Electrifying transportation with e-bikes – A Travel Awareness campaign plan

LYONEL AGUILAR 2015
MVEM30 EXAMENSARBETE FÖR MASTEREXAMEN 30 HP
TILLÄMPAD KLIMATSTRATEGI | LUNDS UNIVERSITET|

Abstract

The current and future problems and increasing consequences that this world has today in the light of climate change; is a hot topic in many countries, including Sweden. The solutions to fight this problem have to be found in many different areas. The bicycle has previously been encouraged as a mode of transportation due to, amongst others, the climate benefits that it provides; something that electric bicycles (also referred to as e-bikes) have been found to provide as well. This project investigates the potential of the e-bike as a replacement for the car; by investigating the drivers and barriers related to the use of this mode of transportation. Subsequently, based on these facts, this project aims at encouraging more individuals to replace the car with the e-bike: The project attempts to do so by proposing a Travel awareness campaign plan, focusing on the region of Skåne, Sweden.

Preface

I would like to thank my tutor Lena Hiselius, for providing me with guidance throughout the process of this project. I would also like to thank Johanna Alkan Olsson, for her support. Finally, I would like to thank all of the respondents in this project, for their crucial contributions with data; and which therefore made this project possible.

1. Introduction

The current and future problems and increasing consequences that this world has today in the light of climate change; is a hot topic in many countries, including Sweden. The solutions to fight this problem have to be found in many different areas. Statistics show that, according to Naturvårdsverket (2015), a third of all Swedish greenhouse gas emissions originate from the transportation sector. Around 58% of these emissions originate from the use of cars (Naturvårdsverket 2015). However, replacing the car as a mode of transportation can be challenging; especially when it comes to, as Rose (2012:81) writes, *"catering for the mobility needs of an ageing population, many of whom have become accustomed to the independent mobility provided by the car"*.

The bicycle has previously been encouraged as a mode of transportation due to, amongst others, the climate benefits that it provides in comparison to e.g. the car; something that electric bicycles (also referred to as e-bikes) have been found to provide as well (Schepers et al. 2014:174). However, only 10% of trips in Sweden are conducted by bicycle (Eriksson 2009:9); while the proportion of trips conducted with public transportation is not much higher, being at 17% of total trips conducted (Trafikanalys 2014:16). Additionally, the e-bike only makes for a few percent of bicycle trips in Sweden (Koucky & Ljungblad 2012:7); accounting for around 1-4% of the distance travelled by bicycle (Clark & Nilsson 2014:18). Nevertheless; benefits with the e-bike include, as with the bicycle, the reduction of congestion and the positive effect on public health in comparison to modes of transportation such as the car (Schepers et al. 2014:174). The e-bike in particular has subsequently been found, by certain studies, to even out age differences when it comes to cycling; in contrast to the conventional bicycle, where older age seems to have a negative effect on mileage (Fyhri & Fearnley 2015:46). This indicates that the e-bike could be an option that permits more age-groups, and other groups that may be unable to bike, to use this mode of transportation. At the same time, e-bike commute has been found, by certain studies, to give relatively large increases in bicycle-mileage; even with small increases in the use of e-bikes for these purposes (Fyhri & Fearnley 2015:51). This is a positive effect that could make more trips be conducted by this climate friendly mode of transportation. Finally, as pointed out by

Koucky & Ljungblad (2012:17), an increase in biking is likely to be provided by the e-bike; due to the possibility of longer and faster travelling.

This project investigates the potential of the e-bike as a replacement for the car; by investigating the drivers and barriers related to the use of this mode of transportation. The project points out the drivers that e-bikes provide: both in relation to the car; as well as in relation to other modes of transportation. This includes drivers in relation to the conventional bicycle; as these drivers could attract individuals who have found barriers related to this mode of transportation. At the same, barriers related to e-bike use are also provided. Subsequently, based on these facts, this project aims at encouraging more individuals to replace the car with the e-bike: The project attempts to do so by proposing a Travel awareness campaign plan, focusing on the region of Skåne, Sweden. There is little knowledge about the causes for individuals choosing e-bikes as a mode of transportation (Rose 2012:86, 88). This, combined with the general advantages of e-bikes pointed above, makes it interesting to conduct this study; especially in the light of a situation in which sustainable mobility options need to be explored.

1.1 Objective and Research questions

- **Objective:** The objective of this project has been to create a basis of information, which can be used as guidance; for formulating a travel awareness campaign plan that can be used to contribute in achieving an increased use of e-bikes. This in order to provide a flexible mode of transportation for individuals to replace the car with. Note: The information basis created in this project will be referred to as a Travel Awareness campaign plan throughout the project.

- **Research questions:** In order to reach the objective of this project, the following research questions have been formulated:

    - Which are the drivers and barriers for the use of e-bikes in Sweden?
    - How can the use of e-bikes be fomented as an alternative to the car in the region of Skåne?

1.2 Delimitations

This project works with e-bikes that have the following criteria as defined by Transportstyrelsen (2015):

- The electric engine's assistance is activated when pressure on the pedals increases
- The electric engine's continuous effect reaches a maximum of 250 watts
- The electric engine can only reinforce the force of the pedals, and does not provide assistance at speeds over 25 km/h

This is due to the fact that these e-bikes dominate the vast majority of e-bikes sold in the market (Winslott Hiselius et al. 2013:6).

Furthermore, the Travel Awareness campaign suggested by this project focuses on the region of Skåne. This is due to the region being the second most densely populated county in Sweden; as well as the residential areas being relatively close to each other (Tillväxtverket 2014).

1.3 Chapter overview

This project contains six chapters: the first chapter presents the introduction of the project; as well as the project's objective, research question and delimitations. The second chapter presents the methodology used to collect and analyze data in the project. The third chapter proceeds by presenting the theoretical framework that this project uses for the analysis of the project. The fourth chapter presents the findings of this project; in the form of drivers and barriers to e-bike use. The fifth chapter presents the analysis of this project; in the form of a Travel Awareness campaign plan. Finally; the sixth chapter summarizes this project and presents the conclusions drawn throughout the project.

2. Methodology

This section presents the methods used in order to collect and analyze data for this project.

2.1 Data collection

2.1.1 Document analysis

The main material used for the findings of this project has been gathered through a document analysis of articles and reports; which covered the drivers and barriers for e-bike use. Some of the most relevant articles for this project were for example the studies conducted by Winslott Hiselius et al. (2013); as well as Koucky & Ljungblad (2012) and Clark & Nilsson (2014). These documents were analyzed for credibility depending on the origin of their authors or the organizations that had been involved in their creation. For example: Winslott Hiselius et al. (2013) is a document produced by university lecturers, and authors with other positions, within the University of Lund. Koucky & Ljungblad (2012) is a research document ordered by the research program *Cycity*; which aims at increasing knowledge on bicycle planning and bikers' preferences. Furthermore, Clark & Nilsson (2014) is a document ordered by the Swedish Transport Administration. These articles were amongst the most relevant due to their delimitation to the Swedish context; which in its turn made them crucial due to the limited amount of literature of this type.

Additionally, documents related to drivers and barriers for e-bike use, with delimitations in other countries, were also used. This was due to the limitations mentioned above; in order to gather information on general drivers and barriers related to e-bike use. Some of the most relevant documents were for example articles and reports such as Gehlert et al. (2012) and Rose (2012). The credibility of these documents was confirmed based on the context of their publications. For example: Gehlert et al. (2012) was a document used in the *International Cycling Safety Conference 2012* in Holland. Furthermore, Rose (2012) is an article within the journal *Transportation*; which is published by the known STM publisher *Springer*.

For the theoretical framework of this work; most of the information was collected through documents produced or published by the MAX project. *MAX* is a comprehensive project within

the European Union's *sixth framework programme*. The project ran from the year 2006 to 2009; and was a research project on Mobility Management. The project *"served to extend, standardize and improve Mobility Management"* (Max website 2015).

Finally; information and documents found on internet websites were used for surrounding information. These were for example data on Swedish energy consumption, gathered through the website of the Swedish Energy Agency; and data on climate-political ambitions of different Swedish political parties.

2.1.2 Online survey

The online survey in this project functioned as a complement to the document analysis conducted. This was in order to gather more specific information on the drivers and barriers to e-bike use in Sweden; due to the limited amount of research available on this topic. This survey was directed at current e-bike users: the experience of e-bike users was assumed to be the most valuable; as individuals who have not used an e-bike may possibly have opinions on their use which could be based on e.g. myths or pre-determined attitudes. It would have been optimal to have the possibility of only gathering data from individuals who have switched from car to e-bike use. However, due to the resources and time-scope of this project, it was not possible to make this selection.

The online survey was created in the platform Google Forms; due to the small amount of economic resources available and therefore the fact that this tool incurs no costs. The answers to the survey were saved automatically on a database accessible to the author. Subsequently, a link to an online survey containing questions with open answers was posted on different groups in the social media Facebook. These were groups that were either related to the use of e-bike or had an environmental purpose. Together with the posted link; a description of the objective and aim of the project was provided in order to inform potential respondents. Potential respondents were also encouraged to contact the author for any questions they may have. The survey was answered by twenty two e-bike users from the different groups. Two of these respondents were however chosen through recommendations from the author's personal contacts. The number of respondents in the survey depended on the amount of individuals willing to answer the survey. The goal was to acquire around twenty respondents; due to the time-scope of this project (and

thus the time it would take to process this information). However, due to the limited amount of e-bike users found (increasingly slowing down after fifteen respondents), the link to the survey was left open until the number of respondents willing to answer ceased to increase. The Facebook groups used to spread the survey were the following:

- Vi som gillar elcyklar (We who like e-bikes)
- Elcyklar, trafiksäkerhet och infrastruktur (E-bikes, traffic safety and infrastructure)
- I-bike Malmö
- Cykla elcykel - Elhojen (Bike with e-bike – Elhojen.) (Recommended by I-bike Malmö)
- Naturskyddsföreningen Malmö (The association for nature protection in the city of Malmö)

The first three Facebook groups were chosen by searching Facebook with keywords such as (translated from Swedish in parenthesis): "elcyklar" (e-bikes), "elcykelentusiast" (e-bike enthusiast), "cykel" (bicycle), "cykel Skåne" (bicycle Skåne) and "elcyklar Skåne" (e-bike Skåne). The amount of Facebook groups that had discussions about e-bikes where few; which was a setback for this project, as it was expected (when planning the project) that there would be a larger number of Facebook groups dedicated to e-bike use available. Additionally, there were surprisingly few conventional bicycle groups that had discussions about bicycle use per se; as there were many groups that used names such as "we who like to use the bicycle", but that either did not discuss bicycle use, did not seem to be active, or seemed to be dedicated to other purposes (using the name misleadingly). Furthermore, the group "Cykla elcykel – Elhojen" was gathered through snowball sampling; as it was recommended by an individual in the group "I-bike Malmö". Finally; the group "Naturskyddsföreningen Malmö" was chosen due to the organization's (Naturskyddsföreningen) fame for containing members interested/working with environmental issues in different parts of Sweden.

The reason why Facebook was used to find respondents was in order to try to reach a wide amount of individuals spread in Sweden; which would otherwise have required large amounts of resources. Facebook was also used due to the fact that this social media is used by individuals in their leisure times; which can, as Gregori & Baltar (2013:137) write, help minimize reluctance towards answering the survey in e.g. working hours. This way, the respondents would find the survey on their free time and could answer it during the same time. The survey posted on the

Facebook groups contained six open questions related to the respondents' opinions on the use of e-bikes (see: Appendix 1).

Respondent	Age	Time having had an e-bike	Gender
#1	31	1 year	Male
#2	45	2 years	Male
#3	35	2 years	Male
#4	34	2 years	Female
#5	27	3 years	Female
#6	44	8 months	Female
#7	58	1,5 years	Male
#8	41	7 years	Male
#9	38	2 years	Female
#10	54	Less than 1 year	Female
#11	35	5 years	Female
#12	41	3 years	Female
#13	65	2 years	Male
#14	33	2 years	Male
#15	47	1 month	Male
#16	48	1 year	Female
#17	45	10 months	Male

#18	23	2 months	Male
#19	42	3 years	Male
#20	52	3 years	Male
#21	62	1 year	Male
#22	38	Did not specify	Female

Table 1. Overview of respondents who participated in the online survey

Telephone interviews

As was mentioned above, respondents were asked if they would be willing to answer questions related to their e-bike use; in order to gather more information on their experiences. This was done through semi-structured interviews. Semi-structured interviews, as Ayres (2008:3) writes, are used in order to have open-questions that are pre-determined. This made the method adequate for this research; as the aim of these interviews was to gather as much information on potential drivers and barriers to e-bike use as possible, while keeping control over the direction of the questions. Eleven respondents were interviewed; which was done in the form of telephone interviews, due to the respondents' own requests and the wide spread of these respondents throughout Sweden. The number of respondents was furthermore left at eleven due to the saturation in answers gathered: the answers being gathered had many similarities. As Ayres (2008:3) prescribes; an interview guide was made for these interviews (see: Appendix 2).

Additionally; user-specific questions were added in some cases, depending on certain pieces of information provided by the respondents on the online survey.

Finally; these telephone interviews were recorded, with the respondents' consent, through the mobile application "Automatic Call Recorder". The interviews were not transcribed fully due to issues of time efficiency. Instead, key pieces of information were selected and used throughout the project. However, the files containing the recordings have been saved and are available through the author.

Interviews

In order to acquire first hand information on practical experiences with these types of campaign in the region of Skåne; two semi-structured interviews were conducted with the public servants Anders Söderberg (working in the department of transportation [gatu -och trafikkontoret] for the municipality of Lund) and Frida Beijer (working for the department of transportation [gatukontoret] for the municipality of Malmö). These public servants have experience with Travel Awareness campaigns conducted within these municipalities. There were plans of interviewing more public servants in other municipalities in Skåne; however, due to the time scope of this project and difficulties in finding public servants with this type of experience, this was not possible. Seven questions were formulated. The Interview guide for these interviews can be found in Appendix 3.

2.2 Data analysis

The data gathered in the findings of this project has been divided into four driver categories and two barrier categories:

- *Unique e-bike drivers: in relation to all modes of transportation (except for the conventional bicycle)*: Contains the general drivers that are unique for the e-bike; and which consequently makes this mode of transportation stand out from other modes.

- *Drivers in relation to the car*: Contains drivers that give the e-bike an edge in comparison to the car.

- *Drivers in relation to alternatives to the car (except the conventional bicycle)*: Contains drivers which give the e-bike an edge in comparison to other alternatives to the car; and which therefore makes this a unique alternative.

- *Drivers in relation to the conventional bicycle*: Contains drivers that give the e-bike an edge over the conventional bicycle.

- *Internal barriers:* Contains barriers for e-bike use which are related to the e-bike's internal qualities.

- *External barriers:* Contains barriers for e-bike use which are created by the surrounding environment.

These drivers and barriers have furthermore been used as a basis for the analysis of this project i.e. the travel awareness campaign plan that this project proposes. The categorization has been adapted to fit the attributes contained by the different groups targeted by the travel awareness campaign plan. This was done in order to tackle the factors that drive these groups towards car use; and away from using alternative modes of transportation.

The analysis of the data has been guided by the first five steps of the *MaxTag design framework*; which has functioned as a step-by-step model for building the Travel awareness campaign. This project has furthermore focused on the first, second and last steps of the design framework; as these are the most relevant steps in relation to the type of data acquired throughout this project. Due to the fact that the *MaxTag design framework* requires the use of a behavioral model; the *seven stages of change* behavioral model has also been used in this project. This model is used on the second step within the *MaxTag design framework*; in order to more specifically provide guidance on the stages of behavior change that are addressed mostly in this campaign. The model is additionally used to guide the way in which the drivers and travel priorities gathered in this project are used to achieve behavior change throughout the relevant stages.

3. Theoretical Framework

This chapter presents the theoretical framework for this project: the section gives a short explanation of Mobility Management; and the Travel Awareness campaign as a tool in the wider spectrum of Mobility Management. The chapter proceeds by explaining the MaxTag design framework; which is used as a step-by-step guide for building the Travel Awareness campaign plan proposed in the analysis. After this, the seven stages of change behavior model, which is used within the MaxTag design framework, is explained. This chapter finalizes by explaining the reasons behind the choice of the car as a mode of transportation; which is important for selecting the target groups for the Travel Awareness campaign plan.

3.1 Mobility Management

Mobility management (MM) is a soft measure approach used with the objective of changing a populations' travel behavior towards more sustainable modes of transportation. (Pressl & Reiter 2003:6-7, 10). Mobility management focuses on reaching change in travel behavior through actors that both influence and generate traffic. Amongst these we can find authorities, work places, events, etc. (Pressl & Reiter 2003:8);

3.1.1 Travel awareness campaign

Travel awareness campaigns are of high importance in mobility management strategies (MAX 2009a:4) and focus on reaching change in travel behavior through the individual. This is done through different types of information campaigns targeted at various ranges of the population; such as individualized campaigns, campaigns aimed at target groups, public awareness campaigns, etc. (Pressl & Reiter 2003:5, 8,).

3.1.2 MaxTag design framework

In order to have a step-by-step guidance on the process of building the proposed travel awareness campaign plan; this project will use the first stage (the planning stage) of the *MaxTag design framework*. Due to the type of data gathered during this project; focus will lay on the first, second and last steps of this stage. The framework was created by the *Workpackage A* of the *MAX*

project, when working with Travel Awareness Campaigns (for description of *MAX* project see: Methodology).

The *MaxTag design framework* gives guidance on building travel awareness campaigns through a framework of 10 steps; which are divided into 3 stages (MAX 2009a:6). This project excludes the *implementation* stage and the *post-campaign* stage. This is due to two reasons: firstly, the implementation stage overlaps with the *planning stage* (MAX 2009a:29); therefore, in order to paint a clearer picture for the planner, recommendations in this project's plan will focus on the *planning stage*. Secondly, the post-campaign stage deals with activities which extend beyond the campaign itself; which are steps outside the scope of this project.

Figure 1: MaxTag design framework

The first stage, the planning stage, comprises steps 1 through 5:

- Step 1- Campaign aim and objectives: Campaign aims and objectives are determined for both the process and the end result of the project. Details that specify the dimensions of the campaign are specified; such as the size of the target population, the type of desired behavior that is to be achieved and other important aspects. Recommendations for

formulating successful objectives prescribe that these should be measurable, specific, acceptable, realistic and time related (MAX 2009a:7-8).

- Step 2 – Formative research: This stage focuses on gathering data that will give an understanding of the subjective and objective factors that affect people's behavior. Specifically important, when it comes to these factors, is understanding the barriers that individuals face for certain type of travel behavior. This is done through a combination of person-specific data, gathered through interviews and surveys; and the use of behavior models or theories (MAX 2009a:9, 11).

- Step 3 – Campaigning the campaign: Travel awareness campaigns depend on forging relationships and gathering support from different actors. Firstly, political support is very important mainly due to the funding that can be acquired through it. Also stakeholders, such as environmental agencies, local authorities, business owners, local transport operators, etc. are important sources of support, including funding; which creates the necessity of establishing stakeholder networks. Finally, having the cooperation of the campaign's targeted community is important as well; which makes it necessary to establish strong links with its inhabitants/workers (MAX 2009a:13-14).

- Step 4 – Developing the social marketing mix: The fourth step is about defining the way in which the campaign will be marketed to the public; called the social marketing mix. According to MAX 2009a:16, 24); this mix should be built based on six elements:

    - Product or social idea: Provides final goal of the campaign and its benefits. In traffic planning this could include less greenhouse gas emissions, less congestion, etc.
    - Price: Relates to personal costs (such as decreased convenience); but enlightens the individual on the personal benefits of adopting the campaign's desired behavior. This could for example be health benefits gained from using a bicycle.

- Place: Handles the necessity of having places in which the individual can acquire information, get personally involved in the campaign, interact with the campaign team, etc. This could be community facilities, exhibitions, etc.
- Promotion: This element is about the way in which the campaign will be marketed in society; which includes for example web pages, social media such as Facebook, TV advertisement, printed advertisement, and more.
- People: Interpersonal communication between members of the campaign and the population can be very useful for a successful campaign. This can for example take place at local meetings; where campaign staff can directly communicate with people, especially those who prefer this kind of communication.
- Processes: This element refers to being attentive and personal with the population when it comes to feedback; through for example answering e-mails, phone calls, etc.

- Step 5- Shaping up the plan using a SWOT analysis: This is the last step of the planning stage; which aims at forming a revised plan based on the previous steps. This includes for example aims and objectives, results from formative research, wider policy objectives, a monitoring and evaluation plan, and a SWOT (Strength, Weaknesses, Opportunities, and Threats) analysis of the surrounding conditions associated to the campaigns design. The SWOT analysis is typically used in order to get an overview of the internal development of the campaign; revealing the strengths that can be built on and the threats that should be addressed before the campaign is implemented. The SWOT analysis includes various dimensions; such as overviews of the data collected from the population, resource base, time scale, stakeholders and their commitment, etc. Particular dimensions important to take into consideration in the analysis are regulatory and fiscal measures that may affect the campaign. Another important dimension is, naturally, a review of the infrastructure (or lack of infrastructure) that could be related to the campaign; such as bus lines, bike lanes, and others (MAX 2009a:17-18, 20)

3.1.3 The seven stages of change model

Models or theories of behavior change are necessary in order to build travel awareness campaigns that aim at changing travel behavior (Pressl & Reiter 2003:26). *The seven stages of change* model will therefore be used in this project as a base for the proposed travel awareness campaign. This model was created by the project TAPESTRY; a project funded by the European Community. The project aimed to "*increase knowledge and understanding of how to develop effective communication programmes to support sustainable transport policies in Europe."* (TAPESTRY 2003:2). The seven stages that the model describes are explained below:

- 1) Awareness of problem or opportunity: Awareness of the problems caused by car usage, such as air pollution, is a pre-condition for initiating behavior change (Pressl & Reiter 2003:32). Awareness of the opportunities of changing travel behavior is often as relevant as knowing the problems in this stage (MAX 2009b:16).

- 2) Accepting responsibility or relevance: This stage is about the individual accepting responsibility for its part in the problem; as well as accepting therefore that there is a part to be played in the solution (Pressl & Reiter 2003:32). Relevance of the problem also plays in at this stage. This is through the individual realizing the problem's relevance and the opportunities provided by efforts to solve the problem (TAPESTRY 2003:13)

- 3) Perception of options: The way that other transportation modes are perceived has a strong effect on the perceived viability of these modes. There are many factors that affect this stage such as safety, accessibility, punctuality and other system related factors; as well as societal factors such as the general view of the alternative modes of transportation (MAX 2009b:16-17).

- 4) Evaluation of options: This stage is about determining the factors that are prioritized by the individual when it comes to choosing modes of transportation. This varies naturally depending on particular circumstances i.e. some individuals' modal choice may be determined by fare prices, or travel time, etc. Therefore, a positive perception of the alternatives, in relation to this, is necessary for a change in behavior (TAPESTRY 2003:13).

- 5) Making a choice: Establishing an intention for behavioral change is an important step before actual behavioral change occurs. Therefore, this steps deals with the likelihood of the individual really developing this intention (MAX 2009b:17).

- 6) Experimental behavior: As the name describes; this stage is the one in which the individual experiments by making trips with the new mode of transportation. This stage is crucial; since a negative experience that goes against the individual's expectations (see perception of options) may cause the individual to go back to the initial mode of transportation. The experience may even lead to a negligent attitude towards the problem i.e. the individual may decrease their concern or feeling of responsibility (Pressl & Reiter 2003:32).

- 7) Habitual behavior: This is the stage in which the final goal of behavior change is reached. At this stage, the individual has broken the old behavior and established a new long-term behavior (in this case a new mode of transport) (MAX 2009b:17).

3.2 Modal choice of the car

Travel mode choice is something that can be explained with different perspectives; one of which is the one related to traditional socio-demographic indicators such as age and gender. It is worth noting that when it comes to gender; the mobility patterns between men and women have become more similar to one another: lately, women's car use and distances travelled in general have increased more than these factors for men in Sweden. However, men are still the gender group who travel the longest on a daily scale and overall (Frändberg & Vilhelmson 2011:1242, 1243). Furthermore, when it comes to age, it can be seen that there is, as Frändberg & Vilhelmson (2011:1242) write, an *"ongoing shift in travel volumes from young to old age groups"* (Frändberg & Vilhelmson 2011:1242). There has been an increase in distance travelled by the elderly; as a result of higher car access for this group. At the same time; there has been a trend in the latest decades which has shown a decrease in younger groups of people acquiring driver's licenses. Furthermore, age differences can also be noticed when studying the differences gender trends: while the increase in distance travelled by the elderly has been higher for men; the

increase in distance travelled by women has been less for younger than for older women. A difference attributed to age can also be noticed when it comes to men; as men under 45 years old have reduced their daily travelled distances, something that goes against historical trends (Frändberg & Vilhelmson 2011: 1238, 1239, 1243).

Other traditional socio-demographic indicators when it comes to modal choice, more specifically when it comes to choosing the car; has been life situation: which, apart from gender and age, includes economic resources, education etc. Economic resources are e.g. determining assets that are necessary for car availability. Subsequently, the factor of car availability tends to affect residential location choice for individuals; usually resulting in a tendency for individuals to live in areas that require more car use due to a less diversified land-use and lower densities. Another factor affecting modal choice could be the urban form of the place of residence; however, as mentioned above, the choice of residential area may already have been affected by transportation decisions (car use) already (Scheiner & Rau 2007:490, 494, 507). In areas, despite being rural, that have a strong availability of public transportation (and short distances) for example; individuals with urban and public transportation preferences have shown to be able to use these modes. The opposite is true for individuals with rural residential preferences; who try to use the car as much as possible despite the public transport options available to them (De vos et al. 2012:7-8) Finally; there have been studies that have suggested a connection between lower levels of education (and thus environmental concern) and willingness to switch modes of transportation from the car to its alternatives (Anable 2005:71)

Modal choice, specifically when it comes to choosing the car, can naturally also be affected by the particular attributes that this mode of transportation has: the car is considered by many as a reliable mode of transportation; that will get the individual to where he/she wants, and most importantly, in time. The car is also often used for activities such as transporting children to school; which is an activity that becomes more challenging with other public transportation. These factors also make the car an instrument to enhance autonomy; something that attracts individuals (Beirão & Cabral 2007:484, 485).

An important perspective which differs from the traditional indicators is the subjective perspective; i.e. psychological variables such as attitudes towards certain modes of transportation (Anable 2005:68; Beirão & Cabral 2007:487). Certain studies have e.g. shown weak differences in socio-demographic indicators between individuals with different (positive or negative) attitudes towards car use. Others have similarly concluded that favorable attitudes towards alternative modes of transportation can be correlated with higher intentions to use these modes (Anable 2005:71, 73). De vos et al. (2012:6) writes for example that *"Walking, bicycling and the use of public transit can be mainly explained by travel-related attitudes and land use preferences"* (De vos et al. 2012:6). This makes it relevant to address individuals, when it comes to transportation, in different ways; due to the different subjective motives they may have for their transportation behavior (Anable 2005:66)

A determining factor within the subjective perspective seems e.g. to be a psychological attachment to the car: apart from dependency on the car, certain car individuals "love" to drive their cars and have quite negative attitudes towards other modes of transportation. Subsequently these individuals have therefore a large reluctance for changing modes of transportation. (Beirão & Cabral 2007:484, 487-487). This attribute can also be explained by the strong car culture that is present in many societies; which makes certain car users use the car despite them not being affected by potential difficulties or disadvantages relating to other modes of transportation (Anable 2005:75). Additionally, individuals who have strived for getting a car, and have had a difficult time with it, may see the car as an achievement; which makes it unlikely for them to stop using the car (Beirão & Cabral 2007: 484). At the same time, strong habits when it comes to car-use may furthermore act as a barrier when trying to attract people towards other modes of transportation by showing the advantages and positive aspects of other modes of transportation (De vos et al. 2012:8).

A study by Anable (2005) makes a classification of attitudes towards the car; a classification that, based on attitudes, illustrates which groups are most and least likely to change their car use towards alternatives:

- The *Die Hard Drivers*: A group which believes they have a right to drive freely and at a low cost; while having negative feelings towards other modes of transportation. Subsequently, this makes them have very low probabilities of changing to an alternative mode of transportation. This group often lacks a feeling of moral obligation relating to car use when it comes the environment; while they at the same time believe that there is a low image related to e.g. bus use (Anable 2005:70, 76)

- The *Complacent Car Addicts*: the *Complacent Car Addicts*, similarly to the *Die Hard Drivers*, also lack the above mentioned feeling of moral obligation and do not find incentives in changing their car use. This group also has a strong psychological attachment to the car. *Complacent Car Addicts* are therefore a group of low probability when it comes to attracting them towards other modes of transportation (Anable 2005:70, 74, 76).

- The *Malcontented Motorists*: This group feels the need to use the car and also has a psychological attachment towards the car; while at the same time finding many barriers for the use of e.g. public transport. However, this group often feels a moral obligation towards the environment; which subsequently leads to feelings of unhappiness and frustration towards their car use. There is therefore a moderate probability of being able to attract this group towards other modes of transportation (Anable 2005:70, 74, 76).

- The *Aspiring Environmentalists*: This is a group that has already reduced car usage considerably due to health reasons and a moral obligation towards the environment. However, they do not want to give up the car due to the practical advantages that come with its use; which includes a sense of control. Additionally; this group's probability of switching completely to other modes of transportation is decreased by a knowledge barrier on the alternative modes available. However, the probability of attracting this group towards a switch like this is high (Anable 2005:70, 74, 76).

- The *Reluctant Riders:* Factors such as lack of financial resources and health reasons may prevent certain individuals from using a car; even though their modal choice preferences

are favorable to car use. Therefore, this group uses other modes such as public transportation involuntarily. These constraints on car use provide therefore very high probabilities of attracting this group towards the (continued) use of alternatives to the car e.g. public transportation (and towards preventing them from acquiring a car in the future); something that could be achieved through pointing out the positive attributes related to other modes of transportation (Anable 2005:70, 77).

- The *Car-less Crusaders*: This is a group with strong moral responsibility feelings towards the environment; and which at the same time feel a dislike towards the car. Subsequently, individuals in this group have given up car-ownership and feel that they have strong control over their mobility with other modes of transportation; at the same time as they have positive views on e.g. public transportation. This group has therefore a very high probability of being persuaded into (continued) use of alternative modes of transportation (Anable 2005:70, 76).

This classification demonstrates the importance of subjective attitudes on modal choice, in contrast to socio-demographic indicators; and therefore the need to address these in transportation campaigns that aim at persuading individuals away from car use.

4. Findings

This chapter presents the drivers and barriers gathered through the data collection during this project; and which will be used as a basis for the Travel Awareness campaign plan proposed later. As Table 2 and Table 3 show below: There are seventeen drivers; which are presented in four categories; as well as twelve barriers divided into two categories.

4.1 Drivers for the use of e-bikes

Drivers for the use of e-bikes			
Unique e-bike drivers: in relation to all modes of transportation (except for the conventional bicycle)	**Drivers in relation to the car**	**Drivers in relation to alternatives to the car (except the conventional bicycle)**	**Drivers in relation to the conventional bicycle**
- Travel reliability - Health advantages - Time savings/speed in relation to other modes of transportation	- Parking - Economically attractive in relation to cars - Riding experience - Environmentally friendly - Legal issues	- Flexibility - Practical - Can replace car trips	- Solution for physical inability to bike: due to e.g. handicap, sickness or old age - Range in relation to conventional bicycle - Reduction of physical effort - Reduction of sweat - Weather - Higher speeds than

			conventional bicycles

Table 2: Drivers for the use of e-bikes

4.1.1 Unique e-bike drivers: in relation to all modes of transportation (except for the conventional bicycle)

Travel reliability

A factor that was pointed out as an advantage by respondents in this study was travel reliability: Respondent #6 stated that the largest reason for acquiring an e-bike was in order to know how long it would take to travel home from the city; as she lived in the suburbs and the travel times (by car) on the routes to her home could vary between 25 minutes and 1 hour, depending on the occurrence (or lack of occurrence) of traffic jams. A similar experience was stated by Respondent #11; who stated that one of the reasons for the e-bike being a good and reliable alternative to the bus was that the route usually taken by the bus did not have bus-lanes. Subsequently, she would come late to work due to the bus getting stuck on traffic jams; which made the bus an unreliable mode of transportation, as opposed to the e-bike. Furthermore, Respondent #1 also stated that the e-bike allowed him to always count on getting to work in 15 minutes; something that he could not count on with the car, due to occasional accidents resulting in traffic jams en-route to work. Finally, Respondent #17 stated that an advantage with the e-bike was that, despite variations in his physical condition, he could be quite sure in knowing the length of his trip.

Health advantages

Individuals who e.g. have not previously been using an e-bike could benefit from e-bike use (Gehlert et al. 2012:8). This is especially true for individuals who switch from using the car to an e-bike: as Popovich et al. (2014:38) writes "*…the largest relative health improvements are gained in the transition from inactivity to moderate physical activity; thus, encouraging a substitution from cars to e-bikes could provide enormous public health benefits."* (Popovich et al. 2014:38). A number of respondents in this project stated that health benefits were an advantage with e-bikes; which leads to the conclusion that these benefits could attract health-minded

individuals towards e-bikes: Respondent #1 and Respondent #6 both stated that one of the reasons for acquiring an e-bike was the health advantages these brought. Respondent #16 stated that her reason was in order to continue commuting by bike to work; stating furthermore that amongst the most important factors when choosing mode of transportation are health and well-being, indicating that health benefits were the reason for acquiring an e-bike. While other respondents did not state this as a direct reason for acquiring an e-bike; they did state that being able to include exercise in their travelling patterns was an advantage with their e-bikes (Respondent #4; Respondent #18). Respondent #18 even stated a dislike towards doing activities with the sole purpose of exercising; pointing out the health benefits of exercising with an e-bike as a large advantage.

Time savings/speed in relation to other modes of transportation

Motorized modes of transportation may commonly be perceived as quicker ways to travel in at first. However, there is indication that, in comparison, e-bikes can be a quicker mode of transportation: This is true for example, as Fyhri & Fearnley (2015:46) points out, when it comes to travelling during times of traffic congestions in rush hour traffic; an advantage that has also been pointed out by respondents in a survey conducted by Popovich et al. (2014:37). Furthermore, e-bike users have also supported this understanding when asked about the advantages of e-bikes in this project: Respondent #1 expressed, as mentioned above, the problem with occasional accidents en-route to work; the time loss of which was avoided with the e-bike. Even without traffic accidents, other e-bike users that had often been stuck in routes with congestions on their commute to work; expressed that e-bike use, in comparison to car use, shortened their travel time during rush hour (Respondent #9; Respondent #18). As was mentioned above, Respondent #11 was delayed to work due to congestions while riding the bus; which was the primary reason for acquiring an e-bike (Respondent #11). Congestion problems presented themselves even for an e-bike user that did not commute to work; his experience also being one of faster travel with an e-bike (Respondent #21). Certain e-bike users, while not expressing time-gains with using an e-bike per se, expressed that the e-bike took the same time as using public transportation when biking relatively long distances (Respondent #2; Respondent

#16). Respondent #3 even expressed that using an e-bike took the same time as driving a car in the daily commute to work.

4.1.2 Drivers in relation to the car

Parking

A number of respondents in this project have pointed out that they had found parking advantages related to e-bikes; specifying that it was an advantage, as opposed to the car, not to have to look for parking spots and have to reckon with the complications that this could bring (Respondent #1; Respondent #6; Respondent #10; Respondent #15; Respondent #21). Respondent #1 and Respondent #6 even specified that having an e-bike provided them with the advantage of not having to pay for parking, as opposed to the car (Respondent #1; Respondent #6). Furthermore; other studies have also indicated towards easier parking being a positive attribute with e-bikes (Feng et al. 2010:417; Rose 2012:88).

Economically attractive in relation to cars

The running costs of e-bikes, in comparison to the car, are low; as they exclude costs such as fuel (Collado et al. 2014:260). E-bikes run namely on electricity for charging their batteries; something that Koucky & Ljungblad (2012:13) have calculated to be around 0.5 Swedish kronor per charge in Sweden[1]. This would mean paying around 0.5 Swedish kronor (SEK) for travelling 50-70km; which is the distance an e-bike can travel on one charge according to the specifications of e-bikes sold by the e-bike retailer Ecoride (Ecoride 2015). The average fuel consumption of a car in Sweden is on average 0.83 liters per 10km for a gasoline driven car; and 0.68 liters per 10km for a diesel driven car (Energimyndigheten 2015b). The fuel prices displayed by two major fuel stations in Sweden, at the time of writing of this project, are of 13,89SEK per liter of gasoline and 13,55SEK per liter of diesel (Statoil 2015; OKQ8 2015). This would mean that driving a distance of 50-70km with a diesel driven car (the cheapest fuel of these two) would

[1] The study made by Koucky and Ljungblad was published in 2012. Therefore, this cost may have changed. However, this was assumed to be irrelevant in this project; due to the fact that this cost is almost insignificant in comparison to the cost with which it is compared.

incur costs of around 46-64SEK. Furthermore, driving a distance of 50-70km with a gasoline driven car would incur costs of around 58-80SEK. Clearly, based on these calculations, energy costs of travelling with an e-bike are almost insignificant if compared to driving a car. No data has been gathered in this study about maintenance costs for e-bikes; however, according to testimony from Respondent #2, maintenance costs of e-bikes are very low. Testimony from other e-bike users indicates support for this; as they state that low costs related to e-bike use are amongst the advantages of this mode of transportation (Respondent #1; Respondent #2; Respondent #3; Respondent #18).

On top of running costs; e-bikes are economically advantageous in other ways. For the user in relation to cars, e-bikes provide advantages when it comes to retail price, something that has even been pointed out by e-bike users in a survey by Popovich et al. (2014:37, 39).

Riding experience

E-bikes have the potential of, through the riding experience of an e-bike, bringing positive experiences to travelling (Gehlert et al. 2012:8). Furthermore, according to Koucky & Ljungblad (2012:16) and Collado et al. (2014:260); the use of an e-bike, in comparison to a conventional bicycle, can make individuals feel safer in traffic. Koucky & Ljungblad (2012:16) claim this to be a result of a swaying motion that is experienced in conventional bicycles as a result of low speeds usually in uphill terrain; stating furthermore that the higher speeds provided by an e-bike could help avoid this. Finally another contributor to a positive experience when riding an e-bike, in the beginning of their time of use, could be brought by a *"hype"* effect: a study conducted by Fyhri & Fearnley (2015:52) showed that test users experienced this when testing an e-bike for the first time.

A number of respondents in this project pointed out the attraction that the positive experience of using an e-bike brought: getting fresh air while riding an e-bike was one of the factors pointed out as an advantage with e-bikes by certain e-bike users (Respondent #4; Respondent #10). Respondent #6 even stated this as one of the reasons for acquiring an e-bike; furthermore pointing out the positive experience of being in contact with nature during her rides. Being

outdoors was also pointed out as an advantage of e-bikes by Respondent #4 and Respondent #18. Furthermore, Respondent #21 expressed that the possibility of being able to move physically, as opposed to being stuck inside a car in traffic jams, was a positive experience; which was his largest focus when choosing modes of transportation. Finally, riding an e-bike was perceived as a fun way of mobilizing by Respondent #20; a feeling that was also experienced by kids riding an e-bike in a pre-school that Respondent #12 works at.

Environmentally friendly

E-bikes provide a mode of transportation with environmental advantages, through lower greenhouse gas emissions in comparison to the car. This is true even if the electricity provided for the e-bikes does not come from renewable energy sources (Collado et al. 2014). An advantage in this case is also that the energy for electric vehicles could be produced through decentralized renewable energy production plants (Rothfuss & Le Bris 2014:209). This could potentially be done at the individual level with production facilities such as solar panels (Rose 2012:90). The region of Skåne has in this case the advantage of being in the southern part of Sweden; which logically means that sunlight hours are more prominent than in e.g. the northern parts of the country. Also, the region has good wind conditions, which could potentially make it possible to use individual wind turbines (Länsstyrelsen Skåne 2015).

Furthermore, e-bikes are beneficial to the environment due to the fact that they are more efficient when considering energy use; in comparison to other motorize modes of transportation (Fyhri & Fearnley 2015:46). According to calculations made by Winslott Hiselius et al. (2013:36); the proportion of the Swedish population using e-bikes is 1%, and the energy savings made from this are of 170 GWh per year. An increase of 5% or 10% would, according to the same study, mean savings of 851 Gwh per year and 1703 GWh per year respectively. According to Energimyndigheten (2015); the energy consumption of road traffic in the year 2013 was of 79400 Gwh. This would mean that such an increase in e-bike use could cause energy savings of 2% of the total energy use from the entire Swedish road traffic sector. Therefore, as Winslott Hiselius et al. (2013:40) points out, energy savings are to be made by the use of e-bikes.

The environmental advantages of e-bikes do not only mean a step forward towards combating climate change per se; but can be an attractive factor for potential e-bike users. A survey conducted by Popovich et al. (2014:39) shows that certain e-bike users chose to use an e-bike in order to reduce their environmental impact. Another survey conducted by Winslott Hiselius et al. (2013:21); resulted in a majority of the participants responding that their e-bike acquisition was a result of environmental awareness and the desire of decreasing their car use. The same study found this to be consistent with other studies made on the topic. Furthermore, answers from respondents in this project have also shown consistency with those results, and indicated that environmental benefits could attract more individuals towards the use e-bikes: some respondents had environmental concerns as one of the reasons for acquiring an e-bike (Respondent #3; Respondent #6; Respondent #21). Other users were already using transportation that was environmentally friendly; specifying that they had chosen these modes of transportation due to climate change (Respondent # 4, Respondent #11, Respondent #16). Amongst the respondents; this project also found users that were actively working, through their employment, with environmental issues in general: one of these was involved in the Swedish green party (Respondent #1), while another was working with the center for sustainable societal development in Lund (Respondent #4). This indicates that environmental consciousness can play a role in the choice for using e-bikes. Finally, environmental concerns were also expressed by respondents in other forms: Respondent #12, when asked about the factors that could attract others to use e-bikes, said that the fact that e-bikes were environmentally friendly could be a factor; while Respondent #18 expressed that one of the reasons for wanting to use an e-bike was that it is environmentally smart.

Legal issues

The e-bike is classified as a normal bicycle according to EU-law; more specifically the EC Directive 2002/24/EC and the EU standard EN15194 (Koucky & Ljungblad 2012:8). These are the same parameters described to be considered a conventional bicycle by the Swedish transportation board (Transportstyrelsen 2015).

This means that the e-bike is not considered to be a motorized vehicle; which subsequently means that users of e-bikes are not subject to regulations such as wearing a helmet, getting

vehicular insurance for their e-bikes, or acquiring a driver's license (Gehlert et al. 2012:4). This is a factor that could prevent new potential e-bike users from being deterred by the extra efforts/costs of complying with legal requirements. More importantly, a factor that (Gehlert et al. 2012:4) points out, the legal parameters for e-bikes mean that e-bikes are allowed to be driven on the conventional bicycle infrastructure (Gehlert et al. 2012:4). Using the conventional bicycle infrastructure can be attractive for e-bike users: certain e-bike users have expressed that the flexibility of being able to bike on any place with the e-bike is among the advantages of e-bike use (Respondent #1; Respondent #2; Respondent #20). The possibility of using bike-paths could also be attractive to e-bike users due to the possibility of avoiding traffic jams in rush hour; which can lead to the time savings mentioned earlier (Respondent #6).

4.1.3 Drivers in relation to alternatives to the car (except the conventional bicycle)

Flexibility

As Fyhri & Fearnley (2015:51) points out, the e-bike can provide the flexibility that is found in the car (Fyhri & Fearnley 2015:51). This flexibility is provided through the fact that e-bikes provide autonomy in choosing routes and times of travel (Collado et al. 2014). E-bikes could furthermore be used to increase flexibility in combination with other public transportation; or with long trips that cannot be replaced by the e-bike: Rose (2012:89) points out the possibilities of using the e-bike for the *"last mile challenge"*, meaning that the e-bike could be used for trips to and from e.g. railway stations. Additionally, the attraction of flexibility in e-bikes for potential users has been confirmed by respondents in this project: one of the reasons for which Respondent #20 acquired an e-bike was the low frequency of public transport rides available in the new area he had moved to. Likewise, Respondent #2 and Respondent #8 pointed out that not having to keep an eye or plan trips depending on public transport schedules; was one of the advantages with having an e-bike. Respondent #18 stated that an advantage with e-bikes was being able to, when doing groceries, ride and park directly in front of the store and then his home; instead of

having to walk to and from bus-stops. This was similarly confirmed by Respondent #21; who pointed out an advantage in being able to ride all the way directly to his destination on his e-bike.

Practical

The extra assistance provided to the user by e-bikes gives this mode of transportation practical attributes. As both Winslott Hiselius et al. (2013:11, 21) and Koucky & Ljungblad (2012:15) point out; e-bikes provide the user with the advantage of transporting heavier payload such as children or heavy objects (Winslott Hiselius et al. 2013:11, 21; Koucky & Ljungblad 2012:15). Koucky & Ljungblad (2012:15) specify that this could be done with connected carts or cargo e-bikes. Furthermore, a number of respondents in the study conducted by Winslott Hiselius et al. (2013:24) have agreed on that e-bikes increase their possibilities to conduct different activities (Winslott Hiselius et al. 2013:24).

The relevance of the practical attributes of e-bikes can also be noticed in the answers provided by respondents in this project: a number of respondents pointed to out that the e-bike allows them to transport heavy bags and other objects (Respondent #3; Respondent #5; Respondent #11; Respondent #18; Respondent #21). More specifically; Respondent #3 and Respondent #5 stated that they conduct this kind of transportation with an attached cart. Similarly; Respondent #18 owns a cargo e-bike; which provides the advantage of being able to carry groceries and equipment that he uses at work. Respondent #18 even stated that the e-bike is *"unbeatable"* for doing groceries; due to the fact of not having to walk with groceries to and from a bus stop (Respondent #18). Certain respondents also confirmed the practical advantages related to being able to transport children with an e-bike (Respondent #2; Respondent #11; Respondent #21). Finally; other practical attributes pointed out by respondents were that e-bikes are easy to use (Respondent #1; Respondent #6); as well as e-bikes being a smooth way to travel around (Respondent #9; Respondent #12).

Can replace car trips

Due to the purpose of this project; the potential of e-bikes for replacing car trips is central.

Different studies have indicated that e-bikes indeed have a potential to replace car trips (Rothfuss & Le Bris 2014:210). A study referred to by Winslott Hiselius et al. (2013:38) has furthermore shown that, in an experiment where e-bikes where made available to certain individuals; the individuals who used an e-bike most often used it for trips that would have otherwise been made with a car (Winslott Hiselius 2013:38). The potential for e-bikes replacing car trips has also been shown in the opinions of respondents in this project: Respondent #3 and Respondent #6 stated that the e-bike had replaced 60% and 75% of their car trips respectively. Respondent #19 stated that one of the reasons for getting an e-bike was to be able to avoid driving a car to work. Furthermore; Respondent #9 expressed that the one reason for acquiring an e-bike was that she wanted to use the car fewer times during the week; stating also that the e-bike had practically replaced the car completely. Similarly, Respondent #1, when asked if he had replaced any car trips with the e-bike; stated that he had done this to the point where he doesn't drive a car anymore. Respondent #21 stated that the car has been completely replaced by the e-bike in the spring and summer months. Furthermore, Respondent #10, Respondent #11 and Respondent #13, all expressed that they had replaced car trips. More specifically, Respondent #10 said that the e-bike is used to travel across town, when trips were a little too long for the conventional bike; and when she therefore would have used a car. Respondent #11 replaced car trips for shopping, transporting heavy things (that do not take too much space) and for transporting children. Respondent #18 stated similarly that having a cargo e-bike made it possible to transport heavy things for which he otherwise would have needed a car. Finally; only one out of the eleven respondents to the semi-structured interviews conducted in this project did not own a car. At the same time, most of the individuals who had access to a car stated that they had replaced car trips with the e-bike. This reinforces the notion that the e-bike is a good alternative to the car; as it is used by individuals despite having the option of using a car.

4.1.4 Drivers in relation to the conventional bicycle

Solution for physical inability to bike: due to e.g. handicap, sickness or old age

The assistance provided by the e-bike opens doors for individuals that are unable to use conventional bicycles (Fyhri & Fearnley 2015:46).

Individuals that have a physical condition, such as sickness or handicap, are sometimes forced to choose away biking (Collado et al. 2014:260; Koucky & Ljungblad 2012:14). This was the case with a respondent in this project who suffered of problems with his knee; expressing that the e-bike caused less strain on him when biking (Respondent #21). Furthermore, Respondent #8 expressed that, during pregnancy, his wife had only been able to transport herself with an e-bike, due to pregnancy related pains.

Another group, who may be unable to use a conventional bicycle, is the elderly. However, e-bikes could make biking possible for this group (Clark & Nilsson 2014:1); and may also allow current bicycle users, reaching old age, to continue biking by using an e-bike (Gehlert et al. 2012:7).

Range in relation to conventional bicycle

E-bikes make travelling at higher speeds possible, which results in reduced travel times needed for biking; as well as it prolongs the user's endurance in comparison to conventional bicycles. This in its turn provides the possibility of travelling longer distances (Gehlert et al. 2012:7). Also, as Koucky & Ljungblad (2012:17) point out, higher speeds and decreased physical efforts make long-distance cycling more attractive for the (otherwise conventional bicycle biker) average biker (Koucky & Ljungblad 2012:17).

The increased range of e-bikes, in relation to conventional bicycles, indicates to be an attractive factor for e-bikers; as some of them have expressed this factor as an advantage. This was for example expressed by e-bikers in a survey conducted by Popovich et al. (2014:39). The advantage with range was also expressed by respondents in this project: Respondent #8 stated that the reason for acquiring an e-bike was in order to commute to work; which was considered by the respondent to be far away. Respondent #13 expressed similarly that getting the ability of biking longer distances provided to him had been one of the reasons for acquiring an e-bike; stating that the e-bike worked well on longer distances of 15-20km. Respondent #16 used to use the conventional bicycle already and switched jobs, making her commuting distance increase;

thus in order to continue biking (despite the long distance) she acquired an e-bike. Respondent #12 worked at a kindergarten; and stated that the kindergarten had acquired e-bikes in order to have the possibility of travelling longer distances with the kindergarten children. Finally, some e-bikers, while not expressing this factor as one of the reasons for acquiring an e-bike, stated that being able to travel longer distances with the e-bike was one of the positive aspects of e-bikes (Respondent #3; Respondent #17). Respondent #17 stated more specifically that commuting with his e-bike long-distance on the hilly terrain to work had the advantage of the commute not feeling strenuous.

Reduction of physical effort.

The power provided by the types of e-bike studied in this project (250W) is within the range that would be considered a *"considerable assistance to any rider"* according to Rose (2012:93). The engine of the e-bike is able to double the amount of power produced by the user of the e-bike. This is helpful in reducing the user's efforts when the trip is done in challenging conditions such as headwind (Koucky & Ljungblad 2012:7, 12). Another advantage coming from the electric assistance of e-bikes is that this assistance is helpful in enabling trips that are of longer range in uneven terrain (Fyhri & Fearnley 2015:46, 51).

These advantages can be of help for increasing the use of e-bikes. In a study made by Collado et al. (2014:256, 260) in the Swedish city of Gothenburg; the small proportion of conventional bicycle use (6%) as a mode of transportation in comparison to other modes such as the car (44%) was partly explained by the fact that the "*...performance of conventional bicycles is dependent on the rider's physical ability to provide the energy for the trip.*" (Collado et al. 2014:256). Collado et al. (2014:260) reinforces this suggestion by pointing out that one of the barriers of conventional bicycles, in relation to e-bikes, can be attributed to certain individuals being lazy; subsequently suggesting that this barrier can partly be reduced by the e-bike. E-bike users have in different occasions indicated towards confirming this fact: a survey conducted by Winslott Hiselius et al. (2013:23) resulted in the majority of respondents agreeing on the fact that e-bikes resulted in less physical strain. Furthermore; respondents in this project pointed to the advantages of the reduced physical strain provided by e-bikes. Certain respondents had this factor as part of

the direct reasons for acquiring e-bikes: Respondent #2 expressed that one of his reasons was that he already did much exercise, and would not have had the energy to bike long distances on top of that. Respondent #22 stated furthermore that one of his reasons was that one of the facilities that they used to travel to had changed to a facility that was high up in a hill. At the same time, Respondent #13 had the fact the he could choose how much exercise he could do while biking as one of the reasons for acquiring an e-bike. While certain respondents did not specify the ability to choose how much assistance they would get/exercise they would do as one of the main reasons for acquiring an e-bike; these respondents did point out this liberty of choice as an advantage with e-bikes (Respondent #7; Respondent #17; Respondent #18). Finally, getting assistance on windy conditions as an advantage with e-bikes was confirmed by users such as Respondent #10, Respondent #15; as well as the advantages with getting assistance on uneven terrain, more specifically *"uphill terrain"*, were pointed out by other e-bike users such as Respondent #11, Respondent #15, Respondent #17 and Respondent #18.

Reduction of sweat

Sweat is a factor that can be a deterrent for certain individuals to use a conventional bicycle (Koucky & Ljungblad 2012:15). E-bikes provide the opportunity to avoid this barrier due to the fact that the user can avoid getting sweaty (Collado et al. 2014:260). This is something that can be specifically advantageous in order to get car users, who may choose the car for this very reason, to switch to e-bike use (Winslott Hiselius et al. 2013:6).

Certain E-bikers have pointed out the advantages that avoiding sweatiness can bring, as a survey from Popovich et al. (2014:40-41) reflects. This advantage has also been pointed out by a number of e-bikers that were asked about the advantages of e-bikes during this project: Some e-bikers stated that one of the reasons for acquiring an e-bike had been in order to avoid getting sweaty (Respondent #2; Respondent #13; Respondent #20). One e-biker even stated that the sole single purpose of acquiring an e-bike was in order to avoid getting sweaty; furthermore stating this factor one more time as the only factor when asked about the advantages that he found with e-bikes (Respondent #14). Others, while not specifying it as one of the reasons for acquiring an e-bike per se, stated avoiding getting sweaty as one of the advantages with e-bike use (Respondent

#3; Respondent #6; Respondent #8; Respondent #9; Respondent #18; Respondent #19). Respondent #3 stated more specifically that he strongly disliked (conventional) biking due to the fact that he got sweaty. Also, Respondent #6 and Respondent #9 specifically expressed that the e-bike was a good replacement for the car due to the advantage of avoiding sweat. Finally Respondent #12, when asked what in his opinion could attract others to use e-bikes, stated the fact of being able to come to the destination without sweating.

Weather

Even though using an e-bike makes users be exposed to weather; the e-bike could make biking in bad weather more attractive: According to Koucky & Ljungblad (2012:17), biking in winter weather could become more attractive with e-bikes; which the study explains by the stability of the power input of e-bikes in uneven terrain, which would decrease chances for falling. The study also suggests that this even amount of power could eliminate the problem of the user experiencing cold in the beginning of the journey and heat/sweat in the end; subsequently making it possible to wear warm clothes from the beginning of the journey without this problem. The e-bike could potentially also alleviate problems with the weather, that conventional biking would bring, when it comes to hot and windy weather: A survey conducted by Popovich et al. (2014:41) showed that most respondents *"enjoy riding their e-bike even in hot and windy weather…because they do not need to exert as much effort as they would on a conventional bicycle."* (Popovich et al. (2014:41). Certain respondents in this project seem to confirm the advantages of e-bikes when it comes to weather: Respondent #7 stated that the one reason for acquiring an e-bike had been the possibility to bike in the entire city of Malmö regardless of the weather conditions. Furthermore, Respondent #18 stated that one of the advantages of e-bikes was being able to bike in rainy weather. Finally, Respondent #21 stated that, besides being able to bike in the rain, he had the possibility of biking in slippery conditions. This respondent furthermore stated that biking in slippery conditions was safer than walking; as he had installed studded tires on his e-bike.

Higher speeds than conventional bicycles

E-bikes allow for higher speeds than conventional bicycles (Gehlert et al. 2012); at the same time as these speeds can be maintained with the same level of effort. Another speed-related advantage is that the electric motor provides assistance in acceleration phases (Koucky & Ljungblad 2012:14). Studies have indicated that this advantage has indeed been exploited by e-bike users in order to bike faster than with conventional bikes (Schleinitz 2014:11). The higher speeds and acceleration of e-bikes seem to attract e-bike users, as expressed by respondents in a survey conducted by Popovich et al. (2014:39). This advantage was even expressed by many of the respondents in this project when asked about the advantages that they found with e-bike use (Respondent #1; Respondent #5; Respondent #6; Respondent #9; Respondent #10; Respondent #13; Respondent #17; Respondent #20; Respondent #21).

Furthermore, it is quite obvious that e-bikes, as Gehlert et al. (2012:7) points out, provide trips of shorter duration than conventional bikes; thus providing shorter travel times. Furthermore, lack of time for biking has in certain cases, according to Collado et al. (2014:260), been found to be a reason for individuals to not use a bicycle; which, according to the same study, could be a barrier reduced by the fact that e-bikes can help maintain constant speeds of 25km/h (Collado et al. 2014:260).

4.2 Barriers for the use of e-bikes

Barriers for the use of e-bikes	
Internal barriers	**External barriers**
- Heavy weight - Safety - Economic unattractiveness - Range - Technical battery issues - Exposure to elements - Theft prone - Practicalities in comparison to the car	- Lack of adequate infrastructure - Stigma - Lack of information - Energy production for e-bikes

Table 3: Barriers for the use of e-bikes

4.2.1 Internal barriers

Heavy weight

A barrier that could be encountered, with the attribute of additional propulsion on an e-bike, for the user and therefore for the practicality of e-bikes; is the need for a battery, as this adds considerable weight to the e-bike. This makes the e-bike harder to use when pedaling without electric assistance from the battery (Fyhri & Fearnley 2015:46). Additionally, the extra weight of e-bikes, which is around 30-40% more in comparison to conventional bicycles, makes it more difficult for bikers to carry an e-bike, in comparison to a conventional bicycle. This may pose problems if the user of the e-bike has the desire to carry the e-bike on public transportation, such as buses. Furthermore; lack of continuous bike-infrastructure may pose a problem if the user is obliged to carry the e-bike (Koucky & Ljungblad 2012:12, 14, 19). Another lifting problem can arise with the e-bike when parking them on bike-racks. Finally, another problem related to the extra weight of the batteries; is that more energy capacity means heavier batteries. This means more energy required to propel the e-bike; which drains more energy from the battery (Rose 2012:84).

The extra weight of e-bikes may be a barrier for attracting potential e-bike users; as some e-bikers have expressed this as a negative quality of e-bikes: certain respondents in a survey conducted by Popovich et al. (2014:42) expressed that the extra weight of the bike could be inconvenient. Similarly, respondents in this project have also expressed this: Respondent #6, Respondent #9, Respondent #13 and Respondent #20 expressed that using the bicycle without battery assistance makes the e-bike heavy to bike with. Furthermore, Respondent #9 specified that this was a problem if e.g. the batteries ran out of power. Another issue, that Respondent #4 and Respondent #10 mentioned; was that they carried their battery with them when leaving the e-bike parked somewhere (in order to avoid theft). This was, according to these respondents, also a nuisance since the battery is heavy to carry around. Furthermore, while not specifying in which specific scenario this was a problem; other respondents still stated that the weight of the e-bike was a negative aspect of e-bikes (Respondent #8; Respondent #16; Respondent #17). However, it is worth to point out that certain individuals may not find this to be a problem: A survey

conducted by Winslott Hiselius et al. (2013:17) showed that the majority of respondents, in this survey did not agree to that the extra weight of e-bikes posed a problem in its use.

Safety

Safety concerns are an issue that needs to be taken into account when treating with e-bikes. According to Schepers et al. (2014:177); e-bike users "…*are more likely to be involved in a crash that requires treatment at ED"* (Schepers et al. 2014:177). A national survey in Switzerland indicates towards the same conclusions; as e-bikers here were also found to be more likely to sustain severe or fatal injuries, in comparison to conventional bikers (Weber et al. 2014). Furthermore, Clark & Nilsson (2014:1) claim that the risk for accidents could increase with e-bikes; due to the possibility that the e-bike provides for it to be used by more individuals (including those who would not otherwise have the capacity to ride a conventional bicycle). Additionally, another aspect that could affect safety is, according to Winslott Hiselius et al. (2013:31-32), that e-bikers are exposed to traffic more than conventional bikers; due to the fact that they bike longer distances than conventional bikers. Increased traffic exposure is also mentioned as a risk by Gehlert et al. (2012:8); as the study mentions that this could be a consequence due to the transfer to the e-bike from a protected travel mode such as the car.

The higher average speeds of e-bikes, and the possibilities provided to the user of travelling at higher speeds, may increase the risk for accidents with an e-bike (Clark & Nilsson 2014:1; Schepers et al. 2014:175; Weber et al. 2014:51). This concern comes together with the concern of the possibilities for potentially higher injury severities in accidents, due to speed (Gehlert et al. 2012:2). Safety concerns, in relation to speed, have also been expressed by individuals who have used e-bikes: certain respondents in a survey conducted by Popovich et al. (2014:42) stated concerns related to the higher speeds of e-bikes. Another study showed that individuals who had used an e-bike had voiced the same concerns (Saleh 2014:8). Finally, one of the respondents in this project stated that the higher speeds of e-bikes made it more difficult to stop the e-bike in a time of need; which was a safety concern (Respondent #4)

Besides the inconveniences that the heavier weight of e-bikes can bring, which were mentioned above; safety is also an issue that could be pointed out in relation to weight: extra weight may

mean more severe injuries for both: the cyclist and a potential third person involved; as well as heavier property damages. This is due the extra inertia and momentum that an e-bike brings with extra weight (Rose 2012:84, 91). One respondent in this project confirmed this; by saying that the heavier weight of the e-bike made it harder to stop in time in case of need, making it more unsafe (Respondent #4). Finally; Schepers et al. (2014:175) states that, for older users, the extra weight of the e-bike may pose a problem while mounting and dismounting the e-bike.

It is however worth noting that, a study conducted in Germany that Weber et al. (2014:47) refers to, found that the frequency or severity of injuries was in fact not higher for e-bikers in relation to conventional bikers. Also, there have been studies that found that e-bikers have a higher tendency to use a helmet than conventional bikers (Weber et al. 2014:49; Saleh 2014:8). A study also found that e-bikers are "…*most certainly aware of the dangers and risks in traffic and adapt their driving behaviour accordingly"* and that they "…*show consideration for pedestrians, ride defensively in general, with adapted speed and ready to brake".* (Saleh 2014:8).

Economic unattractiveness

E-bikes, as mentioned above, are economically attractive in comparison to cars. However, e-bikes do have an economic disadvantage: the price for an e-bike is around double in comparison to conventional bicycles (Koucky & Ljungblad 2012:13). The relative price of e-bikes could be a factor that could be perceived negatively by certain individuals; which can be seen in the way that respondents in this project have expressed themselves: when asked about the negative aspects related to e-bikes; certain respondents had the opinion that e-bikes were expensive (Respondent #7; Respondent #10; Respondent #17; Respondent #18; Respondent #21). More specifically; Respondent #5 assumed that changing parts on an e-bike must be expensive. Furthermore, both Respondent #17 and Respondent #18 stated that a negative aspect (of e-bikes) was the expensive price of batteries for the e-bike; the latter also stating that it was expensive to invest in a good engine. Finally, certain respondents also mentioned, when asked their opinion about what could make e-bikes more attractive for others; that lowering the price and thus making e-bikes less expensive would be a good measure (Respondent #3; Respondent #16; Respondent #20; Respondent #22).

Range

The batteries used on e-bikes, to power the engine, provide a limited range when it comes to electric assistance to the user (Rose 2012:84). This is a negative aspect considering, as mentioned above, that e-bikes are heavy to ride without this assistance. The need to charge the battery (and therefore the limit that batteries have) could subsequently create *"range anxiety"*; which means that the user fears running out of battery, and therefore does not take advantage of the full range of the battery. This problem is amplified by the fact that batteries loose capacity when they get older (Koucky & Ljungblad 2012:19). Furthermore, *"range anxiety"* has been a factor mentioned by certain e-bikers; such as by certain respondents in a survey conducted by Popovich et al. (2014:42). Additionally, certain respondents in this project; have stated that a negative aspect with using e-bikes is that batteries have too little capacity/should last longer (Respondent #1; Respondent #12). More specifically, Respondent # 11 stated that *"range anxiety"* could be a problem with e-bikes; while Respondent #20 stated similarly that the limited range of the batteries was a negative aspect they found with this vehicle. Respondent # 7 stated furthermore that better battery capacity could be a measure; when asked her opinion on what could make it easier to use e-bikes. Finally, the problem with range presented itself in winter for certain respondents; as they found it to be negative that the batteries had decreased capacity in cold temperatures (Respondent #16; Respondent #21).

Technical battery issues

Certain technical aspects of the batteries of e-bikes could be deterrents for using an e-bike: One of these is the issue that was mentioned above; which is the decreased battery capacity in cold temperatures during winter. Another negative aspect expressed by certain respondents in this project; was related to the fact that the battery has to be charged (Respondent #4; Respondent #13; Respondent #17). This was additionally mentioned as a negative aspect by the study conducted by Koucky & Ljungblad (2012:12). Finally; yet another issue mentioned by certain respondents in this project; was that the battery charged too slowly (Respondent #13; Respondent #16). Respondent #16 specified that this is an issue in the daily commute to work; since she cannot commute to work and back on one charge during the low temperatures of winter. This

becomes a problem sometimes; since she occasionally does not have the time to charge the battery at work.

Exposure to elements

E-bike users, as conventional bicycle users, are exposed to the elements when travelling. This means that they are also exposed to bad weather; which has been considered a barrier for using bicycles in general by certain individuals (Collado et al. 2014:260). Certain respondents in this project, while not necessarily directly expressing this as a barrier for using e-bikes; have stated that they cannot/do not use their e-bikes during really bad weather (Respondent #16; Respondent #18) or when there are slippery conditions outside (Respondent #6). Furthermore; Respondent #4 expressed that she had ridden her e-bike in really bad conditions, but that this had been tough. Also, this e-biker had sold her e-bike, due to the fact that the headwind on her daily commute was sometimes too strong to use her e-bike.

When it comes to slippery conditions it is worth taking into account, as a solution, the possibility of studded tires; as was mentioned by Respondent #21 above.

Theft prone

A disadvantage that the higher price of e-bikes, in comparison to conventional bicycles, bring; is that they could potentially be more prone to theft (Koucky & Ljungblad 2012:20). These concerns have been voiced by certain e-bikers before; such as in a survey conducted by Popovich et al. (2014:39). Similarly, some respondents in this project stated that a negative aspect of e-bikes was that they are prone to theft (Respondent #4; Respondent #7; Respondent #10; Respondent #15; Respondent #19; Respondent #21; Respondent #22). Furthermore, many of these respondents expressed that, as a consequence, they had to bring the battery of their e-bikes with them when parked; which was negative due to the heavy battery weight (Respondent #4; Respondent #10; Respondent #15; Respondent #19). More specifically; Respondent #10 expressed that it is negative to have to lock her e-bike very meticulously due to this risk. Finally;

Respondent #2 stated that, when asked what could make it easier to use an e-bike; they would want to be *"able to lock it"*. This statement indicates that more infrastructure in order to lock e-bikes could ease their use.

It is worth noting however, that a majority of respondents in a survey conducted by Winslott Hiselius et al. (2013:18) disagreed with the suggestion that the use of e-bikes would be complicated due to the risk for e-bikes getting stolen (Winslott Hiselius et al. 2013:18). This indicates, considering the opposite suggestions above; that the perception of the fact that e-bikes are prone to theft, by the individual, is more determining than the actual proneness.

Practicalities in comparison to the car

A negative aspect with e-bikes, that certain respondents expressed in this project; was that certain activities could not be conducted with the e-bike as opposed to the car: Respondent #6, while not expressing it as negative per se, stated that kids of a certain age (specifying the ages of eight to nine years old) could not be transported with an e-bike. Respondent #13 and Respondent #18 expressed furthermore that the e-bike was not an adequate mode of transportation when travelling with other people. Additionally; certain e-bike users stated that, when transporting very heavy things, they used a car (Respondent #3; Respondent #21). Finally, other e-bike users expressed that they did not use their e-bike when they were sick (Respondent #16; Respondent #18); which indicates that this is a barrier in comparison to the car.

4.2.2 External barriers

Lack of adequate infrastructure

The existence of proper infrastructure is highly important in order to attract more e-bike users. E-bike sales in Great Britain were almost none during the year 2011; which is believed to be due to bad infrastructure. Additionally, an increase in e-bike use means an increase in bikers in general; which poses higher capacity requirements on infrastructure, as well as an infrastructure with more accessibility to sites with high numbers of visitors. Furthermore, the use of different types

of e-bikes (such as those with carts, etc.) would for example require wider bike-paths. Finally, e-bikes are more sensitive to winter conditions: partly due to the fact that e-bikes have more components that are sensitive to corrosion; and partly due to the decreased battery capacity that low temperatures result in. This makes it less adequate to de-ice bike-infrastructure using salt; and also calls for the availability of heated bike-parking. Finally, as stated above, the problems that e-bikes bring related to weight (when carrying an e-bike) could increase the requirement of a continuous infrastructure system (Koucky & Ljungblad 2012:9, 15, 17-18, 19, 20).

While the higher speeds of e-bikes bring advantages; they may also pose certain problems: As Clark & Nilsson (2014:1) writes; the higher speeds of e-bikes present higher requirements on bike-infrastructure. This is partly due to issues such as, as Koucky & Ljungblad (2012:16-17) point out, safety when maneuvering on bike-paths. The aspect of higher speeds being a problem due to inadequate infrastructure has also been pointed out by certain respondents in this project: when asked about what could make it easier to use an e-bike; Respondent #6 stated that it would be good to have separated bike-paths from pedestrians and cars, as the current situation proved to be dangerous with the higher speeds of e-bikes. Also, Respondent #11 stated that the current infrastructure did not permit her to overtake other bicycles to the extent she would have liked; which was a problem since she travelled at higher speeds than conventional bicycles.

The large majority of respondents in this project expressed issues related to bike infrastructure in one way or another; either when being asked about the negative aspects of using an e-bike, being asked about the factors that could attract more towards e-bike use, or the factors that could ease the use of e-bikes:

- Having separated bike paths from pedestrian paths, as indicated above, was one of these issues: Respondent # 13 and Respondent #21 stated that part of the reason for thinking that the infrastructure was bad; was the fact that pedestrians and bikes were mixed in the same path. Respondent #21 specified that this mix disabled him from being able to travel at higher speeds; while Respondent #19 stated that separating bike paths from pedestrian paths would make e-biking easier. Respondent #4 mentioned furthermore that she was

close to getting into accidents on her e-bike, due to this mix. Similarly, Respondent #6 felt that this mix made it dangerous to use an e-bike, due to the higher speeds of e-bikes.

- The quality of bike-paths in general was also an issue mentioned by some e-bikers: Respondent #5 compared bike paths in Sweden and Denmark, saying that the Swedish bike-paths were not as good. Respondent #13 specified that there were problems with bike paths, that he used, not being maintained well (gravel was for example not taken away); bike paths having bumps, being narrow, and a number of other deficiencies. Respondent #21 similarly stated that the quality of the bike paths (used by this individual) was bad for various reasons: this included discontinuous and narrow bike paths and a lack of care from construction sites along the bike paths; which created bad detours and decreased the quality of bike-paths through the creation of, amongst others, dirt and bumps. Respondent # 11 stated that the bike-paths she used did not allow her to overtake conventional bikers; which was negative due to her higher speeds. Respondent #13 and Respondent #20 stated furthermore that better bike paths would made e-biking easier; and similarly Respondent #8, while not specifying exactly which type of infrastructure, stated that better infrastructure would make it easier to use e-bikes.

- Furthermore, another infrastructural aspect that would be advantageous, according to a number of users, would be the provision of more parking spaces/racks for e-bikes where they could be locked safely (Respondent #2; Respondent #7; Respondent #10; Respondent #13; Respondent #16; Respondent #21; Respondent #22).

- Finally; the existence of more charging possibilities, such as charging stations/poles, was something that certain e-bike users mentioned would be an advantage for e-bikes (Respondent #9; Respondent #11; Respondent #12; Respondent #14; Respondent #15; Respondent #15; Respondent #18; Respondent #21)

Stigma

A possible issue that may deter certain individuals from using an e-bike could be the potential stigma that e-bikes could bring in comparison to conventional bicycles: certain respondents in this project, when asked about their thoughts on what could attract more e-bike users; stated that fighting this stigma could help in this matter (Respondent #15; Respondent #17 2015). Respondent #17 stated that this may be done by increasing e-bike use and subsequently having more individuals speaking about the advantages with e-bikes. Finally; Respondent #18 confirmed the presence of this stigma, by stating that certain people saw his use of an e-bike as *"cheating"* in comparison to a conventional bicycle.

Lack of information

The way in which information about e-bikes is spread in Sweden; may prove to have been a problem when it comes to attracting more individuals towards e-bike use, according to respondents in this project: When asked what could attract others towards e-bike use; Respondent #2 answered that, in order for e-bikes to become popular, there was a need for individuals to get aware of the advantages of e-bikes. Respondent #6 answered furthermore that knowledge on e-bikes generally felt quite low. The latter was also confirmed by other e-bike users: when asked if there had been enough information on e-bikes; Respondent #16 said that at the time of purchase (one year ago) there was not enough information on e-bikes. Subsequently, Respondent #10 answered that she thought there could (should) be more information on e-bikes out there. Respondent #11 answered similarly that it would have been good with more information; as, due to the fact that she actively had to search for information, she may have given up on the idea of acquiring an e-bike if she hadn't already decided that she wanted one. The negative issue of having to actively search for the information was also expressed by Respondent #4 and Respondent #13.

Energy production for e-bikes

When talking about the advantages of e-bikes in relation to climate change; certain aspects are important to be taken into account: This due to the fact that, since e-bikes are electric, it is commonly known that they do not directly release greenhouse gas (GHG) emissions; as they do

not have internal combustion engines. However, as Rose (2012:89) points out; there could still be environmental impacts if the power used to charge the e-bikes is produced e.g. by a coal power station. Another negative aspect that could arise from increased e-bike use is the one of individuals switching from a conventional bicycle to an e-bike; as this would have negative environmental impacts (Winslott Hiselius et al. 2013:40; Rose 2012:89). However, as the data in (Ekonomifakta 2015) points out, the Swedish energy mix originates largely from GHG emission free sources; which minimizes the (dirty energy production) problem in the region of Skåne. Also, as has been pointed out above, e-bikes could be charged with decentralized renewable energy production plants; which would further help minimize potential environmental problems with e-bike use.

5. Analysis

5.1 Step 1- Campaign aim and objectives: The purpose of the campaign

The aim and objective of this travel awareness campaign is to attract more individuals towards using the e-bike; instead of the car. This does not mean that it will only be car users that will be targeted; but instead means that potential future car users will also be targeted. As has been mentioned earlier, this campaign will be aimed at the region of Skåne; which is the target population. Skåne has, according to Statistics Sweden (SCB 2014), around 1 275 000 inhabitants. The size of the population means that this campaign would most likely require large amounts of resources in order to reach out to all inhabitants. Therefore, a selection has been made of the type of individuals that will be targeted by the campaign.

The selection of individuals to be targeted by this travel awareness campaign will begin with the most objective criteria: socio-demographic variables. The individuals targeted by this campaign, based on these variables, will in this case be: men and women over 45 years old. As has been mentioned above; factors such as gender, age, life situation and residential location (even though the latter can be affected by the ones above) affect the use of the car to some extent. Starting with age, since younger groups of people in Sweden have seen a tendency towards a decrease in car use; this campaign will have a stronger focus on individuals over 45 years old. When it comes to gender, based on the fact that men travel more in cars than women, it would be more logical to direct the campaign mostly towards men. However, as mentioned above, car travel (and travel in general) has seen a fast increase in women; contributing in gradually closing the gap between travelling patterns of women and men. Therefore, as these tendencies suggest that potential car users can increasingly be found in women; it is deemed appropriate to target this campaign both towards men and women. Furthermore, there are indications that individuals with lower levels of education have higher reluctance to switch from the car to other modes of transportation. However, this campaign will address all levels of education, due to the fact that subjective attitudes have a large effect on modal choice; at the same time as this campaign takes into consideration the fact that certain studies have found weak differences in socio-demographic

factors in modal choice. Finally; the economic situation of certain individuals may, as mentioned above, act as a barrier for them to acquire a car. However, aspirations to have a car (which, as mentioned earlier, could also be seen as an achievement) may lead to these individuals acquiring a car in the future. Since this makes them potential car users, this campaign will target this group as well and thus not make any discrimination based on this criterion. Finally, this campaign will target both individuals living in areas that typically require higher car use (further away from city centers) as well as central areas in the cities. This is due to the large variations, found while interviewing e-bike users in this project, in distances travelled with an e-bike: these distances varied from 5km to 20km in one direction. Furthermore, these e-bike users all lived in urban areas; which indicates that potential e-bike users would most likely be found in these areas. However, excluding rural areas may exclude potential e-bike users who live in areas with distances close enough that they could be travelled with an e-bike. Rural areas, being of lower densities and less diversified land uses, also typically require higher car use, as mentioned earlier. Therefore, both the urban and rural population will be targeted in this campaign.

Since socio-demographic indicators, as mentioned earlier, have proven to be of limited use when predicting modal choice; this campaign will use subjective attitude aspects in order to target proper individuals. For this, the classification made by Anable (2005) will be used:

To start with, this campaign would most likely not be effective when targeting groups such as the *Die Hard Drivers* and *Complacent Car Addicts*; as they lack a feeling of responsibility towards the environment and generally possess very low probabilities of changing modes of transportation due to their attitudes. This ineffectiveness factor should especially be true in Skåne: the two public servants working for the municipalities of Lund and Malmö in Skåne (Söderberg: Interview; Beijer: Interview), expressed that awareness about the effect of transportation on climate change per se was not necessary to bring up in these campaigns; as it is assumed that there is a high level of awareness about these issues in Sweden already. Therefore, it might be appropriate to assume that the *Die Hard Drivers* and *Complacent Car Addicts* would most likely not be affected by the campaign; considering the high level of awareness that is already out there (that has not affected them) and their high level of attachment to car use (resulting in them possessing, as mentioned above, very low probabilities of changing from the car to other modes). Other groups that would most likely also be less important for the campaign

to target are the *Car-less Crusaders*; as this group already uses the car very little and is already reluctant towards this mode of transportation.

The attitude groups that this campaign will address are instead the *Reluctant Riders*, the *Aspiring Environmentalists*, and the *Malcontented Motorists*. *Reluctant Riders* will be targeted in order to try to tackle the desire of acquiring a car in case of future possibilities of acquiring one; showing instead the e-bike as an alternative. When it comes to the *Aspiring Environmentalists*, as was mentioned above, their use of other modes of transportation may be limited by a lack of information about these other modes; which could be tackled by this campaign showing the e-bike as a good alternative mode of transportation. Finally the *Malcontented Motorists*, with their feelings of frustration towards car-use, have the potential for changing modes of transportation if the right information about alternative modes (in this case the e-bike) would be provided to them. This due to the fact that this group perceives many barriers for the use of alternative modes of transportation. Something that could be tackled by this campaign as well.

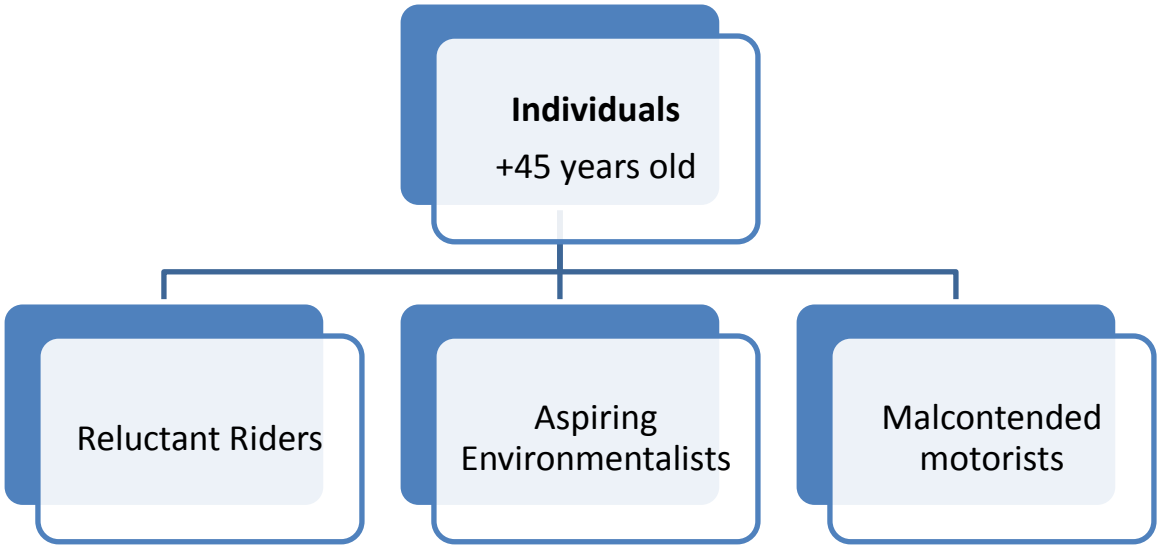

Fig 1: Selection of groups of individuals targeted by this TA campaign

It is worth noting that it is recommended by the MaxTag framework, as mentioned above, for objectives in travel awareness campaigns to be, amongst others; specific, time-related, measurable, etc. However, since the objective of this project is to create a basis of information for

formulating a Travel Awareness campaign plan; the scope of this project, as it is, does not allow for the campaign to be executed in practice. Therefore, concrete numbers and timelines cannot be provided in this project.

5.2 Step 2 – Formative research: Identifying and using drivers and barriers for e-bike use

Research during this project has delivered a number of drivers for e-bike use that can be used as a basis to address the targeted groups throughout this campaign. This project has also found barriers in relation to e-bike use; which will be addressed in the last step of this campaign plan. The formative research of this project combines the drivers found in this project with the *seven stages of change* behavioral model.

The first two stages of this model, as presented above, are the *awareness of problem or opportunity* and *accepting responsibility or relevance* stages. However, these stages will not be used when planning the campaign; due to the fact that, as mentioned earlier, levels of awareness about transportation in relation to climate change are already high in Sweden. Additionally, as Söderberg (Interview) and Beijer (Interview) stated, such information has therefore already been omitted in other transportation campaigns that deal with reducing car use/increasing use of public transportation in Skåne. Furthermore, according to Söderberg (Interview), talking about climate change creates a feeling of bad conscience in individuals. This can subsequently lead to the formation of excuses (for the "need" of using the car) in these individuals; and therefore the creation of a “wall” around them, which does not permit further discussion about the topic.

The next stage in the behavioral model is *perception of options*. This is an important stage; as all three attitude groups addressed in this campaign have either: a lack of information for alternatives to the car (the *aspiring environmentalists*), a perception of high barriers present when using alternatives to the car (the *malcontented motorists*), or a desire to use the car which could potentially be reduced by pointing out the positive aspects of e-bikes (the *reluctant riders*). As has been mentioned above; this stage deals with specific attributes of the modes of transportation being promoted e.g. accessibility, punctuality, etc. as well as other aspects related to it. Therefore the following drivers, found in the research conducted in this project, are used to address this stage:

First of all are the *unique e-bike drivers: in relation to all modes of transportation (except for the conventional bicycle).* This category addresses both those individuals who do not want, or find it difficult, to use e.g. public transportation; at the same time as it addresses those individuals who believe that the car is a solution to the barriers encountered with other modes of transportation:

- *Travel reliability*: As has been seen; pointing out the fact that the e-bike can provide for a reliable calculation of the time spent en-route is an important factor for certain e-bike users. This especially for those who use the e-bike to commute. This factor could attract those who have found travel reliability to be deficient in e.g. buses or trains due to delays; as well as those who have a very varied travel-time depending on traffic jams in e.g. rush hour.

- *Health advantages:* Health advantages that come from cycling may be considered a bonus with e-bikes in comparison to the car. Furthermore, it would be reasonable to assume that the same health advantages would be gained when using an e-bike in comparison to other modes of transportation; as long as the alternative mode of transportation is one in which the individual is as passive as in the car. According to Söderberg (Interview), communicating messages of health advantages may be especially successful with individuals with a higher education and higher income.

- *Time savings/speed in relation to other modes of transportation*: There are advantages when pointing out that using an e-bike could save time in e.g. rush hour when both using the car and the bus. This driver could e.g. potentially create a certain sense of control; which would be positive, specifically for the *aspiring environmentalists*. This driver could furthermore both: attract *reluctant riders* through showing them yet another advantage with this mode of transportation; and possibly reduce a potentially perceived barrier of delays with public transportation by the *malcontented motorists*, while instead showing this group that this barrier can be avoided with this alternative to the car.

Secondly, we find the *drivers in relation to the car*. This could address the "thirst" for the car; which is found in all three groups through the desire of a sense of control (*aspiring*

environmentalists), the feeling of a need to use the car (*malcontented motorists*) and the desire to use the car (*reluctant riders*):

- *Parking:* In comparison to taking the car; this driver could attract the target groups by showing that the e-bike provides the advantage of possessing the flexibility of the car, while not having to deal with the inconveniences that are brought around by parking.

- *Economically attractive in relation to cars:* Considering the fact that a car is more expensive than an e-bike; it may be correct to assume that this economic factor may not be as strong as other drivers: car users may most likely already have bought a car and may have harmonized the costs of using a car into their economy. However, according to Söderberg (Interview), conveying messages about the small relative costs of e-bikes in comparison to the car may be successful among groups of individuals with lower income.

- *Riding experience:* As was mentioned above, the riding experience on an e-bike was a driver found in this project. Both Söderberg (Interview) and Beijer (Interview) stated furthermore that the positive experience of riding bikes was something that was used in previous bicycle travel awareness campaigns; stating therefore that this is something that could attract users towards cycling. This could therefore be an advantageous driver for attracting e-bike users.

- *Environmentally friendly:* This driver may not have as strong of an effect in comparison to other environmentally friendly modes of transportation. However, due to the high level of awareness on climate change, the lack of this driver may have caused the e-bike to possibly be chosen away by an individual already wanting to switch travel mode.

- *Legal issues:* This driver allows individuals to feel that starting the use of an e-bike as a mode of transportation is relatively easy; due to the lack of legal requirements such as licensing and due to the possibilities of using them flexibly with bike-infrastructure.

Thirdly are the *drivers in relation to alternatives to the car (except the conventional bicycle)*; in order to address perceived barriers and negative feelings (found in the target groups) in relation to alternatives to the car such as public transportation. This is in order to highlight the e-bike as an alternative to the car that possesses some of the advantages of the car; which other modes of transportation may not be able to provide.

- *Flexibility:* A driver which could have a strong effect on individuals; due to the fact that this attribute is hard to find with alternative modes of transportation. Having to adjust to public transportation schedules, for example, could feel limiting to an individual who is used to be able to depart and arrive as they please with a car.

- *Practical:* Another attribute that could be hard to find in other public transportation (and which may therefore prevent others from using alternatives to the car) is practicality: the fact that e-bikes, as mentioned above, can be used to transport children, heavy payloads, groceries, etc. could make them attractive in comparison to modes such as e.g. the bus

- *Can replace car trips:* This driver can enlighten individuals with the perception of the e-bike, just as other modes of transportation, being able to be used as a replacement for car trips.

Furthermore; the following drivers may attract those who have considered the bicycle as an alternative mode of transportation; but have however not chosen this mode due to various perceived barriers with (conventional) bicycle use. These are the *drivers in relation to the conventional bicycle*:

- *Solution for physical inability to bike - due to e.g. handicap, sickness or old age:* Individuals that would like to cycle as an alternative to the car, but cannot do this due to disabilities, could now "open the door" to biking due to this driver. This gives the perception of a new alternative to the car.

- *Range in relation to conventional bicycle:* This is a driver that could be advantageous to those individuals who may not have had a perception of the bicycle being a good

alternative for anything other than short distances; increasing the perceived range of places to which individuals could cycle.

- *Reduction of physical effort:* With this driver; factors such as headwind or hilly terrain on certain routes become less decisive when choosing to cycle. This can add to the perception of the e-bike providing a flexible mode of transportation; as users do not have to take these limiting factors into consideration.

- *Reduction of sweat:* The conventional bicycle, as mentioned above, could be considered by many as an inconvenient mode of transportation due to sweat: certain individuals, as mentioned above, may choose not to bike e.g. to work due to the fact that they get sweaty. The e-bike opens the door to biking for these groups of individuals.

- *Weather:* As was mentioned above, the e-bike may attract users to cycle in weather where the conventional bicycle may not have been used.

- *Higher speeds than conventional bicycles:* As mentioned above, this driver is appreciated by many e-bike users.

Next is the stage *evaluation of options*. E-bikers interviewed more thoroughly in this project have expressed the following factors as the most important when choosing modes of transportation: *Time* or *"quickness"* was the most prominent factor found amongst users; something in which the e-bike has an advantage with its "*Time savings/speed in relation to other modes of transportation"* driver. *Smoothness* was the second most prominent factor found; which is advantageous when it comes to the e-bike due to the *flexibility, practical* and *parking* drivers. Other factors found were (positive) *health*, *flexibility* and *environmental impact*; all of which have been mentioned above as drivers with the e-bike.

The last stages of the *seven stages of change* model (*making a choice, experimental behaviour* and *habitual behaviour*) are those which are to be achieved by the actions taken in the previous stages; as well as by all the other actions taken in the campaign. In other words, these are the

stages that finally translate into the final objective of the campaign: a *habitual behaviour* in the use of e-bikes instead of the car.

5.3 Step 3 – Campaigning the campaign: Involving the right actors

Due to the fact that this project is not implemented in practice; actors that may or may not be involved in this type of campaign have not been contacted. As a result; it is difficult to draw conclusions on which these actors may be. However examples are brought up based on the type of actors that the *MaxTag design framework* suggests; which are presented as an Appendix. (See: Appendix 4).

5.4 Step 4 – Developing the social marketing mix: How to promote the Travel Awareness campaign

As the MaxTag design framework prescribes; there are six elements that will be used in order to develop the social marketing mix of this Travel Awareness campaign plan, and thus to promote the campaign. Suggestions on how these steps could be conducted are however presented as an Appendix (See Appendix 4)

5.5 Step 5- Shaping up the plan using a SWOT analysis: Recommendations before implementation

As has been mentioned above; this step aims at forming a revised plan of the campaign based on the previous step. However; the steps in order to plan this campaign have all been gathered and revised in this document already. Therefore, writing the revised plan on this step has been omitted; as it would virtually be a repetition of the information written above instead of a revision. In this particular campaign plan; this final step will focus on the SWOT analysis of the campaign. The *MaxTag design framework* prescribes a focus on the strengths and threats in the planned campaign. However, the SWOT analysis is used here instead in order to give recommendations for the potential campaign team to address when it comes to weaknesses and threats that should be addressed before implementation (i.e. excluding opportunities and strengths). The reason for this is that the strengths and opportunities presented here have already been used in the previous steps of the campaign plan. Nevertheless, strengths and opportunities

will still be included in the analysis in order to provide a complete picture of all the factors in the SWOT analysis.

Strengths: The strengths of this campaign are naturally directly related to the drivers that have been presented above for e-bike use; as these are the cornerstone for promoting the use of e-bikes instead of the car. Furthermore, the fact that e-bikes possess many drivers that relate to the versatility of car use (such as the *flexibility* and *practical* drivers); is something that gives the e-bike an edge in comparison to other alternatives to the car. This means that the e-bike could potentially provide a feeling of compromise between: giving up some of the advantages of the car (such as carrying very heavy payloads); while keeping some of the most important ones (such as the ability to freely choose departure times). Thus, the e-bike could furthermore potentially be considered an innovative transportation solution; instead of e.g. "yet another form of clean transportation".

Weaknesses: The weaknesses of this campaign are mostly related to internal barriers, that research in this project has found, related to e-bike use; which are factors related to e-bikes per se that could deter potential users from using an e-bike. These are the barriers: *heavy weight, safety, economic unattractiveness* (in relation to the car), *range, technical battery issues, exposure to elements, theft prone* and *practicalities in comparison to the car* (see: *Barriers for the use of e-bikes.*). The weaknesses presented here could be communicated to e-bike producers in Sweden; in order for them to gain more awareness about these barriers with the purpose of these barriers eventually being addressed.

The weaknesses of this campaign are also related to the fact that, due to the scope of this project; this campaign plan lacks certain key pieces of information. Therefore, these pieces of information are presented here in order for the potential campaign team to address before implementation. The pieces of information that are missing in this plan and need to be addressed are:

- The actors/stakeholders that would in fact be involved in this campaign; something that, as mentioned earlier, is important in planning for e.g. funding.

- The resources that would be available to this campaign if it would be conducted; which could directly affect its design, as it may prevent certain actions: A lack of resources

could e.g. limit the amount of brochures that could be printed and sent out to households; as well as the amount of information that could be printed on newspapers or the amount of staff that could work with the information given out in social media (see Appendix 4).

- The time scale of this campaign has not been set; due to the scope of this project which was explained earlier. Variations in time-scale could potentially have large implications on the project's design and success: as Söderberg (Interview) pointed out, it is important to repeat the message many times in order for the campaign to spread and get noticed; which could take years. Not knowing the time-scale of the campaign could therefore prove to be problematic.

Opportunities: The previously mentioned factor of the already high level of environmental awareness in Sweden; is a factor that may ease the success of this campaign. This is evident based on the first stages of the behavior change model used in this project; which point out the necessity of waking environmental consciousness, and feeling of responsibility towards this, in order to reach behavioral change towards alternative modes of transportation to the car. Thus, the situation in Sweden makes these stages unnecessary and saves time and resources that would have had to be spent on those stages. Furthermore; the driver *legal issues* presented above, is an opportunity due to the lack of fiscal and regulatory measures that could create a constraint for e-bike use.

Threats: The threats that are present for this campaign are factors related to the external barriers found during research in this project; which relate to the external environment:

- *Lack of adequate infrastructure:* This is an issue that could potentially counter-act the effects of the campaign; as e-bike users may be deterred from using e-bikes without the proper infrastructure. A lack of adequate infrastructure may also, through the same word to mouth effect used to promote this campaign through social media (See Appendix 4), spread a negative rumor towards e-bike use due to this barrier; potentially resulting in individuals not opening up to information about the drivers related to e-bike use. Therefore, the campaign team should take contact with the local governments of the region of Skåne (which may already be in co-operation with the campaign); in order to

communicate and recommend a review and improvement of the bicycle infrastructure in the region.

- *Stigma:* The stigma related to e-bike use may have the same effect as mentioned on the barrier above: individuals may potentially not open up to the idea of using an e-bike or the information on the advantages of e-bikes. This could potentially even be true not only for individuals who believe in this stigma; but also individuals who may be open to using an e-bike, but may feel hindered in doing so due to the opinions of others around them. This stigma should however be automatically addressed through the campaign; as the campaign points out the advantages of e-bikes, including the advantages in relation to conventional biking (such as the longer range available). This could make individuals change their idea of the e-bike as a "cheating" mode of transportation.

- *Lack of information:* The lack of information available on e-bikes per se could result in certain individuals choosing away the e-bike: if an individual for example would look for technical information on e-bikes and not find it; it may, as was mentioned earlier, get this individual to give up and subsequently not acquire an e-bike (see *lack of information* in *Barriers for the use of e-bikes*). In order to counter this; the campaign team could include technical and price information on e-bikes as part of the information sent out in the campaign. The campaign team could additionally contact e-bike retailers in order to suggest a win-win co-operation with the campaign: the e-bike retailers could send additional brochures with details about their products either together with the campaign (See Appendix 4) or separately through their own advertising campaigns.

- *Energy production for e-bikes:* As was mentioned above, the environmental friendliness of e-bikes depends largely on whether or not the energy produced to power the e-bikes is clean. This is not currently a barrier in the Swedish context; however it could potentially become a threat to this campaign if the Swedish energy mix were to change during or before this campaign took place. No recommendations are given based on this barrier; due to the fact that this is not a current issue.

6. Conclusions

In the light of the global problems brought by climate change and the need for reduced greenhouse gas emissions from various sectors; this project draws its focus towards the Swedish transportation sector. Using the region of Skåne as a geographical delimitation; this project has had as its objective to create a basis of information for formulating a travel awareness campaign plan; that can be used to contribute in achieving an increased use of e-bikes as an alternative to the car. The following research questions have been formulated in order to reach this objective:

- Which are the drivers and barriers for the use of e-bikes in Sweden?

  Drivers and barriers for the use of e-bikes in Sweden have been found through a combination of methods: Firstly; a document analysis has been conducted in order to find drivers and barriers that are generally applicable to the use of e-bikes. This has included research conducted in other countries and regions of Europe and the world. Subsequently, due to the limited amount of research found on the use of e-bikes in Sweden; online surveys were sent out to twenty two e-bike users in Sweden, complemented with eleven semi-structured interviews with e-bike users who agreed to be interviewed through the survey.

  There are different types of drivers and barriers for the use of e-bikes found throughout the research of this project. Drivers have been divided into four categories: firstly comes the category *unique e-bike drivers: in relation to all modes of transportation (except for the conventional bicycle)*; which includes drivers such as *travel reliability* and *time savings/speed in relation to other modes of transportation.* After this category we find the *drivers in relation to the car* category; which includes, amongst others, the *parking* and *riding experience* drivers. Furthermore, we find the *drivers in relation to alternatives to the car (except the conventional bicycle)* category; which includes the *flexibility* and *practical* drivers. Finally we find the *drivers in relation to the conventional bicycle* category; which includes, amongst others, the *reduction of sweat* and *range in relation to conventional bicycle* drivers. Barriers have been categorized into *internal barriers* and

external barriers. Internal barriers are those barriers related to attributes of the e-bike itself; and include for example the *safety* and *theft prone* barriers. Finally, *external barriers* are those barriers related to the surrounding environment; and include for example the *lack of adequate infrastructure* and *stigma* barriers.

- How can the use of e-bikes be fomented as an alternative to the car in the region of Skåne?

  The way in which this project attempted to foment the use of e-bikes instead of the car in Skåne is through the creation of a Travel Awareness campaign plan. This campaign plan has been created in a step-by-step approach based on the first five steps of the *MaxTag design framework*; with a focus on the first, second and last steps of this framework. Subsequently, the *seven stages of change model* was used based on the need for behavior change theories within the framework mentioned above. Additionally; two public servants, experienced in Travel Awareness campaigns, were interviewed from the city of Lund and Malmö. This was done in order to gather first hand information on practical experiences with these types of campaign in the region.

  The result has been a plan for a travel awareness campaign plan which targets men and women over 45 years of age in Skåne; and which, within this selection, targets individuals within the subjective attitude groups: *reluctant riders, malcontented motorists* and *aspiring environmentalists.* The campaign plan proceeds by suggesting the type of actors that could be contacted in order to seek support for the campaign (See Appendix 4). Thereafter, the campaign plan suggests a social marketing mix with which to target the selected individuals with information on e-bike use; in order to promote the campaign (See Appendix 4). This is done based on the drivers found in this project; which are used to promote e-bike use (in accordance to the objective of this campaign) and lift up the positive aspects of e-bikes in order to counter the personal costs that come to individuals when stopping car-use. Finally; a SWOT analysis is presented in order to provide recommendations on the weaknesses and threats for the potential campaign team to address before implementing the campaign.

There is a limited amount of research conducted on the subject of e-bike use in Sweden. Examples of such research are the investigations conducted by Winslott Hiselius et al. (2013), Koucky & Ljungblad (2012) and Clark & Nilsson (2014); which cover topics such as the potential for e-bikes as a replacement for the car, infrastructural requirements of e-bike use, and safety aspects related to the use of e-bikes. This project therefore contributes to current research by gathering together these different types of information; as well as other information related to e-bike use. This project subsequently contributes to current research by providing an analysis of a way in which behavior change can be achieved in the Swedish region of Skåne; in order for the potential of e-bikes to be exploited as an environmentally friendly mode of transportation. Future research could investigate strategies that could be used on the national level in order to increase e-bike use; as well as ways in which e-bike use can be combined with other modes of transportation in Sweden.

Reference list

Documents and internet sources

Anable, J. (2005) 'Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behaviour segments using attitude theory. *Transport Policy*, Vol: 12:1, pp.65-78.

Ayres, L. (2008) Semi-Structured Interview. *The SAGE Encyclopedia of Qualitative Research Methods*.

Beirão, G. and Sarsfield Cabral, J. (2007) Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy*, Vol:14:6, pp.478-489.

Clark, A. & Nilsson, A. (2014) *Trafiksäkerhetsaspekter av ökad användning av elcyklar i Sverige.* Trafikverket.

Centerpartiet (2015) *Klimat.* Available at: https://www.centerpartiet.se/var-politik/alla-fragor/miljo/klimat/ (Retrieved 2015-05-03)

Collado, M., Yu, A. H. H., & Pettersson, S. (2014) Targeting the introduction of E-bikes based on behaviour change potential and user perception. *Urban Transport XX*, Vol. 5:6.

De Vos, J., Derudder, B., Van Acker, V. and Witlox, F. (2012) Reducing car use: changing attitudes or relocating? The influence of residential dissonance on travel behavior. *Journal of Transport Geography*, Vol: 22, pp.1-9.

Ecoride (2015) Available at: http://www.ecoride.se/elcyklar/ (Retrieved 2015-04-17)

Ekonomifakta (2015) Available at: http://www.ekonomifakta.se/sv/Fakta/Energi/Energibalans-i-Sverige/Elproduktion/ (Retrieved: 2015-04-07)

Energimyndigheten (2015) *Energiläget i siffror 2015*.

Energimyndigheten (2015b) Available at: https://www.energimyndigheten.se/Foretag/Ekodesign/Produktgrupper1/Dack-/Kom-langre-som-medveten-bilist/ (Retrieved: 2015-04-17)

Eriksson, L. (2009) *Tema Cykel – faktorer som påverkar cykelanvändning utifrån ett individperspektiv -En litteraturstudie.*

Feng, Z., Raghuwanshi, R., Xu, Z., Huang, D., Zhang, C. and Jin, T. (2010) Electric-bicycle-related injury: a rising traffic injury burden in China. *Injury Prevention*, Vol. 16:6, pp.417-419.

Folkpartiet (2015) *Klimat.* Available at: http://www.folkpartiet.se/politik/politik-a-o/klimat/ (Retrieved 2015-05-03)

Frändberg, L. and Vilhelmson, B. (2011) More or less travel: personal mobility trends in the Swedish population focusing gender and cohort. *Journal of Transport Geography*, Vol: 19:6, pp.1235-1244.

Fyhri, A. & Fearnley, N. (2015). Effects of e-bikes on bicycle use and mode share. *Transportation Research Part D*. Vol. 36, pp. 45-52. Elsevier Ltd.

Gehlert, T., Kuhn, M., Schleinitz, K., Petzoldt, T., Schwanitz, S., & Gerike, R. (2012) *The German pedelec naturalistic cycling study–study design and first experiences.* International Cycling Safety Conference 2012: 7-8 November 2012, Helmond, The Netherlands.

Gregori, A. and Baltar, F. (2013). Ready to complete the survey on Facebook: Web 2.0 as a research tool in business studies. *International Journal of Market Research*, Vol. 55:1, pp.131.

Koucky, M. & Ljungblad, H. (2012) *Elcyklar och cykelinfrastrukturen. Kräver elcyklar en förändring i hur vi planerar för cykel? CyCity, delproject 12*.

Klimatsamverkan Skåne (2015) *Om Klimatsamverkan.* Available at: http://www.klimatsamverkanskane.se/om-klimatsamverkan (Retrieved 2015-05-03)

Kristdemokraterna (2015) *Klimatförändring.* Available at: https://kristdemokraterna.se/VarPolitik/Korta-Svar-AO/Klimatforandring/ (Retrieved 2015-05-03)

Länsstyrelsen Skåne (2015) Available at: http://www.lansstyrelsen.se/skane/Sv/miljo-och-klimat/klimat-och-energi/fonybar-energi/vindkraft/Pages/index.aspx (Retrieved: 2015-04-12)

MAX (2009a) *MaxTag - Travel Awareness Campaign Guide.* Available at: http://www.max-success.eu/wpa.phtml. (Retrieved: 2015-02-03)

MAX (2009b) *WPB – Final Report.* Available at: http://www.max-success.eu/downloads/MAX_WPB_FinalReport.pdf. (Retrieved: 2015-02-03)

Max website (2015) Available at: http://www.max-success.eu/. (Retrieved: 2015-02-03)

Miljöpartiet (2015) *Klimat.* Available at: http://www.mp.se/politik/klimat (Retrieved 2015-05-03)

Moderaterna (2015) *Klimat.* Available at: http://www.moderat.se/miljo-och-klimat (Retrieved 2015-05-03)

Naturvårdsverket (2015) *Utsläpp av växthusgaser från inrikes transporter 1990-2013.* Available at: http://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Vaxthusgaser-utslapp-fran-inrikes-transporter/. (Retrieved 2015-01-28)

Neergaard, K. and Håkansson, M. (2011). *MaxLupoSE - råd om hur mobility management kan användas i den kommunala planeringen*. Trafikverket.

OKQ8 (2015) Available at: **http://www.okq8.se/pa-stationen/drivmedel/** (Retrieved: 2015-04-17)

Popovich, N., Gordon, E., Shao, Z., Xing, Y., Wang, Y. and Handy, S. (2014) Experiences of electric bicycle users in the Sacramento, California area. *Travel Behaviour and Society*, Vol. 1:2, pp.37-44.

Pressl, R and Reiter, K. (2003) *Mobility Management and Travel Awareness.* Available at: http://www.eu-portal.net/material/downloadarea/kt7_wm_en.pdf. (Retrieved: 2015-02-03)

Statoil (2015) Available at: http://www.statoil.se/sv_SE/pg1334072467111/privat. (Retrieved: 2015-04-17)

Region Skåne (2015a) *Politik och påverkan.* Available at: http://www.skane.se/organisation-politik/Politik-och-paverkan/ (Retrieved 2015-05-03)

Region Skåne (2015b) *Miljö och natur.* Available at: http://www.skane.se/framtid-och-utveckling/Miljo-och-natur/ (Retrieved 2015-05-03)

Rose, G. (2011) E-bikes and urban transportation: emerging issues and unresolved questions. *Transportation*, Vol. 39:1, pp.81-96. Springer Science+Business Media, LLC. 2011.

Rothfuss & Le Bris, R. & Le Bris, J (2014) Electro mobility and Pedelecs: Spatial reconfiguration of the transport system?. *Socio-Economic Sustainability, Regional Development and Spatial Planning: European and International Dimensions & Perspectives.*

Saleh, P. (2014) Electric bicycles–Riding habits like bicycles or mopeds? Overview about the project SEEKING–SAFE E-BIKING. *Transport Research Arena (TRA) 2014: Paris.*

SCB (2014) *Folkmängd i riket, län och kommuner 31 december 2013 och befolkningsförändringar 2013.* Available at: http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Befolkning/Befolkningens-sammansattning/Befolkningsstatistik/25788/25795/Helarsstatistik---Kommun-lan-och-riket/370301/ (Retrieved: 2015-02-22)

Scheiner, J. and Holz-Rau, C. (2007). Travel mode choice: affected by objective or subjective determinants?. *Transportation*, Vol: 34:4, pp.487-511.

Schepers, J., Fishman, E., den Hertog, P., Wolt, K. and Schwab, A. (2014). The safety of electrically assisted bicycles compared to classic bicycles. *Accident Analysis & Prevention*, Vol: 73, pp.174-180.

Schleinitz, K., Petzoldt, T., Franke-Bartholdt, L., Krems, J., & Gehlert, T. (2014) *The German Naturalistic Cycling Study: comparing cycling speed of riders of different e-bikes and conventional bicycles.* International Cycling Safety Conference 2014: 18-19 November 2014, Göteborg, Sweden

Socialdemokraterna (2015) *Klimat.*Available at: http://www.socialdemokraterna.se/Var-politik/Var-politik-A-till-O/Klimat/ (Retrieved 2015-05-03)

Sverigedemokraterna (2015) *Miljöpolitik.* Available at: http://sverigedemokraterna.se/var-politik/miljopolitik/ (Retrieved 2015-05-03)

TAPESTRY (2003) *Travel Awareness Publicity and Education Supporting a Sustainable Transport Strategy in Europe*. Available at: http://www.max-success.eu/tapestry/www.eu-tapestry.org/. (Retrieved: 2015-02-03)

Tillväxtverket (2014) Available at: http://www.tillvaxtverket.se/download/18.2fb8c83014597db7ce98e6df/1399539151839/11.+Sk%C3%A5ne.pdf Retrieved: 2015-02-01.

Transportstyrelsen (2015) *Cykel med elassistans.* Available at: http://www.transportstyrelsen.se/sv/vagtrafik/Fordon/Fordonsregler/Moped/Elcykel/. (Retrieved 2015-02-25).

Trafikanalys (2014*) Lokal och regional kollektivtrafik 2013 - Local and regional public transport 2013.*

Vänsterpartiet (2015) Available at: http://www.vansterpartiet.se/politik/klimat (Retrieved 2015-05-03)

Weber, T., Scaramuzza, G. and Schmitt, K. (2014) Evaluation of e-bike accidents in Switzerland.*Accident Analysis & Prevention*, Vol: 73, pp.47-52.

Winslott Hiselius, L., Svensson, Å., Bondemark, A. & Rye, T. (2013) *I vilken utsträckning kan elcyklar (och elmopeder) ersätta dagens biltrafik?* Bulletin 288. Trafik och väg, Institutionen för Teknik och samhälle, Lunds Universitet, Lund.

Interviews (with public servants)

Anders Söderberg. Municipality of Lund: Department of Transportation (Gatu –och trafikkontoret) Interviewed on: 2015-04-08.

Frida Beijer. Municipality of Malmö: Department of Transportation (Gatukontoret). Interviewed on: 2015-04-21

Appendixes

Appendix 1- Survey questions

The survey posted on the Facebook groups contained six open questions related to the respondents' opinions on the use of electric bicycles (Translated from Swedish in parenthesis):

- *"I hur många år har du haft elcykel? Vad är det som i första hand fick dig att införskaffa en elcykel? (For how many years have you had your e-bike? What is it that mainly got you to acquire an e-bike?)"*

  The answers gathered through these questions aimed at finding the main drivers that would affect an individual towards acquiring an e-bike. The amount of time having had an e-bike was initially asked in an attempt to find differences in the answers given depending on this variable. However, no relevant differences were found; and therefore the answers in the age variable were not used in the project.

- *Trivs du med din elcykel? Vad är det som gör att du trivs? (Do you thrive with your e-bike? What is it that makes you thrive?)*

  This question was created in an attempt to gather other surrounding drivers (apart from the main drivers that affected the choice of acquiring an e-bike) related to e-bike use.

- *Tycker du att det finns något negativt med elcyklar? Vad i så fall?*

  The answers provided through these questions were attempted to provide information on the main barriers with e-bike use perceived by e-bike users.

- *Vad tycker du skulle kunna locka andra till att använda elcyklar? (What do you think could attract others towards e-bike use)*

This question was formulated in an attempt to increase the chance of bringing up hidden drivers that may not have been thought of by the respondent in the previous questions.

- *Vad tycker du skulle kunna göra det lättare att använda elcyklar? (What do you think could make it easier to use an e-bike)*

  The question was created in order to gather information on barriers to e-bike use related to the surrounding environment, instead of the e-bike per se; such as e.g. infrastructural barriers.

- *Vilka typer av resor brukar du mest använda din elcykel för? (Which type of trips do you use your e-bike for mostly?)*

  This question had the objective of gathering information on the frequency of e-bike use (using the e-bike for work commute would e.g. show a high frequency); in order to be able to conclude whether or not the e-bike could be considered a mode of transportation for everyday life or if it mostly was used for leisure. In the case of the latter; further investigation would have been conducted on the reasons for this behavior. However, the vast majority of respondents did use the e-bike for work; and the information provided by this question was therefore not used.

- *Kön, ålder (Respondents were asked to provide their age and gender?*

  The purpose of this question was to gather information that would be used to help determine the groups who would be targeted by the Travel Awareness campaign plan.

- *Skulle du kunna tänka dig att ställa upp för en intervju om elcyklar för att få djupare information om din upplevelse? (Would you be willing to participate in an interview about e-bikes in order to gather deeper information about your experience?)*

The purpose of this question is as it stated on the question itself; and will be explained further below.

- *Namn (Respondents were asked to provide their name)*

  Even though respondents were promised to be neutral; their name was asked in order for the author to be able to contact them in case they agreed to be interviewed.

Appendix 2 – Semi-structured interview questions

- *Vart bor du? Är det i landsbygden eller tätort? (Where do you live? Is it in a rural or urban area?*

  This question was formulated in order to gather information in order to help determine the groups who would be targeted by the Travel Awareness campaign plan.

- *Äger du eller har du tillgång till bil? Om tillgång, i vilken utsträckning? (Do you own or have access to a car? If access: to what extent?)*

  This question was formulated in order to investigate if car owners would replace car trips with the e-bike.

- *Hur stora avstånd brukar du resa med elcykel? (How long are the distances you usually travel with your e-bike?)*

  The data gathered through this question was used in the selection of target groups for the campaign.

- *Påverkade klimatproblematiken ditt val av att köpa elcykel eller var det huvudsakligen andra orsaker? (Did climate change issues affect your choice of buying an e-bike or was it mainly other reasons?)*

This question was based on the first stage of the *seven stages of change* behavioral model; in order to assess the strength of this driver, and therefore how much emphasis should be put on this. Additionally, many respondents did not provide an answer to this in the first survey question (related to the reasons for choosing an e-bike); but instead only provided an answer on how long they had owned an e-bike, which was a setback to the project. This question was then meant to work as a complement to these cases.

- *Vilket färdmedel använde du främst innan du skaffade elcykeln? Ersatte du några bilresor? (Which mode of transportation did you mostly use before you acquired an e-bike? Did you replace any car trips?)*

  This question was formulated in order to determine if e-bike users generally (even those that did not own or have access to a car) had replaced trips with the e-bike that could have been conducted with the car or would have had to be conducted with the car.

- *Vad är det som fick dig att få uppfattningen att elcykeln kunde vara ett bra färdmedel att ersätta din f.d. färdmedel med? Tycker du att det fanns tillräckligt mycket information om elcyklar där ute? (What gave you the perception of the e-bike being a good mode of transportation to replace your previous mode of transportation with? Do you think that there was enough information on e-bikes available?)*

  The information gathered through this question was used in order to determine the level of available information on e-bikes per se; and the effect that this could have on the choice of acquiring an e-bike.
  Vad brukar vara din högsta prioritét när det gäller färdmedel?(Which is usually your highest priority when it comes to modes of transportation?)

  This question was formulated in order to determine whether or not the travel priorities of e-bike users were in conflict or in harmony with the attributes of this mode of transportation.

- *Hur stor andel av dina resor brukar du göra med elcykeln generellt? Du nämnde även att du använde elcykeln främst för att _____: Hur stor andel av dina _____resor görs med elcykel? (How large is the proportion of your trips done with an e-bike? You also mentioned that you used the e-bike mostly for trips related to _____: How large is the proportion of your _____trips conducted with an e-bike?)*

  This question was formulated in order to gather information on the extent to which e-bikes could be integrated into the general mobility of e-bike users; in order to determine if there would be a barrier if this was not the case.

Appendix 3 – Interview questions for public servants

- *Vilka typer av TA kampanjer har ni genomfört i kommunen?(Which types of TA campaigns have you conducted in the municipality?)*
- *Hur har resultaten sett ut för dessa TA kampanjer?(What have been the results of these TA campaigns?)*
- *Vilka åtgärder i kampanjerna har fungerat bäst? Och vilka mindre bra? (Which actions have worked best in the campaigns?)*
- *Har ni använt er av någon specifik beteendeteori? Vilka delar av teorin har det varit fokus på? (Have you used a specific behavior theory? Which parts of the theory has the focus been put on?)*
- *Har ni använt någon specifik steg-för-steg struktur för att bygga upp kampanjerna? Vilka steg har varit viktigast i så fall?(Have you used a specific step-for-step structure in order to build the campaigns? Which steps have been the most important in that case?)*
- *Har ni några framtida planer för TA kampanjer för elcyklar? Har ni funderat på det? (Do you have future plans for TA campaigns on e-bikes?)*
- *Tycker du att det finns någon standard för hur man genomför TA kampanjer i Sverige? (Do you think there is a standard on how TA campaigns are conducted in Sweden?)*

Appendix 4 – Steps 3 and 4 of MaxTag design framework

Step 3 – Campaigning the campaign

Due to the fact that this project is not implemented in practice; actors that may or may not be involved in this type of campaign have not been contacted. As a result; it is difficult to draw conclusions on which these actors may be. However examples will be brought up based on the type of actors that the *MaxTag design framework* suggests:

Political support for the campaign could potentially be acquired through virtually every major Swedish political party. This due to the fact that all of these parties have policy that address climate change in one way or another (Centerpartiet 2015; Folkpartiet 2015; Kristdemokraterna 2015; Miljöpartiet 2015; Moderaterna 2015; Socialdemokraterna 2015; Sverigedemokraterna 2015; Vänsterpartiet 2015). When it comes to stakeholders it could be logical to contact the local municipalities of Skåne; since these have shown to conduct these kinds of projects. Examples are the Skåne municipalities of Lund and Malmö; which have conducted Travel Awareness campaigns that relate to bicycle use (Söderberg 2015; Beijer 2015). Another administrative organization to contact could be Region Skåne; which is a regional organization that is controlled by the regional council in Skåne. This is due to the fact that this organization has sustainable development as one of its areas of responsibility; which could therefore make this campaign be an interesting project for the organization (Region Skåne 2015a; Region Skåne 2015b). Other stakeholders could be e-bike retailers in the region, who could potentially promote their e-bikes by contributing to the travel awareness campaign through e.g. sponsorship. Finally, it could also be beneficial to contact environmental organizations that dedicate themselves to questions about climate change, such as Klimatsamverkan Skåne; which is a co-operation between municipalities in Skåne, the county authority (Länsstyrelsen) and Region Skåne (Klimatsamverkan Skåne 2015). Finally; the MaxTag design framework recommends having the co-operation of the targeted community and involve them. However, Söderberg (Interview) states that, from experience, individuals in the region do not like having to be involved in the project; since it takes their time and energy. Instead, the best approach is, according to Söderberg (Interview), to only provide the inhabitants with the right information.

Step 4 – Developing the social marketing mix

As the MaxTag design framework prescribes; there are six elements that will be used in order to develop the social marketing mix of this Travel Awareness campaign:

Product or social idea: The social idea of this campaign will be the same as what the objective of this project tries to achieve: to reduce greenhouse gas emissions by replacing the car with an e-bike.

Price: The personal costs of individuals, when switching from a car to an e-bike, are mostly related to certain practicalities related to the car. These practicalities have been mentioned earlier as barriers to e-bike use, and are namely the following: travelling on an e-bike can be very difficult for individuals with children of older ages; as well as it can be difficult to travel with other people if the travelling per se is meant to be a social event or interaction. Furthermore, as was also mentioned earlier, the car can be used to carry much heavier things than the e-bike; as well as it can be used in very bad/slippery weather conditions in which the e-bike may not be adequate to be ridden. These practicalities would naturally be lost with the e-bike. Finally, the fact that the car can be used when individuals are too sick to use an e-bike is something that giving up the car completely would take away. It is relevant for the campaign to have information on the personal costs of individuals when stopping car use. These costs are however addressed by pointing out the advantages that individuals would get in comparison to the car; which is done (based on the drivers found in this project) through the *promotion* step below.

Place: The places in which individuals could acquire information could vary depending on the actors involved. Since municipalities have previously conducted Travel Awareness campaigns in Skåne; it could be assumed that these actors would be involved in the campaign. Therefore, facilities such as city halls in the different municipalities in Skåne could be good places in which to have information on the campaign; as well as individuals that work with the campaign that could be available to answer questions. Furthermore, information about the campaign (in the form of e.g. brochures) could possibly be available in the offices of the different actors involved. Depending on the level of commitment to the campaign, these actors could also potentially have a person(s) in charge of face-to-face answering questions related to the campaign.

Promotion: There are different ways of promoting a Travel Awareness campaign. According to Beijer (Interview), the municipality of Malmö has used techniques such as individuals talking to

people on the streets, putting advertisement on newspapers and billboards, making websites, etc. Advertisement on newspapers has furthermore been a successful way of reaching out to people in Malmö. According to Söderberg (Interview), the best method to spread a campaign is through word of mouth; which is, according to this respondent, more effective than printed material. The way in which this is reached is through pointing out the good stories related to the campaign. The municipality of Lund, for example, distributed bags with a fruit and a drink to all cyclists along certain routes when conducting a Travel Awareness campaign for promoting bicycle commuting. One of the cyclists shared this on the social media Facebook; which had much effect for the campaign. The aim, according to Söderberg (Interview), is to get individuals to talk to each other about whatever it is that is being promoted: in this particular example, the aim was to get individuals to talk about the positive experiences of biking. It is in this aspect, according to Söderberg (Interview), that social media has strength. Additionally, according to this respondent, individuals find gratitude in speaking about a step such as starting to cycle. Söderberg (Interview) stated that the municipality of Lund had sent information, to the homes of individuals, in the form of a map with the bike paths available; at the same time as the back of this map had different pieces of information about the advantages of biking and information that is good to have when biking. This information was diversified; since different people react to different things, which makes it meaningless to just focus on one piece of information. Finally; an important aspect when conducting these campaigns is to give out the right information and repeat the message and information of the campaign many times, in order to make an impression on people: *"Let them see the message many times: they see the "commute with a bike" in the newspaper, on billboards in town, they get a little brochure, they hear the message all the time "commute with a bike".* (Söderberg: Interview).

Based on this information; the ways in which this Travel Awareness campaign should be promoted are therefore:

- Social media such as the popular Facebook, Twitter, etc. This in order to get the word to mouth effect between individuals in Skåne.
- Information on newspapers; and brochures that are distributed to all households with inhabitants over 45 years old.

The information given out through these mediums should be diversified; taking into consideration that the different attitude groups targeted in this campaign will most likely prioritize different things. A way of doing this could be by having the information printed in a format of a primary message (based on a certain driver, mentioned above) followed by different secondary messages based on the rest of the drivers. These pieces of information could subsequently be rotated amongst different newspaper issues and different brochures: for example, the information could be printed in a newspaper during one day with a certain primary message in focus (e.g. the health advantages of using e-bikes in comparison to the car); with the rest of the secondary messages (based on the rest of the drivers with e-bike use) printed on the side with less focus. The primary message could subsequently be changed and be based on a different driver the next day (or newspaper issue); still being accompanied by the rest of the secondary messages (the rest of the drivers), including naturally the driver which was used as a basis for the primary message the day before. When it comes to diversifying the information on the brochures; the same principle could be applied: brochures could be sent in different waves to households; varying the primary and secondary messages on each wave. The different brochures sent in the different waves could furthermore be available at the *places* mentioned above. Promoting the campaign via both mediums would make the information be repeated several times; at the same time as the different pieces of information (messages with drivers related to e-bike use) would be lifted up in order to reach as many individuals (and their varying priorities) in the different target groups as possible. Finally, information in social media (such as in Facebook pages) could also be varied in this way; by changing the information displayed as primary and secondary messages periodically.

People: This campaign focuses on marketing the campaign socially through the actions mentioned above: social media and printed material in the form of information on newspapers and brochures. Therefore, this element will not be of large focus. However, it could be beneficial for this campaign to arrange periodic meetings that provide all the information used/provided by the campaign in person. This in order to reach the groups that may have questions and may not desire going to one of the places, mentioned above, where this information is given out.

Processes: Giving feedback to the population through mediums such as e.g. phone calls and e-mails; could be done at the same places, mentioned above, that have individuals responsible of

answering questions. This could either be done by the same individuals or individuals that are solely responsible for this type of non-face-to-face communication; depending on the workload that these individuals already have.