verkehrsmittel ich für Arbeits- oder Bildungswege benutze	○	○	○	○	○
Umweltverantwortung ist für mich als Person wichtig	○	○	○	○	○
Jede/r Einzelne kann einen Beitrag zu einem nachhaltigen Verkehrssystem leisten	○	○	○	○	○

.

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

Acceptance items

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Radfahren für Arbeits- oder Bildungswege kann ein wichtiger Beitrag zur Lösung städtischer Probleme sein	○	○	○	○	○

Autofahren für den Arbeits- oder Bildungsweg kann ein wichtiger Beitrag zur Lösung städtischer Probleme sein	○	○	○	○	○
Zu Fuß gehen für den Arbeits- oder Bildungsweg kann ein wichtiger Beitrag zur Lösung städtischer Probleme sein	○	○	○	○	○
Öffentliche Verkehrsmittel für den Arbeits- oder Bildungsweg kann ein wichtiger Beitrag zur Lösung städtischer Probleme sein	○	○	○	○	○

Zur Erinnerung: Denken Sie bitte bei ALLEN Aussagen an Ihr übliches Reiseverhalten **VOR** COVID-19 und die dadurch eingeführten Sperrmaßnahmen im März 2020.

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an.

Acceptance items

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Ich bin theoretisch dazu bereit, auf das Auto als Verkehrsmittel umzusteigen, um die Umwelt zu schonen	○	○	○	○	○
Ich bin theoretisch dazu bereit, auf öffentliche Verkehrsmittel umzusteigen, um die Umwelt zu schonen.	○	○	○	○	○
Ich bin theoretisch dazu bereit, auf das Fahrrad als Verkehrsmittel umzusteigen, um die Umwelt zu schonen	○	○	○	○	○
Ich bin theoretisch dazu bereit, mehr Wege zu Fuß zurückzulegen, um die Umwelt zu schonen	○	○	○	○	○

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an.

Acceptance items

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Autofahren ist eine umweltfreundliche Option der Fortbewegung	○	○	○	○	○

Wenn mehr Menschen zu Fuß gehen und Rad fahren, hätte dies einen positiven Effekt auf unsere Umwelt.	○	○	○	○	○
Ich befürworte Geschwindigkeitsbegrenzungen, um den Verkehr zu reduzieren	○	○	○	○	○
Öffentliche Verkehrsmittel sind eine umweltfreundliche Option der Fortbewegung	○	○	○	○	○
Radfahren und zu Fuß gehen sind umweltfreundliche Optionen der Fortbewegung	○	○	○	○	○

.

.

Zur Erinnerung: Denken Sie bitte bei ALLEN Aussagen an Ihr übliches Reiseverhalten **VOR** COVID-19 und die dadurch eingeführten Sperrmaßnahmen im März 2020.

Geben Sie bitte an, mit welchen der folgenden Verkehrsmitteln Sie normalerweise Arbeits- und Bildungswege zurück legen

- ☐ Öffentliche Verkehrsmittel
- ☐ Auto
- ☐ Fahrrad
- ☐ Zu Fuß
- ☐ _____ Andere

Geben Sie bitte an, wie viele **Kilometer** Sie durchschnittlich in der **Woche** mit folgenden Verkehrsmitteln Arbeits- oder Bildungswege zurücklegen.

	0	20	40	60	80	100	120	140	160	180	200	
Privates Auto												
Fahrrad												
Öffentliche Verkehrsmittel												
Zu Fuß												
Andere												

.

Geben Sie bitte an, wie **häufig** Sie durchschnittlich in der **Woche** mit folgenden Verkehrsmitteln Arbeits- oder Bildungswege zurücklegen. Dabei zählen jeweils Hin- und Rückwege.

	0	2	3	5	6	8	9	11	12	14	15
Privates Auto											
Fahrrad											
Öffentliche Verkehrsmittel											
Zu Fuß											
Andere											

Zur Erinnerung: Denken Sie bitte bei ALLEN Aussagen an Ihr übliches Reiseverhalten **VOR** COVID-19 und die dadurch eingeführten Sperrmaßnahmen im März 2020.

Benefit awareness items

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Durch einen Wechsel vom Auto zu anderen Verkehrsmitteln wird der Stau in der Stadt verringert	○	○	○	○	○
Durch den Wechsel vom Auto zu anderen Verkehrsmitteln wird die Zahl der Unfälle reduziert	○	○	○	○	○
Durch den Wechsel vom Auto zu anderen Verkehrsmitteln werden gesundheitliche Schäden durch den Verkehr vermehrt	○	○	○	○	○
Durch den Wechsel vom Auto zu anderen Verkehrsmitteln wird persönlicher Stress verringert	○	○	○	○	○
Durch den Wechsel vom Auto zu anderen Verkehrsmitteln wird die Luftqualität in der Stadt verschlechtert	○	○	○	○	○

.

Problem awareness items

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Fahrzeugemissionen stellen nur ein kleiner Teil der gesamten weltweiten Emissionen dar	○	○	○	○	○
Verkehrsbedingte Luftverschmutzung ist gefährlich für unsere Gesundheit	○	○	○	○	○
Umweltthemen wie globale Erwärmung werden übertrieben dargestellt	○	○	○	○	○
Verkehrsemissionen stellen eine Bedrohung für die Umwelt dar	○	○	○	○	○
Im Verkehr ausgestoßenes Kohlendioxid (CO_2) unterstützt die globale Erwärmung	○	○	○	○	○

Die urbane Flächeneinnahme durch den Verkehr ist eher ein geringeres Problem	○	○	○	○	○

.

.

Zur Erinnerung: Denken Sie bitte bei ALLEN Aussagen an Ihr übliches Reiseverhalten **VOR** COVID-19 und die dadurch eingeführten Sperrmaßnahmen im März 2020.

Information and education items

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
die Qualität der verfügbaren Informationen über nachhaltige Verkehrsmittel ist angemessen	○	○	○	○	○
Der Umfang der verfügbaren Informationen über nachhaltige Verkersmittel ist angemessen	○	○	○	○	○
Der Zugang zu verfügbaren Informationen über nachhaltige Verkehrsmittel ist einfach und problemlos	○	○	○	○	○
Ich fühle mich gut über nachhaltige Verkehrsmittel informiert	○	○	○	○	○
Die verfügbaren Informationen über nachhaltige Verkehrsmittel sind verständlich und umfassend	○	○	○	○	○

.

Car Status items

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Mein Auto zeigt, wer und was ich bin	○	○	○	○	○
Ich bin manchmal eifersüchtig auf jemanden mit einem schönen Auto	○	○	○	○	○
Sie können eine Person anhand ihres Autos einschätzen	○	○	○	○	○

Ein Auto verleiht Status und Prestige	○	○	○	○	○
Die Automarke ist für mich wichtiger als die funktionalen Eigenschaften eines Autos	○	○	○	○	○

.

.

Zur Erinnerung: Denken Sie bitte bei ALLEN Aussagen an Ihr übliches Reiseverhalten **VOR** COVID-19 und die dadurch eingeführten Sperrmaßnahmen im März 2020.

Geben Sie bitte an, wie sicher Sie sich mit folgenden Verkehrsmitteln im Straßenverkehr fühlen:

	Sehr unsicher 0	1	Unsicher 2	3	4	Weder noch 5	6	Sicher 7	8	Sehr sicher 9	10
Privates Auto											
Fahrrad											
Öffentliche Verkehrsmittel											
Zu Fuß											

Safety perception items

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Radfahren ist für mich eine sichere Transportmöglichkeit.	○	○	○	○	○
Autofahren ist für mich eine sichere Transportmöglichkeit	○	○	○	○	○
Öffentliche Verkehrsmittel sind für mich eine sichere Transportmöglichkeit	○	○	○	○	○
Zu Fuß gehen ist für mich eine sichere Transportmöglichkeit	○	○	○	○	○
Ich fühle mich in einem privaten Auto sicherer als in anderen Verkehrsmitteln	○	○	○	○	○
Je mehr Verkehrsmittel auf der Straße sind, desto mehr Verkehrsunfälle gibt es	○	○	○	○	○

Zur Erinnerung: Denken Sie bitte bei ALLEN Aussagen an Ihr übliches Reiseverhalten **VOR** COVID-19 und die dadurch eingeführten Sperrmaßnahmen im März 2020.

Geben Sie bitte an, für wie teuer Sie folgende Verkehrsmittel empfinden:

	Sehr günstig 0	1	2	Günstig 3	4	Weder noch 5	6	Teuer 7	8	Sehr teuer 9	10
Fahrrad											
Öffentliche verkehrsmittel											
Auto											
Zu Fuß											

.

Cost perception items

Geben Sie bitte Ihre Zustimmung zu folgenden Aussagen an

	Stimme voll und ganz zu	Stimme zu	Weder noch	Lehne ab	Lehne voll und ganz ab
Ich mache mir Sorgen darüber, dass ich einen zu großen Teil meines monatlichen Einkommens für Verkehrsmittel ausgebe	○	○	○	○	○
Ein privates Auto ist mir zu teuer	○	○	○	○	○
Öffentliche Verkehrsmittel sind mir zu teuer	○	○	○	○	○
Ein Fahrrad ist mir zu teuer	○	○	○	○	○

.

.

Nun noch einige Fragen zu Ihrer Person.

Bitte geben Sie Ihr **Alter** an.

.

Geben Sie bitte das **Geschlecht** an, mit dem Sie sich am ehesten identifizieren können.

- ○ Männlich
- ○ Weiblich
- ○ Divers

.

Wie ist Ihr Haushalt derzeit zusammengesetzt?

- ○ Single Haushalt **ohne** Kind/er
- ○ Single Haushalt **mit** Kind/ern
- ○ Lebe mit meinem Partner/meiner Partnerin **ohne** Kind/er zusammen
- ○ Lebe mit meinem Partner/meiner Partnerin **und** Kind/ern zusammen
- ○ Wohngemeinschaft
- ○ Lebe mit meinen Eltern oder anderen Familienangehörigen zusammen

.

Wählen Sie bitte aus, was auf Sie zutrifft (mehrere möglich)

- ☐ SchülerIn
- ☐ StudentIn
- ☐ In Ausbildung
- ☐ Angestellt
- ☐ Selbstständig
- ☐ Beschäftigungslos
- ☐ Rente

.

Geben Sie Ihren höchsten **Bildungsabschluss** an

- ○ Qualifizierender Hauptschulabschluss
- ○ Mittlerer Bildungsabschluss
- ○ Hochschulreife
- ○ Bachelor
- ○ Diplom
- ○ Master
- ○ _____ Sonstige

.

Besitzen Sie ein Abonnement für die öffentlichen Verkehrsmittel?

- ○ Ja, ich kaufe mir regelmäßig eine **Wochenkarte**
- ○ Ja, ich kaufe mir regelmäßig eine **Monatskarte**
- ○ Nein
- ○ _____ Sonstiges Abonnement:

.

Besitzen Sie ein Fahrrad?

- ○ **Ja**, ich besitze mindestens ein Fahrrad
- ○ **Nein**, ich besitze kein Fahrrad

.

Besitzen Sie ein eigenes Auto?

- ○ **Ja**, ich besitze ein Auto
- ○ **Nein**, ich besitze kein Auto, habe aber über Bekannte/Familie oder andere regelmäßig **Zugriff** auf eins
- ○ **Nein**, ich besitze kein Auto und habe auch **keinen** regelmäßigen **Zugriff** auf eins

Wie hoch ist Ihr **monatliches** Einkommen nach Abzug der Steuern? (optional)

.

Falls Sie an der Verlosung der Gutscheine teilnehmen möchten, geben Sie bitte hier Ihren Kontakt an (optional)

English

English (United Kingdom)

Default Question Block

.

Hi!

My name is Miriam. As part of my master's thesis at the Erasmus University Rotterdam I am conducting a survey. I am particularly interested in how different modes of transport are used and valued. The survey should not take more than 10 minutes of your time. Your data will of course be treated anonymously and will be deleted after completion of my thesis.

With your participation you have the chance to win one of three Amazon vouchers worth 15 Euro each.

Privacy Policy:
All data collected in this study will be treated with the utmost confidentiality and will not be disclosed to third parties. Your anonymity will always be guaranteed. The data will only be analysed group-related.
You can of course request further information on the purpose, procedure etc. of the study from the person carrying out the data collection at any time before, during and also after the study. Participation in this study is completely voluntary. You can stop the study at any time - even without giving reasons - with no consequences.

- I agree
- I DO NOT agree

. The COVID-19 pandemic has changed our everyday life in many ways, including our mobility behavior and our attitudes towards it. Please try to refer to your situation BEFORE COVID-19 and the resulting measures in March 2020 in all your answers.

.

Please indicate your agreement to the following statements.

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Each and every one of us can contribute to a sustainable transport system	○	○	○	○	○
Environmental considerations play an important part in my decision which mode of transport I use for commuting	○	○	○	○	○
Environmental responsibility is important to me as a person	○	○	○	○	○
We must find ways to make our transport system more sustainable	○	○	○	○	○
From an ecological point of view, it is important to reduce exhaust fumes from traffic	○	○	○	○	○
The traffic situation in the city plays an important part in my decision which mode of transport I use for commuting	○	○	○	○	○
From an environmental perspective, it is important to reduce car traffic	○	○	○	○	○

.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Using public transport to work or education can be an important contribution to solving urban problems	○	○	○	○	○

Cycling to work or education can be an important contribution to solving urban problems	○	○	○	○	○
Driving your car to work or education can be an important contribution to solving urban problems	○	○	○	○	○
Walking to work or education can be an important contribution to solving urban problems	○	○	○	○	○

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate your agreement to the following statements.

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I am theoretically willing to switch to the car as a mode of transport to reduce the impact on the environment	○	○	○	○	○
I am theoretically willing to switch to the bike as a mode of transport to reduce the impact on the environment	○	○	○	○	○
I am theoretically willing to walk more distances to reduce the impact on the environment	○	○	○	○	○
I am theoretically willing to switch to public transport transport to reduce the impact on the environment	○	○	○	○	○

Please indicate your agreement with the following statements.

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I am in favour of speed limits to reduce car traffic	○	○	○	○	○
Driving a car is an environmentally friendly option for transportation	○	○	○	○	○

If more people were to walk and cycle, it would have a positive effect on our environment	○	○	○	○	○
Public transport is a environmentally friendly option for transportation	○	○	○	○	○
Cycling and walking are environmentally friendly options for transportation	○	○	○	○	○

.

.

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate which of the following modes of transport you typically use to commute to work or education

- ☐ Public Transport
- ☐ Walking
- ☐ Car
- ☐ Bike
- ☐ _____ Other

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate the average number of kilometres per **week** you travel to work or education with the following modes of transport.

	0	20	40	60	80	100	120	140	160	180	200	
Private car												
Bike												
Public Transport												
Walking												
Other												

.

Please indicate the average number of your trips per **week** to work or education using the following modes of transport. This includes both outward and return trips.

	0	2	3	5	6	8	9	11	12	14	15	
Private car												
Bike												
Public transport												
Walking												
Other												

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Switching from the car to other modes of transport increases health damage caused by traffic	○	○	○	○	○
Switching from cars to other modes of transport worsens air quality in the city	○	○	○	○	○
Switching from cars to other modes of transport will reduce congestion in the city	○	○	○	○	○
Switching from car to other modes of transport reduces personal stress	○	○	○	○	○
Switching from cars to other modes of transport reduces the number of accidents	○	○	○	○	○

.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Urban land take by the traffic poses a problem	○	○	○	○	○
Transport emissions pose a threat to the environment	○	○	○	○	○
Vehicle emissions are one of the main sources of air pollution problems worldwide	○	○	○	○	○
Environmental threats such as global warming are overstated	○	○	○	○	○
Carbon dioxide (CO2) emitted by transport worsens global warming	○	○	○	○	○

Traffic-related air pollution is dangerous to our health	○	○	○	○	○

.

.

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Access to available information on sustainable transport is satisfactory and easy.	○	○	○	○	○
The amount of information available on sustainable transport is sufficient	○	○	○	○	○
The quality of information available on sustainable transport is sufficient	○	○	○	○	○
I feel well informed about sustainable transport	○	○	○	○	○
The information available on sustainable transport is clear and comprehensive	○	○	○	○	○

.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I may be jealous of someone with a nice car.	○	○	○	○	○
You can judge a person by their car	○	○	○	○	○
My car shows who and what I am	○	○	○	○	○
A car gives status and prestige	○	○	○	○	○
The brand of a car is more important to me than the functional characteristics of a car	○	○	○	○	○

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate how safe you feel when using the following modes of transport on the road:

	Very unsafe		Unsafe		Neither safe or unsafe		Safe		Very safe	
	0	1	2	3	4	5	6	7	8	9	10
Private car											
Bike											
Public transport											
Walking											

.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Driving a car is a safe way of transport for me	○	○	○	○	○
The more vehicles on the road, the more traffic accidents happen	○	○	○	○	○
Public transport is a safe way of transport for me	○	○	○	○	○
I feel safer in a private car than in other modes of transport	○	○	○	○	○
Walking is a safe way of transport for me	○	○	○	○	○
Cycling is a safe way of transport for me	○	○	○	○	○

.

.

Reminder: Please recall your usual travel behaviour BEFORE COVID-19 and the resulting measures in March 2020.

Please indicate how expensive you consider the following modes of transport to be:

	Very cheap		Cheap		Neither cheap or expensive		Expensive		Very expensive	
	0	1	2	3	4	5	6	7	8	9	10
Bike											
Public transport											

Car	
Walking	

.

Please indicate your agreement with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
A private car is too expensive for me	○	○	○	○	○
Public transport is too expensive for me	○	○	○	○	○
A bike is too expensive for me	○	○	○	○	○
I worry that I spend too much of my monthly income on transportation	○	○	○	○	○

.

.

A few more questions about your person.

Please indicate your age.

.

Please enter the gender you can identify with the most.

- ○ Male
- ○ Female
- ○ Other

.

What is the current composition of your household?

- ○ Living alone
- ○ Sharing my apartment with children
- ○ Sharing my apartment with a partner
- ○ Sharing my apartment with a partner and children
- ○ Sharing my apartment with roommates
- ○ Sharing my apartment with family members

.

Please select what applies to you

- ☐ Pupil
- ☐ Student
- ☐ Apprentice

- [ ] Employed
- [ ] Self-employed
- [ ] Unemployed
- [ ] Retired

.

Indicate your highest completed education

- ○ Qualifizierender Hauptschulabschluss
- ○ Mittlerer Bildungsabschluss
- ○ Abitur
- ○ Bachelor
- ○ Diplom
- ○ Master
- ○ _____ Other

.

Do you have a public transport subscription?

- ○ Yes, I have a weekly subscription
- ○ Yes, I have a monthly subscription
- ○ No
- ○ _____ Other subscription

Do you own a bike?

- ○ Yes, I own at least one bike
- ○ No, I do not own a bike

.

Do you own a car?

- ○ Yes, I own a car
- ○ No, I do not own a car, but I have regular access to one through friends or family
- ○ No, I do not own a car and I do not have regular access to one

.

What was your **monthly** income last year after taxes? (optional)

.

If you would like to participate in the voucher lottery, please enter your contact details here (optional)

Annex 4: Statistical Output

A. General Statistical Output

Table 6: Descriptive Statistics for commuters characteristics (Author, 2020)

Summery

		Frequency	Percent
Age	15 - 25	95	31.1%
	26 - 35	134	43.9%
	36 - 45	27	8.9%
	46 - 55	35	11.5%
	56 - 65	14	4.6%
	Total	305	100%
Gender	Female	111	36.5%
	Male	192	62.8%
	Divers	2	0.7%
	Total	305	100%
Household Structure	Single household, no children	73	24.0%
	Single household, children	11	3.6%
	Living with partner, no children	94	30.9%
	Living with partner, children	26	8.6%
	Living with roommates	63	20.4%
	Living with family	38	12.5%
	Total	305	100%
Education	Secondary school	5	1.6%
	Middle Maturity	18	5.9%
	University Qualification	88	28.9%
	Bachelor	81	26.6%
	Diplom	40	13.1%
	Master	65	21.3%
	Master craftsman	1	0.3%
	State examination	3	1.0%
	PhD	1	0.3%
	No Answer/No Education	3	1.0%
	Total	305	100%
Occupation	Pupil	11	3.6%
	Student	114	37.4%
	In apprenticeship	5	1.6%
	Employed	175	57.4%
	Self-employed	23	7.5%
	Other	9	2.7%
Income	< 1000 €	57	19.7%
	1000 - 2000 €	44	14.5%
	2000 - 3000 €	43	14.1%
	3000 - 4000 €	16	5.3%
	> 4000 €	9	3.6%
	Total	169	57.2%
Bike Ownership	Yes	272	89.2%
	No	33	10.8%
	Total	305	100%
Car Ownership	Yes	104	34.1%
	No, but have access	96	31.5%
	No	105	34.4%
	Total	305	100%
Public Transport Subscription	Weekly subscription	3	1.0%
	Monthly subscription	88	28.9%
	Yearly subscription	21	6.9%
	Jobticket	5	1.6%
	Educational ticket	39	12.8%
	Other subscription	3	1.0%
	No subscription	146	47.9%
	Total	305	100%

Table 7: Summery of important descriptive statistics (Author, 2020)

	N	Minimum	Maximum	Mean	Std. Deviation
Age	304	15	65	31.70	11.07
Income	174	60	10000	1920.56	1432.28
Acceptance	304	1	4.69	1.73	0.54
Benefit Awareness	304	1	4	1.94	0.66
Problem Awareness	304	1	5	1.89	0.66
Information and Education	304	1	5	2.80	0.83
Car Status	304	1	5	3.71	0.85
Safety Perception	304	1.2	5	3.44	0.61
Cost Perception	304	1	5	3.60	0.61

Table 8: Acceptance by personal characteristics (Author, 2020)

		Mean	Median	Std. Deviation	Minimum	Maximum	N
Gender	Female	1.73	1.62	0.51	1	2.96	111
	Male	1.73	1.65	0.56	1	4.69	191
	Divers	1.33	1.33	0.09	1.27	1.39	2
Age	15 to 25	1.73	1.60	0.57	1	3.68	95
	26 to 35	1.78	1.73	0.51	1	4.69	133
	36 to 45	1.66	1.57	0.50	1.05	2.82	27
	46 to 55	1.55	1.48	0.34	1	2.45	35
	56 to 65	1.79	1.52	0.94	1	4.28	14
Education	Secondary School	1.4975	1.4429	0.30755	1.25	2.03	5
	Middle Maturity	1.7798	1.758	0.51845	1.11	2.72	18
	University Qualification	1.7491	1.6768	0.62232	1	4.69	88
	Bachelor	1.7502	1.7196	0.46991	1	2.81	81
	Diplom	1.6751	1.4446	0.66186	1.06	4.28	40
	Master	1.6797	1.6196	0.4209	1	2.91	64
	Other	1.854	1.6973	0.67224	1.07	2.96	8
Income	N/A	1.87	1.80	0.59	1	4.69	130
	< 1000 €	1.54	1.48	0.40	1	2.79	60
	1000 - 2000 €	1.69	1.62	0.52	1	2.91	44
	2000 - 3000 €	1.59	1.57	0.41	1.05	2.68	43
	3000 - 4000 €	1.75	1.54	0.76	1.06	4.28	16
	> 4000 €	1.68	1.63	0.43	1	2.44	11
Car Ownership	Yes	1.94	1.81	0.65	1.06	4.69	104
	No but access	1.63	1.58	0.46	1	2.81	95
	No	1.60	1.57	0.42	1	2.83	105

Table 9: Test for internal consistency (Author, 2020)

	Cronbach's Alpha	N of Items
Acceptance	0.912	20
Benefit Awareness	0.655	3
Problem Awareness	0.811	6
Information	0.9	5
Car Status	0.768	5
Safety Perception	0.605	5
Cost Perception	0.531	3

Table 10: Tests of Normality (Author, 2020)

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Acceptance	0.09	304	0.000	0.903	304	0.000
Benefit Awareness	0.106	304	0.000	0.952	304	0.000
Problem Awareness	0.091	304	0.000	0.925	304	0.000
Information	0.093	304	0.000	0.978	304	0.000
Car Status	0.084	304	0.000	0.967	304	0.000
Cost Perception	0.114	304	0.000	0.965	304	0.000

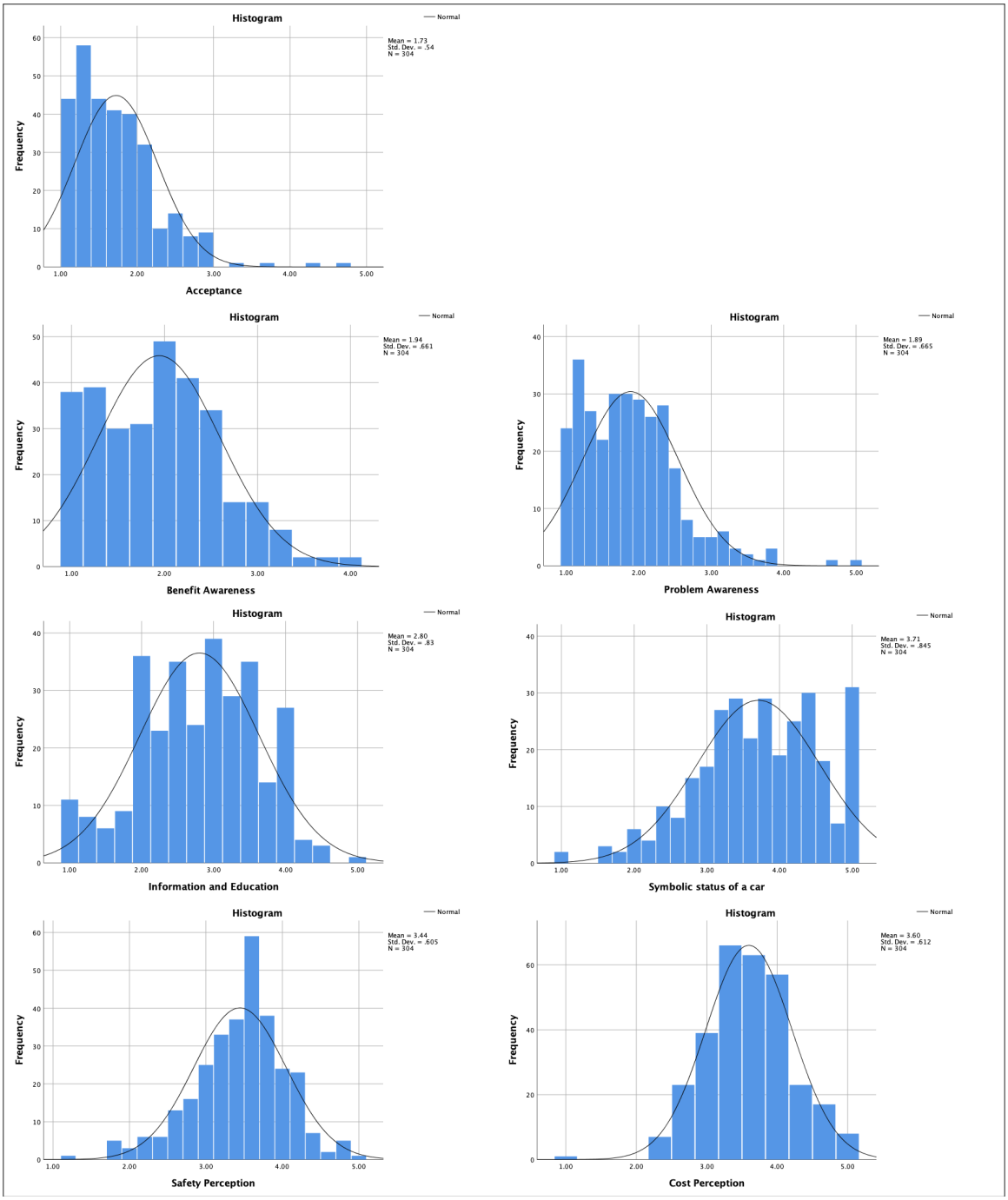

Figure 29: Histograms for dependent and independent variables (Author, 2020)

B. Inferential analysis

Table 11: ANOVAs and Levene Tests (Author, 2020)

ANOVA
Acceptance

		Sum of Squares	df	Mean Square	F	Sig.
Household	Between Groups	3.933	5	0.787	2.772	0.018
	Within Groups	84.561	298	0.284		
	Total	88.494	303			
Education	Between Groups	0.779	6	0.13	0.44	0.852
	Within Groups	87.715	297	0.295		
	Total	88.494	303			
Income	Between Groups	0.957	4	0.239	1.05	0.383
	Within Groups	38.495	169	0.228		
	Total	39.452	173			
Age	Between Groups	1.698	4	0.424	1.462	0.214
	Within Groups	86.796	299	0.29		
	Total	88.494	303			

Test of Homogeneity of Variances
Acceptance

		Levene Statistic	df1	df2	Sig.
Household	Based on Mean	2.454	5	298	0.034
	Based on Median	2.172	5	298	0.057
	Based on Median and with adjusted df	2.172	5	250.606	0.058
	Based on trimmed mean	2.359	5	298	0.04
Education	Based on Mean	1.302	6	297	0.256
	Based on Median	1.066	6	297	0.383
	Based on Median and with adjusted df	1.066	6	218.778	0.384
	Based on trimmed mean	1.176	6	297	0.319
Income	Based on Mean	1.398	4	169	0.237
	Based on Median	0.856	4	169	0.492
	Based on Median and with adjusted df	0.856	4	78.64	0.494
	Based on trimmed mean	1.022	4	169	0.398
Age	Based on Mean	4.444	4	299	0.002
	Based on Median	3.246	4	299	0.013
	Based on Median and with adjusted df	3.246	4	199.353	0.013
	Based on trimmed mean	3.856	4	299	0.005

Table 12: Welch-tests (Author, 2020)

	Statistica	df1	df2	Sig.
Welch for Age	2.68	4	60.436	0.04
Welch for income	0.92	4	43.758	0.463
Welch for Housegold	3.76	5	68.689	0.005
Welch for Education	0.68	6	34.623	0.671

Table 13: Post-hoc test for age (Author, 2020)

Multiple Comparisons
Dependent Variable: Acceptance

	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	15 - 25	26 - 35	-0.051	0.073	0.956	-0.253	0.151
		36 - 45	0.071	0.113	0.969	-0.249	0.392
		46 - 55	0.181	0.081	0.179	-0.045	0.407
		56 - 65	-0.067	0.259	0.999	-0.870	0.736
	25 - 35	15 - 25	-0.248	0.258	0.869	-1.050	0.555
		36 - 45	0.123	0.106	0.777	-0.182	0.427
		46 - 55	.23251*	0.072	0.015	0.032	0.433
		56 - 65	-0.015	0.256	1	-0.814	0.784
	36 - 45	15 - 25	-0.071	0.113	0.969	-0.392	0.249
		56 - 65	-0.248	0.258	0.869	-1.050	0.555
		46 - 55	0.110	0.112	0.863	-0.209	0.429
		56 - 65	-0.138	0.270	0.985	-0.960	0.684
	46 - 55	15 - 25	-0.181	0.081	0.179	-0.407	0.045
		26 - 35	-.23251*	0.072	0.015	-0.433	-0.032
		36 - 45	-0.110	0.112	0.863	-0.429	0.209
		56 - 65	-0.248	0.258	0.869	-1.050	0.555
	56 - 65	15 - 25	0.067	0.259	0.999	-0.736	0.870
		26 - 35	0.015	0.256	1	-0.784	0.814
		36 - 45	0.138	0.270	0.985	-0.684	0.960
		46 - 55	0.248	0.258	0.869	-0.555	1.050

* The mean difference is significant at the 0.05 level.

Table 14: t-test for gender (Author, 2020)

		Levene's Test for Equality of Variances		t-test for Euality of Means						
									95 % Confidence Interval Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	St. Error Difference	Lower Bound	Upper Bound
Acceptance	Equal variances assumed	0.311	0.577	-0.055	300	0.956	-0.004	0.065	-0.131	0.124
	Equal variances not assumed			-0.056	249.923	0.955	-0.004	0.063	-0.127	0.12

Table 15: Post-hoc test for household structure (Author, 2020)

Multiple Comparisons
Dependent Variable: Acceptance

	(I) Household structure	(J) Household structure	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Games-Howell	Single no children	Single, with children	0.035	0.186	1	-0.577	0.647
		Living with partner, no children	-0.060	0.093	0.987	-0.327	0.207
		Living with partner, with children	0.161	0.105	0.642	-0.146	0.467
		Living with roommate	0.208	0.085	0.152	-0.039	0.456
		Single, no children	-0.161	0.105	0.642	-0.467	0.146
	Single with children	Single, no children	-0.035	0.186	1	-0.647	0.577
		Living with partner, no children	-0.095	0.182	0.994	-0.701	0.511
		Living with partner, with children	0.126	0.188	0.983	-0.490	0.742
		Living with roommate	0.173	0.178	0.918	-0.429	0.775
		Single, no children	-0.161	0.105	0.642	-0.467	0.146
	Living with partner no children	Single, no children	0.060	0.093	0.987	-0.207	0.327
		Single, with children	0.095	0.182	0.994	-0.511	0.701
		Living with partner, with children	0.221	0.096	0.214	-0.063	0.505
		Living with roommate	.26827*	0.075	0.006	0.051	0.485
		Living with family	-0.045	0.110	0.998	-0.368	0.278
	Living with partner with children	Single, no children	-0.161	0.105	0.642	-0.467	0.146
		Single, with children	-0.126	0.188	0.983	-0.742	0.490
		Living with partner, no children	-0.221	0.096	0.214	-0.505	0.063
		Living with roommate	0.048	0.090	0.995	-0.219	0.314
		Living with family	-0.266	0.120	0.248	-0.620	0.088
	Living with roommate	Single, no children	-0.208	0.085	0.152	-0.456	0.039
		Single, with children	-0.173	0.178	0.918	-0.775	0.429
		Living with partner, no children	-.26827*	0.075	0.006	-0.485	-0.051
		Living with partner, with children	-0.048	0.090	0.995	-0.314	0.219
		Living with family	-.31365*	0.104	0.043	-0.621	-0.006
	Living with family	Single, no children	0.105	0.117	0.946	-0.238	0.448
		Single, with children	0.140	0.195	0.977	-0.488	0.768
		Living with partner, no children	0.045	0.110	0.998	-0.278	0.368
		Living with partner, with children	0.266	0.120	0.248	-0.088	0.620
		Living with roommate	.31365*	0.104	0.043	0.006	0.621

* The mean difference is significant at the 0.05 level.

Table 16: Correlations (Author, 2020)

		Benefit Awareness	Problem Awareness	Information and Education	Car Status	Safty Perception	Cost Perception
Acceptance	Pearson Correlation	.685**	.732**	0.056	-.314**	-.473**	-.477**
	Sig. (2-tailed)	0.000	0.000	0.331	0.000	0.000	0.000
	Sum of Squares and Cross-products	74.126	79.707	7.61	-43.498	-46.9	-47.857
	Covariance	0.245	0.263	0.025	-0.144	-0.155	-0.158
	N	304	304	304	304	304	304

** Correlation is significant at the 0.01 level (2-tailed).

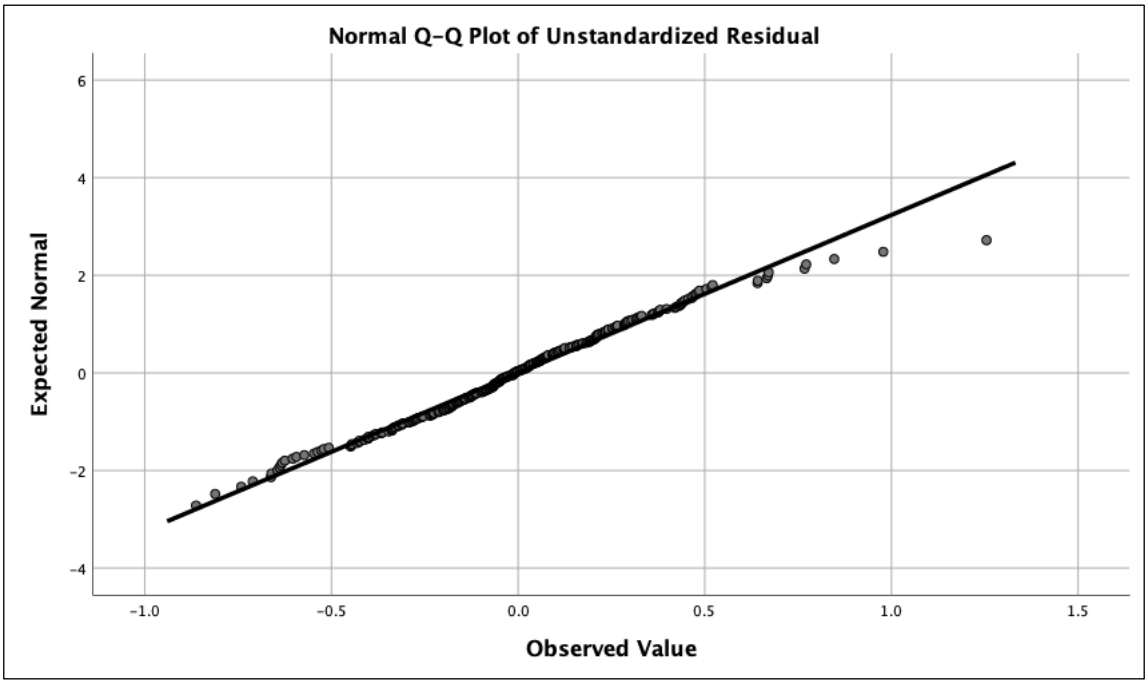

Figure 30: Normal Q-Q-Plot of unstandardised residuals (Author, 2020)

Table 17: Cook's Distance (Author, 2020)

Residuals Statisticsa

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	0.8768	3.7095	1.7255	0.44326	304
Std. Predicted Value	-1.915	4.476	0	1	304
Standard Error of Predicted Value	0.021	0.113	0.042	0.013	304
Adjusted Predicted Value	0.8715	3.5606	1.7255	0.4416	304
Residual	-0.86261	1.25449	0	0.30916	304
Std. Residual	-2.767	4.024	0	0.992	304
Stud. Residual	-2.883	4.152	0	1.007	304
Deleted Residual	-0.93617	1.33573	-0.00004	0.31905	304
Stud. Deleted Residual	-2.919	4.271	0	1.013	304
Mahal. Distance	0.386	39.036	4.984	4.212	304
Cook's Distance	0	0.288	0.005	0.022	304
Centered Leverage Value	0.001	0.129	0.016	0.014	304

a Dependent Variable: Acceptance

Table 18: Breusch-Pegan test for heteroscedasticity (Author, 2020)

	Chi-Square	df	Sig.
Modified Breusch-Pagan	48.013	1	0.00
Breusch-Pagan	71.123	1	0.00

a Dependent variable: Acceptance
b Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.
c Predicted values from design: Intercept + BenefitAwareness + ProblemAwareness + CarStatus + SafetyPerception + CostPerception

Table 19: Multiple linear regression model I (Author, 2020)

Correlations

		Acceptance	Age
Pearson Correlation	Acceptance	1	-0.081
	Age	-0.081	1
Sig. (1-tailed)	Acceptance	.	0.078
	Age	0.078	.
N	Acceptance	304	304
	Age	304	304

Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.081a	0.007	0.003	0.53952	0.007	2.019	1	302	0.156	1.935

a Predictors: (Constant), Age
b Dependent Variable: Acceptance

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.588	1	0.588	2.019	.156b
	Residual	87.906	302	0.291		
	Total	88.494	303			

a Dependent Variable: Acceptance
b Predictors: (Constant), Age

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.852	0.094		19.696	0	1.667	2.037					
	Age	-0.004	0.003	-0.081	-1.421	0.156	-0.009	0.002	-0.081	-0.081	-0.081	1	1

a Dependent Variable: Acceptance

Collinearity Diagnosticsa

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	Age
1	1	1.944	1	0.03	0.03
	2	0.056	5.907	0.97	0.97

a Dependent Variable: Acceptance

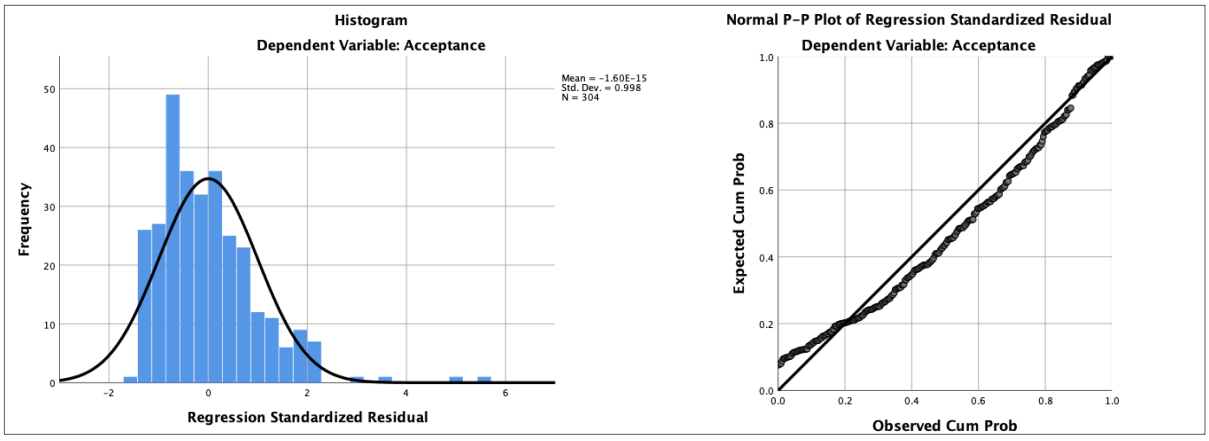

Figure 31: Histogram and P-P Plot of regression model I (Author, 2020)

Table 20: Multiple linear regression model II (Author, 2020)

Correlations

		Acceptance	Benefit Awareness	Problem Awareness
Pearson Correlation	Acceptance	1	0.685	0.732
	Benefit Awareness	0.685	1	0.603
	Problem Awareness	0.732	0.603	1
Sig. (1-tailed)	Acceptance	.	0.000	0.000
	Benefit Awareness	0.000	.	0.000
	Problem Awareness	0.000	0.000	.
N	Acceptance	304	304	304
	Benefit Awareness	304	304	304
	Problem Awareness	304	304	304

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.793a	0.629	0.627	0.33012	0.629	255.51	2	301	0

a Predictors: (Constant), Problem Awareness, Benefit Awareness

b Dependent Variable: Acceptance

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	55.691	2	27.846	255.51	.000b
	Residual	32.803	301	0.109		
	Total	88.494	303			

a Dependent Variable: Acceptance

b Predictors: (Constant), Problem Awareness, Benefit Awareness

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	0.349	0.064		5.446	0.000	0.223	0.475					
	Benefit Awareness	0.312	0.036	0.382	8.685	0.000	0.242	0.383	0.685	0.448	0.305	0.636	1.572
	Problem Awareness	0.408	0.036	0.502	11.411	0.000	0.338	0.479	0.732	0.55	0.4	0.636	1.572

a Dependent Variable: Acceptance

Collinearity Diagnosticsa

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	Benefit Awareness	Problem Awareness
1	1	2.898	1	0.01	0.01	0.01
	2	0.059	6.991	0.97	0.11	0.28
	3	0.042	8.287	0.02	0.88	0.71

a Dependent Variable: Acceptance

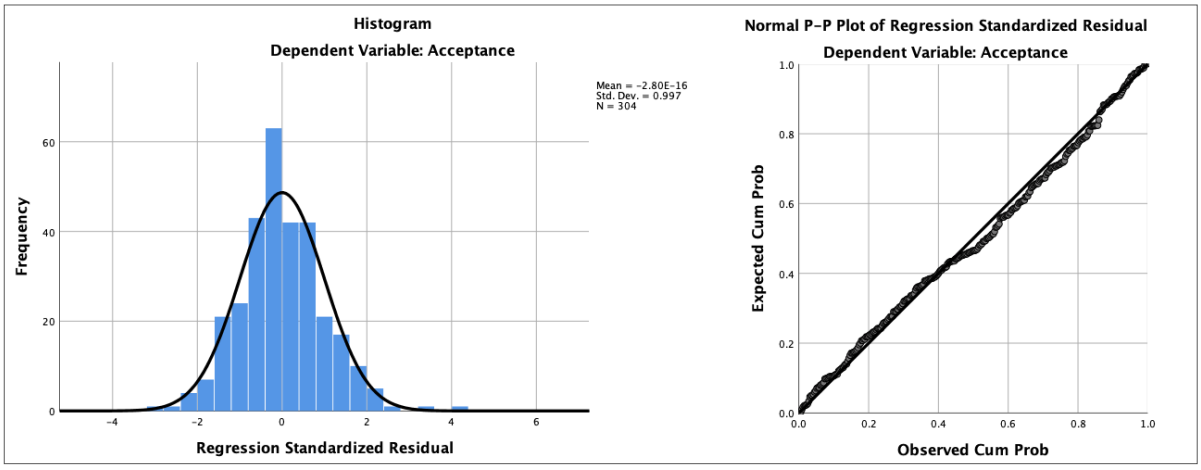

Figure 32: Histogram and P-P plot of regression model II (Author, 2020)

Table 21: Multiple linear regression model III (Author, 2020)

Correlations

		Acceptance	Car Status	Safety Perception	Cost Perception
Pearson Correlation	Acceptance	1	-0.314	-0.473	-0.477
	Car Status	-0.314	1	0.301	0.272
	Safety Perception	-0.473	0.301	1	0.469
	Cost Perception	-0.477	0.272	0.469	1
Sig. (1-tailed)	Acceptance	.	0.000	0.000	0.000
	Car Status	0.000	.	0.000	0.000
	Safety Perception	0.000	0.000	.	0.000
	Cost Perception	0.000	0.000	0.000	.
N	Acceptance	304	304	304	304
	Car Status	304	304	304	304
	Safety Perception	304	304	304	304
	Cost Perception	304	304	304	304

Model Summary (b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.571a	0.326	0.32	0.44578	0.326	48.442	3	300	0.000

a Predictors: (Constant), Cost Perception, Symbolic status of a car, Safety Perception

b Dependent Variable: Acceptance

ANOVA (a)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.879	3	9.626	48.442	.000 (b)
	Residual	59.615	300	0.199		
	Total	88.494	303			

a Dependent Variable: Acceptance

b Predictors: (Constant), Cost Perception, Symbolic status of a car, Safety Perception

Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Correlations		Collinearity Statistics		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.917	0.184		21.264	0.000	3.554	4.279					
	Car Status	-0.093	0.032	-0.145	-2.891	0.004	-0.156	-0.03	-0.314	-0.165	-0.137	0.887	1.127
	Safety Perception	-0.256	0.049	-0.287	-5.24	0.000	-0.353	-0.16	-0.473	-0.29	-0.248	0.747	1.338
	Cost Perception	-0.268	0.048	-0.303	-5.58	0.000	-0.362	-0.173	-0.477	-0.307	-0.264	0.761	1.314

a Dependent Variable: Acceptance

Collinearity Diagnostics (a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	Car Status	Safety Perception	Cost Perception
1	1	3.937	1	0.000	0.000	0.000	0.000
	2	0.034	10.831	0.02	0.96	0.07	0.08
	3	0.016	15.894	0.11	0.000	0.92	0.37
	4	0.014	16.868	0.87	0.03	0.01	0.55

a Dependent Variable: Acceptance

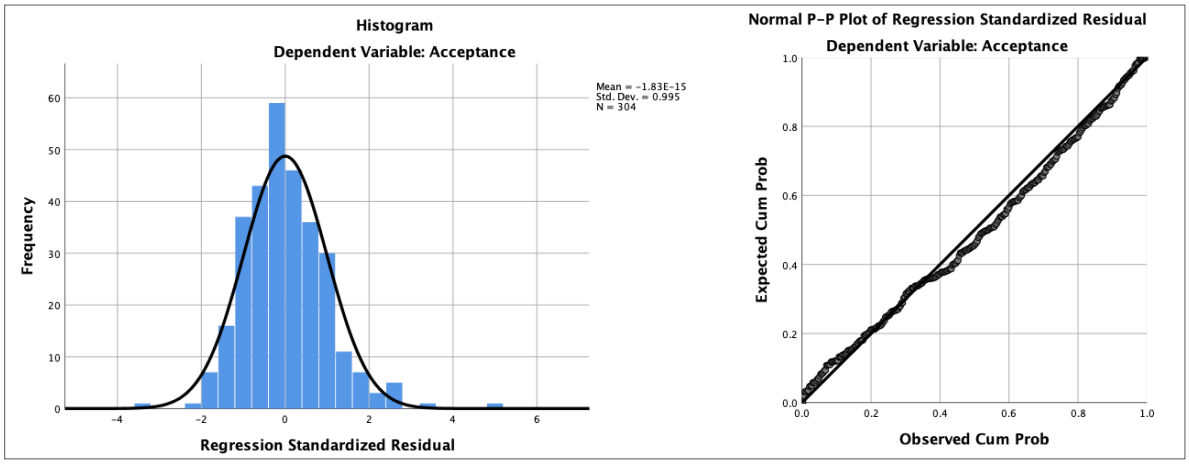

Figure 33: Histogram and P-P Plot of regression model III (Author, 2020)

Table 22: Multiple linear regression model IV (Author, 2020)

Variables Entered/Removed (a)

Model	Variables Entered	Variables Removed	Method
1	Cost Perception Age Information Car Status Problem Awareness Safety Perception Benefit Awareness (b)	.	Enter
2	.	Information	Backward (criterion: Probability of F-to-remove >= .100).
3	.	Age	Backward (criterion: Probability of F-to-remove >= .100).

a Dependent Variable: Acceptance
b All requested variables entered.

Model Summary (d)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.821a	0.674	0.667	0.31199	0.674	87.591	7	296	0.00
2	.821b	0.674	0.668	0.31157	0.00	0.198	1	296	0.657
3	.820c	0.673	0.667	0.31174	-0.001	1.327	1	297	0.25

a Predictors: (Constant), Cost Perception, Bitte geben Sie Ihr Alter an., Information and Education, Symbolic status of a car, Problem Awareness, Safety Perception, Benefit Awareness
b Predictors: (Constant), Cost Perception, Bitte geben Sie Ihr Alter an., Symbolic status of a car, Problem Awareness, Safety Perception, Benefit Awareness
c Predictors: (Constant), Cost Perception, Symbolic status of a car, Problem Awareness, Safety Perception, Benefit Awareness
d Dependent Variable: Acceptance

ANOVA (a)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.682	7	8.526	87.591	.000b
	Residual	28.812	296	0.097		
	Total	88.494	303			
2	Regression	59.663	6	9.944	102.434	.000c
	Residual	28.831	297	0.097		
	Total	88.494	303			
3	Regression	59.534	5	11.907	122.521	.000d
	Residual	28.96	298	0.097		
	Total	88.494	303			

a Dependent Variable: Acceptance
b Predictors: (Constant), Cost Perception, Bitte geben Sie Ihr Alter an., Information and Education, Symbolic status of a car, Problem Awareness, Safety Perception, Benefit Awareness
c Predictors: (Constant), Cost Perception, Bitte geben Sie Ihr Alter an., Symbolic status of a car, Problem Awareness, Safety Perception, Benefit Awareness
d Predictors: (Constant), Cost Perception, Symbolic status of a car, Problem Awareness, Safety Perception, Benefit Awareness

Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.588	0.219		7.265	0.000	1.158	2.018					
	Age	-0.002	0.002	-0.04	-1.187	0.236	-0.005	0.001	-0.081	-0.069	-0.039	0.957	1.045
	Benefit Awareness	0.241	0.036	0.294	6.657	0.000	0.17	0.312	0.685	0.361	0.221	0.562	1.779
	Problem Awareness	0.368	0.035	0.453	10.633	0.000	0.3	0.436	0.732	0.526	0.353	0.606	1.65
	Information	-0.01	0.022	-0.015	-0.445	0.657	-0.053	0.034	0.056	-0.026	-0.015	0.958	1.044
	Car Status	-0.049	0.023	-0.076	-2.134	0.034	-0.094	-0.004	-0.314	-0.123	-0.071	0.862	1.16
	Safety Perception	-0.107	0.036	-0.12	-3.015	0.003	-0.178	-0.037	-0.473	-0.173	-0.100	0.69	1.449
	Cost Perception	-0.107	0.035	-0.121	-3.028	0.003	-0.176	-0.037	-0.477	-0.173	-0.100	0.691	1.448
2	(Constant)	1.548	0.199		7.774	0.000	1.156	1.940					
	Age	-0.002	0.002	-0.039	-1.152	0.250	-0.005	0.001	-0.081	-0.067	-0.038	0.965	1.036
	Benefit Awareness	0.24	0.036	0.294	6.655	0.000	0.169	0.311	0.685	0.36	0.22	0.563	1.777
	Problem Awareness	0.369	0.035	0.454	10.702	0.000	0.301	0.437	0.732	0.528	0.354	0.609	1.642
	Car Status	-0.049	0.023	-0.077	-2.155	0.032	-0.094	-0.004	-0.314	-0.124	-0.071	0.863	1.159
	Safety Perception	-0.106	0.035	-0.118	-2.988	0.003	-0.175	-0.036	-0.473	-0.171	-0.099	0.699	1.43
	Cost Perception	-0.105	0.035	-0.119	-3.007	0.003	-0.175	-0.036	-0.477	-0.172	-0.1	0.695	1.439
3	(Constant)	1.481	0.191		7.772	0.000	1.106	1.856					
	Benefit Awareness	0.246	0.036	0.300	6.859	0.000	0.175	0.316	0.685	0.369	0.227	0.573	1.746
	Problem Awareness	0.367	0.034	0.451	10.643	0.000	0.299	0.435	0.732	0.525	0.353	0.612	1.635
	Car Status	-0.053	0.023	-0.082	-2.324	0.021	-0.097	-0.008	-0.314	-0.133	-0.077	0.878	1.139
	Safety Perception	-0.103	0.035	-0.115	-2.918	0.004	-0.173	-0.034	-0.473	-0.167	-0.097	0.702	1.424
	Cost Perception	-0.104	0.035	-0.118	-2.968	0.003	-0.173	-0.035	-0.477	-0.169	-0.098	0.696	1.437

a Dependent Variable: Acceptance

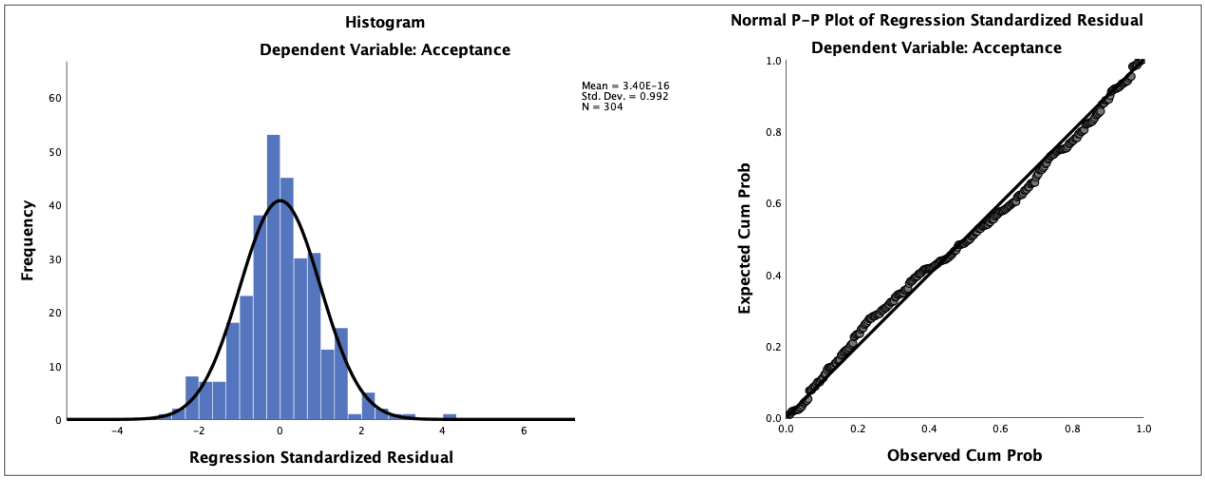

Figure 34: Histogram and P-P Plot of regression model IV (Author, 2020)

Table 23: Multiple linear regression model V (Author, 2020)

Parameter Estimates with Robust Standard Errors
Dependent Variable: Acceptance

Parameter	B	Robust Std. Error (a)	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	1.481	0.253	5.853	0.000	0.983	1.979
BenefitAwareness	0.246	0.049	4.992	0.000	0.149	0.342
ProblemAwareness	0.367	0.055	6.669	0.000	0.258	0.475
CarStatus	-0.053	0.028	-1.905	0.058	-0.107	0.002
SafetyPerception2	-0.103	0.042	-2.442	0.015	-0.186	-0.02
CostPerception	-0.104	0.038	-2.745	0.006	-0.179	-0.029

a HC3 method
Adjustet R Squared = .667

IHS
Making cities work

Institute for Housing and
Urban Development Studies of
Erasmus University Rotterdam