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# Encouraging commuters to Groningen to use the e-bike instead of the car

How it is currently done and how it can possibly be improved for the future



Daan Schmidt (s3209172)

Bachelorproject Spatial Planning  
and Design – Faculty of Spatial  
Sciences

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Supervisor: Farzaneh Bahrami

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## Summary

This research is conducted within the theme 'towards a post-car society'. The focus is on the transport mode shift from the car to the e-bike for commuters to the city of Groningen. The city of Groningen is well known about its cycling culture. Nevertheless, are there still too many commuters to the city who use the car. In and around the city are multiple measures done to improve the quality of cycling infrastructure and to financially and socially incentivize people to use the (e-)bike instead of the car for commuting. Different policy strategies with regards to encouraging commuters to use the e-bike are analyzed in this research. On the other hand, this research focuses on the motivations of both car users and e-bike users whether or not to take the e-bike using a questionnaire survey. The respondents do not see the infrastructural related aspects as the most encouraging. However, an increased awareness of the impact of this choice on environmental and health related aspects is or has been a relatively influential encouraging development. This and the other findings of the questionnaire and together with the policy analysis will in the end result in a recommendation for future policy to improve the encouraging of commuters to the city of Groningen to use the e-bike instead of the car.

## Introduction

### Background

The necessity of having a car to participate daily life and the corresponding interdependency of cars with institutions and infrastructure is the main barrier for the transition to a post-car society (Urry, 2004; Morton et al., 2017). This necessity needs to disappear to make the transition possible. This could be done by addressing the named interdependency. One way to realize this, according to Urry (2004), is the transport policy change from predict-to-provide to demand-reduction. This can possibly be realized by creating a new interdependency and stimulating people to use bikes. Policy which aims at encouraging people to cycle and making cycling more pleasant than using the car, can reduce the demand for car-use. This is done within the city center of Groningen where bikes are the most used mode for daily transport. From the daily transport movements made within the city, more than 60% is made by bikes. Therefore, the city of Groningen is called ‘*cycling city Groningen*’ (Groningen Fietstad, 2015). Also for the future, the municipality of Groningen aims at reducing car-use and focuses on alternative transport modes like the bike (Gemeente Groningen, 2017). This intention has several reasons. Cars used for commuting are the main causes of the traffic congestions during rush hours in Groningen and have therefore a negative effect on the accessibility of the city (MuConsult, 2018). Besides that, there is the potential to achieve more active mobility and health gain which is an objective of the municipality as well (Buekers et al., 2015; Groningen Fietstad, 2015). However, there is an amount of people working in the city of Groningen who are living outside the city which is worth mentioning. They need to travel to the city on a daily base. The amount of commuters to the city is increasing and also for the future a further increase is expected (see figure 1). The origin of the commuters to Groningen is displayed in figure 2. It shows that only 34% of the people working in the city of Groningen also lives within in the city. Next to this, from all trips made by cars in the Netherlands, commuting is the most common motive to use a car (Ministerie van Infrastructuur en Milieu, 2017). Therefore, commuters are a relevant target group for reducing the overall car-use.



Figure 1: Numbers showing the increase and expected increase of the amount of commuters to the city of Groningen (Groningen Fietstad, 2015)

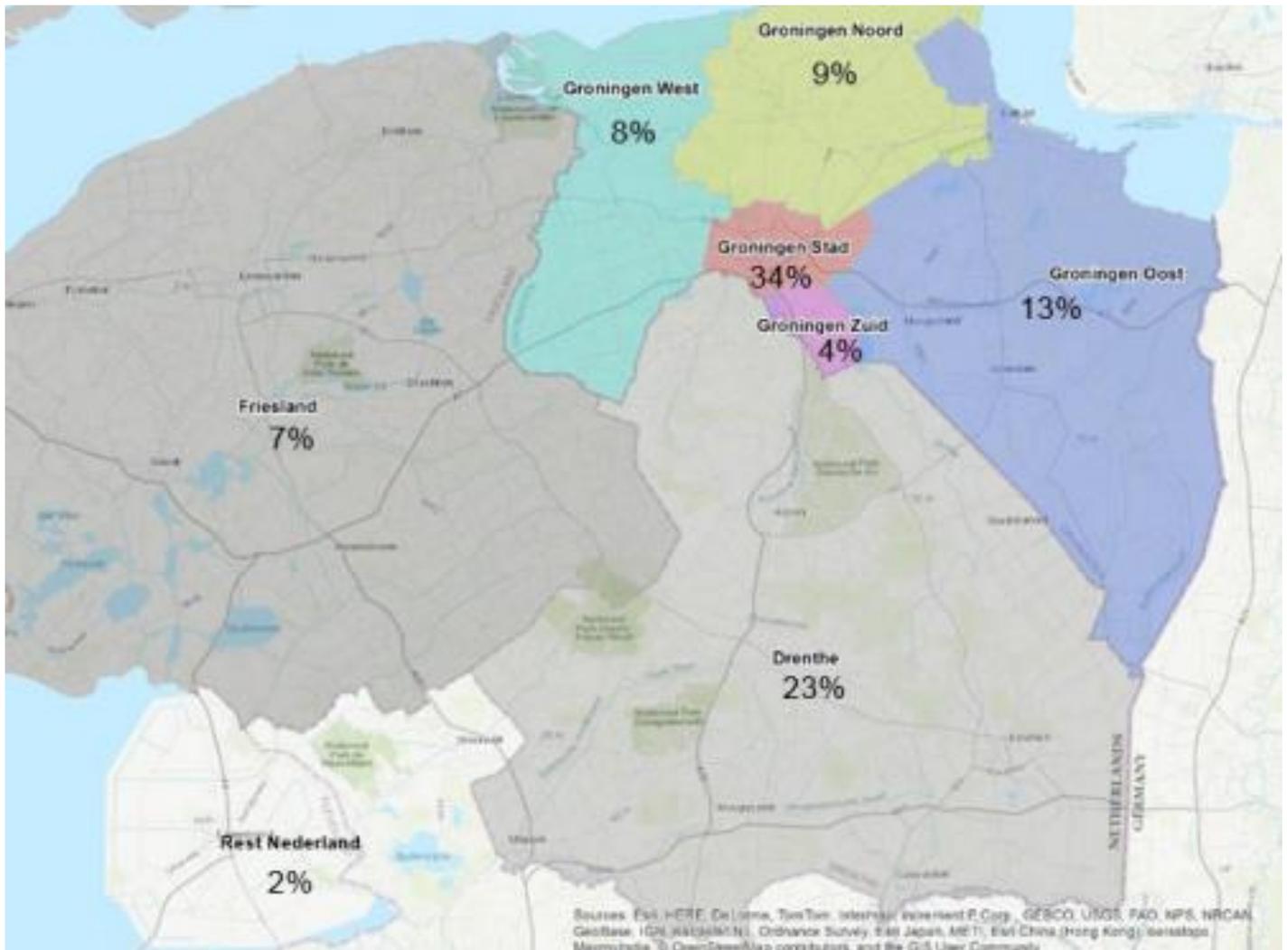


Figure 2: The origin of commuters to the city of Groningen (MuConsult, 2018)

**Research problem:**

An upcoming trend which reduces the car-use is the usage of regular bikes or electric bicycles (from now on called ‘e-bikes’) instead of the car for commuting. The e-bike, because of its electronic support, is becoming a more popular alternative for the car than the regular bike for longer distance trips (Fyhri et al., 2017). This has to do with the extra benefits of in comparison with regular bikes with regards to travel range and efforts. These benefits of the e-bikes have also regards to “*promoting increased travel distance, easier acceleration from stops, and higher average speeds while overcoming challenging terrain and other obstacles*” (Langford et al., 2015, p.220). The benefits of the e-bike, the number of commuters living outside and working inside the city of Groningen together with the ambitions of the municipality of Groningen to reduce car-use and to focus on alternative transport modes in the future emphasize the importance of the focus on the e-bike as an alternative for the car for commuting to Groningen.

## Research questions

How the municipality and province of Groningen together with cooperating companies is already encouraging the target group of the research, people living outside the city borders within a radius of 21km and working inside the city, to use e-bikes instead of the car for commuting and how this can possibly be improved according to this target group will be investigated in this research. To address this topic, the following main research question is composed:

How commuters to the city of Groningen can be incentivized to use the e-bike instead of the car for commuting?

Sub-questions:

- How is the target group already incentivized by current policy in Groningen to use the e-bike?
- What are the motives for e-bike users to use the e-bike for commuting to Groningen?
- What could be possible incentives for car users to use the e-bike instead of the car for commuting to Groningen?
- How can the current policy in Groningen, with regards to encouraging people to use the e-bike for commuting instead of the car, be improved based on focus points as result of the questionnaire survey?

## Structure of thesis

In the next section, the theory behind this travel mode choice is discussed. The theoretical framework is the basis for the conceptual framework. The conceptual framework consists of the fundamental concepts and relations underlying this research. These will have the form of influencing factors regarding this travel mode choice. Further, in the methodology is explained how the answers for the research questions will be found. This research uses mixed methods for data collection. Secondary data is obtained in the form of policy reports. Besides, primary data is collected using an online questionnaire survey. The analysis of the data is pointed out in this section as well. How these data collection and analysis methods has come to results is appointed in the results section. In this section and in the end, in the conclusion is also paid attention to a recommendation for future policy.

## **Theoretical framework**

### **The e-bike as an alternative for the car**

Cycling to your work brings benefits for both individuals and the society as a whole. For individuals can commuting by bicycle instead of other transport modes result in better health conditions and a reduction of travel costs. For society, the benefits have the form of environmental sustainability, public health improvements and cheap infrastructure requirements (Heinen et al., 2010). Disadvantages of cycling are the uncertainty of the weather circumstances you have to deal with and the physical effort you have to make when cycling (Heinen et al., 2010). For the last aspect, the e-bike is a good solution. The e-bike is a bicycle with electronic support powered by a battery. The electronic support is optional and helps you cycle faster with making less effort until the velocity of 25km/h. From a legal perspective, e-bikes in the Netherlands belong to the same category of vehicles as the regular bike (BOVAG, 2014). This research focuses on pedal-assisted e-bikes only. The main advantage of e-bikes in comparison with regular bikes is that they could substitute journeys by car that are not likely to do with a regular bike. This is why the role of the e-bike in low carbon transport and healthy city policies could be significant (Jones et al., 2016).

### **Factors determining this transport mode choice**

To answer the question about how to incentivize people to use the e-bike instead of the car for commuting, it is necessary to set out the different factors determining this choice. The only relevant factors for this research are the factors that could be influenced by policy. Once these factors are set out, we can have a look on how the current policy in Groningen is affecting these factors. According to Heinen et al. (2010), the factors influencing bicycle use differ from other transport modes. This is due to the fact that cycling requires physical effort. Besides, cycling for commuting is influenced by other factors than cycling for leisure. Heinen et al. (2010) subdivide five sets of factors influencing bicycle use. These sets of factors together with additional literature are the basis for the theory underlying this research. However, this research will focus on policy-related and e-bike related factors in particular.

### **Infrastructural and build environment related factors**

The build environment and the corresponding infrastructure as a result of spatial planning forms the first set of factors. These factors have on their place influence on travel costs, effort, and time. According to Wuerzer and Mason (2015) travel distance is an important factor for people deciding whether or not to take the bike. The same applies for e-bikes except from the fact that these are used for longer distances than normal bikes (Cherry and Cervero, 2007). They also point out that there are factors determined by the build environment which can influence the impact of the travel distance on peoples transport mode choice: *“Dedicated bike paths, cycle-tracks, bike lanes, and/or park-n-ride/bike facilities can render cycling more efficient and attractive for commuting by enabling cyclists to overcome farther distances with ease and in feasible durations”* (Wuerzer and Mason, 2015, p. 104). In addition to these cycling friendly adaptations to the build environment, the reduction of the number of stops during a trip is another one which can improve the traffic flow and therewith increase the use of bikes. This accounts for e-bikes in particular according to Cherry and Cervero (2007). The reduction of signalized stops and intersections can also increase the safety perception of a certain route (Bai et al., 2013; Langford et al., 2015). The perceived safety during a trip is a determining factor as well. Especially because e-bike users are at a higher risk of injuries (Fishman and Cherry, 2016). The safety provided by the infrastructure can be determined by appropriate build environment policy. It is, for example, assumed to be safer to separate cyclists from other transport modes using separated cycling paths (Heinen et al, 2010). Next to the safety and distance related factors, is place valuation another factor affecting transport mode choice. The aesthetic value of the build environment along certain routes can affect people’s place valuation and therewith their enjoyment. This accounts for active transport mode users, like cyclists or pedestrians, in particular (Böcker et al., 2015). Lack of enjoyment of a cycling journey to work is a frequent reason not to do it (Heinen et al., 2010). However, promoting the enjoyment of using the e-bike for commuting can support the development of sustainable transport systems (Plazier et al., 2017).

### **Bike facilities at work**

It is worth mentioning that policy influencing e-bike use does not always have to be developed by the public sector. Employers can make their company a bike-friendly one. Bike amenities at work could help the promotion of commuting by bike (Heinen et al., 2010;

Wuerzer and Mason, 2015). Possible bike amenities at work could have the form of showers, storage places and charging points for e-bikes.

### **Social, psychological, and economic factors**

Policy does not necessarily have something to do with the build environment. Social and economic incentives could also play a role in affecting people's transport mode choice (Riggs, 2017). By raising awareness of the environmental issue caused by increased car-use, people could be socially incentivized to choose other, more sustainable transport modes (Morton et al., 2017). This awareness, once created, could also cause a guilty feeling towards the other participants of the society which can eventually express itself in social pressure. Therefore, social pressure and the degree of environmental concern are both factors affecting commuter's transport mode choice (Donald et al., 2014). These factors are of a psychological nature and have to do with the social norm and common practice. Moser et al. (2018) named another psychological factor. People's travel behaviour seems to be habitual. This means that people will not easily shift transport modes. They also point out that life changing events or external disruptions like natural disasters could change these habits. Disruptions like these could be imitated by specific policy. Organizing e-bike trials has the potential to change external factors which causes a shift towards more sustainable behavior (Moser et al., 2018).

Economic factors play a role in the decision whether or not to use the e-bike for commuting as well. Travel costs that belong to an e-bike are the purchase price, charging costs, and maintenance. However, these are not the only costs which should be taken into account. Financial rewards for cycling to work and the alternative costs, when using a car for the same journey also play a role in the economic considerations (Heinen et al., 2010). In comparison with the car, the main financial benefit of the e-bike besides the purchase price, parking prices, and road tax, is that you do not have to pay for gasoline. A regular bike is another and cheaper alternative for the car. However, the e-bike is most of the time used as a replacement of motorized transport (Fyhri et al., 2017 ). The way in which e-bikes are a better alternative for the car than regular bikes is a factor determining the willingness to pay. This has to do with the benefits of e-bikes above traditional bikes that are related to ease, convenience and speed (Fyhri et al., 2017).

### Conceptual model

The factors named in the theoretical framework and their interdependent relations are shown in this model (see figure 3). The model is divided in two parts. In the red part on the upper side, the different types of policies are displayed. The blue part is about different factors affecting the choice whether or not to use the e-bike for commuting on which policy can have influence. The link between the two parts shows how policy can have influence on these factors.

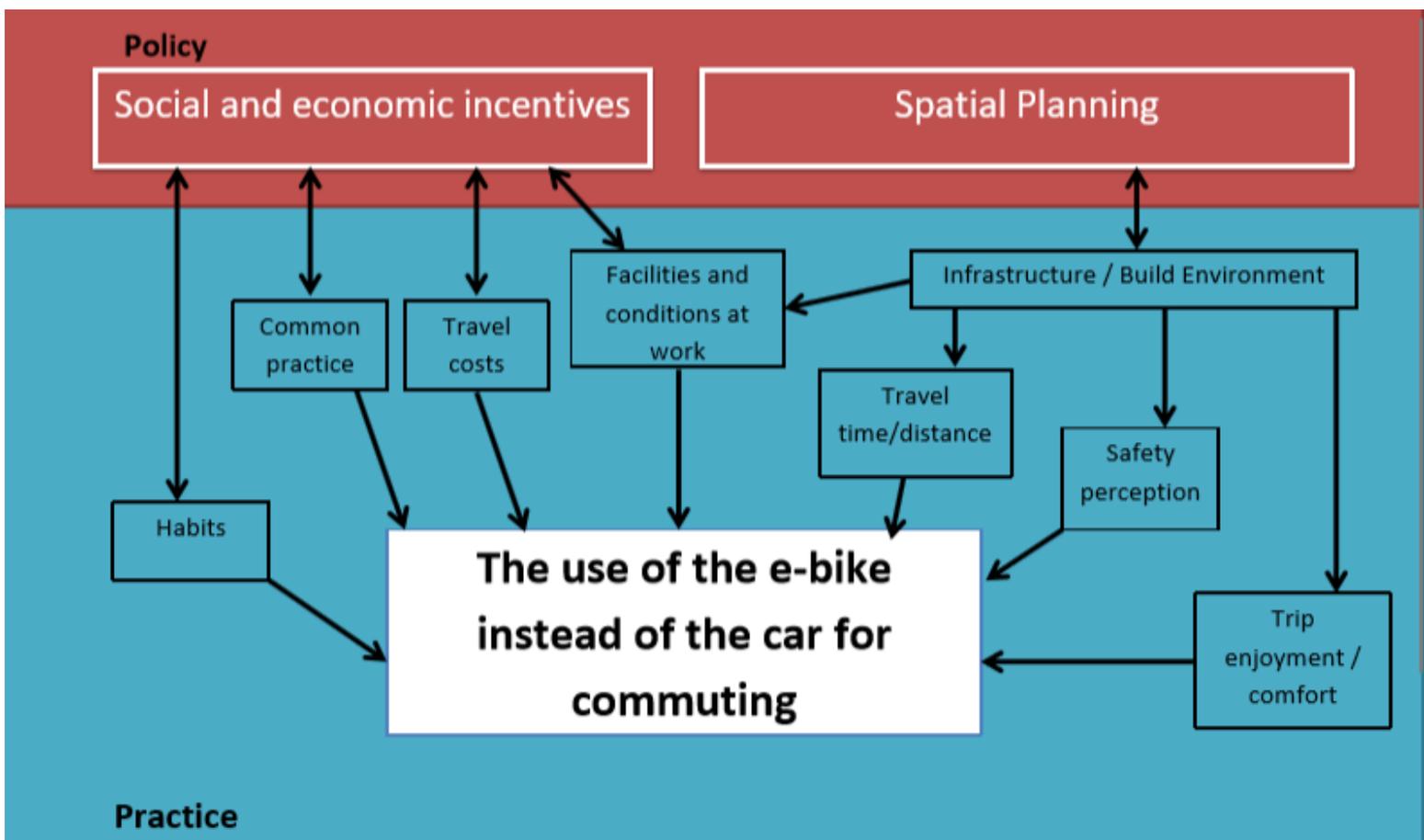


Figure 3: The conceptual model, based on the theoretical framework (Daan Schmidt, 2019)

## Methodology

Both primary and secondary data will be used to answer the main research question. The region in which the research and data collection will take place is the surrounding of the city Groningen. There is a certain limit to distance which are likely to overtake with an e-bike for commuting purposes. Therefore, take the longest distance traveled by a respondent who uses the e-bike for commuting will be taken as the limit for the radius surrounding the city of Groningen. The collection of primary data will be done using an online questionnaire survey. The secondary data collection will have the form of a data analysis using policy reports regarding (e-)bike strategies of the municipality, province of Groningen, and cooperating parties.

## Policy analysis

To answer the first sub-question: “How is the target group already incentivized by current policy in Groningen to use the e-bike?” a policy analysis will be done. Different reports of the municipality and province of Groningen and cooperating parties with regards to traffic, accessibility, bike strategies and how to incentivize people to use sustainable alternatives for the car will be analyzed. The different policies will be linked to the factors named in the theoretical framework. The different aims and actions within the policy reports will be linked to one or more factors affecting the transport mode choice of the target group as displayed in the conceptual model.

The following reports will be used as source of secondary data to answer the first sub-question:

- Groningen Fietsstad (2015). Fietsstrategie 2015-2025: This report consists of the strategy of the municipality of Groningen with regards to cycling for the period 2015-2025.
- MuConsult (2018)<sup>1</sup>. Effectmeting mobiliteitsmanagement: This report is made by a consultant company to evaluate the effect of the mobility management of Groningen Bereikbaar which aims at improving the accessibility of Groningen. They cooperate with 81 partner organizations which include more than 50.000 employees. One main focus point of Groningen Bereikbaar is to let commuters use alternative transport modes than the car.

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<sup>1</sup> This report developed by MuConsult is obtained on request and not available online

- Provincie Groningen (2016). Verbinden met de fiets, fietsstrategie 2016-2025: This report is made by the province of Groningen. It is mainly about connecting more places by cycling paths and consists of the cycling strategy for the province of Groningen for the period 2016-2025.

During the analysis of these policy reports, the focus will be on policy with a direct relation to the topic of this research whereas the named reports address broader topics as well. Due to the cooperation of the different parties, the municipality, the province, and Groningen Bereikbaar, there are multiple measures or strategies in one report which are repeated in another. These will be notated as a single measure or strategy with multiple sources.

### Questionnaire survey

For answering the second and third sub-questions: “What are the motives for e-bike users to use the e-bike for commuting to Groningen and what could be possible incentives for car users to use the e-bike instead of the car for commuting to Groningen?”, a questionnaire survey among the target group, consisting of commuters living outside and working inside the city of Groningen, will be executed. Both e-bike users and car users will be part of the respondents. This will result in a broader view from both sides of what reasons and considerations people have to make this decision. The different topics discussed in the questionnaire will be based on the factors named in the theoretical framework. This means that every question will relate to at least one of the named factors of the conceptual framework. This will make the connection to the policies, which is listed based on the same factors, a logical one.

The data collected through the questionnaire will lead to answers for the research questions in different ways. At first, for car users there is a question about in what extent a certain development could be an incentive for car users to use the e-bike instead. Next to this, e-bike users will be asked what developments made them see the benefits of using an e-bike. These questions need to be answered using a fixed Likert scale. A five-point Likert scale will be used because it provides more information than a three-point scale. However, when the number of categories increases, respondents could lose their attention (McLafferty, 2016). Therefore, a five-point scale is a good option in between. These questions will lead to information about what developments were incentives for people to use the e-bike and what developments could be incentives to do it in the future.

The questionnaire survey as used in this research could be found in appendix III. The choice for an online questionnaire survey is because its distribution options through e-mail, Internet, and social media (McLafferty, 2016). The recruitment of participants will also be done using these mediums. Because the target group is a relatively specific one with multiple requirements, both passive and active recruitment of respondents will be done. Several people, companies, and organizations will be asked to fill in the questionnaire and distribute it further. In order to let the distribution and execution of the questionnaire survey be ethically justified and anonymously done, respondents will not be asked to give their name or address and filling in the survey will just take about 3 minutes. However, the respondents will be asked to fill in their place of residence and zip code of their working place. The purpose of this, is to be able to calculate the shortest cycling distance to their work using Google Maps. This information is necessary to confirm whether the respondents fits in the target group or not.

The goal is to gain results of at least 50 respondents despite the specific requirements of the target group. Nevertheless is the total amount of people in the population of the target group will probably be about a tenfold of this (MuConsult, 2018). It is therefore impossible to achieve a completely representative research. The research design is too small and the available amount of time for this bachelor thesis project is not enough to reach a representative amount of respondents that meets the named requirements. The results of the questionnaire survey will therefore be used for exploring the topic. So unfortunately, the analysis of the results will just give an indication for focus points for future policy. The results will have the form of frequency tables which give a clear overview of the divide of respondents over the different answer options. Besides, a map showing the distribution of the respondents around Groningen will be made to give the results a geographical context.

### **Policy recommendation**

As already mentioned, the factors which could be incentives for people to use the e-bike which have already worked the most according to the e-bike users or which could potentially be most influential in encouraging car users to do so, will be used as points of attention for future policy. Besides, it will be checked whether these aspects are already emphasized in the already consisting policy .

## Results

The results of this results are divided in two sections. The first section consists of the strategies as result of the policy analysis as explained in the methodology. The second section shows the results of the questionnaire survey. This section is divided in two sections as well. One part is about the commuters who already use the e-bike for commuting. The other shows the results of the questionnaire among the car users.

### 1. Policy analysis

The first part of the research consists of an analysis of the current policy with regards to encouraging commuters to Groningen to use the bike and in particular the e-bike. Three policy reports, as named in the methodology, are analyzed to find the different types of measures and strategies which are developed by the municipality and province of Groningen together with cooperating parties.

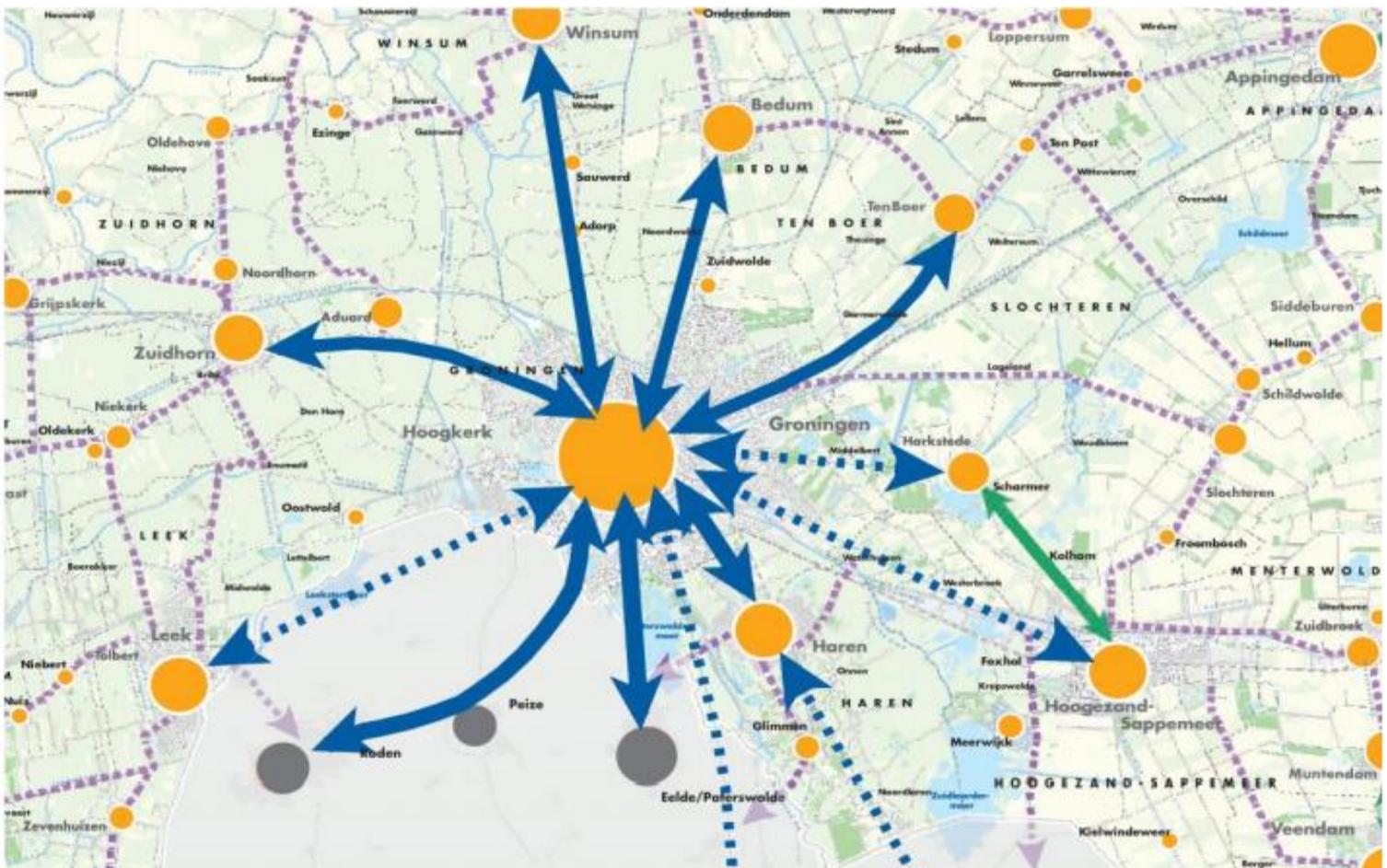


Figure 4: The 'Fietsroute Plus' network surrounding the city of Groningen, the already consisting routes are displayed in blue, the planned routes in blue dots (Provincie Groningen, 2016)

## The current policy strategies in Groningen regarding e-bikes

### *Infrastructure and build environment related measures*

A majority of the measures have to do with the build environment infrastructure. One of the most important measures is the so-called 'Fietsroutes Plus' project. The aim of this project is to realize eight comfortable direct cycling routes to the city of Groningen from different villages in the surrounding of the city for distances until 15 km (see figure 4). Cyclists have as much priority as possible along these routes which results in a better traffic flow and reduced travel time for cyclists. All cycling paths on these routes are four meters wide. This means that it is easier and safer for e-bike users to catch up others. Besides, in contrast to the situation before, along a couple of these routes, the cycling paths are separated from the regular roads. Separating cars from bikes is one of the general aims of the municipality of Groningen as well. The overall purpose of these infrastructural measures is both to reduce the travel time along the main cycling routes to the city and to increase the safety for the users of these routes. A part of one of the 'Fietsroutes Plus' is displayed below in figure 5. Within the city of Groningen, another strategy which reduces travel time for cyclists is called 'cyclists first'. This strategy focuses on the attention for the role of cyclists during large infrastructural projects. This means that there are alternative routes made for cyclists during road construction projects for example.

There are also more technical infrastructural measures with the purpose to increase the safety for cyclists. After multiple complains, the Province aims at preventing slippery conditions at cycling paths during the winter. One way they want to accomplish this, is to use solar energy or city heat to heat the cycling paths. At locations where this is not possible the Province want to give more attention to address the problem of slippery cycling paths



Figure 5: The 'Fietsroute Plus' between Oostwold and Groningen is called 'quick and comfortable'. (Provincie Groningen, 2016)

which cause unsafe situations for cyclists. Besides the slippery conditions there are other conditions a cycling path could have. Users of cycling paths could share their complains about the quality of the path using a tool to inform the maintainer. The Province pays attention to the clarity of the edge marking and road signs as well to make the cycle paths 'self-explaining'. This could warn the users of the cycle paths at certain crossings and so helps to increase the safety of the cyclists just as the previously named measures do.

It is also possible to use different transport modes during the journey to work. Several facilities at P+R and public transport hubs are needed to make the switch between these transport modes possible. One of the measures named in the cycling strategy is to increase the amount, and improve the quality of facilities for e-bikes at these locations. These facilities could have the form of solar panel powered charging points for e-bikes and lockers in which you can store your e-bike. Besides, it is already possible at some locations to rent e-bikes to use them for the last part of the journey to your work. These are all measures which aim at making it more convenient and more comfortable for commuters to use the e-bike for a part of the journey to work.

#### *Social and economic incentives*

Not all measures have directly to do with the build environment. The municipality of Groningen is working with promotional campaigns as well. A striking part of this is that they created the brand 'cycling city Groningen' (see figure 6). The intention of this is to promote cycling by linking the image of the city to cycling and make the citizens proud of it. There are also more specific actions done for commuters in particular next to this general promotion of cycling. Groningen Bereikbaar is promoting the use of alternative transport modes for commuting to reduce the amount and intensity of traffic jams in the city. They cooperate with 81 companies in the city in order to inform the employees of these companies about the benefits of using alternative transport modes to the car like the e-bike. To make sure not only these employees are informed well about the smartest, fastest, shortest, and safest cycling routes to their work, the municipality of Groningen aims at improving travel information for cyclists both online and along the cycling routes as well.



**Figure 6: The 'cycling city' logo of the municipality with the areal phone code 050 incorporated into it (Groningen Fietsstad, 2015)**

Groningen Bereikbaar have organized several actions with regards to consciously considering your transport mode for commuting for the companies they are in contact with. One of these is persuading employers of these companies to compensate the travel costs of their employees who use alternative transport modes to the car, just as they compensate their employees who use the car. Next to this, they arranged a sustainability game called ‘the Low Car Diet’ between the companies and also within these companies between the employees. This game is about using more sustainable transport modes than the car to travel to your work. Other actions which enable employees to win prizes for using (e-)bikes for commuting are the ‘national cycle to your work day’ and ‘Love to Ride FC Groningen’. Next to cooperating with large employers in the city, Groningen Bereikbaar cooperates with some local bicycle dealers as well. One purpose of this is to create e-bike sales for commuters to the city of Groningen. Another result of this cooperation is the possibility to try out an e-bike for free. The different actions, their publicity, and the share of participants as evaluated by MuConsult (2018) in their investigation among commuters to Groningen are showed in table 1.

<b>Action</b>	<b>Content</b>	<b>Publicity</b>	<b>Participants as share of the people who are familiar with the action</b>
Low Car Diet	Sustainability game between companies and employees of these companies to travel to your work as sustainable as possible	17%	15%
National cycle to your work day	Cycling to your work on this day gives you the possibility to win prizes or support a charity	23%	29%
Love to Ride FC Groningen	A mobile application which gives you the possibility to win prizes provided by FC Groningen. The chance to win a prize increases as you cycle more	2%	17%
(E-)bike sales	(E-)bike sales at cooperating bicycle dealers for employees of the participating companies	5%	10%
Free try out periods	The possibility to try out an e-bike for free made thanks cooperating bicycle dealers	18%	12%

Tabel 1: The different actions organized by Groningen Bereikbaar and corresponding publicity and participants as result of the evaluation of MuConsult (MuConsult, 2018)

## 2. Questionnaire survey

### General characteristics of the respondents

The online distribution of the questionnaire survey resulted in an amount of 120 respondents of which only 52 met the requirements of the target group as explained in the methodology. The location of the places of residence of the 52 respondents together with the transport mode they use for commuting is showed in the map in figure 8. Of these people, 31 use the e-bike for commuting and 21 use the car.

The average age of both types of commuters is about 48

years. The average travel distance of e-bike users is lower (10,77km) than that from the car users (13,39km) (see figure 7). Another characteristics that stands out is the fact that more than 70% of the respondents is female. This has influence on the representative quality of the research. All the other results in the form of frequency tables can be found in appendix III.

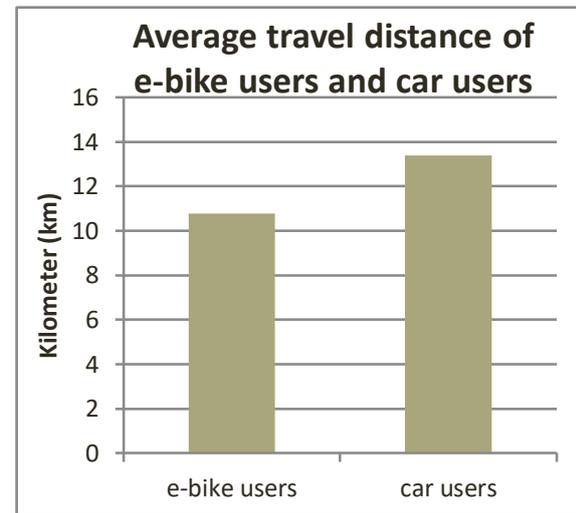


Figure 7: The average travel distance of the e-bike users and car users in this research

### Motives of the respondents regarding e-bike use for commuting

#### *E-bike users*

The most interesting e-bike users for this research are the ones who previously used the car for the part of their journey to work for which they now use the e-bike. From the e-bike users in this sample, 32,3% used the car before and 51,6% used a regular bike before. An analysis of the results on multiple factors of these two sets of e-bike users showed a difference. The Mann-Whitney U test showed significant differences between the different groups of e-bike users in the results on Likert scale questions about the following aspects: improvement of travel advice, decrease in travel distance/time, change of travel habits in general, and an increased awareness of positive health effects (see 'tests' section in appendix III). There is, therefore, chosen to have a closer look on the e-bike users who used the car before as this is the most relevant type of e-bike users for this research.

# The respondents' transport mode choice and place of residence

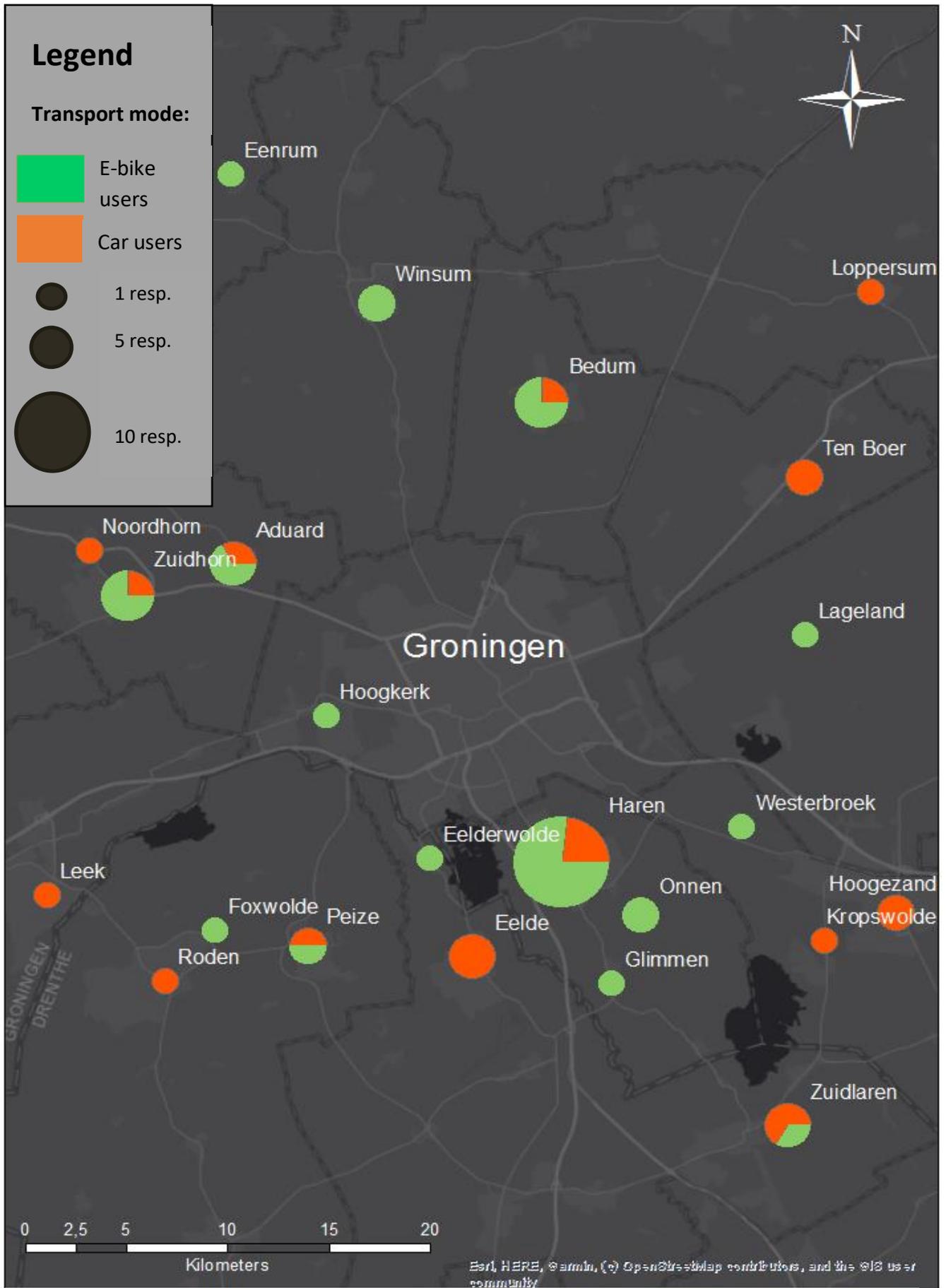


Figure 8: Map showing the respondents' transport mode choice and place of residence (Daan Schmidt, 2019)

The results of the respondents who previously used the car for commuting show accordance among them. Therefore, only the aspects with the highest scores of agreement will be shown. With regards to infrastructural aspects only the question about the improved traffic flow scores high. Namely 70% agrees with the statement that an improved traffic flow with the use of an e-bike made them recognize the benefits of the e-bike. Other aspects that stand out are the improvement of travel advice (40% agree, 20% strongly agree), increased awareness of the possibility to save on travel costs (40% agree, 20% strongly agree), increased awareness of the consequences for the environment (70% agree, 10% strongly agree), and a change of travel habits in general (70% agree). The most influential aspect that made the respondents see the benefits of the e-bike has to do with their own health conditions. An increased awareness of the positive effects of using an e-bike for the health conditions was for almost all respondents (60% agree, 30% strongly agree) an incentive to use the e-bike. The answers on the open question about aspects which are not mentioned in the questions also show interesting findings. One respondent wrote: *“E-bike is faster than the car; no parking costs”*.

The respondents who used a regular bike before also show accordance with each other in the answers on the open question. Arriving at work less sweaty is a frequently mentioned reason to take the e-bike instead. Besides, there are a couple of respondents who mention health issues as an incentive to take the e-bike.

### *Car users*

The main purpose of the questionnaire survey among the car users is to find incentives which could eventually trigger them to use the e-bike instead. These incentives may not be applicable when you need a car to execute your job. From all 21 car users who responded to the questionnaire, only 1 person occasionally needs the car for his/her job. This is, therefore, ignored in analyzing the results. There are two respondents who indicated that they are physically not able to cycle to their work. The results of these respondents are not taken into account in the analysis. After analyzing the results of the remaining 19 respondents, a couple of developments or changes that could be an incentive for them to use the e-bike instead of the car stand out. Only about 20% of the respondents disagrees with a reduced travel distance or travel time as result of using the e-bike being an incentive for them to use the e-bike instead. Besides, more than 50% does agree with this. It might be useful for these people to check whether the use of an e-bike causes an reduction in the travel time to their work as it could be an incentive for them to use the e-bike. In addition, more than 60% of the car users in this research agrees with an increased traffic flow being a potential incentive to use the e-bike. An increased traffic flow can also reduce the overall travel time. Both these findings emphasize the importance of the factor travel time. To a lesser extent but nevertheless worth mentioning, the respondents in this section agree with an increased safety perception (36,8%) and an increase in the amount separated cycling paths (31,6%) being possible incentives to use the e-bike. These findings show that the purpose of the current infrastructural policy to reduce travel time and to improve the safety on cycling paths is not without a reason.

An improvement of the facilities at work did not turn out to be a influent factor. However, an increase in beneficial promotions at work for using the e-bike could be an incentive for the majority of car users (52,6% agrees and 26,3% strongly agrees). Economic developments turn out to be potential incentives as well. Both these developments, a reduced purchase price of an e-bike (47,6% agree, 23,8% strongly agree) and an increased awareness of the possibility to save on travel costs by using an e-bike (52,4% agree, 9,5% strongly agree), confirm this. For the reduced purchase price of an e-bike, the same problem as for the beneficial promotions at work arises. The extent of the reduction is not given in this survey. Therefore, this factor is hardly any interpretable.

Two other aspects which are already emphasized in the current policy are potential incentives for the car users who responded. These findings indicate that people seem not completely aware of the consequences of their commuting transport mode choice. An increased awareness of the positive effects of using an e-bike for commuting on their health conditions, is for almost three quarters of the respondents (42,1% agree, 26,3% strongly agree) a potential incentive to use the e-bike instead of the car. Another example has to do with the environmental impact of certain transport modes. The majority of car users in this research agree that an increased awareness of the environmental impact of their transport mode choice could be an incentive to use the e-bike (63,2% agree, 10,5% strongly agree). According to these results and knowing the effects of these aspects as explained earlier in this paper, the car users even admit that they are not completely aware and that an increase in this awareness could be an incentive for them to use the e-bike instead.

## Conclusions

The consisting policy strategies show multiple actions and measures with regards to both spatial planning and social and economic incentives. The 'Fietsroute Plus' cycling network connecting the city of Groningen with the surrounding villages is the main spatial planning project with regards to this subject. Groningen Bereikbaar is focusing on social and economic incentives by being in contact with about 50.000 employees with the purpose to make them conscious about their transport mode choice. After all, we could say that there is serious attention given to cycling policy in general in and around the city of Groningen by developing multiple cycling strategies for the future. Nevertheless, the intention of this research is to find focus points for future policy to improve these strategies. The results of the questionnaire filled in by car users and e-biker users who previously used the car give us some interesting indications of focus points for future policy. Except of the increased traffic flow with the use of an e-bike, infrastructural aspects do not turn out to be influential aspects in the extent of the following aspects. The increased awareness of the environmental impact and the positive effects on health conditions of using an e-bike for commuting turn out to be the most influential incentives for both groups. Although this research has an exploring character, we can conclude that it might be useful for future policy strategies, with the same purpose as the strategies discussed in this research, to focus on these two aspects. This could possibly be realized by emphasizing the two aspects while persuading commuters to avoid traffic congestions by using alternative transport modes as Groningen Bereikbaar is already doing. An increase of the publicity and the amount of participants of their actions could possibly contribute to this emphasis as well. On this way, the purpose of the municipality to improve the vitality of the inhabitants could eventually be used as a means to realize it. There are namely multiple actions organized to incentivize commuters to use the (e-)bike, but almost none of them is literally emphasizing the purpose of increasing awareness of the two named aspects. How this could be efficiently executed in reality is an interesting topic for further research.

## **Limitations**

Although the research went well in general, there are still some points of improvements. To begin with the questionnaire survey, the amount of respondents is not enough to name this sample a representative one. Although in the first case a total of 120 people responded, only 52 turned out to be of the right target group. Although I tried to mention the requirements of the target group appropriately in the request to fill in the questionnaire, people seem to still not completely understand it. Recruiting more respondents with the right requirements turned out to be too difficult. More time, connections and eventually money is needed to recruit more respondents. Nevertheless, is the previously set target of 50 respondents achieved and can be concluded that the situation was estimated well in advance. Next time when I have to do a research of this extent, I will make sure that the target group of the research has not that strict requirements as that of this research. It will probably be easier to recruit participants and more convenient to analyze the results.

Also the content of the questionnaire can be better next time. Unless the fact that it was extensively tested beforehand, some complains were received about uncertainties while reading the questions. These were mainly about the questions on Likert scale. Next time, the different options should be notated more to the point and better understandable for everyone. Next to this, the economic aspects in the questionnaire are not well interpretable due to the formulation. Also for analyzing the results, it would eventually have been more interesting to find some correlations using statistical tests. The data collected in this research was not suitable for this application to get relevant results.

## References

- Bai, L., Liu, P., Chen, Y., Chang, X. and Wang, W. (2013). Comparative analysis of the safety effects of electric bikes at signalized intersections. *Transportation Research Part D: Transport and Environment*, 20, 48-54..
- Böcker, I., Dijst, M., Faber, J. and Helbich, M. (2015). En-route weather and place valuations for different transport mode users. *Journal of Transport Geography*, 47, 128-138.
- BOVAG (2014). Keuzewijzer E-bike. BOVAG. Derived on 20-1-2019 from <http://www.verbakeltweewielers.nl/wp-content/uploads/2013/01/Keuzewijzer-e-bike-okt.-2013.pdf>
- Buekers, J., Dons, E., Elen, B. and Int Panis, L. (2015). Health impact model for modal shift from car use to cycling or walking in Flanders: application to two bicycle highway. *Journal of Transport & Health*, 2, 549–562.
- Cherry, C. and Cervero, R. (2007). Use characteristics and mode choice behavior of electric bike users in China. *Transport Policy*, 14, 247–257.
- Donald, I.J., Cooper, S.R. and Conchie, S.M. (2014). An extended theory of planned behaviour model of the psychological factors affecting commuters' transport mode use. *Journal of Environmental Psychology*, 40, 39-48.
- Fishman, E. and Cherry, C. (2016). E-bikes in the Mainstream: Reviewing a Decade of Research. *Transport Reviews*, 36(1), 72-91.
- Fyhri, A., Heinen, E., Fearnley, N. and Sundfør, H.B. (2017). A push to cycling—exploring the e-bike's role in overcoming barriers to bicycle use with a survey and an intervention study. *International Journal of Sustainable Transportation*, 11(9), 681–695.
- Gemeente Groningen (2017). Meerjarenprogramma Verkeer en Vervoer 2018 – 2021.
- Groningen Fietsstad (2015). Fietsstrategie 2015-2025. Derived on 1-3-2019 from [https://groningenfietsstad.nl/friksbeheer/wp-content/uploads/2016/03/Groningen\\_Fietsstad\\_Strategie\\_2015-2025.pdf](https://groningenfietsstad.nl/friksbeheer/wp-content/uploads/2016/03/Groningen_Fietsstad_Strategie_2015-2025.pdf)
- Heinen, E. van Wee, B. and Maat, K. (2010). Commuting by Bicycle: An Overview of the Literature. *Transport Reviews*, 30(1), 59-96.
- Jones, T., Harms, L. and Heinen, E. (2016). Motives, perceptions and experiences of electric bicycle owners and implications for health, wellbeing and mobility. *Journal of Transport Geography*. 53, 41-49.
- Langford, B.C., Chen, J. and Cherry, C.R. (2015). Risky riding: Naturalistic methods comparing safety behavior from conventional bicycle riders and electric bike riders. *Accident Analysis & Prevention*, 82, 220-226.
- McLafferty, S. (2016). Conducting questionnaire surveys. "In" N. Clifford, M. Cope, T. Gillespie and S. French (Red.), *Key Methods in Geography* (pp. 192-141), Glasgow: Sage.
- Ministerie van Infrastructuur en Milieu (2017). Mobiliteitsbeeld 2017.

- Morton, C., Budd, T., Harrison, G. and Mattioli, G. (2017). Exploring the Expectations of Transport Professionals Concerning the Future Automobility System: Visions, challenges and transitions. *International Journal of Sustainable Transportation*, 11 (7), 493-506
- Moser, C., Blumer, Y. and Hille, S.L. (2018). E-bike trials' potential to promote sustained changes in car owners mobility habits. *Environmental Research Papers*,13(4), 1-6
- MuConsult (2018). Effectmeting Mobiliteitsrapport.
- Plazier, P.A., Weitkamp, G. and van den Berg, A.E. (2017). "Cycling was never so easy!" An analysis of e-bike commuters' motives, travel behaviour and experiences using GPS-tracking and interviews. *Journal of Transport Geography*, 65, 25-34.
- Provincie Groningen (2016). Verbinden met de fiets, fietsstrategie 2016-2025. Derived on 15-3-2019 from [https://www.provinciegroningen.nl/fileadmin/user\\_upload/Documenten/Beleid\\_en\\_documenten/Documentenzoeker/Verkeer\\_en\\_vervoer/Fiets/Fietsstrategie-2016-2025-Verbinden-met-de-fiets.pdf](https://www.provinciegroningen.nl/fileadmin/user_upload/Documenten/Beleid_en_documenten/Documentenzoeker/Verkeer_en_vervoer/Fiets/Fietsstrategie-2016-2025-Verbinden-met-de-fiets.pdf)
- Riggs, W. (2017). Painting the fence: Social norms as economic incentives to nonautomotive travel behavior. *Travel Behaviour and Society*, 7, 26–33.
- Urry, J. (2004). The 'System' of automobility. *Theory, Culture & Society*, 21 (4-5), 25-39.
- Wuerzer, T., and Mason, S. G. (2015). Cycling willingness: Investigating distance as a dependent variable in cycling behavior among college students. *Applied Geography*, 60, 95–106.

## Appendices

### Appendix I: Policy analysis results

Table 2: Results of the policy analysis listed per factor as shown in the conceptual model

Factors	Measures
Build environment/ Infrastructure (Multiple sub-factors)	<ul style="list-style-type: none"> <li>• Fietsroutes Plus (FP), the realization of eight “wide (four meters) and comfortable” bicycle routes to the city of Groningen for distances until 15 km (see figure) (Province and municipality of Groningen)</li> <li>• Cyclists First, Attention for the role of cyclists in developments and infrastructural projects with other purposes than facilitating cyclists (Province and municipality of Groningen)</li> <li>• Applying solar panels on bicycle stands in order to create charging points for e-bikes (Province of Groningen)</li> <li>• Improve the comfort and quickness of the main cycling network between the most important commuting areas for e-bike users by broadening the cycle paths and improve the quality of the asphalt (Municipality of Groningen)</li> <li>• Separate cyclists from cars as much as possible (Municipality of Groningen)</li> <li>• Offer rental e-bikes at P+R locations to incentivize commuters to use them for the last part of their journey (Municipality of Groningen)</li> <li>• Banners and apps for advice about the smartest, fastest, shortest and safest cycling routes (Municipality of Groningen)</li> </ul>
Habits	<ul style="list-style-type: none"> <li>• Free try out periods for e-bikes (Groningen Bereikbaar)</li> <li>• Include cycle paths around schools in the cycling paths network in order to let children create cycling habits (Province of Groningen)</li> </ul>
Travel costs	<ul style="list-style-type: none"> <li>• E-bike sales at local bicycle dealers (Groningen Bereikbaar)</li> <li>• Arrange travel costs compensation for (e-)bike users with employers (Groningen Bereikbaar)</li> </ul>
Common practice	<ul style="list-style-type: none"> <li>• encouraging a change of behavior towards cycling with promoting new cycling paths (Province of Groningen)</li> <li>• Emphasizing the importance of vitality and the fun of cycling with supporting different events in order to let people realize that cycling is a healthy and funny thing to do (Province of Groningen)</li> <li>• The creation of a 050 Fietsstad-logo for the ‘brand’ Groningen Fietsstad (meaning Groningen Cycling city). The aim is to promote cycling, with regards to commuters as well (Municipality of Groningen)</li> <li>• Love to Ride FC Groningen: Campaign organized by Groningen Bereikbaar. It is about an mobile application which gives you the possibility to win prizes provided by FC Groningen. The chance to win a prize increases as you cycle more (Groningen Bereikbaar)</li> <li>• ‘National cycle to your work day’: Cycling to your work on this day gives you the possibility to win prizes or support a charity. (Groningen Bereikbaar)</li> </ul>

	<ul style="list-style-type: none"> <li>• Low Car Diet: Sustainability game between companies and employees of these companies to travel to your work as sustainable as possible. (Groningen Bereikbaar)</li> </ul>
Facilities at work	<ul style="list-style-type: none"> <li>• The realization of cycling stand of good quality in the city centre and attractive walking routes towards shops (only applicable for people working in the city center) (Municipality of Groningen).</li> <li>• Cooperation with employers to make sure they consciously handle with the mobility of their employees (Groningen Bereikbaar)</li> </ul>
Travel time/distance	<ul style="list-style-type: none"> <li>• Smart traffic lights: Give cyclists from all directions a green light at the same moment to reduce travel time (municipality)</li> </ul>
Safety perception	<ul style="list-style-type: none"> <li>• The use of solar energy or city heat to warm up cycling paths during the winter (Province of Groningen)</li> <li>• More attention to addressing slippery cycling paths during the winter (Province of Groningen)</li> <li>• Maintenance of cycling paths with attention to the complains of the cyclists using a tool (Province of Groningen)</li> <li>• Realization of innovative crossings with reflective lighting to warn car users (Province of Groningen)</li> <li>• Making the cycle paths 'self-explaining' using clear edge marking</li> <li>• The main cycling routes will be kept free of snow (Municipality of Groningen)</li> <li>• High quality traffic lights along the main cycling routes to improve the social safety (Province of Groningen)</li> </ul>
Trip enjoyment /comfort	<ul style="list-style-type: none"> <li>• Contributing to facilities for bikes at P+R's and public transport stations like more bicycle stands, lockable bike stands, charging points and travel information (Province of Groningen, municipality of Groningen, and Groningen Bereikbaar)</li> <li>• Emphasizing the 'peace and space' of the Groningen landscape (Province of Groningen).</li> </ul>

## Appendix II: Questionnaire survey

### Survey Flow:

**Block: Algemene informatie respondent (8 Questions)**

**Branch: New Branch**

**If**

**If E-bike Is Selected**

**Block: For e-bike users (3 Questions)**

**Branch: New Branch**

**If**

**If E-bike Is Not Selected**

**And Car Is Selected**

**Block: For car users (2 Questions)**

**EndSurvey:**

Page Break

**Start of Block: General information respondent**

Q1 Thank you for participating this survey! It will help with improving the quality of the results. This questionnaire is about the transport mode choice of e-bike users and car users commuting to Groningen and living outside the city. The first couple of questions are about some general characteristics of the respondent. The last part is about the influence of different factors on your transport mode choice. Filling in the whole questionnaire will only take about 3 minutes.

Q2 What is your age?

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Page Break

Q3 What do you associate yourself with the most?

- Female (1)
- Male (2)
- Other (3)
- None (4)

Page Break

Q4 What village or city do you currently live in?

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Page Break

Q5 What is the zip code of your working adress?

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Page Break

Q6 Do you have an e-bike?

Yes (1)

No (2)

Page Break

Q7 Which transport mode(s) do you use to travel to your work?

Regular bike (1)

E-bike (2)

Public Transport (3)

Car (4)

Other, namely: (6) \_\_\_\_\_

Page Break

Q8 Do you need one of chosen transport modes during your work?

Yes, namely: (1) \_\_\_\_\_

No (2)

Page Break

**End of Block: General information respondent**

**Start of Block: For e-bike users**

Q9 Which transport mode did you previously use for the (part of the) trip to your work for which you currently use the e-bike?

- Regular bike (1)
- Public transport (2)
- Speed pedelec (3)
- Car (4)
- I have always used the e-bike for commuting (5)
- Other, namely: (6) \_\_\_\_\_

Page Break

**Q10 I chose for using the e-bike to travel to my work. This is because of the recognition of the benefits of the e-bike as a result of:**

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
A decrease in the travel distance/time by using an e-bike (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A better quality of the e-bike facilities at work than before (charging points, stands, showers etc.) (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An increase in beneficial promotions at work as a reward for the use of the e-bike (16)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

An improvement of the quality/amount of e-bike facilities at P+R locations and/or public transport stations (3)	<input type="radio"/>				
An increased safety perception during my commuting trip with the use of the e-bike (4)	<input type="radio"/>				
An improved traffic flow along the route to my work with the use of the e-bike (5)	<input type="radio"/>				
An increase in the amount of separated cycling lanes along my commuting route (6)	<input type="radio"/>				
A lower purchase price of the e-bike than before (7)	<input type="radio"/>				
An increased awareness of the possibility to save on my travel costs by using an e-bike (13)	<input type="radio"/>				
An improvement of the available	<input type="radio"/>				

travel advice  
about the  
shortest,  
fastest and  
most safe  
cycling route  
(14)

An increased  
awareness of  
the  
consequences  
for the  
environment  
of my  
transport  
mode choice  
(9)

A change of  
my travel  
habits in  
general (10)

A change of  
the social  
norms with  
concerns to  
transport  
mode choice  
(11)

An increased  
awareness of  
the positive  
effects of  
using an e-  
bike for my  
health  
conditions  
(12)

Page Break

Page Break

Q11 Is there another important reason why you chose for using the e-bike for commuting?

- Yes, namely (6) \_\_\_\_\_
- No (7)

**End of Block: For e-bike users**

**Start of Block: For car users**

*Carry Forward All Choices - Displayed & Hidden from "Q10"*

*Carry Forward All Answers - Displayed & Hidden from "Q10"*



Q12 The following development/change could be an incentive for me to use the e-bike instead of the car for commuting:

	Strongly disagree (1)	Disagree (2)	Neutral (4)	Agree (5)	Strongly agree (6)
A decrease in the travel distance/time by using an e-bike (x1)	<input type="radio"/>				
A better quality of the e-bike facilities at work than before (charging points, stands, showers etc.) (x2)	<input type="radio"/>				
An increase in beneficial promotions at work as a reward for the use of the e-bike (x16)	<input type="radio"/>				
An improvement of the quality/amount	<input type="radio"/>				

of e-bike facilities at P+R locations and/or public transport stations (x3)

An increased safety perception during my commuting trip with the use of the e-bike (x4)

An improved traffic flow along the route to my work with the use of the e-bike (x5)

An increase in the amount of seperated cycling lanes along my commuting route (x6)

A lower purchase price of the e-bike than before (x7)

An increased awareness of the possiblity to save on my travel costs by using an e-bike (x13)

An improvement of the available travel advice about the shortest, fastest and

most safe cycling route (x14)  
An increased awareness of the consequences for the environment of my transport mode choice (x9)  
A change of my travel habits in general (x10)  
A change of the social norms with concerns to transport mode choice (x11)  
An increased awareness of the positive effects of using an e-bike for my health conditions (x12)

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

Page Break

Q13 Is there another development/change that could be an incentive for you to use the e-bike instead of the car for commuting?

Yes, namely (1) \_\_\_\_\_

No (2)

**End of Block: For car users**

**End of Questionnaire**

**Appendix III: Overview of respondents and frequency tables**

		Age	Travel distance (km)
N	Valid	52	52
	Missing	0	0
Mean		48,02	11,8269
Median		50,50	11,5000
Mode		55	10,00 <sup>a</sup>
Std. Deviation		11,050	3,86990
Minimum		19	5,50
Maximum		68	21,00
Sum		2497	615,00

		Frequency	Percent
Valid	Female	37	71,2
	Male	15	28,8
	Total	52	100,0

a. Multiple modes exist. The smallest value is shown

**E-bike users**

		Age	Travel distance (km)
N	Valid	31	31
	Missing	0	0
Mean		48,19	10,7710
Median		51,00	10,5000
Mode		53 <sup>a</sup>	10,00
Std. Deviation		12,379	3,65415
Minimum		19	5,50
Maximum		68	20,50
Sum		1494	333,90

a. Multiple modes exist. The smallest value is shown

**Car users:**

		Age	Travel distance (km)
N	Valid	21	21
	Missing	0	0
Mean		47,76	13,3857
Median		50,00	13,0000
Mode		55	12,00 <sup>a</sup>
Std. Deviation		9,022	3,72563
Minimum		26	6,70
Maximum		61	21,00
Sum		1003	281,10

a. Multiple modes exist. The smallest value is shown

**For e-bike users:**

**Which transport mode did you previously use for the (part of the) trip to your work for which you currently use the e-bike?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Regular bike	16	30,8	51,6	51,6
	Public transport	1	1,9	3,2	54,8
	Car	10	19,2	32,3	87,1
	I have always used the e-bike for commuting	3	5,8	9,7	96,8
	Other, namely:	1	1,9	3,2	100,0
	Total	31	59,6	100,0	
Missing	System	21	40,4		
Total		52	100,0		

**I chose for using the e-bike to travel to my work. This is because of the recognition of the benefits of the e-bike as a result of:**

**: A decrease in the travel distance/time by using an e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	20,0	20,0	20,0
	Disagree	0	0	0	20,0
	Neutral	6	60,0	60,0	80,0
	Agree	2	20,0	20,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- A better quality of the e-bike facilities at work than before (charging points, stands, showers etc.)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	0	0	0	0
	Disagree	5	50,0	50,0	50,0
	Neutral	2	20,0	20,0	70,0
	Agree	3	30,0	30,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An increase in beneficial promotions at work as a reward for the use of the e- bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	40,0	40,0	40,0
	Disagree	1	10,0	10,0	50,0
	Neutral	4	40,0	40,0	90,0
	Agree	1	10,0	10,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An improvement of the quality/amount of e-bike facilities at P+R locations and/or public transport stations**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	20,0	20,0	20,0
	Disagree	0	0	0	20,0
	Neutral	6	60,0	60,0	80,0
	Agree	2	20,0	20,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An increased safety perception during my commuting trip with use of the e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	20,0	20,0	20,0
	Disagree	3	30,0	30,0	50,0
	Neutral	2	20,0	20,0	70,0
	Agree	3	30,0	30,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An improved traffic flow along the route to my work with the use of the e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	10,0	10,0	10,0
	Disagree	1	10,0	10,0	20,0
	Neutral	1	10,0	10,0	30,0
	Agree	7	70,0	70,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An increase in the amount of seperated cycling lanes along my commuting route**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	10,0	10,0	10,0
	Disagree	3	30,0	30,0	40,0
	Neutral	5	50,0	50,0	90,0
	Agree	1	10,0	10,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- A lower purchase price of the e-bike than before**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	20,0	20,0	20,0
	Disagree	3	30,0	30,0	50,0
	Neutral	3	30,0	30,0	80,0
	Agree	2	20,0	20,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An increased awareness of the possibility to save on my travel costs by using an e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	20,0	20,0	20,0
	Disagree	1	10,0	10,0	30,0
	Neutral	1	10,0	10,0	40,0
	Agree	4	40,0	40,0	80,0
	Strongly agree	2	20,0	20,0	100,0
	Total	10	100,0	100,0	

**- A improvement of the available travel advice about the shortest, fastest and most safe cycling route**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	20,0	20,0	20,0
	Disagree	1	10,0	10,0	30,0
	Neutral	1	10,0	10,0	40,0
	Agree	4	40,0	40,0	80,0
	Strongly agree	2	20,0	20,0	100,0
	Total	10	100,0	100,0	

**- An increased awareness of the consequences for the environment of my transport mode choice**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	0	0	0	0
	Disagree	1	10,0	10,0	10,0
	Neutral	1	10,0	10,0	20,0
	Agree	7	70,0	70,0	90,0
	Strongly agree	1	10,0	10,0	100,0
	Total	10	100,0	100,0	

**- A change of my travel habits in general**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	0	0	0	0
	Disagree	2	20,0	20,0	20,0
	Neutral	1	10,0	10,0	30,0
	Agree	7	70,0	70,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- A change of the social norms with concerns to transport mode choice**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	10,0	10,0	10,0
	Disagree	3	30,0	30,0	40,0
	Neutral	5	50,0	50,0	90,0
	Agree	1	10,0	10,0	100,0
	Strongly agree	0	0	0	100,0
	Total	10	100,0	100,0	

**- An increased awareness of the positive effects of using an e-bike for my health conditions**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	0	0	0	0
	Disagree	0	0	0	0
	Neutral	1	10,0	10,0	10,0
	Agree	6	60,0	60,0	70,0
	Strongly agree	3	30,0	30,0	100,0
	Total	10	100,0	100,0	

**Is there another important reason why you chose to use the e-bike for commuting?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, namely:	18	34,6	58,1	58,1
	No	13	25,0	41,9	100,0
	Total	31	59,6	100,0	
Missing	System	21	40,4		
Total		52	100,0		

**Is there another important reason why you chose for using the e-bike for commuting? -Yes, namely: Text**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	34	65,4	65,4	65,4
electrische fiets is sneller dan de auto; geen parkeerkosten	1	1,9	1,9	67,3
gewoon lekker blijven fietsen en niet stil hoeven staan met de auto of met tegenwind met normale fiets er veel langer over doen	1	1,9	1,9	69,2
Gezondheidsproblemen	1	1,9	1,9	71,2
Ik fiets 150 km per week. Dat is te veel voor een gewone fiets. Mijn gezondheid is beter door het fietsen.	1	1,9	1,9	73,1
ik kom minder bezweet aan. Op een normale fiets probeerde ik ook altijd zo snel mogelijk te fietsen	1	1,9	1,9	75,0
Ik train tegelijkertijd voor mijn sport: marathonroeier	1	1,9	1,9	76,9
Je komt wakkerder aan op je werk en ontspanter naar huis	1	1,9	1,9	78,8
Knieklachten	1	1,9	1,9	80,8
Kosten besparen	1	1,9	1,9	82,7
lichamelijke klachten	1	1,9	1,9	84,6
Man gebruikt auto, ik word ouder	1	1,9	1,9	86,5
Mijn schoonmoeder had er 1 staan die ze niet gebruikte, die mocht ik hebben	1	1,9	1,9	88,5
minder vermoeid aankomen op het werk dan met een normale fiets	1	1,9	1,9	90,4
Minder zwaar dan een gewone fiets	1	1,9	1,9	92,3
niet zo moe en bezweet aankomen op mijn werk	1	1,9	1,9	94,2

Slechte parkeervoorziening bij ziekenhuis en prijs OV	1	1,9	1,9	96,2
toelichting: ik gebruik voornamelijk mijn gewone fiets, en alleen wanneer ik niet fit ben, de e-bike	1	1,9	1,9	98,1
Ziekte, minder fysieke kracht	1	1,9	1,9	100,0
Total	52	100,0	100,0	

### For car users:

**The following development/change could be an incentive for me to use the e-bike instead of the car for commuting:**

- **A decrease in the travel distance/time by using an e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	3	6,0	15,8	21,1
	Neutral	5	10,0	26,3	47,4
	Agree	7	14,0	36,8	84,2
	Strongly agree	3	6,0	15,8	100,0
	Total	19	38,0	100,0	

- **A better quality of the e-bike facilities at work than before (charging points, stands, showers etc.)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	4,0	10,5	10,5
	Disagree	4	8,0	21,1	31,6
	Neutral	9	18,0	47,4	78,9
	Agree	3	6,0	15,8	94,7
	Strongly agree	1	2,0	5,3	100,0
	Total	19	38,0	100,0	

- **An increase in beneficial promotions at work as a reward for the use of the e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	0	0	0	5,3
	Neutral	3	6,0	15,8	21,1
	Agree	10	20,0	52,6	73,7
	Strongly agree	5	10,0	26,3	100,0
	Total	19	38,0	100,0	

- **An improvement of the quality/amount of e-bike facilities at P+R locations and/or public transport stations**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	10	20,0	52,6	57,9
	Neutral	4	8,0	21,1	78,9
	Agree	3	6,0	15,8	94,7
	Strongly agree	1	2,0	5,3	100,0
	Total	19	38,0	100,0	

- **An increased safety perception during my commuting trip with the use of the e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	4	8,0	21,1	26,3
	Neutral	6	12,0	31,6	57,9
	Agree	7	14,0	36,8	94,7
	Strongly agree	1	2,0	5,3	100,0
	Total	19	38,0	100,0	

- **An improved traffic flow along the route to my work with the use of the e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	2	4,0	10,5	15,8
	Neutral	4	8,0	21,1	36,8
	Agree	11	22,0	57,9	94,7
	Strongly agree	1	2,0	5,3	100,0
	Total	19	38,0	100,0	

- **An increase in the amount of separated cycling lanes along my commuting route**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	1	2,0	5,3	10,5
	Neutral	9	18,0	47,4	57,9
	Agree	6	12,0	31,6	89,5
	Strongly agree	2	4,0	10,5	100,0
	Total	19	38,0	100,0	

- **A lower purchase price of the e-bike than before**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	1	2,0	5,3	10,5
	Neutral	4	8,0	21,1	31,6
	Agree	8	16,0	42,1	73,7
	Strongly agree	5	10,0	26,3	100,0
	Total	19	38,0	100,0	

- **An increased awareness of the possibility to save on my travel costs by using an e-bike**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	1	2,0	5,3	10,5
	Neutral	4	8,0	21,1	31,6
	Agree	11	22,0	57,9	89,5
	Strongly agree	2	4,0	10,5	100,0
	Total	19	38,0	100,0	

- **An improvement of the available travel advice about the shortest, fastest and most safe cycling route**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	4,0	10,5	10,5
	Disagree	5	10,0	26,3	36,8
	Neutral	9	18,0	47,4	84,2
	Agree	3	6,0	15,8	100,0
	Strongly agree	0	0	0	100,0
	Total	19	38,0	100,0	

- **An increased awareness of the consequences for the environment of my transport mode choice**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	4,0	10,5	10,5
	Disagree	0	0	0	10,5
	Neutral	3	6,0	15,8	26,3
	Agree	12	24,0	63,2	89,5
	Strongly agree	2	4,0	10,5	100,0
	Total	19	38,0	100,0	

- **A change of my travel habits in general**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	1	2,0	5,3	10,5
	Neutral	2	4,0	10,5	21,1
	Agree	12	24,0	63,2	84,2
	Strongly agree	3	6,0	15,8	100,0
	Total	19	38,0	100,0	

- **A change of the social norms with concerns to transport mode choice**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	10,0	26,3	26,3
	Disagree	6	12,0	31,6	57,9
	Neutral	4	8,0	21,1	78,9
	Agree	4	8,0	21,1	100,0
	Strongly agree	0	0	0	100,0
	Total	19	38,0	100,0	

- **An increased awareness of the positive effects of using an e-bike for my health conditions**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	2,0	5,3	5,3
	Disagree	1	2,0	5,3	10,5
	Neutral	1	2,0	5,3	15,8
	Agree	9	18,0	47,4	63,2
	Strongly agree	7	14,0	36,8	100,0
	Total	19	38,0	100,0	

**Is there another development/change that could be an incentive for you to use the e-bike instead of the car for commuting? – Yes, namely Text**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	45	86,5	86,5	86,5
beloning door werkgever	1	1,9	1,9	88,5
Douches op werk, zodat je een douche kunt nemen	1	1,9	1,9	90,4
Makkelijker aan fiets komen	1	1,9	1,9	92,3
Medicatie die mijn reuma kunnen genezen	1	1,9	1,9	94,2
Minder stoplichten, locatie werk kost veel tijd om te bereiken daardoor	1	1,9	1,9	96,2
Niet per se, maar omdat er geen ande mogelijkheid is om dit ergens in te vullen: door een beenblessure kan ik deze afstand niet fietsen en ga ik daarom met de auto. De antwoordkeuze in de enquete zijn daarom niet altijd op mijn situatie van toepassing	1	1,9	1,9	98,1
Toename filedruk	1	1,9	1,9	100,0
Total	52	100,0	100,0	

## Tests

	An improvement of the available travel advice about the shortest, fastest and most safe cycling route	A decrease in the travel distance/time by using an e-bike	A change of my travel habits in general	An increased awareness of the positive effects of using an e-bike for my health conditions
Mann-Whitney U	40,000	14,000	42,000	30,000
Wilcoxon W	176,000	69,000	178,000	166,000
Z	-2,176	-3,680	-2,081	-2,717
Asymp. Sig. (2-tailed)	,030	,000	,037	,007
Exact Sig. [2*(1-tailed Sig.)]	,036 <sup>b</sup>	,000 <sup>b</sup>	,047 <sup>b</sup>	,007 <sup>b</sup>

## Ranks

	Which transport mode did you previously use for the (part of the) trip to your work for which you currently use the e-bike?	N	Mean Rank	Sum of Ranks
An improvement of the available travel advice about the shortest, fastest and most safe cycling route	Regular bike	16	11,00	176,00
	Car	10	17,50	175,00
	Total	26		
A decrease in the travel distance/time by using an e-bike	Regular bike	16	17,63	282,00
	Car	10	6,90	69,00
	Total	26		
A change of my travel habits in general	Regular bike	16	11,13	178,00
	Car	10	17,30	173,00
	Total	26		
An increased awareness of the positive effects of using an e-bike for my health conditions	Regular bike	16	10,38	166,00
	Car	10	18,50	185,00
	Total	26		