

Thesis 344

Affecting the modal choice: efficiency in modern transport planning

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Abstract:

One of the most prioritized goals in transport planning of today is the cost-effective goal to shift the modal split in favour of sustainable transport modes, as e.g. bicycle. The aim of this master thesis is to investigate how to efficiently and successfully realize such transport planning. To do so, it is important to identify which factors affect the modal choice and how these factors should be measured. Further, the aim of this thesis is to investigate how transport planners of today, in two modern industrial countries, work with this type of transport planning and to detect possible ways of improvement. In order to answer the research questions of this thesis a literature study, a document study and an interview study was made. The literature study showed that the true relationship between the studied factors and the modal choice is difficult to determine, and that they therefore should be individually chosen for each project. In order to identify which factors to choose, studies of the pre-state are important. As different factors are measured in different ways, different types of studies, as e.g. observational studies and surveys, should be carried through. The document study showed that surveys are rarely made in the two studied countries, and the interview study confirmed this finding and revealed that the cause mainly is a lack of resources. As goals in transport planning are determined in connection with politics, it is recommended that politicians are made aware of the discrepancy between goals set and the resources invested.

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Foreword

This thesis is the final work of my studies in civil engineering at Lund University. The study was conducted in 2019 and the master's thesis was finalized in 2020.

For their help, I would like to thank the interviewees for their participation and my thesis speculators for their feedback and guidance.

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Lund, February 2020

Therese Linde



Summary

The modern society of today faces many challenges. Measurable climate change is complemented by spreading physical and mental illness, and many studies show that the way we transport ourselves can play an important role in reversing these problems. The positive mobility effects from the usage of popular private motor vehicles, driven on fossil fuels, are complemented by e.g. increased amounts of combustion and reductions of our physical activity and social interactions. Many researchers have therefore, since the 1980s, been rising awareness to these problems, and advocated that the amount of trips made by car should be minimized. One way to achieve this is to change the modal split in favour of more sustainable transport modes and to thereby achieve a modal shift. The bicycle is one such sustainable transport mode, which is also very competitive on trips up to at least 5 kilometers, as well as a very cost-effective alternative to the car.

In order to define factors affecting such a change of the modal split, a literature review on the topic has been made. The literature review showed that factors like infrastructure, politics, travel behaviour and attitudes, together with socio-economic factors like car ownership, are some of the factors affecting the modal choice. In transport planning, these factors are found to be measured in different ways in order to best detect changes after implemented interventions. Whereas some factors can be manually or mechanically measured or observed, other factors are found to be best accounted for by conducting e.g. surveys or interviews.

As transport planning in the last approximately 100 years has been focused on creating a well-functioning transport system for cars, the results from observational studies, like traffic counts and speed measurements, is traditionally what pre-state analyzes are based on. In order to achieve a successful and effective transport planning it is though believed that all the affecting factors should be analysed before choosing which interventions to carry through. In order to research how transport planning in two of the leading countries in modern transport planning, Sweden and Austria, accounts for the affecting factors found in the literature review, a document and an interview study has been carried out on the topic.

The document study showed that politicians in both Sweden and Austria have set up high national, regional and local goals for making the transport sector more sustainable, and that most of this work is to be carried out in the local municipalities. Furthermore, the document study showed that national and regional travel behaviour surveys are common in both Sweden and Austria, but that there, apart from these studies, are only a few surveys conducted. The most common goal set in the municipalities is though found to be to change the modal split, in favour for the sustainable transport modes. The interview study was conducted with local transport planners from respectively three different suburban municipalities of the cities of Malmö (Sweden) and Vienna (Austria). This study further confirmed the finding in the document study, that almost no surveys are carried out, despite the goals defined. The most frequent reason for this finding was mentioned to be a lack of political support in the form of resources and economical means, which shows on a discrepancy between the ambitious goals set and the possibility the transport planners of today have to realize them.



1 Introduction

1.1 Background

Perchtoldsdorf, a suburb of the Austrian capital Vienna, with national, regional as well as local intentions of lowering the number of trips made by car, plan to do an update of their transport plan. With the new transport plan there is a possibility to especially focus on increasing the latest measured bicycle share of 5% of the total amount of trips made in the area (55% car, 17% walking, 22% public transport, 1% other) (Amt der NÖ Landesregierung, 2016). Because of a big amount of people commuting from suburbs to bigger cities, a change in modal split in the suburb is also believed to affect the Modal Split in Vienna.

As the work to make a new transport plan starts, one of the first important steps is to analyze the current situation. This is important in order to identify the existing problems together with the possibilities of the new transport plan, and in order to detect changes after implementing the chosen measurements (Trafikverket, 2015b). The gathering of data describing the current situation can be done in many different ways. Because of the nature of the different study types, measurements, observations, etc. is in transport planning used for studying transport system characteristic. Surveys and interviews are, on the other hand, used to study individual travel characteristics and behaviour (Trafikverket. 2015a).

When the pre-state is analyzed, the suitable measurements should be chosen in order to effectively reach the goals set. In order to know which measurements to choose, it is important to identify which factors affect the modal split in the specific situation.

In order to effectively implement transport planning experience could be gathered from other municipalities. A study of transport planning of today is therefore found suitable in order to identify strengths, weaknesses and potentials in the realization of successful transport planning. As the author has connection to the two countries Sweden and Austria, two European countries which are both part of the United Nations, these two countries were chosen for this study.

1.2 Scope and research questions

This study aims to investigate how pre-state studies are used in traffic planning in two modern countries, Sweden and Austria, in order to effectively realize successful transport planning with the goal of shifting the modal split in favour of sustainable transport modes as e.g. bicycle. The study also aims to identify similarities, differences and possible ways of improvement of the use of pre-state studies in these countries. These results are believed to help planners make the outcome from transport planning more cost- and resource effective. The research questions of this study are:

- Which factors are important for choosing interventions affecting the modal choice in modern countries like Sweden and Austria? (RQ1)
- How should transport planners in these countries measure these factors? (RQ2)
- Are there any differences in planning (who is responsible and what is the content) between organizational levels and countries and how does it affect which studies are made? (RQ3)
- How can the use of the pre-state studies be improved in transport planning in Sweden, Austria and other countries with similar characteristics? (RQ4)

1.3 Delimitations

The study focuses on factors which in first place affect the modal choice of travelling by car or travelling by bicycle. How these, or other, factors affect the modal choice of other sustainable transport modes, such as public transport etc., has not been studied.

As traditional transport planning often focuses on factors which are measured by observational studies, only factors found in the literature review, with other characteristics and measurement methods, are further studied in the document and interview study.

Furthermore, the study only focuses on a few countries, states/regions and municipalities, and is limited to a few interviews with transport planners on a local level (municipality), in order to fit the frames of the study.

1.4 Important expressions

Modal share - the percentage of travelers using a particular type of transport mode

Modal split - the percentage share of each mode of transport in the total transport

1.5 Outline

- Chapter 2 - Method

This chapter aims to give an explanation to how the study was conducted.

- Chapter 3 - Literature review

This chapter aims to provide a deeper understanding of the subject and to present a theoretical review of relevant literature on which factors affect the modal choice.

- Chapter 4 – Document study

This chapter presents a countrywise review of transport goals, strategies and how the factors defined in the literature review are accounted for in Sweden and Austria.

- Chapter 5 - Interview study

This chapter presents the results from an interview study which further examined the transport planning culture in Sweden and Austria and how planners in the chosen municipalities implement interventions and studies connected to the affecting factors determined.

- Chapter 6 - Analysis of results

In this chapter the results from the conducted studies in presented and analysed in relation to the research questions (RQ1-4) defined for the study.

- Chapter 7 - Discussion and conclusions

In the final chapter the chosen study methods and the results are discussed. Finally, conclusions, together with recommendations for further studies, are presented.

The following figure presents the themes studied in this thesis and how they are covered by the different methods chosen. The ingoing methods are further explained in chapter 2.

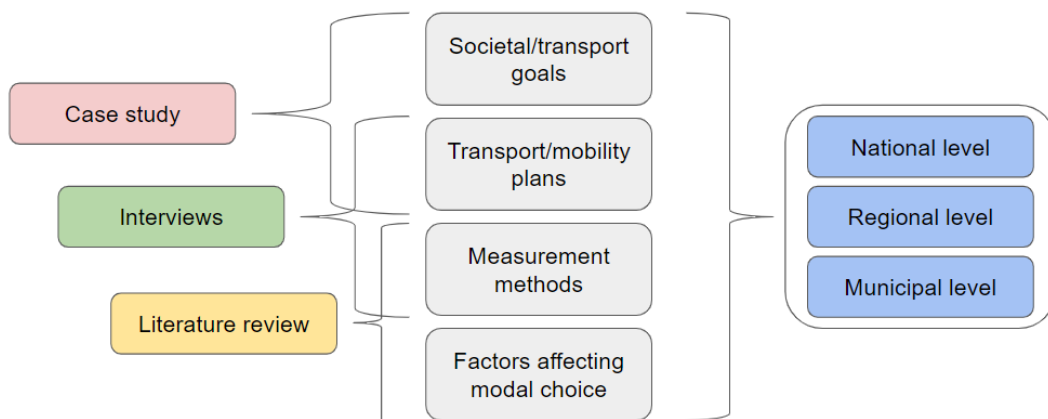


Figure 1. The construction of this study (illustration made from the author).

2 Method

2.1 Choice of study method

The choice of method is important since it sets the preconditions for how the study is to be conducted. Because of the form of the research questions, the method chosen for this study has qualitative research characteristics. This means that it aims to provide a deep understanding of the subject, rather than mirroring a surface description of a large-scale sample (Denscombe, 2014). The method chosen includes a literature review, a document study and an interview study.

2.2 Literature review

The first part of this study is a literature review. The literature review was conducted in order to create a base of knowledge, which the document study could be related to, and in order to answer RQ1 and RQ2. The knowledge which was collected specifically regards the concept of transport, the historical background of transport and the factors which affect the modal choice.

The literature for the literature review was found by searching directly for relevant articles and authors on recommendation from the supervisors of this study and by searching databases like Google Scholar and ScienceDirect. The search was made with a mix of general and specific keywords. Examples of the keywords used are “modal split”, “bicycle planning”, “Transtheoretical model” and “Theory of planned behaviour”. Much of the literature found had good sources of references which could also be studied in order to get a deeper understanding of the subject.

2.3 Document study

The second part of the study is a document study made in Sweden and Austria, where the content in different official documents, such as transport plans or transport mode strategies, are descriptive analyzed in order to present country characteristics and goals connected to transport for the studied countries. This is made in order to gather background information for RQ3. The studied documents are gathered from different organisation levels, from national to regional and down to local (municipality) level, to get the full understanding of which support the suburbs receive in their work with transport planning. The two studied countries, Austria and Sweden, and the two cities, Vienna and Malmö, were chosen by the author. The only criteria which affected the choice of which states/regions and municipalities to study, was that the state/region had one suburban municipality which directly boarded to Vienna/Malmö. A few municipalities were then randomly picked out, and the municipalities finally chosen were the ones where contact with a local transport planner could be first established.

2.4 Interview study

The last part of the study is an interview study, as an interview study can be a good source of information in studies with qualitative research characteristics (Denscombe, 2014). In the interview study, semi-structured interviews were held with transport planners responsible for transport planning on local level in both countries. The interview study was carried out in spring and autumn in 2019, and interviews were held in Sweden (in Swedish) and in Austria (in German) with local transport planners from different municipalities. The semi-structured interviews are characterized by a set of pre-decided interview questions with the possibility to discuss further relevant questions or topics that may occur (ibid). The number of interviews made are three in Sweden and three in Austria. Information about the interviewed persons are found in table 1. The planners interviewed were selected after availability, as they were the ones responding to a mailing sent out to some local planning authorities in the suburbs of the cities of Malmö (Sweden) and Vienna (Austria). The questions in the interview study were constructed with the goal set to get further understanding and information to answer RQ4. These questions are presented in Appendix 1.

Table 1. Information about the interviewed transport planners.

Country	Municipality	Gender
Sweden	Lomma	Female
Sweden	Vellinge	Female
Sweden	Burlöv	Male
Austria	Klosterneuburg	Male
Austria	Groß-Enzersdorf	Male
Austria	Brunn am Gebirge	Male



3 Literature review

3.1 The concept of transport

To understand the concept of transport, it is important to understand that the total amount of transport is built up by an amount of individual trips. The total amount of trips is derived from the individual needs and desires of the travellers, like the need to commute to the workplace, going to the grocery store etc., or desires to take part in social activities (Trivector, 2010). Some trips can also be motivated by a combination of these. An example of this kind of trip is the commuter trip to the workplace, as some people express that the desire to interact with colleagues complement the need of going to work for economic reasons (Milakis & van Wee, 2018).

3.2 Historical background

For thousands of years the size of cities was rarely bigger than five kilometers in diameter. This had a very natural cause since this is a distance which is easily traveled by foot. But since the invention of the car in the late 1800s the planning for cars has been promoted and spread around the world. As a result, many of the modern cities and regions which grew during the 20th century was planned and built to meet the requirements of a well-functioning transport system bound to private vehicles (Hydén et al., 2008).

When transport planners started to plan mainly for the accessibility of cars, problems with traffic safety often caused them to introduce a physical separation of the different transport modes. An example of this is found in the Swedish SCAFT-principles (Statens planverk, 1967), see Figure 2. This kind of approach and principles led to a built environment where a high amount of vehicles were assembled on often wide and straight roads. The cyclists and pedestrians were removed from the bigger streets and were instead located to separated infrastructure in the form of "safe" roads. Roads which, most often, were given e.g. less priority of directness. Walking and cycling therefore soon became less attractive and an epoque where the car was the dominating modal choice had, in many modern cities around the world, started (Hydén et al., 2008).

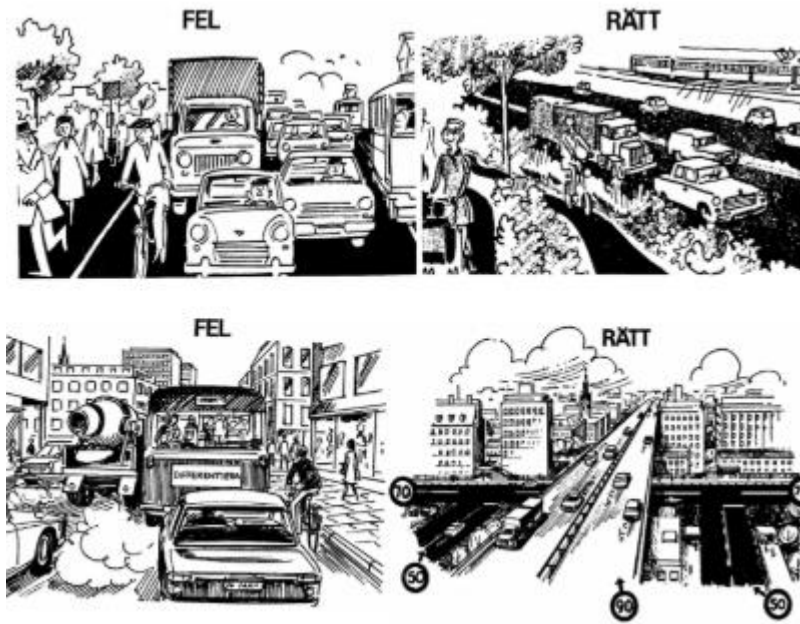


Figure 2. Principles of separation. Fel=Wrong, Rätt=Correct
 Source: Gunnarsson and Lindström (1970, s.65)

The main reason for travelling by car is often argued to be time-savings, but other factors like comfort, flexibility and the possibility of taking goods are in fact found to be the main attractors of car-transport (Hydén et al., 2008). The convenience of the car highly increased people's possibility to travel longer distances, and this more often.

The change in transport planning and travel behaviour affect the society of today in many ways. One of the most known effects is the environmental effect, as the technique for driving the motors led to an increased amount of combustion of fossil fuels. This led to a dramatic increase of carbon emissions from the transport sector during the latter half of the 20th century, which, together with an increase of emissions from other sectors, has led to an extreme increase of the total amount of carbon oxide emissions during the 20th century (IPCC, 2014), see figure 3. Carbon oxides, and especially carbon dioxide (CO₂), are gases which assembles in the atmosphere and thereby hinder thermal energy to escape into space (EPA, n.d.). An increased amount of thermal energy means that the temperature on the surface of the earth increases, which has been found to increase the extreme weather, rise the sea level and contribute to losses in biodiversity (IPCC, 2018).

Global Carbon Emissions from Fossil Fuels, 1900-2014

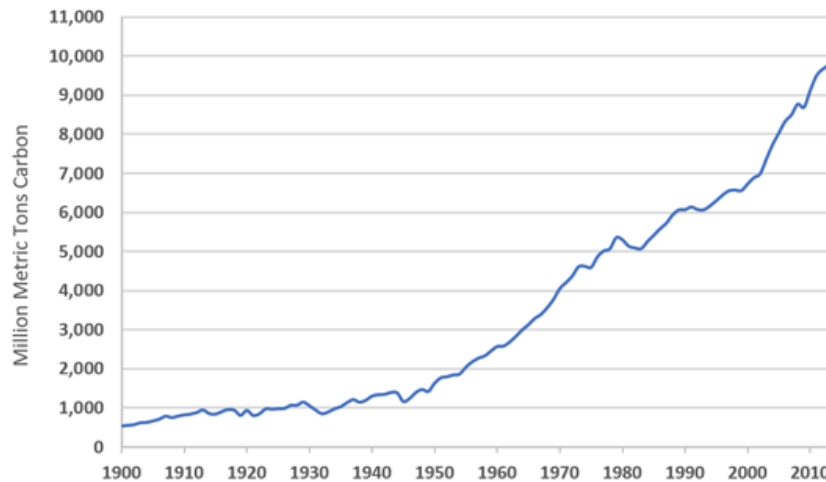


Figure 3. Global carbon emissions from fossil fuels between the years 1900 and 2014
Source: Boden, Marland and Andres. (2017).

But alongside the increasing usage of cars, our society also experiences several other existential problems related to e.g. low physical, as well as mental, public health (WHO, 2000). In the 1980s, the understanding of the many negative effects of our behaviour led to the founding and spreading of the expression “sustainable development”. One of the most well-known reports, which puts focus on this problem, is the one from the World Commission on Environment and Development (WCED) from the year 1987. The report is called “Our Common Future”, but is also known as the “Brundtland Report”. Sustainable development is in this report defined as

“...development that meets the needs of the present without compromising the ability of future generations to meet their own needs”

and is explained to consist of the three segments environmental-, social- and economic sustainability (WCED, 1987). Environmental sustainability should assure the protection of ecosystems and a reasonable use of natural resources, social sustainability should assure human rights and equality and economic sustainability should assure economic growth (ibid).

To further highlight the worldwide challenges of today, the United Nations (UN) created goals for climate and energy questions in 2009. In 2015 these were further developed into “2030 Agenda for Sustainable Development”, with 17 defined global goals for creating a better world, see figure 4 (UN, 2015). These 17 goals are all in some way connected to the transport system and its causes.



Figure 4. The United Nations 17 global sustainable development goals. Source: United Nations, in collaboration with Project Everyone (2015)

To ease the realization of a sustainable transport system the multidisciplinary research program TransportMistra was conducted. From the results of this research program, Trivector (2009) concludes that a measurement in the transport system is only improving the sustainability when it eases the stress on the environment, improves the quality of life for the generations of today and has a democratic implementation. One such, very effective, measurement is to change the modal split in favour of walking and cycling (WHO, 2000). For shorter distances up to 2 km, and for longer distances up to traditionally 5 km, walking respectively cycling are very competitive modes of transport (Hydén et al., 2008). Since walking and cycling require physical effort, they also reduce the risk of many diseases (WHO, 2000). At the same time, they generate much lower levels of traffic noise, emissions and severe injuries, which are all effects that are positive for the individual as well as for the society (ibid).

3.3 The role of transport goals and transport plans

In order to consciously create the cities of tomorrow, many countries plan their transport by defining transport goals and strategies. The strategies defined are, in modern transport planning, gathered and presented in transport plans, which are often presented on the webpage of the founding organisation. As there can be big local differences within a country, goals and their associated transport plan can be defined on different levels, e.g. national, regional and local level. These plans guide transport planners in their daily work with transport planning, and a suitable definition of such goals and strategies are therefore of importance in order to achieve the wanted changes (Hrelja, 2018).

But despite the knowledge about the positive effects from sustainable transport modes, which is no longer news, the modal share for motor vehicles is in many cities still much higher than the modal shares for walking and biking (EPOMM, n.d.). Since especially travelling by bike is a competitive transport mode for a trips up to at least 5 kilometers (Hydén et al., 2008), and has many positive effects (WHO, 2000), the failure to put it into wide practice is surprising. It is therefore very interesting to further examine which the important factors for choosing interventions affecting the modal choice are and how these are accounted for in different countries and in different levels of transport planning.

3.4 Different factors effect on the modal choice

3.4.1 Socio-economic and socio-demographic factors

Gender, age, education and income are some of the most basic socio-economic and socio-demographic factors. Gender and age are typically factors which are correlated to fear of violence (SCB, 2018) respective physical vulnerability (Hydén et al. 2008), as women and older individuals state a higher compliance when asked questions about these topics. Gender has also been found to correlate with sustainable behaviour, as women tend to value altruism higher, and therefore act more sustainable, then men do (Dietz, Kalof and Stern, 2003). Some studies also show that men value the symbolic function of car use higher than women do (Steg, 2005).

A study carried out in six small cities in the U.S. showed that gender is also a factor which affects commuters' likelihood to choose bicycle as their mode of transport, and more specifically that men are more likely to commute by bicycle than women (Handy & Xing, 2011). These results have been found in other studies as well - studies which have been carried out in places where the infrastructure for bicycles are limitedly developed (Garrard et al. 2008; Heinen et al. 2012; Carse et al. 2013). However, the results on how gender, and other socio-economic and socio-demographic factors, affect the modal choice are often not consistent.

That gender is a factor which affects the modal choice, or that it is a factor that affects the modal choice in the way mentioned above, is in fact not being supported in all studies. Examples of this are the studies from Wardman et al. (2007), who found no connection between gender and modal choice, and from Sick Nielsen et al. (2013), who in fact found a converse effect of gender. Nielsen et al. (2013) namely found that women were more likely to make bicycle their modal choice than men. Ekblad et al. (2016) sum this up by concluding that the location, or more specifically the modal share of cycling on the location, could be an explanation to these variations.

The same results are found for the factors education and income, more specific that higher education and higher income have a negative effect on the likelihood of choosing the bicycle as modal choice in countries with a low modal share of bicycle, whereas the converse, or a neutral, result is found in countries with high share of bicycle transport (Handy and Xing, 2011; Sick Nielsen et al. 2013; Carse et al, 2013). Education is also found to have a correlation with the likelihood of rapidly adopting new ecologically friendly behaviour, which can suggest that individuals with a higher education have a more open mindset and better learning potential (Jansson et al. 2011). The same results are though not found for age (ibid). Age was also not found to be significant for commuting by bike (Handy & Xing, 2011; Wardman et al. 2007) but was found to affect the modal choice in the region of Skåne, Sweden (Region Skåne, 2014).

Car ownership can also be considered as a socio-economic factor, and it is a factor which has been found to affect the modal choice considerably. Studies have shown that the modal share for cars increases with the gross domestic product (GDP) per capita and the level of car ownership (Santos et al. 2013), and that car ownership is one of the strongest explanatory factors for travelling distances shorter than five kilometers by car (Carse et al. 2013). As presented earlier in this study, this is a distance where the bicycle is a highly competitive mode of transport.

Furthermore, a Dutch study made by Heinen et al. (2012) found a connection between commuting by bicycle and the characteristics of the workday and the workplace,

showing that individuals who wear suits, or shift location during their workday, are less likely to make bicycle their modal choice. The same study states a compliance with the theory that female commuters are as likely as men to choose bicycle as their mode of transport, but found furthermore that women are more sensitive when it comes to the distance of the commute ride. This correlates with findings in other studies which shows that women travel shorter distances with bicycle than men do (Garrard et al. 2008), even though men and women were, by Börjesson and Eliasson (2012), found not to value time differently.

3.4.2 Infrastructure

As stated in the previous chapter, some of the studies on how socio-economic and socio-demographic factors affect the modal choice show that the result of the same research question vary with the location of where the study was carried out. This is confirmed by several researchers, who state that e.g. the presence of infrastructure for bicycle traffic leads to an increased amount of bicycle travel (Santos et al. 2013; Buehler and Pucher, 2008). In their study, Garrard et al (2008) also found that the correlation between available bicycle infrastructure and the modal share for bicycle traffic seem to be extra strong for women, since a bicycle infrastructure with separated bicycle paths and lanes were more attractive for women in the study. As the authors of the study conclude that the result most likely has a connection to the perceived risk of travelling by bicycle (Garrard et al. 2008), the same result is possibly found for other sensitive groups who are often under-represented in areas with a poor standard of bicycle infrastructure, such as elderly and children. Mutrie et al. (2002), who examined if a self-help intervention could increase the amount of walking and bicycling commuters in Glasgow (Scotland), sums this up in a good way by concluding that “the environment for cycling must be improved before cycling will become a popular option” (Mutrie et al. 2002, p. 407). This, the authors concluded after finding that the self-help intervention increased the amount of walking commuters unproportionally to the amount of bicycling commuters, which did not increase at all. To invest in bicycle infrastructure and to separate the unprotected travelers from car-traffic and other vehicles, as transport planners have been doing for decades, are thus not seen as inadequate.

But even though most studies show that a high modal share for bicycling correlates with the availability and quality of the bicycle infrastructure, some researchers express an uncertainty about the true nature of this correlation, i.e. Heinen et al. (2009). These researchers point at the fact that the nature of many conducted studies make it hard to determine whether the implementation of infrastructure for bicycles solely stands for the increase of its modal share, or if a high amount of trips made by bicycle also helps to increase these specific infrastructure investments (ibid).

3.4.3 Localisation and prioritization

As the transport planners of the 20th century often did implement separate infrastructure for walking and cycling travelers, the poor results of the bicycle planning in the past decades can not only be a result of a lack of bicycle infrastructure. One of the factors which are found to affect the modal choice for commuters is the distance of the trip, where a longer distance decreases the likelihood of bicycle being the modal choice (Heinen et al. 2012; Lee et al. 2014). As mentioned before, the study from Heinen et al. (2012) shows that the correlation between the modal choice and the

distance of the trip differs between men and women, where women show a bigger resistance to longer trips.

Because of the correlation between the distance of the trip and the likelihood of bicycle being the modal choice, a mixed land use is concluded to promote the modal share for trips made by bicycle (Lee et al. 2014; Buehler and Pucher, 2006). It is also concluded that a mixed land use is to prioritize before only increasing the density of housing, since a mixed land use more effectively decreases the need to travel longer distances for meeting the needs and desires of the travelers (Lee et al. 2014). To make it possible to also reach a bigger area by bicycle, the travel time in the network is found to be an important factor (Rietveld and Daniel, 2004). To increase the modal share of bicycle travel, it is therefore of importance to prioritize a continuous network with direct routes and a low amount of obstacles, such as traffic lights etc. (ibid).

The acceptable travel time for commuter trips has been examined through two identical studies carried out in Berkley, USA, and Delft, the Netherlands. These studies showed on an acceptable general travel time of 42.5 respectively 36.4 min, but also that the most satisfying travel time are 15 minutes (with the option to choose from 0, 15, 30, 45, 60 or over 60 min.), see figure 5 (Milakis & van Wee, 2018). This result shows on the complex motivators for transport, as the option where travel time is 0 min, which refers to working from home, generally generated lower satisfaction than a trip on 15 minutes. This was motivated by the fact that the travel time could be used as time for relaxation or reflection, and that spending time at the workplace had a positive influence on their everyday in form of e.g. the fellowship of colleagues.

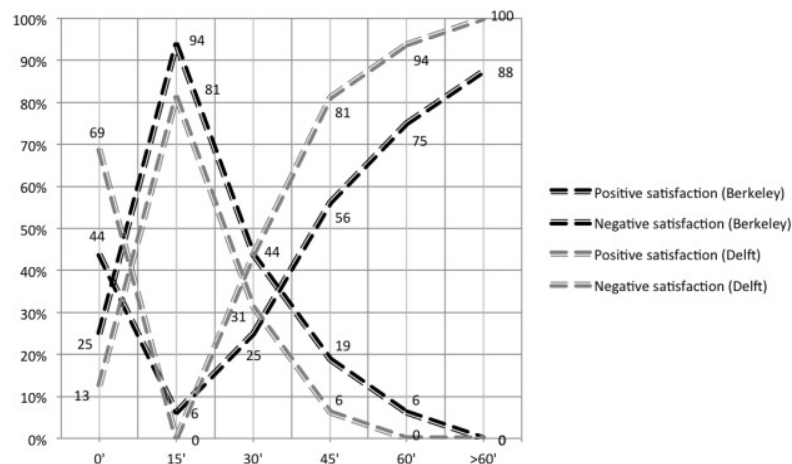


Figure 5. Positive and negative levels of satisfaction (%) for a range of hypothetical commute times. Source: Milakis & van Wee (2018).

Börjesson & Eliasson (2012) also found that people who commute a longer distance by bicycle have a lower value of time, which could be a result of self-selection. Thus, even though the correlation between the distance of the trip and the modal choice is confirmed by the studies mentioned above, an exact correlation is not yet known.

3.4.4 Politics

How the built environment is formed highly depends on the political attitudes and decisions. Even though there might be uncertainty about the exact correlation between the modal split and the availability and quality of the bicycle infrastructure, as stated

before, the form of the built environment is concluded to be of importance for the modal share of trips made by bicycle. This is supported by research, which shows that cities who traditionally have had a positive political attitude towards bicycle transport and intentions to integrate urban and transport planning, are found to also have a high modal share of bicycle travel, as e.g. the city of Copenhagen, Denmark (Koglin, 2015). In their research, Buehler, Pucher and Seinen (2011) studied how the newly adopted focus and planning for bicycles affected the modal split in three Canadian and six American cities. The researchers found that the more focused planning and building for bicycle transport, the greater the increase of the modal share for bicycle transport (ibid).

Political decisions can also affect the modal split in other ways, especially through transport-related pricing (Rietveld and Daniel, 2004). As for the effects of the built environment on the modal split, similar effects have been found for the price on gas and parking, as cities with high costs for travelling with car are found to also have a high modal share of bicycle (Buehler & Pucher, 2009a). That such a correlation between pricing, especially the pricing of parking, and the modal share of bicycle transport exists is also verified by several studies of commuter trips which shows that a high price on car-parking has a positive effect on the share of bicycle trips (Handy & Xing 2011; Heinen et al. 2013).

For a successful implementation of different sustainable transport policies, Buehler & Pucher (2009b) list some strategies which are found to be of importance. The authors (Buehler & Pucher 2009b, p.60-62) define that these are:

- “1. Implement Controversial Policies in Stages
2. Plans Should be Flexible and Adaptable over Time to Changing Conditions
3. Policies Must be Multi-Modal and Include Both Incentives and Disincentives
4. Fully Integrate Transport and Land-Use Planning
5. Citizen Involvement Must be an Integral Part of Policy Development and Implementation
6. Support From Higher Levels of Government is Crucial to Making Local Policies Work
7. Sustainable Transport Policies Must be Long Term, with Policies Sustained Over Time, for Lasting Impact”.

These strategies have shown positive results in practical examples (Buehler & Pucher, 2009b), but a common threat to the implementation of sustainable transport policies is political and public resistance. As the car-industry employs a big amount of people, and many individuals have created an everyday life where they depend (or believe to do so) on the car as a mode of transport, these changes are for some people unrealistic (Hydén et al. 2008).

3.4.5 Landscape, climate and weather

Some environmental factors can though not be affected by political decisions and policies, e.g. the landscape, the climate and the weather. These factors can be reasons

for not traveling by bicycle, since a hilly landscape and a windy weather requires extra physical effort, extreme temperatures can be unpleasant and a rainfall can make bicyclists involuntarily wet .

Regarding the presence of slopes, they are found to have a negative effect on the bicycle use (Rietveld and Daniel, 2004). Most of the cities with a high modal share for bicycle in the Netherlands, Denmark and Germany have indeed a flat topography. Though, studies have shown that the modal share for bicycle trips is not affected as much by the weather as it is by slopes, since countries as e.g. Denmark, Germany and the Netherlands have unpredictable, and often rainy, weather - and anyhow some of the highest modal share of bicycle travel in the world (Buehler and Pucher, 2008). Studies from North American cities also confirm this finding, since rainy cities like Portland and Vancouver have some of the highest modal share for bicycle on the North American continent (Buehler, Pucher and Seinen, 2011). This finding indicates that there could be ways to get around this specific resistance towards travelling by bicycle, maybe with additional equipment as e.g. rain repellent clothes. In recent years products which compensate for the physical effort from hills, like electric bicycles, have also been released on the market. A survey in Sweden also shows a positive attitude towards such products, and the percentage of electric bikes in Sweden was 12% of the total market in the year of 2018 - a number which is expected to increase further in the year of 2019 (Svensk cykling, 2018).

3.4.6 Values and attitudes

In the end, the modal choice is a behaviour and a choice made by the traveller. One of the psychologists who has been trying to explain human behaviour is Icek Ajzen, who founded the Theory of planned behaviour. This theory assumes that the behaviour is a result of a person's intention and perceived behavioural control (Ajzen, 1988). The intention is further explained to be a result of three factors: the person's attitude towards the behaviour, the social norms and, also, the perceived behavioural control, see figure 6.

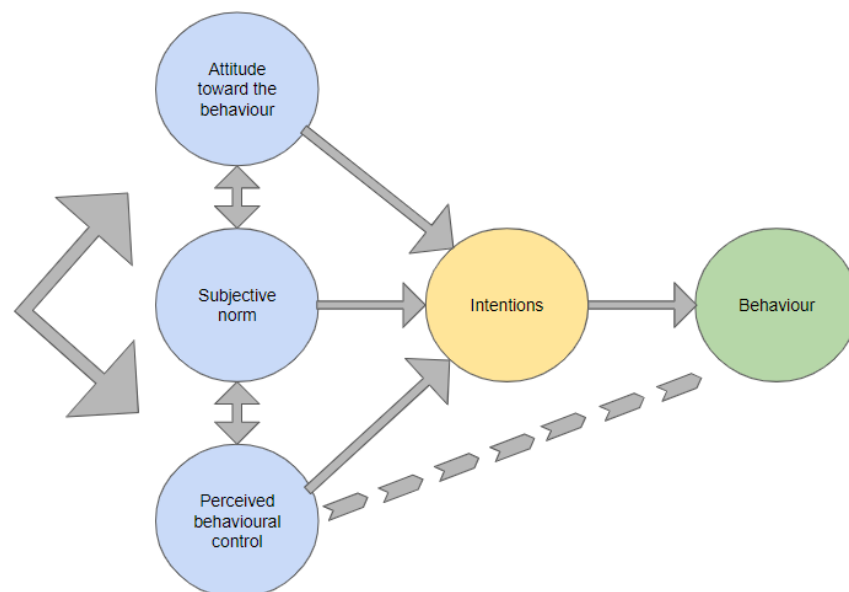


Figure 6. Theory of planned behaviour (illustration made from the author)

To further explain the correlation between these factors, the theory says that the more positive the individual attitude and subjective norm to a behaviour are, and the greater the perceived behavioural control is, the stronger is also the individual's intention to behave in the predicted way (Ajzen, 1988). How much each one of these factors affect the intention is though found to vary between different situations and behaviours (ibid).

With this information, together with the belief that attitudes derives from values, Paulssen et al. (2013) examined if personal values affect travel mode choice behaviour - and did find such a correlation. More specifically, the researchers empirical results made them conclude that an individual's value of hedonism, power and security affect their attitude towards flexibility, convenience, comfort and ownership, which they finally found to correlate with the travel mode choice behaviour, see figure 7. To be able to understand the behaviour of an individual, and to be able to affect this behaviour, it is therefore of interest to understand its personal values.

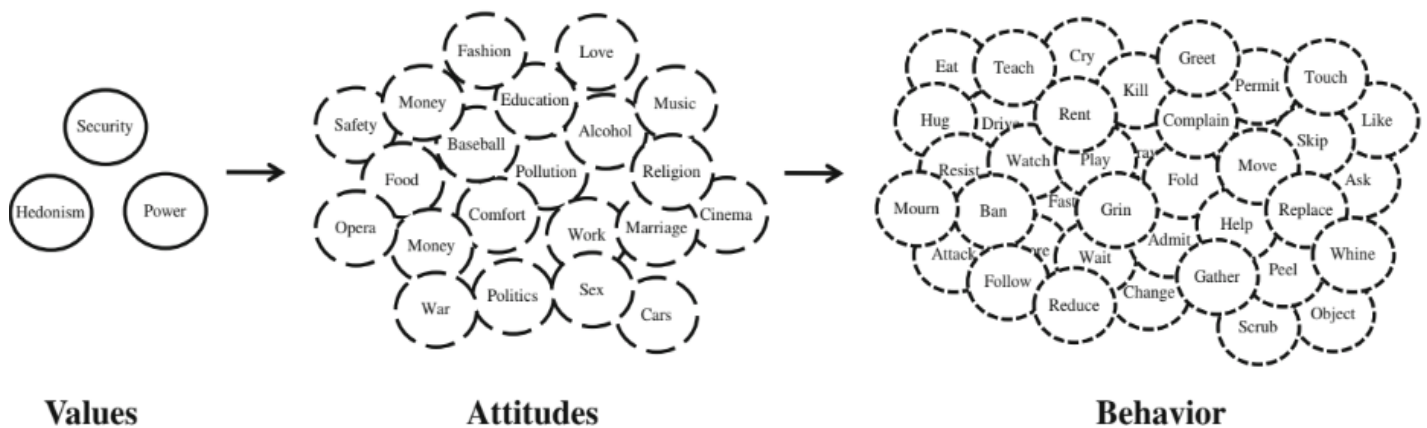


Figure 7. An illustrative representation of the value-attitude-behaviour hierarchical model.
Source: Paulssen et al. (2013)

The car is also found to have an instrumental and functional value, as it is used to transport people and goods. Dittmar (1992) explains though, that material goods, such as cars, can further have symbolic and affective values as well. These values are used by an individual to express himself and to claim belonging to a social group or position (Dittmar, 1992). Steg (2005) further examined the correlation between the values of the car and the modal choice. Steg found that individuals who often choose car as travel mode do express higher symbolic and affective values for the car than individuals who travel less by car do. Interestingly, the same results were not found for the instrumental value of the car, as the instrumental and functional value of the car was stated by both groups of travellers (non car travellers vs. car travellers).

Furthermore, the study carried out by Steg (2005), found that the symbolic and affective values for cars affected the modal choice for social and recreational trips, but also especially affected the modal choice for commuter trips, which actually is considered to be a more functional type of trip. This further supports the theory that the travel behaviour cannot be explained only by travel time and travel distance.

Referring to advertisement and the way people talk about cars, Steg (2005) state that the car has developed to be a symbol of power, social status and self-esteem and thus that:

“People do not only drive their car because it is necessary to do so, but also because they love driving.”

3.4.7 Stage of change

The individual behaviour can though change over time. A person's behaviour is found to be explained by in which stage of change the individual is (Brussel et al. 2012). The theory of the *Stages of Change* is described in the Transtheoretical Model (Stages of Change Model) (Prochaska and DiClemente, 1983; Prochaska and Velicer, 1997). This model describes five stages, which explain the process of behavioural change: Pre-contemplation (no intention to change), Contemplation (growing intention), Prepared for action (strong intention and possible irregular or tentative performance of the behaviour), Action (recent initiation of regular behaviour) and Maintenance (establishment of permanent behaviour), see figure 8.

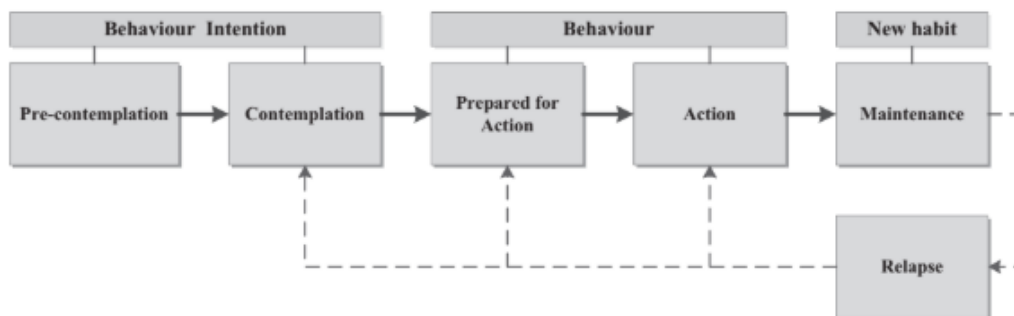


Figure 8. Stages of change model. Source: Brussel et al. (2012).

This knowledge is found to be important, as an individual traveller is found to react differently to policies and motivational measures depending on which of these stages he/she is in (Brussel et al. 2012). To achieve a change in travel behaviour, it is therefore found to be of importance to know in which stage of change the individual traveller is in (Brussel et al. 2012). Therefore, to effectively achieve a change in travel behaviour, and thus a change in the modal split, the directed actions should be designed to separately fit groups in different stages (ibid).

3.4.8 Measurement methods

Some of the factors mentioned above should be measured or observed in order to be monitored and analyzed. This information is important when the work with transport planning starts, as one of the first important steps is to analyze the current situation.

The gathering of pre-state data can be done by conducting observational studies or surveys.

Observational studies, such as traffic counts or measurements (manual or mechanical), are, together with inventories, in transport planning most often used for studying transport system characteristics. Surveys and interviews are instead used to study the individual travel characteristics and behaviour (Trafikverket, 2015a). The Swedish Transport Administration present some examples of measurement methods, depending on which factor examined, in their guide on how to plan the transport system in order to create an attractive city (TRAST, Trafik för en attraktiv stad), see table 2 (ibid).

Table 2. Appropriate measurement methods for different factors affecting the modal choice.
Source: Trafikverket (2015a).

Factor	Measurement methods
Traffic flow, travel speed, travel time	Traffic counts, traffic measurements
Travel behaviour, travel destinations	Travel behaviour surveys, interviews
Attitudes, motives	Attitude surveys, interviews
Infrastructure, Landscape	Physical inventories, observations

As can be seen in table 1, not only one type of study method can be used to measure all the factors which affect the modal split. For a successful transport planning, it is therefore preferred to not only conduct observational studies, but also to conduct surveys or interviews in order to study attitudes and behaviours.

As traditional transport planning often focuses on factors which are measured by observational studies and inventories, the goals defined and the availability of measurements connected to attitudes and behaviours and surveys conducted are further studied in the document and interview study. This is made in order to identify strengths, weaknesses and potentials in the transport planning, together with differences in planning culture in suburbs in Sweden and Austria.

4 Document study

4.1 Sweden

4.1.1 Planning system

The spatial planning in Sweden has its foundation in national interests, but no multidisciplinary spatial planning exist on a national level. Instead, non-binding guidelines are defined and presented in different planning documents. This is the case on the regional level as well, as no multidisciplinary spatial planning exist - except in the regions of Stockholm and Scania. In these regions is regional planning prescribed, but the guidelines defined are not binding in the spatial planning. The national interests are though to be further prioritized on the regional level – so that these interests are coordinated and carried out on local level. The definite spatial planning is carried out on the local municipality level. The municipalities can with different regulations, such as masterplans or detailed development plans, fully decide the land use (Boverket, 2019).

4.1.2 National

By approving the United Nations (UN) 2030 Agenda, Sweden commits to the 17 global goals and to translate them into a Swedish context (SOU 2019:13, 61). In 2008 the parliament of Sweden also decided on two transport policy objectives - one impact objective and one function objective (Prop. 2008/09:93). The goal of the first objective is to improve the overall quality of trips made of residents and the industry, so that equality and business competitiveness are fostered. It is also specified that the preconditions for public transport, bicycle and walking are to be improved. The second goal aims to decrease the number of deaths in road traffic by 50% and the amount of severely injured persons by 25% until 2020, to lower the impact from traffic on the environment and health, and to have a car fleet free from fossil fuels by the year 2030. These objectives put out the foundation and direction for all work with transport planning in Sweden, and a modal shift is one of the main ways stated to reach them. Reports are though already showing that the measurements which have been taken are not enough and that some of the goals will be hard to reach. This already caused the last-mentioned goal to be revised to only lower the emissions from the transport sector with 70% year 2030 compared to the year 2010 (Naturvårdsverket, 2019).

In relation to the transport policy objectives the parliament of Sweden has also published a national bicycling strategy for a safe and an increased amount of trips made by bicycle. In this strategy, five priorities are defined, of which all mainly refer to changes in transport planning, infrastructure and technology. The term “behavioural change” is only brought up briefly as it is mentioned that the parliament has a positive attitude towards municipalities carrying out campaigns etc. on the subject (Regeringen, 2017). The subject of behavioural change is instead presented more in detail in publications from the Swedish Transport Administration, Trafikverket, whom e.g.

presents examples of mobility management actions, handbooks and tools which municipality employees can use as guidance and inspiration (Trafikverket, 2012, n.d.). These publications also point at the fact that the responsibility of realizing these actions mainly lies on the districts and municipalities (ibid).

In order to visualize changes in transport over time, and to study the level of fulfillment of the two transport policy objectives, the Swedish authority Trafikanalys has had the task to identify indicators and to monitor them (Trafikanalys, 2018). Trafikanalys have therefore carried out different surveys, which have connections to transport. An example of this is the national travel behaviour surveys, where the most recent was carried out between 2011 and 2016. The survey consisted of questions about the amount of trips made, such as questions about the travel length, duration, destination, chosen travel mode etc. (Trafikanalys, 2017). These questions were also complemented by questions about socio-economic and socio-demographic variables. Another survey carried out examined the residents' attitude towards different climate friendly solutions. In this survey, some questions with connection to transport occurred, e.g. the attitude toward increased taxes on fossil fuels and flights, and the attitudes towards travelling more with public transport, bicycle for trips up to 5 km, car sharing and choosing a more climate friendly car when need of an update (Naturvårdsverket, 2018).

These surveys show that an interest of the survey-measured factors exist at a national level, but since Sweden has approximately 10,2 million inhabitants and an area of 450 300 km², which results in the very low population density of 23 persons per km² (SCB, 2019a), bigger variations between areas occur. To handle such variabilities, the country of Sweden is organizational split up in 21 regions, which are further split up in 290 self-governing municipalities (SCB, 2019b). It is therefore with these organisations the responsibility of carrying out the transport planning in more detail lies (Trafikverket, 2019a).

4.1.3 The Region of Scania (Skåne)

Scania is the name of the most southerly region of Sweden and it has approximately 1,35 million residents spread across an area of 11 000 km². This results in a population density of 123 persons per km² (31.12.2018). The biggest city in the region is Malmö, with just over 300 000 residents, but the region has a strong polycentric structure, see figure 9. The polycentric structure creates a strong region, which is something that is promoted by the board of the region, Region Skåne (Region Skåne, 2013).

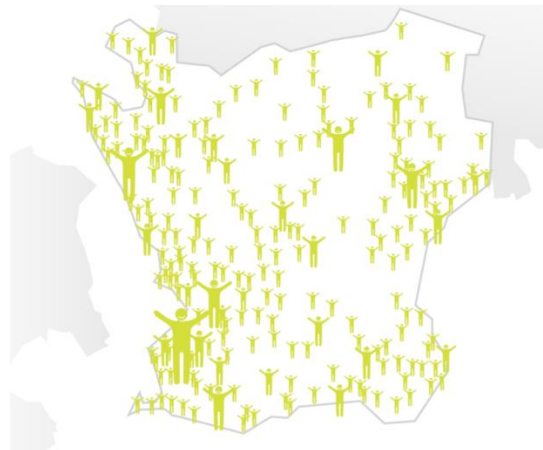


Figure 9. The polycentric region of Scania. Source: Region Skåne (2013).

Within the region of Scania, a travel behaviour survey has been carried out every fifth year since 2007. The results from the conducted surveys show that the polycentric structure leads to a complex travel pattern within the region (Region Skåne, 2014a). More specifically, the survey examined the travel pattern and characteristics for a specific day, decided by the conductors of the study, and a wide range of socioeconomics and socio-demographics for the respondents. The total amount of questioned residents was 70 000, divided between strata of at least 4 000 individuals in the different municipalities, and the response rate was 37% (ibid.).

The results from the survey show that many trips are made between the different municipalities, which complicates transport planning within the municipalities. This fact has led to the intentions of a strong inter-municipal mindset regarding planning in the region of Scania. The foundation for the regional planning in Scania is the “Regional Development Strategy until year 2030” (Region Skåne, 2014b). Here, five different goals for the region of Scania are put out, which are complemented by a goal for the modal split (see figure 10) (Region Skåne, 2017):

1. Scania is to offer belief in the future and quality of life
2. Scania is to be a strong sustainable growth hub
3. Scania is to take advantage of its polycentric structure
4. Scania is to develop the welfare services of tomorrow
5. Scania is to be globally attractive

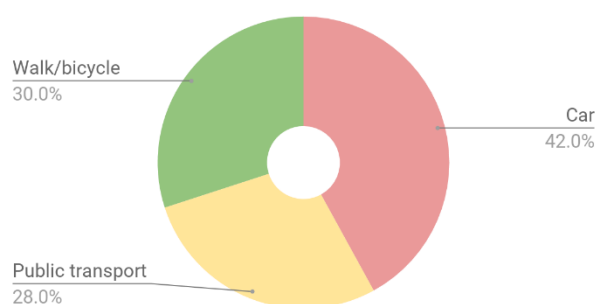


Figure 10. The goal for the modal split in Scania until year 2030. Source: Region Skåne (2017)

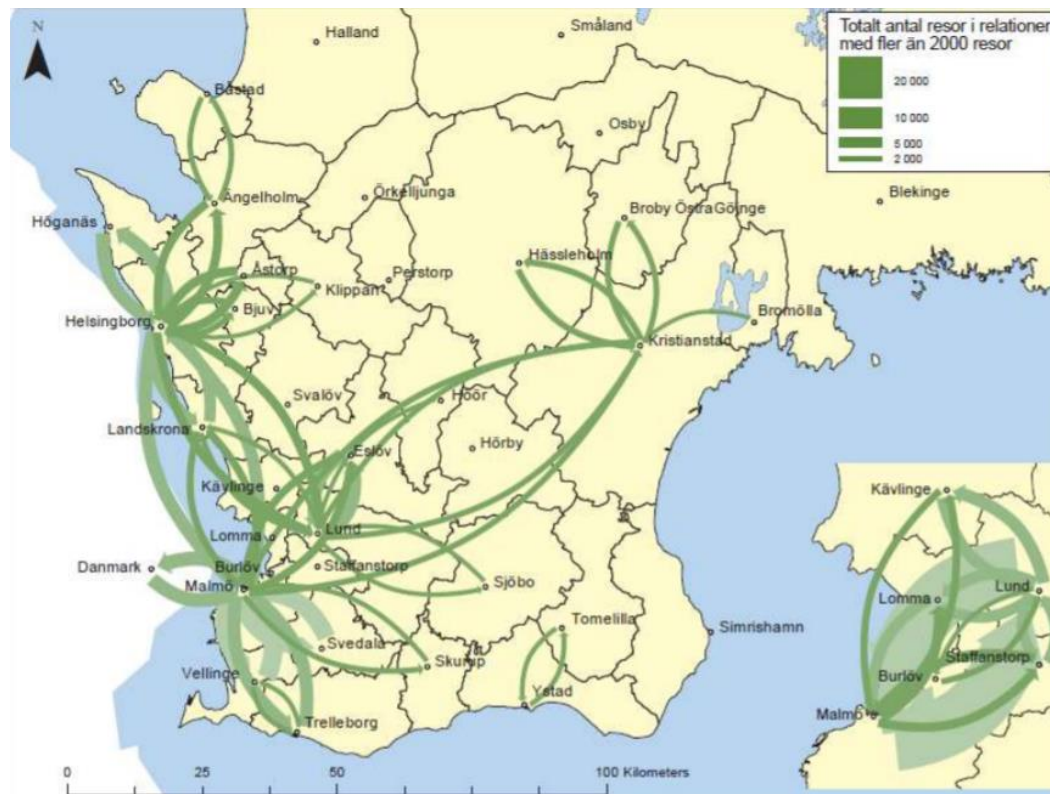


Figure 11. The travel pattern in the region of Scania. Source: Region Skåne (2014b)

In order to reach these goals, the region of Scania presents other strategy and planning documents, like the “Strategy for the Polycentric Scania” and “Strategy for a Sustainable Transport System in Scania 2050”. These documents aim to set out and present the long-term strategic transport planning direction for upcoming work with transport planning (Region Skåne, 2017). The transport strategy is also followed up by more specific plans and strategies like the “Bicycle Strategy” and, lately also, the first regional mobility plan in Sweden, the “Mobilitetsplan för Skåne” (Region Skåne, 2018). The aim of this mobility plan is set to increase the modal share for trips made by walking, bicycling and public transport - and this primarily through changing the attitudes and behaviours of travellers. Region Skåne is defined to be an impelling and cohesive force in this process, but it is stated that it is in the municipalities the anchoring and implementation is to take place (ibid.).

In the mobility plan, the “four-step principle” is mentioned. This principle is a way to cost-effective work with transport planning, since step one is to change the need of transport, or the modal split, step two aims to use the existing infrastructure more effectively, and re- and new constructions of the infrastructure first occurs in step three and four.

A part of step one in this principle, is to focus on changing the attitudes and behaviours of travellers. Some tools which are mentioned, are to inform about the sustainable travel modes and their availability, to merchandise the sustainable travel modes and to conduct campaigns like “try it out”. The mobility plan specifies these tools, and mentions that collaboration between different organisations is important, but does not more thoroughly explain how the process should be formed by the municipalities or mention pre-state surveys on the subject of attitudes and values. What is mentioned, is that the infrastructure should have a good standard to not discourage individuals who

are new to the sustainable travel modes - which again puts focus on the build environment (ibid.).

One of the few surveys with connection to attitudes made in Skåne, is a survey which examined the resident's attitudes toward the bicycle as a transport mode (Region Skåne, 2016). Here, questions about the travellers transport behaviour were asked, in order to determine in which stage of change they were, together with questions about their valuation of different factors and their, and their acquaintances, attitudes towards the bicycle as a transport mode. The answers from the approximately 1 650 residents, who agreed on joining a survey-panel, was analysed and translated to numbers for the whole region of Scania (ibid). The mobility plan for Skåne and the conducted survey on attitudes, show that an interest in attitude and behavioural change exist in the Region of Scania.

4.1.4 The MalmöLund region

Within Scania 11 municipalities in the southwest have decided to create the project “MalmöLundregionen”, see figure 12. The project MalmöLundregionen is especially interesting as the cooperating municipalities together have constructed a structure plan for the region in year 2035 (MalmöLundregionen, 2016). The plan contains goals and strategies on themes like living quality, mobility, labour market etc., and when it comes to mobility, bicycle infrastructure is mentioned as an important part of the future MalmöLund region. More specifically it is defined that the region shall work with the implementation of a regional fast-track network for travellers commuting by bicycle, and that it is desirable to plan for further connections in the bicycle infrastructure between cities in the region. As to pre-state analyzes, the results presented in the structural plan imply e.g. a car dependence, but do not present any deeper pre-state analyzes. The purpose of the structure plan is stated to mainly be a support for the included municipalities, but also to be an informational document for higher organizational instances (ibid).

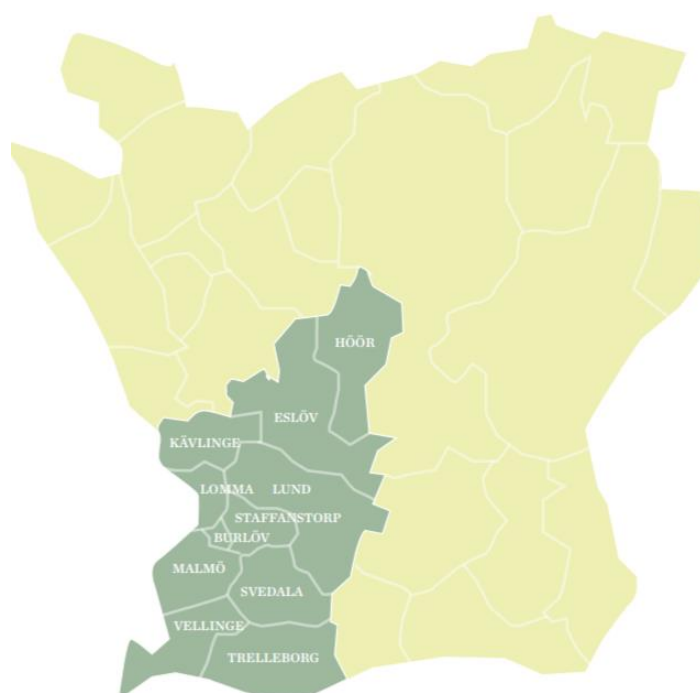


Figure 12. The MalmöLund region. Source: MalmöLundregionen (2016)

4.1.5 Municipalities in Scania

Three suburban municipalities in Scania, which are also a part of the MalmöLund region, have been chosen for further studies. The three municipalities are Lomma, Vellinge and Burlöv. The location of these municipalities is shown in figure 13.



Figure 13. The location of the three chosen municipalities in Scania (illustration made from the author).

Lomma

The municipality of Lomma is a smaller suburb municipality which covers an area of 55,5 km². Lomma is located north of the municipality of Malmö and west of the municipality of Lund. The distance from Lomma city center to the city center of Malmö is approximately 10,5 kilometers, which is a vast but reachable distance which takes approximately 30 minutes to bicycle, while the distance from the northern parts of the municipality, as e.g. Bjärred, is the double (Lomma kommun, 2018). The modal split for Lomma, which has approx. 24 000 residents and a population density of 436 residents per km², is presented in figure 14.

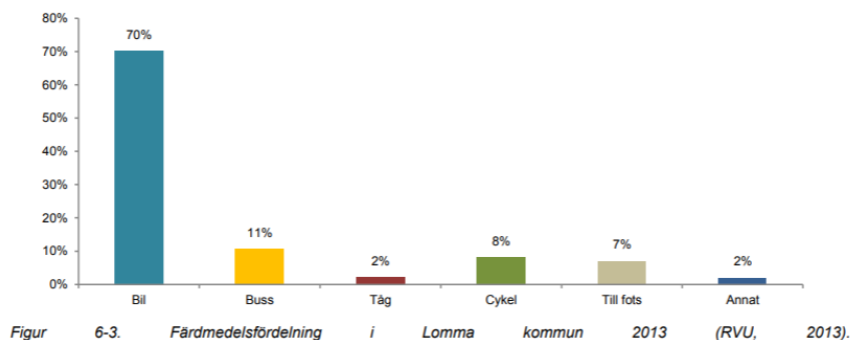


Figure 14. The modal split for Lomma municipality in 2013. Source: Lomma kommun (2018)

The board of the municipality has, in the year 2019, specified four goals which the municipality will strive for until the year of 2022 (Lomma Kommun, 2019). The goals are:

1. High quality service
2. Security throughout all life stages
3. Balanced sustainability work
4. The communicative municipality

In order to reach these goals, the board has specified strategies, but none of them is specified towards transport. In relation to the national and regional environmental goals, Lomma municipality has though made local adoptions. This is made by defining local environmental goals, of which some are focused on transports. The core of these goals is to increase the modal share for the sustainable transport modes (Lomma kommun, 2014). As a strategy for reaching these goals, it is defined that a transport plan will be constructed, with start in 2015, but on the webpage of the municipality there is not yet a transport plan to be found.

What is to be found is a new and extensive bicycle plan (from 2016). The bicycle plan is good anchored to international, national and regional environmental and transport objectives and presents bicycle planning in a wide perspective. As background information, data from the regional travel behaviour survey and vast physical inventories are presented. When it comes to which strategies to prioritize, they also put focus on attitudes and behaviour change. In relation to this, suggestions for measures are presented, where different policies, public activities and campaigns are given as examples. It is though not specified if Lomma municipality plans to realize all of them, or, if not, how they will choose which ones to prioritize (Lomma Kommun, 2016).

Vellinge

The municipality of Vellinge is a big suburban municipality located just south of the municipality of Malmö. Vellinge has approx. 36 500 residents in an area of approximately 143 km², which gives Vellinge municipality the low population density of 255 residents per km². Vellinge is, as Skåne as a whole, polycentric, but many locations within the municipality are reachable with sustainable transport modes like the bicycle. The distance between points of interest in the municipality of Vellinge and Malmö varies greatly. The distance between e.g. the city center of Vellinge and the new residential and commercial area Hyllie is 12 kilometers, whilst the distance between the more southern Höllviken and the city center of Malmö is approximately 27 kilometers. This fact limits the possibility of using the bicycle as the main transport mode for commuting trips to Malmö, but the availability of public transport still makes it possible to make longer trips using e.g. a combination of different sustainable transport modes. The modal split in the year 2013 for the municipality of Vellinge is shown in figure 15.

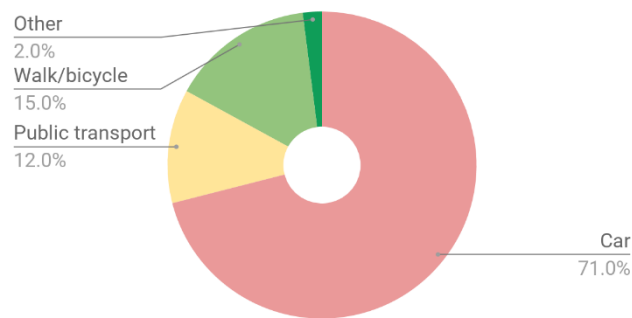


Figure 15. The modal split for the municipality of Vellinge in 2013. Source: Vellinge kommun (2018).

The board of the municipality has specified four goals which the municipality strive for. These are:

1. Healthy and sustainable growth
2. Attractive environment for living
3. Best citizen utility possible
4. Maximization of the tax funds

In order to reach these goals, a Mobility Strategy for Vellinge municipality has recently been presented (Vellinge kommun, 2018). To define the goals, a pre-state analysis, with data from e.g. the regional travel behaviour survey, a local school travel behaviour survey, traffic flow analyzes and physical inventories, is presented. The results from the pre-state analysis defines that the foundation of the mobility strategy is derived from the main problematic with the transport system of today: the vast car dependency. The goals set for the year 2030 is therefore set to increase the modal share for walking, traveling by bicycle and public transport to a total of 35%, which was measured to be 27% in 2013, and to eliminate schoolchildren's perceived fear in traffic environments close to schools or leisure time activities (ibid.). To reach the goals, five different methods are specified, of which one of them is to focus on changing traveller attitudes and values through campaigns, education and dialogues. Though, the mobility plan does not present any information which indicates that surveys have been made to examine the residents pre-state attitudes and values in the municipality.

Burlöv

The municipality of Burlöv is a suburban municipality located just north of the municipality of Malmö. Burlöv is, with its area of 19 km², one of the smallest municipalities in Sweden. Burlöv has approx. 18 000 residents, which results in a population density of 947 residents per km². This number is approximately twice as high as the population density of Lomma, four times higher the number for Vellinge and even comparable to the number of Malmö (1003 residents per km²). The distance between Burlöv and Malmö Central station is approximately 8 km. The modal split for Burlöv is presented in figure 16.

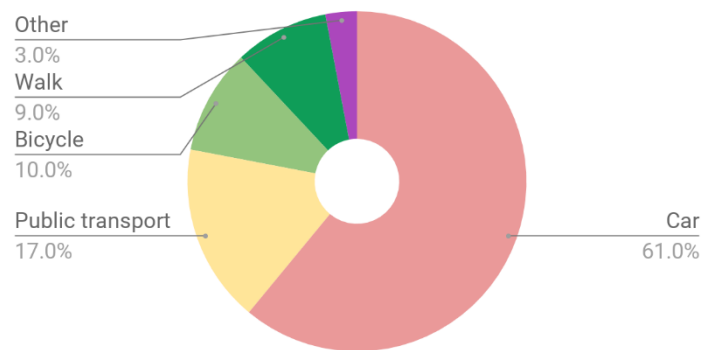


Figure 16. The modal split for the municipality of Burlöv in 2013. Source: Burlöv kommun (2014)

The municipality board of Burlöv has, like the ones of Vellinge and Lomma, specified goals which the municipality strive for in the period 2019-2022. These are gathered within four areas:

1. Attractiveness
2. Accessibility
3. Sustainability
4. Safety

These goals can all be connected to transport, but none of the specific goals and indicators refer to changes in transport or travel patterns. Goals connected to transport are instead found in the separate transport plan for Burlöv from year 2014 (Burlöv Kommun, 2014). In the transport plan, a thorough pre-state analysis is first presented, with data derived from the regional travel behaviour survey, physical inventories, measurements, counts and a short, five question survey. In this survey, one question, which can be related to attitudes and values, is found:

“Rank between 1-4 (1=most important, 4 least important) which of the transport modes bus, train, car or bicycle and walking that are most important to invest in the future”

The 50 survey answers (of which not all were complete) show that the answering residents in Burlöv find it most important to invest in the sustainable transport modes in the future, see figure 17.

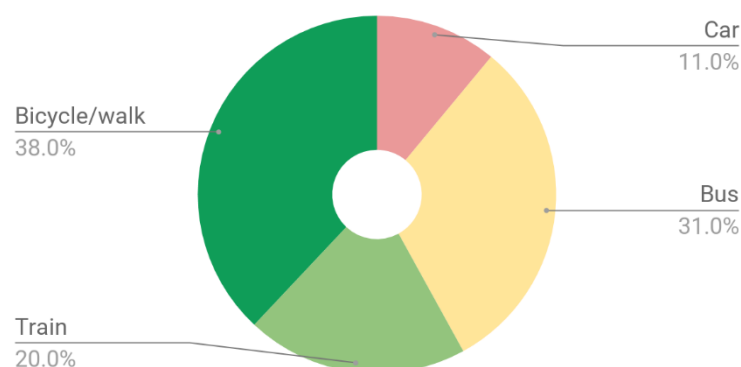


Figure 17. The most important transport mode to invest in, according to the residents in Burlöv. Source: Burlöv kommun (2014)

This result is though derived from a low amount of respondents, which indicates that the result might not be representative for the whole population in Burlöv. But in line with this result, the priority order for future measurements in Burlöv is set to:

1. Walking
2. Bicycling
3. Public transport
4. Motor vehicles

Goals, priorities and strategies to increase the modal split for the sustainable transport modes are therefore defined. The overall goal is, that not more than $\frac{1}{3}$ of all trips should be made by car. One of the nine, more specific, goals is to affect the travel behaviour. In the transport plan, it is explained that transport behaviour is strongly related to perceptions about the transport system, which is in line with the findings in this study, and that a faulty transport behaviour therefore can be a cause of faulty perceptions. It is though also mentioned, as in the mobility plan for Skåne, that another reason for a faulty travel behaviour could be faulty design and maintenance of the transport system. These statements show an awareness of the subject's complexity, but no further statements about researching the true nature of the travel behaviour in Burlöv is presented. As strategies to reach the goals, different policies and information campaigns are mentioned, together with conscious physical planning and safe and attractive infrastructure. In the transport plan in total, approximately 50 different strategies are mentioned, which of most are time- and cost consuming. The realization of all of them could therefore be questionable (Burlöv Kommun, 2014).

4.2 Austria

4.2.1 Planning system

As in Sweden, spatial planning in Austria has its foundation in national interests and non-binding guidelines. A fundamental difference between spatial planning in the two studied countries is though that regional planning plays an important role in the Austrian planning system as every Austrian state has the right to define own rules and guidelines. These are to be followed by the municipalities, which also get support in the process of defining masterplans or detailed development plans. With these as fundament, the land-use is finally defined by the municipalities (Gruber et. al, 2018).

4.2.2 National

As a member state of the UN, Austria also agreed on the 2030 Agenda, and to further define how this work will be put into national practice (Bundeskanzleramt, 2016). The parliament of Austria has therefore e.g. decided on a climate and energy strategy, which presents goals on ecological sustainability, reliable energy supply and economic competitiveness (Bundeskanzleramt, 2018). The strategies presented here put sustainable mobility in great focus. As examples of strategies for reaching a more sustainable mobility, they suggest reconstructions of the infrastructure, together with mobility management (ibid). Austria also has a national master plan for transport, in which they define the goals and strategies for the national transport planning until year 2025. The goals set are to lower the amount of people killed in traffic with 50%, lower the carbon dioxide emissions from traffic with 19%, lower the nitrogen oxide emissions with 70% and to lower the fine dust emissions with 50% compared to year 2010 (BMVIT, 2012). As for the strategies to reach these goals, they are concentrated on prioritizing public transport, technology and electric vehicles while subjects like bicycle infrastructure or mobility management are not mentioned. This absence is though compensated by a separate master plan for bicycling for the years 2015-2025.

The Austrian master plan for bicycling is comprehensive, and its many strategies for increasing the amount of trips made by bicycle presents a distinct orientation for transport planning for bicycling in Austria (BMLFUW, 2015). The strategies are derived from six different sub departments:

1. Coordination and investments in bicycle transport
2. Bicycle friendly urban planning
3. Information systems and awareness rising
4. Optimization of changes between transport modes
5. The role of bicycles in the economic system
6. Health advantages of bicycling

For every strategy it is also defined which the instances carrying the responsibility for the implementation are. Austria has a different organisational suborder than Sweden, as the country is divided into nine states, which are divided into in total 79 political regions and 15 self-governing cities. These regions and cities are finally split up into almost 2100 municipalities in different sizes. The general answer to the question about who the responsible actors, is that the authorities (Bund), states (Länder) and municipalities (Kommunen/Gemeinden) are the ones who have the main responsibility (BMLFUW, 2015).

When it comes to surveys made nationally, no surveys connected to attitudes or values were found in the document study. What was found was a travel behaviour survey, which corresponds to the one made in Sweden, which was conducted in 2013-2014. As the country of Austria covers a much smaller area than Sweden does, approximately 83 900 km² (compared to the 450 300 km² of Sweden) and the size of the population is 8,86 million residents, Austria has a national population density of approximately 106 residents per km² (31.12.2018).

4.2.3 The state of Lower Austria (Niederösterreich)

Lower Austria (Niederösterreich) is the name of the northeastern state which surrounds the capital city of Austria, Vienna (Wien), see figure 18. The state of Lower Austria has approximately 1 670 000 residents in an area of almost 19 200 km², which results in a population density of 87 persons per km² (31.12.2018). The biggest city in Lower Austria is St. Pölten, with just above 60 000 residents, and the state is, like the region of Scania, characterized by its polycentric structure as many residents live in the surroundings of Vienna.



Figure 18. The nine states of Austria.

The polycentric structure of Lower Austria generates a regional mindset regarding planning, and the foundation for the regional planning is the “Mobility Concept for Lower Austria 2030+” (Land NÖ, 2015). In this document four different goals are stated for the transport planning:

1. Better accessibility
2. Minimized effects on climate and environment from transports
3. Higher efficiency in the transport system
4. Ensuring a safe operation of the infrastructure

This document also put a separate focus on the bicycle as a transport mode, and presents the goal of increasing the modal share for bicycle trips from 8% (year 2013) to 14%. As the way to reach this goal, campaigns for travelling with bicycle are highlighted, together with the development of the bicycle infrastructure and bike-rental offers (ibid). In line with the UN “2030 Agenda for Sustainable Development” these measurements are further put in to focus in the “Lower Austria Climate- and Energy

program 2020” (Amt der NÖ Landesregierung, 2017). This extensive program defines 43 measurements with over 220 instruments in total, of which 8 measurements and 46 instruments are defined to be directly connected to individual transport and building structure. As ground pillars in the program, it is described that the state of Lower Austria should stand as a role model and that information, education and push- and pull initiatives are important to realize a behavioural change. A project group is therefore formed, which is set to organize the internal and external work, as the realisation of these measurements are stated to only be reached by cooperation between actors from different levels (ibid).

The strategies regarding the development in infrastructure are further broken down into more specific strategies in the “Mobility package for Lower Austria 2018-2022” (Land Niederösterreich, 2017). The responsibility for realising these strategies lies on the state Lower Austria in cooperation with national and local authorities and companies (ibid). The work with behavioural change through campaigns are from the state of Lower Austria further dedicated to the department for energy and environment, eNu. eNu is found to work widely with these questions, and examples of what they organize are frequent campaigns (under the name RADLand) and consultation, guidance and education for municipality employees.

In line with this, the state of Lower Austria has been carrying out a travel behaviour survey every fifth year since 2003 (Land Niederösterreich (NÖ), 2018). This survey examines the individual travel pattern and travel characteristics for two specific days, decided by the conductors of the study, together with a wide range of socioeconomics and socio-demographics for the respondents (Amt der NÖ Landesregierung, 2016). The total amount of questioned households was approximately 13 900, divided between stratum, in year 2013 and the response rate was 30%. The results from the survey show that the residents in Lower Austria travel approximately 52 km per day, and that 11,2% of the total amount of 4,3 million trips per day is made between Lower Austria and Vienna (ibid). No other surveys have been found in this document study.

4.2.4 Districts in Lower Austria

As mentioned earlier, the organisational suborder in Austria differs from the one in Sweden. In Austria, the level under state is the districts and self-governing cities. These have a direct connection to the state, as the state chief and state council are the ones assigning the district chief, and their responsibilities are to handle national public affairs on a more local level. Examples of what the districts organize are the police operations, social affairs etc., and these are regulated from the state. When it comes to transport planning there is not much decided on the district level, but the district can function as an impelling and cohesive force as the municipalities work with the realization of national and regional projects. Examples of districts in Lower Austria are Mödling (119 000 residents), Gänserndorf (100 000 residents) and Tulln (100 000 residents), se figure 19.

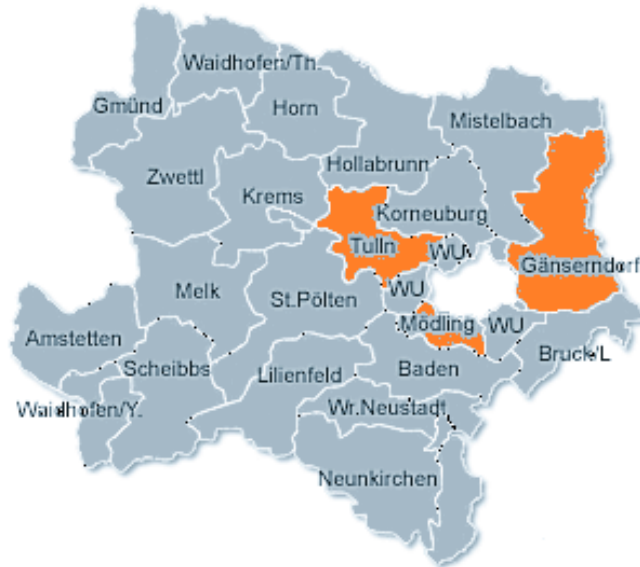


Figure 19. The location of the three chosen districts in Lower Austria

In these districts, the municipalities Klosterneuburg (Tulln), Groß-Enzersdorf (Gänserndorf) and Brunn am Gebirge (Mödling) have been further studied, see figure 20.



Figure 20. The location of the three chosen municipalities in Lower Austria

4.2.5 Municipalities in Tulln, Gänserndorf and Mödling

Klosterneuburg, Tulln

The municipality of Klosterneuburg is located northwest of Vienna and widens over 76,2 km². The number of residents is approximately 27 400, which results in a population density of 360 residents per km². The distance between the center of Klosterneuburg and Vienna city center is approximately 14 km, but no major height differences are to be found. The modal split for Klosterneuburg is presented in the new Mobility Concept for Klosterneuburg 2030+ (Deusch, Rosenkranz and Stocker, 2019), which is visualized in figure 21.

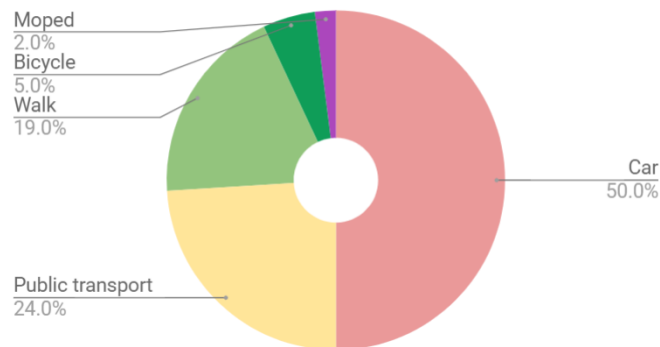


Figure 21. The modal split for the municipality of Klosterneuburg in 2018.
Source: Deusch, Rosenkranz and Stocker (2019)

The municipality board of Klosterneuburg has, with the help from a consulting company, also specified two guiding principles in the Mobility Concept which the municipality will work by (Deusch, Rosenkranz and Stocker, 2019). These are defined as:

1. Klosterneuburg is actively shifting transport to sustainable forms of mobility
2. Klosterneuburg designs public areas which are living- and recreational room for everyone

From these guiding principles the municipality board has also defined several “relevant” measurements which they set out to realize:

1. Expansion of Park and Ride facilities at the stations and creation of secure bicycle parking spaces to strengthen multimodal nodes
 2. Optimization of transfers in public transport
 3. An increase of bicycle parking facilities in central locations
 4. Continuous cycle paths on the main axes
 5. Shared space for narrow streets etc.
 6. Creation of traffic-calmed zones away from main transport axes
- (Deusch, Rosenkranz and Stocker, 2019)

These measurements are well in line with the specified guiding principles but are all focused on the third and fourth step in the earlier mentioned “four-step principle” (see chapter 4.1.2). Measurements from step one and two, which focuses on achieving a change in the modal split without reconstruction of the infrastructure, are not mentioned to be among the “relevant” measurements.

As to pre-state analyzes, data on the topic is presented in the Mobility Concept. This data is based on traffic counts, surveys and physical inventories (Deusch, Rosenkranz

and Stocker, 2019). This data shows e.g., that the modal share for trips made by car has not decreased between the years 2007 and 2017, and that most of the every-day trips originating in Klosterneuburg has Vienna as destination. From the conducted survey it is also pointed out that the quality of trips made by foot, bicycle and public transport is rated as lower than the quality of trips made by car in Klosterneuburg, and that the answering residents find it important to, in the future, invest in 1. Public transport, 2. Bicycling and 3. Walking (PlanSinn, 2018). Furthermore, the pre-state analysis shows that the topography within Klosterneuburg, together with a lacking bicycle infrastructure, results in a low modal share for trips made by bike. This is something which is mentioned to be affectable in the future, through e.g. a promotion of E-bikes, but the priority of this measurement is unclear, since it is not mentioned as one of the most relevant measurements. It is also not mentioned how this promotion should be best designed (focus on price, knowledge etc.?) for maximal return (Deusch, Rosenkranz and Stocker, 2019).

Groß-Enzersdorf, Gänserndorf

The municipality of Groß-Enzersdorf is, with its approximately 84 km², a bigger municipality on the eastern border of Vienna. The number of residents living in Groß-Enzersdorf is only approximately 11 500 (2019), which results in a population density of 134 residents per km². Since its area is mostly covered with farmland, most of the households are gathered in a settlement located in the southwest parts of the municipality. From this part of the municipality there is a distance of approximately 17 km to the most central parts of Vienna. For Groß-Enzersdorf there are no planning documents which show any transport planning directives, like e.g. Mobility Concept, to be found on the webpage of the municipality. It is though presented that a city renewal project, where the thematic of mobility is included, is taking place (Stadtgemeinde Groß-Enzersdorf, n.d.). No time plan or further details are presented.

Brunn am Gebirge, Mödling

The last studied municipality, Brunn am Gebirge, is found south of Vienna. With its approximately 12 000 residents and 7,3 km² area, the population density in Brunn is as high as 1 640 residents per km². This is the by far highest municipal population density found in this study, followed by Burlöv with 947 residents per km². The distance from the central parts of Brunn am Gebirge to the central parts of Vienna is approximately 14 kilometers, and the journey only includes smaller height differences. As for Groß-Enzersdorf, no transport planning documents which show transport planning directives are to be found on the webpage of the municipality of Brunn am Gebirge. In the conducted interview study, it is though mentioned that such a planning document does exist, and that the name of it is *Kommunale Mobilitätsmanagement - Brunn am Gebirge*. This document was then handed over, via Email, so that the document could be studied.

The studied mobility concept, which was presented already in the year 2009 (Knoflacher, 2009), takes ground in the fact that the realization of transport planning much depends on the political will in the municipality. Because of this knowledge, the creator of the mobility concept starts by presenting a study of the will and goals from different groups of politicians in the municipality. The study showed that there were no conflicts between the goals of the different groups of politicians, and that they all had mutual goals to increase the meaning of trips made by foot and bicycle, to minimize noise and pollution and to increase the quality of public spaces.

In the mobility concept, further pre-state studies are presented, which show data on the amount of car travelers and walking travelers in different corridors and crossings, but does not present a total modal split. The transport planning guidelines presented take stand in the defined political goals and present the measurements to reach them. The measurements are concentrated on different themes, such as walking, travelling by bike, information etc. One theme is also "Monitoring", which states the importance of following controls of measurements made by redoing the traffic counts, surveys etc. made in the pre-state study. No further specifications are though made on the subject (ibid).

The document study made showed on differences in planning culture in the two studied countries, but also on differences in planning culture in municipalities within the same country. The study also found possible lacks in transport planning, such as a lack of planning documents, directives and analyses of the traffic situation. In order to get a deeper understanding of the planning culture in the analyzed municipalities the following interview study was made.



5 Interview study

5.1 Sweden: Lomma

In line with national and regional goals, Lomma municipality strives to change their modal split by increasing the share for sustainable transport modes. This is confirmed in the interview with transport planners from Lomma municipality, and it is stated that Lomma has been actively working with this matter for a few, approximately 10, years. As a part of this work, the municipality has been working with a new transport plan. The transport plan is not yet accepted by the politicians, which is mentioned as a problem in Lomma. The transport planners imply that it can be hard to realize some of the desirable measurements because of a lack of support from the local politicians. It is also further stated that only 6% of the municipality budget is designated to transport planning and the chosen measurements.

When it comes to the cooperation with, and support from, the region of Scania, workshops held by Region Skåne are mentioned as good opportunities to get new input and to establish a contact with transport planners from other municipalities. As to the relevant strategies and planning document created by the region of Scania, which are presented in the document study, it is stated that these are not often used in the local transport planning. What however is used, is the data from the regional travel behaviour survey in Scania. This data is mentioned to be important, and is mentioned to be data which the municipality would not have money and resources to extract on its own. The data from the travel behaviour survey is therefore also stated to, in many cases, be the only pre-state survey data used in the transport planning, as Lomma municipality generally do not have the economical means to carry through any pre-state surveys. The attitudes and values of the travellers in Lomma are anyhow mentioned to be of importance to the transport planners in Lomma. As mentioned in the bicycle plan for Lomma (Lomma kommun, 2016), different policies, public activities and campaigns are some of the suggested measurements, which Lomma municipality also plan to carry through in the future. The transport planners in Lomma though imply that they do not have a strategy for distinguishing which the most relevant measurements would be, or which one to prioritize for a maximum dividend.

5.2 Sweden: Vellinge

In the municipality of Vellinge they also strive for a changed modal split, but the goal set is to increase the modal share for walking, cycling and public transport to a total of 35% (from 27% in year 2013, see chapter 4.1.4.2). The local transport planner state, that a further breakdown to travel-mode-specific goals is not of importance in Vellinge, as the primary goal is to decrease the modal share for trips made by car. This is a matter which the transport planners have had in mind for years, but which the municipality politicians just recently started to agree on. The support from the local

politicians is implied to still be limited, but the new Mobility plan, and its effects, is stated to be a positive action and a step in the right direction.

When creating the Mobility plan, the municipality had strategic documents from Region Skåne as inspirational materials, but it is stated that the material from Region Skåne is not often used in transport planning in Vellinge. Region Skåne is though mentioned, as it is in Lomma, to be a good organisator of workshops etc., but the transport planner in Vellinge state that the high workload limits the possibility to attend such events. In Vellinge, cooperation in the MalmöLund region is also mentioned as a positive project.

The interviewed transport planner in Vellinge implies that pre-state descriptions are desirable in their work and that they are trying to further implement such. As a basis for the general transport planning, it is stated that they sometimes use measurements from traffic flows, travel speed and the regional travel behaviour survey from Region Skåne. For measurements which are based on complaints from municipality residents, additional measurements and/or observations are sometimes also made. The transport planner also explains that they, in relation to the renovation of one of the bigger local bus stations, conducted a public pre-state survey to find further development potentials. This project was one of only a few examples, but as the outcome was seen as positive, it is implied that pre-state surveys can become more regular in the future. This is in line with the new (1 year old) mobility plan for Vellinge, but no specific action plan for the strategies on attitude and behaviour change is yet created.

5.3 Sweden: Burlöv

In Burlöv, the overall goal set is to minimize the amount of trips made by car to a maximum of $\frac{1}{3}$ of the total amount of trips. Burlöv is stated to be a strong commuter municipality, where a reconstruction of the national railway (from two to four tracks) has been in the planning for many years. The reconstruction has now begun, but the local transport planner states that the political approval for this investment not is a result from a sudden sustainable-transport mode-friendly change. Contrariwise, it is implied that the political resistance towards such changes is still highly noticeable. A possible reason is mentioned to be that many of the politicians in Burlöv municipality have chosen to live in Burlöv because of its location and good accessibility by car. The interviewed transport planner therefore believes that a generation change must take place before bigger changes can be accomplished. Since much of the infrastructure and many residential areas in the municipality were built half a decade ago, and the municipality organisation is constructed to meet these requirements, the transport planner express that the transport planning department in the municipality has a very high workload. The interviewed transport planner, who works alone as a transport engineer in Burlöv municipality, therefore state that he does not have time to go on as many workshops etc. as he wishes he had.

It is also implied that the high workload eliminates the possibility to conduct pre-state studies or attitude and value changing campaigns etc. As a result of this, it is stated that, since the interviewed transport planner started in his job three years ago, no such studies or events have been carried through in Burlöv.

5.4 Austria: Klosterneuburg

The interviewed transport planner in Klosterneuburg confirms that there has been a great focus on sustainable mobility in the municipality the last couple of years, especially after the founding that the modal share for trips made by car did not decrease in the period between 2007 and 2017. It is further stated that focus was put on this topic already before, but the missing results made the municipality realize that further measurements had to be carried through. The new Mobility Concept, which is constructed with the help from a consulting company and the district of Lower Austria, is therefore stated to be a good guiding document, with a well-defined vision, which is already stepwise being realized (until year “2030+”). As the realization has just begun (2019), the interviewed transport planner states that the engagement in the different departments of the municipality is big, but also that a fear of future withdrawals of resources exists.

The pre-data presented in the Mobility Concept gives an overall description of the pre-state, and a survey has been carried out in order to investigate the future direction of transport planning wished by the residents in Klosterneuburg. The interviewed transport planner does though imply that this survey study could have been further expanded if the resources had been greater or allocated differently. The interviewed transport planner also mentioned that it would be of great interest to further study the attitudes and values of the residents in the municipality, but that this is something which never has been done in Klosterneuburg - because of a lack of resources and knowledge. As to pre-state studies conducted it is further stated that simple traffic counts are common, but that no further type of studies are standard for analysing the pre-state.

5.5 Austria: Groß-Enzersdorf

In the interview conducted with a transport planner in Groß-Enzersdorf, it is confirmed that they, in line with national and regional goals, strive to change their modal split by decreasing the amount of trips made by car. As to the actual modal split, the interviewed transport planner state that they do not have any exact numbers, but that approximately 60% of the trips are made by car. It is stated that the transport planners in the municipality have been actively working with this matter for a few, approximately 8, years, but that not all of the representatives of the municipality have this as a high priority question. This is also implied to be one of the reasons why Groß-Enzersdorf does not yet have any guiding documents for transport planning, and instead only implement single measurements where a need arises. The board of the municipality are though stated to be more and more interested in sustainable mobility questions, and it is further stated that some important projects, concerning new bicycle roads and urban renewal concepts, are taking place. In this work, the collaboration with, and consulting help from, the departments of the state Lower Austria is mentioned as important.

When it comes to pre-state data, it is something which is seen as important in Groß-Enzersdorf, and the transport planners try to stay informed on the residents' opinions. Though, not too many pre-state studies are made, but the interviewed transport planner implies that they anyway have a “good feeling” of the status in their municipality. One conducted pre-state study which is mentioned, is a survey about the needs of a new Park and Ride facility and a possible new bus connection between this facility and the

closest subway station in Vienna. This survey is though conducted by the external climate proactive group named “Gr.Enz.Bewusst”, but it definitely serves its purpose (Gr.Enz.Bewusst, n.d.). On the subject of attitude and value changing campaigns etc., the transport planners and the municipality are working with informing through articles in different types of local media, and try-it-out tickets for public transport (bus), but it is stated that no pre-state studies has been made in connection to these measurements.

5.6 Austria: Brunn am Gebirge

In the municipality of Brunn am Gebirge, the interviewed transport planner states that the municipality board has been showing interest in a better and more climate friendly transport system for at least 10 years. The mobility plan for Brunn am Gebirge was, in this matter, stated to be an important and strengthening project for defining goals and accelerating some of the processes. The outcome from this project was clear goals, but it is further stated that the realization of these measurements still encounters some resistance, as the financial means stays relatively limited. But some measurements are already realized, as e.g. the continuity of the bicycle transport system has been improved, and some projects are stated to be in the realizing state, such as a bicycle highway. The bicycle highway is planned to run from Vienna and down to Mödling, though many different municipalities, which complicates the realization of the complete project. The state of Lower Austria is therefore stated to be an important coordinating and impelling part in this, and other such, project/projects.

As to pre-state analyzes, the transport planners in Brunn am Gebirge do not have any developed standards, but it is stated that they adopt them depending on the planned or wished measurement. The interviewed transport planner also state that they get many proposals from the residents in the municipality, and that they therefore do punctual measurements for being able to analyse the pre-state. The proposals are often regarding high car traffic volumes, but the transport planners are also trying to affect the car traffic volume by e.g. improving the bicycle facilities and informing about such in different media. These measurements are implied to be sporadically initiated, as they do not have any specific pre-state surveys or strategy for this matter.

6 Analysis of results

In this chapter the results from the conducted studies will be presented and analysed in relation to the defined research questions (RQ1-4).

Which factors are important for choosing interventions affecting the modal choice in modern countries like Sweden and Austria? (RQ1)

From the studied literature it is found that the factors which affect the modal choice are e.g. the extension and the quality of the infrastructure, the political environment, the travellers attitudes and values together with socio-economic factors like gender, age, education level and car ownership. The true relationship between the transport mode choice and a specific factor are though found to still be hard to define, as it seems to vary in combination with other factors.

- How should transport planners in these countries measure these factors? (RQ2)

The factors found in the literature study are also found to have different characters, since some are connected to the physical environment, some are connected to our socio-economics and socio-demographics and some are connected to our individual preferences and choices. In order to monitor changes over time, some of these different factors should be measured. How they are best measured depends on the character of the factor. Factors regarding e.g. infrastructural characteristics can be manually or mechanically measured or observed. On the other hand, factors regarding e.g. attitudes and values are best accounted for by conducting surveys or interviews.

- Are there any differences in planning (who is responsible and what is the content) between organizational levels and countries and how does it affect which studies are made? (RQ3)

The conducted document study, with the review of official documents from both studied countries, and the interview study has shown that there are both similarities and differences between transport planning in the two studied countries.

At a national level, both Sweden and Austria derive their transport planning goals from the 17 global goals defined by the United Nations (UN) 2030 Agenda. The goals defined by the two countries are also alike, as they focus on making the transport system more secure and on minimizing the environmental effects from it. This makes finding strengthen the comparability of the studied countries. Changing the modal split, in favour of sustainable transport modes, is in both countries defined to be a good strategy to reach these goals. This strategy is in both countries broken down into measurements, from which some are connected to attitudes and values, as e.g. awareness raising and bicycle-friendly transport planning. The realization of these

measurements are then mostly assigned to the regions (Sweden)/states(Austria) and the municipalities in respective countries. On a national level it is though, in both countries, carried out comparable national travel behaviour surveys. The factors, which are studied by conducting surveys, were also further studied in Sweden. This possibly shows a raised awareness of the importance of these factors, but the general focus on the topic was found to be low in both countries.

On the next organisational level, the region in Sweden and the state in Austria, more similarities are to be found. The studied state and region are both characterized by a polycentric structure with a strong regional transport planning, and both have the closeness to a major city, which strengthen the comparability of these two. The city of Vienna is though much bigger than the city of Malmö, both in size and in the amount of residents, which could possibly have an effect on the results. No signs of such effects were though detected in the study. The studied municipalities all varied in distance to the major city center, size, amount of residents, and therefore also population density, but were all suburban municipalities, since this was the only precondition for studying a specific municipality. The two objects of study present clear goals, strategies and measurements in line with the national goals, which are specified in the Mobility Concepts and Bicycle Strategies. When it comes to surveys, comparable travel behaviour studies have been carried out in both studied areas. The responsibility for the execution of the transport planning are in both objects of study mainly given away to the municipalities - but with the stated help from the region/state. In Scania nevertheless, one more study, which studied residents' attitudes toward the bicycle as a transport mode, has been carried out.

On the lowest organisational level studied, the municipality level, most of the differences were found. From the six studied municipalities, only four had an updated Mobility Strategy, Transport Plan etc. The variations in population density and distance to the inner city of Malmö/Vienna did not show any clear explanatory pattern to this finding. Furthermore, the four municipalities with a Mobility Strategy/Transport Plan all stated a focus on changing traveller attitudes and values, but did not present any indicators of surveys being made in order to examine the residents actual pre-state attitudes and values for any measurements made, nor presented a plan or strategy on how to work with these questions.

- How can the use of the pre-state studies be improved in transport planning in Sweden, Austria and other countries with similar characteristics? (RQ4)

The interview study verified that the goal to change the modal split in favour of sustainable transport modes, such as bicycle, are set in all the studied municipalities. The work with this change is though stated to still meet resistance, as it is stated that many measurements cannot be carried through because of a lack of resources. In order to improve the realization of successful and cost-effective transport planning it is therefore found important that the right resources are invested. It was also further stated that some of the transport planners do work with minor surveys in the municipalities, but none of the interviewed transport planners implied that they, even though it is a defined strategy to work with affecting the travellers attitudes etc., generally adapt pre-state surveys on the subject.

7 Discussion and conclusions

7.1 Discussion of chosen method

In order to get a deep understanding of the subject, which was needed in order to answer the research questions, the study methods chosen are found suitable. Nevertheless, the studies conducted do contain possible sources of error.

The literature review presents a review of relevant studies, but the true relationship between the different factors presented in the literature study and the travel mode decision is found hard to define. This could be a possible source of error, since the effect from some factors possibly could originate from other factors. The factors discussed in this study are the ones found in the studied literature, but more factors are believed to exist. The limited amount of time for researching for this study limited the amount of literature which could be studied.

To only study two countries, Austria and Sweden, was a conscious choice in order to not exceed the planned extent of this study, but to still get an interesting comparison between two industrial countries which both put great focus on sustainable transport planning. More countries could have been studied in order to get a wider perspective of how transport planning is executed, but the depth of the research questions was then not expected to be reached. If other countries would have been chosen there would be a possibility that the results of the study would be different from the results from this study.

The document study is primarily based on a review of different planning and strategy documents presented on the official web pages for the studied organisations (country, state/region and municipality). This could be a limitation, as some of the current work and valid documents might not be uploaded on the internet, which then would create a discrepancy between the reality and the outcome from this study. This possible discrepancy has not been further studied for the national and regional organisation level, but the interview study gave opportunities for such an analysis on the local level.

As to interview studies, they do include a risk of misinterpretation and a false presentation of the given answers. In the interview study conducted, the language barrier could possibly be an additional cause of error, since the interviewer did not speak fluent German. This can therefore have led to smaller misunderstandings, but these risks were tried to be minimized through transcription and comparison of the recordings with the final result. An overall risk with interview studies, where the different interviews take place at different times, can also be that the answers from the previous interviewed persons cause the interviewer to ask leading questions. The interviewer was also not trained in conducting interview studies, which can have had an effect on the result of the interview study.

7.2 Discussion of results

The results from the literature review are found very interesting, as the true relation between the transport mode choice and some of the factors studied is still hard to define. This is found to be a result from the fact that the effect from these factors seem to vary in combination with other factors, and the fact that the modal choice depends on human behaviour. This finding makes it hard to define a transport strategy which will be efficient in every place and in every situation. A key to a successful and effective transport planning is therefore believed to be to analyse the factors affecting the modal choice and to choose the ones suitable for the specific situation. As these factors are studied in different ways, with e.g. observational studies or surveys, different types of studies are believed to be necessary in order to define which the suitable factors are.

The document study showed that Sweden and Austria have similar transport, but that there are both differences and similarities in the transport planning. Even though some differences were found, the study did not show any bigger differences in how transport planning is carried through. Even though this result was not very surprising, as both countries are industrial countries with great focus on sustainable development, the similarities were strikingly many, as the countries even showed similar shortcomings. This could be one of the few disadvantages with international spreading of ideas, which would be an advantage when it comes to spreading improved working methods. Two of the studied municipalities did not have a published transport plan. This could be a sign of an increased risk of discrepancy also on the national and regional level, as there could be a possibility that not all leading documents are available online. It is though more likely that these higher organisations have higher external demands on documenting and publishing their work, and that such discrepancy therefore does not, to a wide extent, exist. To further analyse this risk, additional interviews with representatives from national and regional level would be of interest.

The interviewed local transport planners stated that they have good use of the data from the regional travel behaviour studies, since they most often do not have the time and resources for conducting survey studies - or any pre-state studies at all. This lack could be an effect from a lack of resources, but also from lacking knowledge, as this shortcoming was found in all studied objects. As high goals are set, on local as well as regional and national level, and a lot of focus today is put on sustainable development, it is found surprising that not more resources are dedicated to the realization of these measurements, since many of such measurements are also very cost-effective. In order to make the best use of resources available, it is therefore important to further study this topic and to educate individuals working with these measurements, as e.g. the transport planners interviewed. Since the available resources for transport planning are decided by the politicians, it is important to also make the politicians aware of the discrepancy between the goals set and the invested resources meant to be used to realize them.

7.3 Conclusions and recommendations

In order to realize transport planning in an effective way, which is highly demanded in the transport planning of today, it is important to take the factors affecting the modal choice into account in transport planning. This is only possible with the right knowledge and the right resources. The conducted document and interview studies showed a lack of such resources, and a possible lack of such knowledge. In order to cost-effectively realize the, in this study, most prioritized goal set by the studied countries, states/regions and municipalities - to achieve a modal shift in favour of sustainable transport modes - it is important that the corresponding resources are invested. As this is a highly political matter, it is recommended to make politicians aware of this discrepancy in order to reach the goals set and to reverse the related problems.

The further recommended studies are studies on:

- how different factors affect the modal choice
- how surveys are used on a national and regional level.
- how to effectively implement surveys.
- how resources are allocated to sustainable development.
- which level of knowledge the transport planners responsible have about the factor's attitudes and behaviour and survey studies.
- how the studied topic is handled in other countries.



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Appendix 1. Guiding questions for interview study

1. How is the modal split in the municipality currently?
2. Does a desire to change the current modal split exist?
3. If yes, how long has the municipality been actively working on changing the modal split?
4. Does the municipality have a transport plan/strategy, mobility plan/strategy etc.?
5. Is there political support for a prioritization of the sustainable transport modes in the municipality?
6. How is your cooperation with the state/region in questions regarding transport planning?
7. What importance do pre-state studies have for transport planning in the municipality?
8. How do you work with pre-state studies for transport planning in the municipality?
9. How do you work with pre-state surveys for transport planning in the municipality?
10. Do you focus on the travellers attitudes and values in the municipality?